

# **NANOMATERIALS IN WASTE WATER:** *for the Region VI Pretreatment Association, U.S. EPA, and State EPA Region VI Oklahoma City August, 2008*

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Natural Resources Defense Council

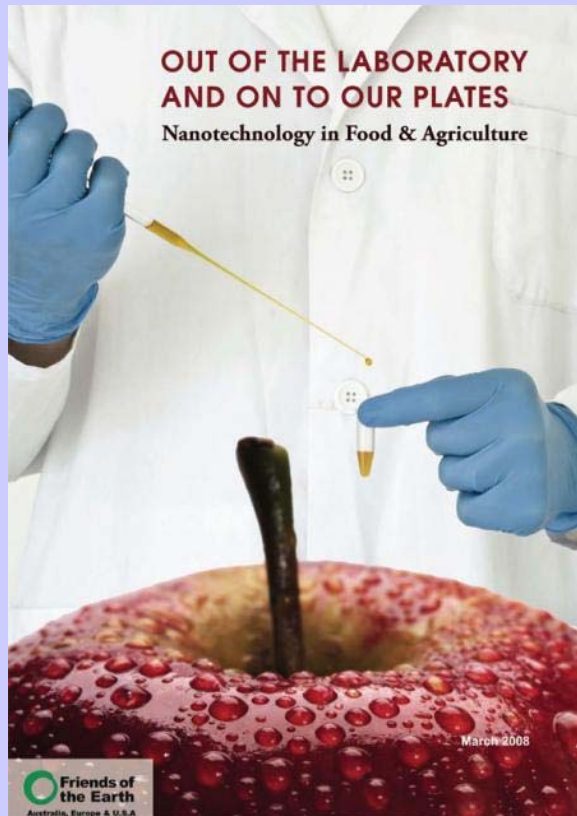
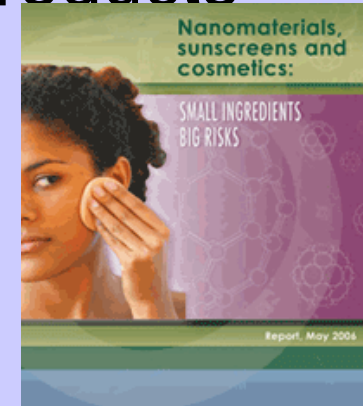


J Sass NRDC



# The Nano-Titanic has left port

- More than \$50 billion of nano-enabled products
- 500+ nano-enabled consumer products,
- 125+ nanosilver consumer products



Large corporations are embracing nanotechnology to drive product innovation



# Promises of the future

Clothing covered in nano-zinc oxide wires could power devices. (Nature, Feb 2008)

Medical "nanomiracles" include drug delivery and imaging devices.

Iron nanoparticles can decontaminate solvent-soaked soil up to 1,000 times faster than a conventional iron mixture.

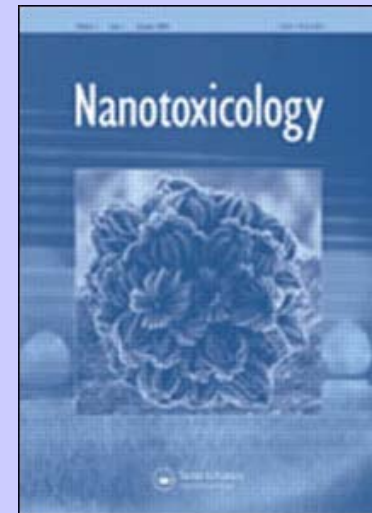
# Current applications

- Stain-resistant clothing (nano-perfluorinated compounds)
- Clear sunscreen (TiO<sub>2</sub>)
- Self-cleaning window coatings (TiO<sub>2</sub>)
- Nano ceramic window coatings block heat but not light,
- Microbe-killing washing machines and plastic food storage containers (nano silver)
- Lighter, stronger bicycles and hockey sticks (carbon nanotubes)

It is clear that **inhaled nanomaterials** can pass into the blood stream, and from the blood through the blood-brain-barrier, and the placental barrier.

Nano metal oxides in sunscreens may **penetrate skin**, though most tests on intact skin have reported only limited penetration.

Not much is known about whether **ingested nanomaterials** can pass from the gut into the blood stream.



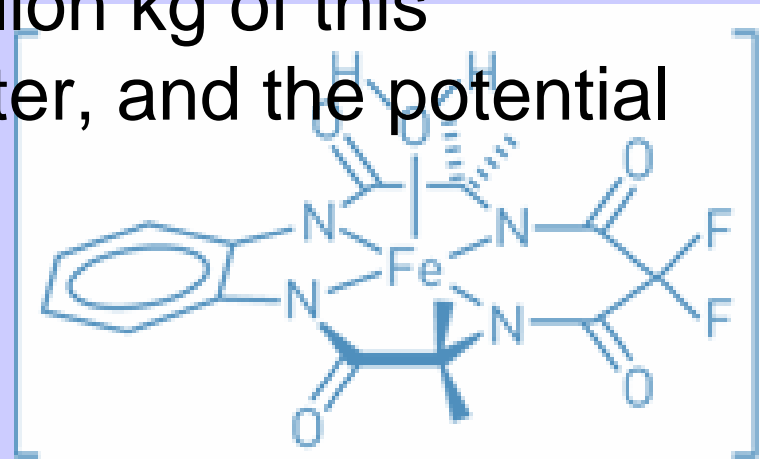
Papp T, Schiffmann D, Weiss D, Castranova V, Vallyathan V, Rahman O (2008) Human health implications of nanomaterial exposure, *Nanotoxicology*, 2:1, 9 - 27

# Fe-TAML

In the lab Fe-TAMLs together with hydrogen peroxide can rapidly degrade not only estrogenic compounds, but also bacterial spores similar to those of anthrax, sulfur compounds in motor fuels, dyes in textile mill wastewater, and organic colorants discharged from pulp and paper mills.

(Shappell et al, *Env Sci Tech*, 2008: 42(4):1296)

This would require maybe a billion kg of this treatment compound in our water, and the potential harm is poorly understood





# Problem: no enforceable regulations for most nanomaterials

The screenshot shows a web browser window displaying the EPA's website for Nanotechnology and the Environment. The page title is "Nanoscale Materials Stewardship Program". The browser's address bar shows the URL "http://www.epa.gov/oppt/nano/stewardship.htm". The website header includes the EPA logo and the text "U.S. ENVIRONMENTAL PROTECTION AGENCY". The main navigation bar features "Recent Additions" and "Contact Us" links, along with a search bar. The search results show "All EPA" and "Nanotechnology and the Environment". The breadcrumb trail indicates the user's location: "EPA > Prevention, Pesticides and Toxic Substances > Pollution Prevention and Toxics > Nanotechnology under the Toxic Substances Control Act > Nanoscale Materials Stewardship Program". The main content area is titled "Nanoscale Materials Stewardship Program" and includes a list of links under "On this page:" such as "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". A sidebar on the left lists various categories like "OPPT Home", "Basic Information", "Partnerships and Programs", etc. Two callout boxes on the right provide "More Information" and "Interested in the Nanoscale Materials Stewardship Program (NMSP)?". A footer note mentions the need for Adobe Reader to view PDF files.

nanoscale materials stewardship program | nanotechnology and the environment | US EPA - Mozilla Firefox

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US EPA http://www.epa.gov/oppt/nano/stewardship.htm

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## Nanoscale Materials Stewardship Program

On this page:

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- [Under the In-Depth Program](#)
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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. Nanoscale materials that are either new or existing chemical substances (as determined by the status of the substance on the TSCA Chemical Substances Inventory) can be included in the program. See [TSCA Inventory Status of Nanoscale Substances - General Approach \(2008\) \(PDF\)](#), (7 pp, 37K). The NMSP contains a basic and an in-depth program:

**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](#).

You will need Adobe Reader to view some of the files on this page. See [EPA's PDF page](#) to learn more.

Done

## Special Case of Nanosilver

Over 125 consumer products claim to use nanosilver;

Nanosilver, like silver, kills both harmful and beneficial microbes. The nanoscale version is more toxic than regular silver.

In cultured mouse sperm stem cells, a 48 hr treatment of nanosilver (15 nm diameter) was 45-fold more toxic than silver carbonate (EC50 of 8.75 v 408 ug/ml).

(Braydich-Stolle et al, *Toxicological Sciences*, 2005)



# Calls to regulate nanosilver as a pesticide, 2006



Chuck Weir  
*Tri-TAC Chair*  
East Bay Dischargers Authority  
2651 Grant Avenue  
San Lorenzo, CA 94580  
(510) 278-5910  
[cweir@ebda.org](mailto:cweir@ebda.org)



22 November 2006

Jim Jones, Director  
Office of Pesticide Programs  
U.S. Environmental Protection Agency  
Ariel Rios Building  
1200 Pennsylvania Ave., NW  
Washington, D.C. 20460

**Re: Registration of Nanosilver as a Pesticide under FIFRA**

Dear Mr. Jones:

January 27, 2006

Jim Jones, Director  
Office of Pesticide Programs  
U.S. Environmental Protection Agency  
Ariel Rios Building  
1200 Pennsylvania Ave. NW  
Washington, D.C. 20460

Dear Mr. Jones:

**Request to Require Registration of Samsung Silver Wash clothing washing machine, and Silver Ion Pesticide products**

*Vice Chair*  
Jim Colston  
Orange County  
Sanitation District  
P.O. Box 9127  
Fountain Valley, CA 92728  
(714) 593-7458  
[jcolston@ocsd.com](mailto:jcolston@ocsd.com)

*Water Committee  
Co-Chairs*  
Ben Horenstein  
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Utility District  
375 11th St. MS702  
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Terrie Mitchell  
Sacramento Regional  
County Sanitation Dist



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# SAMSUNG Laundry Featuring SilverCare™ Technology

on Feb 13, 2006

### Silver Ions Sanitize Clothing, All In An Energy-Saving Cold Water Wash

New York, NY - Samsung Electronics, one of the world's largest appliance and electronics manufacturers, expands its award-winning home appliance line into the new millennium with the introduction of the world's first washing machine to employ advanced SilverCare™ Technology. The new Samsung front-loading washer uses Silver Ions in its wash and rinse cycles to kill 99.9% of tested bacteria to sanitize laundry, all in cold water without the use of bleach.

An increased consumer demand for energy-saving products prompted Samsung to develop a system to use silver, widely known for its anti-microbial properties, in the wash water of its newest line of washing machines. Metallic silver atoms, electrolytically stripped of an electron, are injected during the wash and rinse cycles, allowing over 100 quadrillion silver ions to penetrate deep into the fabric to sanitize clothing without the need for hot water or bleach.

[http://www.samsung.com/us/news/newsRead.do?news\\_group=productnews&news\\_type=consumerproduct&news\\_ctgry=laundrywasherdryer&news\\_seq=3071&search\\_keyword=&from\\_dt=&to\\_dt=](http://www.samsung.com/us/news/newsRead.do?news_group=productnews&news_type=consumerproduct&news_ctgry=laundrywasherdryer&news_seq=3071&search_keyword=&from_dt=&to_dt=)

EPA says, "ion generators that incorporate a substance (e.g., silver or copper) ... for the purpose of preventing, destroying, repelling, or mitigating a pest (e.g., bacteria or algae)...are considered pesticides for purposes of FIFRA, and must be registered prior to sale or distribution." (FR Notice, Sept 07)

All products must apply to EPA for registration by March 21, 2008, if they want to continue to sell after that date.

[http://switchboard.nrdc.org/blogs/jsass/us\\_epa\\_levies\\_fine\\_against\\_nan.html](http://switchboard.nrdc.org/blogs/jsass/us_epa_levies_fine_against_nan.html)

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

EPA tells me that so far no companies have voluntarily registered their nanosilver-containing products.



The screenshot shows the Nanowerk website interface. At the top, there is a navigation bar with links for Home, Databases, News, Resources, Nanowerk, Introduction to Nanotechnology, Career Center, and NanoTalk. Below the navigation bar, there are two images: a Confocal Raman image and a TERS image, both with a 200 nm scale bar. The main content area features a news article titled "EPA fines technology company \$208,000 for 'nano coating' pesticide claims on computer peripherals" posted on March 7, 2008. The article text states: "(Nanowerk News) 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." Below the text is a small image of a green computer mouse with a "Wireless! Keyboard & Mouse" label and a "Green Tree" logo. On the left side of the page, there is a sidebar with "Article Tools" (Printer-friendly, E-mail this article, Daily News Email Digest, News Feeds, and a SHARE button) and "Research and General News" (click here for Business News). A list of other news items is visible in the sidebar, including "First neutrons created at the ISIS second Target Station" (Aug 3rd, 2008), "The brightest, sharpest, fastest X-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".

LA TIMES  
Aug 4, 2008

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## Nanosilver products raise concerns of safety, effectiveness

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## Nanosilver use prompts worries of resistant bacteria

**The advent of nanosilver products raises the possibility of new strains of silver-resistant bacteria, although there's little evidence of that.**

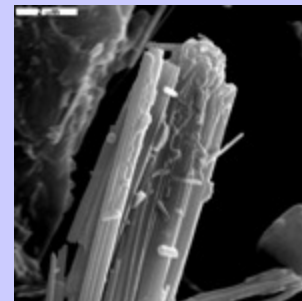
By Margaret Woodbury, Special to The Times  
August 4, 2008

Could the use of nanosilver products create another problem for medicine -- strains of bacteria that are resistant to silver? Although silver is not used to treat disease, it is used in hospital settings to speed wound-healing, prevent eye infections in newborns and as a coating for catheters, where it can cut infection rates.

Carbon nanotubes introduced into the abdominal cavity of mice show asbestos-like pathogenicity in a pilot study.

(Poland et al. *Nature Nanotechnology*, 2008)

Injecting the mesothelial lining of the body cavity of mice with multiwalled carbon nanotubes results in asbestos-like, length-dependent, pathogenic behaviour at 7 days. This includes inflammation and granulomas.



[http://icon.rice.edu/resources.cfm?doc\\_id=12299](http://icon.rice.edu/resources.cfm?doc_id=12299)

# Gov't nano budget

US has \$1.9 billion FY09 budgeted for US National Nanotechnology Initiative (NNI):

- EPA- \$25 M
- DOD -\$431M
- NSF - \$397
- DOE - \$331

([www.nano.gov/html/about/funding.html](http://www.nano.gov/html/about/funding.html))

About \$13 M spent on risk-relevant research  
[www.nanotechproject.org/news/archive/ehs-update/](http://www.nanotechproject.org/news/archive/ehs-update/)



"...nanotechnology is being overseen by the same government organizations that promote it; research strategies are not leading to clear answers to critical questions; collaborations are not being as productive as is needed; and stakeholders are not being fully engaged."

-Hansen et al (2008)

*Nature Nanotechnology*

<http://www.nature.com/nnano/journal/vaop/ncurrent/pdf/nnano.2008.198.pdf>



<http://www.onearth.org/article/our-silver-coated-future>

For more info....



Jen Sass blog: <http://switchboard.nrdc.org/blogs/jsass/>

EDF blog: <http://environmentaldefenseblogs.org/nanotechnology/>

ICON: <http://cohesion.rice.edu/CentersAndInst/icon/index.cfm>

PEN: <http://www.nanotechproject.org/>