

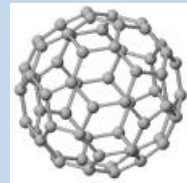
US EPA ARCHIVE DOCUMENT

New World of Nanowaste:

Review of Regulations, Positions, Policies
and Action Related to Nanotechnology

Tracy Hester
Bracewell & Giuliani, LLP

Environmental Impact of Nanotechnology
EPA OSWER Conference
Washington, DC
July 13, 2006



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New World of Nanowastes

Here and Now



- Over 270 consumer products marketed as containing nanomaterials
- Projected market of \$9 billion for carbon nanotubes alone by 2020
- Concerns emerging about unintended effects
 - Environmental fate and transport
 - Toxicological effects
 - Bioaccumulation

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Growing Concerns About Nanotech

- **Growing interest in management standards for nanomaterials**
 - EPA TSCA Pilot Registration Program
 - Petition to FDA for regulation of cosmetics and sunscreens containing nanomaterials
 - Petition to EPA for registration of nanosilver from Samsung products
 - Calls for moratorium
- **Coalescing national and international standards, but none yet final**



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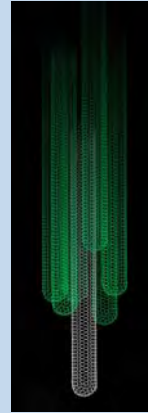
Nanowaste Scenarios

- Scenario 1: How to respond to a spill of nanoscale materials?
- Scenario 2: How does a RCRA TSDF permit reflect management of nanoscale wastes?
- Scenario 3: Any regulatory issues for using advanced nanoscale materials in a remediation project?

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Scenario 1: Big Spill of Little Stuff

- The scene: an overturned truck spills several drums into a ditch at the entrance to the facility.
- Potential materials: titanium dioxide, aluminum or carbon nanotubes.



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Scenario 1: Big Spill of Little Stuff

- Reporting the spill
- Determining what emergency actions to undertake
- Disposing of the wastes from the response action

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Scenario 1: Big Spill of Little Stuff

Emergency Response Information

- Spill containment and response notification to NRC and LEPC
 - Reporting under CERCLA: which “hazardous substance” is it?
 - If it is one, what RQ does it have?
 - Is it reportable under EPCRA or state law?
- MSDS – describes bulk or nanoscale materials?

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RAW SINGLE-WALL CARBON NANOTUBES (SWNT)
Material Safety Data Sheet

Manufacturer: Nanotubes, P.O. Box 1405, Preopontasopole (University Campus), Rio-Patris 26500 GREECE
Tel: +30-2610-987208
Fax: +30-2610-990997
info@nanotubes.com
<http://www.nanotubes.com>

1. Product Composition and Specifications:

Raw SWNTs		Characterization method
Prediction method	CCVD	
Available form	Black powder	
Diameter	0.8-1.2 nm	TEM, Raman
Length	> 3 μm	SEM, TEM
Bundles	15-30 nm	SEM, TEM
Nanotubes purity	>95%	TGA, SEM
Metal particles	<10%	TGA
Aerophyl: carbon (in the predetermined Nanotubes purity)	<1%	TGA, Raman
Odor	Odorless	



2. Hazards Identification
Indications of Hazards to Humans and the Environment: Irritating to eyes and respiratory system.

Date Created: 12/04/2005 Date Revised: 04/01/2006

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PRODUCT AND COMPANY IDENTIFICATION

DATE: October 03

1.1 Product Name - Tin Oxide Nanopowder
1.2 Chemical Symbol - Tin (IV) oxide SnO₂ Synonyms: Stannic oxide, tin dioxide

Special care should be taken to avoid ingestion, inhalation, skin contact or eye contact

1.3 **This powder is an experimental sample, comprised of loosely aggregated ultrafine nanometer particles. No data yet exists on the effects of such fine particles on the body.**

Special care should be taken to avoid ingestion,

inhalation, skin contact or eye

2. COMPOSITION / INFORMATION ON INGREDIENTS

Supplied in the following purities

2.1 Tin Oxide Nanopowder CAS No: 18282-10-5
EINECS: 2421590

3. HAZARDS IDENTIFICATION

Tin oxide is not considered to be a hazardous product as specified in Directive 67/548/EEC

4. FIRST AID MEASURES

4.1 Ingestion **No data available but seek medical advice immediately.**

4.2 Skin Contact

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Scenario 1: Big Spill of Little Stuff

Handling the spilled materials

- Designating nanoscale materials as “discarded”
- Waste coding
- Spill removal standards

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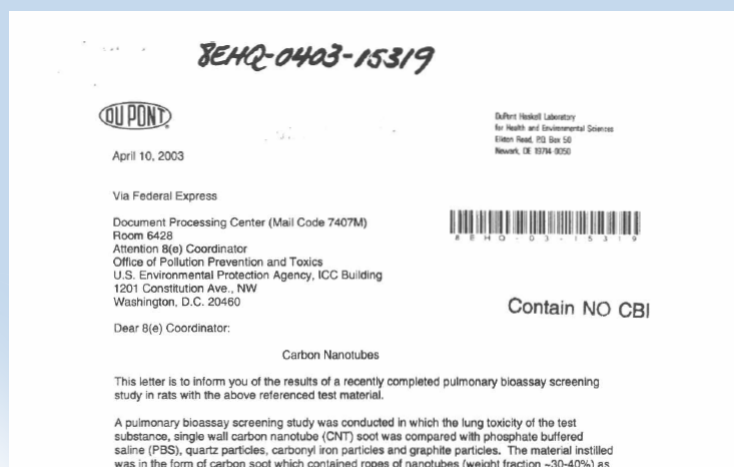
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Scenario 1: Big Spill of Little Stuff

Follow-up, if any, for nanomaterial spills

- Notice to exposed workers
- TSCA notifications

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TSCA Reporting



TSCA 8(e)
Notice for
CNT health
Effects, Du
Pont, April
10, 2003

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Scenario 2: Nano-Permitting

- An existing facility begins to produce a product that incorporates nanoscale silver
- The production process will generate off-specification nanosilver product and solid wastes

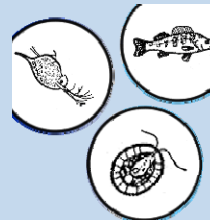


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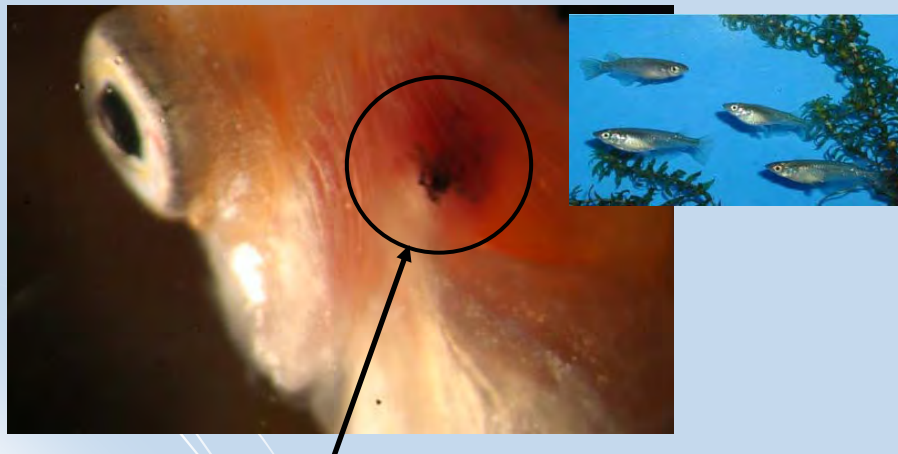
Scenario 2: Nano-Permitting

- Wastewater permitting:
 - Aquatic toxicity of nanoscale silver
 - Pending TriTAC petition on nanoscale silver discharges to water



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Nanoiron on Medaka Fish Gills



Nanoiron aggregates accumulate on Medaka fish gills-(Richard Winn UGA)

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Scenario 2: Nano-Permitting

- Solid wastes containing nanoscale silver
 - Production wastes
 - D011 (silver)
 - Effect of nanoscale on Method 1311
 - Off-specification products – waste?
 - Precious metals recovery and recycling
 - Speculative accumulation
 - Potential RCRA exemptions (in-process reuse, closed-loop recycling, etc)

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Scenario 2: Nano-Permitting

- Management of nanoscale wastes in RCRA units
 - 90-day storage tanks and containers
 - Exempt units and wastes – TETFs, WWTUs, ENUs, product tank bottoms
 - Satellite accumulation areas
 - Small quantity generators/CESQGs

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Scenario 2: Nano-Permitting

- Hazardous wastes and nanomaterials
 - Corrective action
 - Land ban treatment standards
 - Omnibus permitting authority
 - Imminent hazard abatement authority

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Scenario 2: Nano-Permitting

Public participation
and notice for
permit issuance
and modifications

Berkeley Daily Planet

Bus Lane Plans Provoke Telegraph Neighborhood

Telegraph Avenue neighbors and merchants packed a Planning Commission meeting Wednesday to protest proposals to speed up buses from downtown Berkeley all the way to San Leandro by eliminating some traffic lanes for motorists on Telegraph Avenue and turning the three northernmost blocks of the street into a car-free, bus-only pedestrian mall.

"This would be the end of the world as we know it. Telegraph would look like a Greyhound Station," said Ken Sarachan, owner of Rasputin Music, who along with other leading Telegraph merchants—including the owners of Cody's Books, Moe's Books and Amoeba Music—opposed banishing cars from Telegraph north of Haste Street.

Matthew Artz: Protestors gathered at the entrance to the Lawrence Berkeley National Laboratory Thursday to protest today's planned groundbreaking for the Molecular Foundry.

Molecular Foundry Foes Protest Groundbreaking

About 30 protesters withstood steady drizzle early Thursday morning, worried that once Lawrence Berkeley National Laboratory (LBNL) completes its newest laboratory complex, far smaller, more dangerous particles could rain down on them. [FULL STORY](#)

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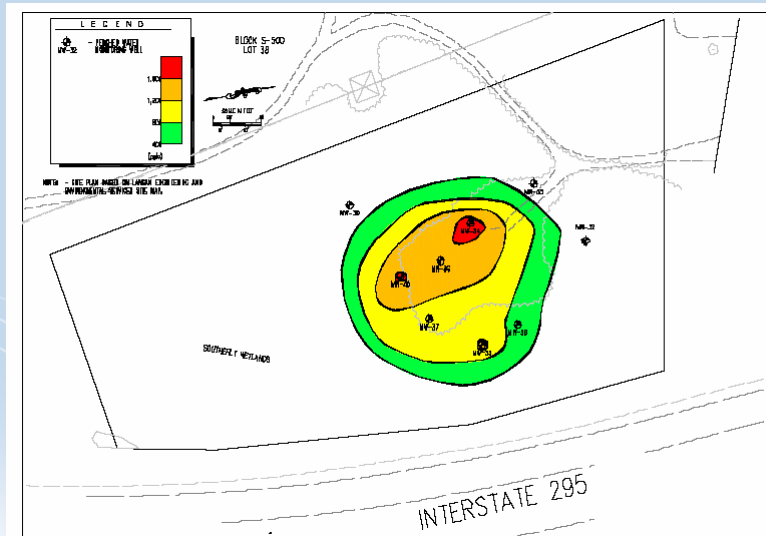
Scenario 3: Nano-Remediation

- Nanoscale materials pose great opportunities as well as challenges
- One rapidly emerging technology: groundwater remediation
 - Nanoscale iron
 - Used in several field tests with generally positive results

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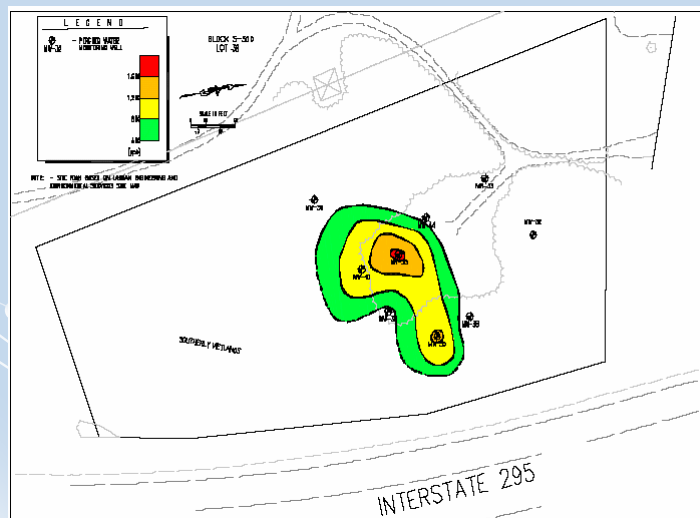
Scenario 3: Nano-Remediation



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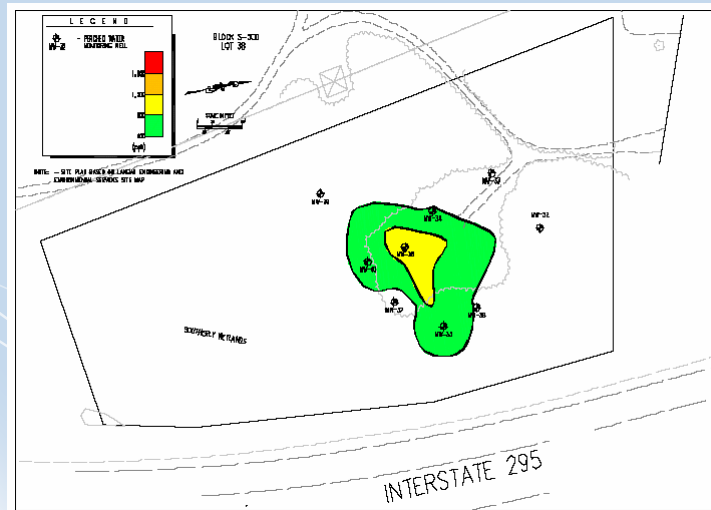
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Scenario 3: Nano-Remediation



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New World of Nanowastes Scenario 3: Nano-Remediation



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New World of Nanowastes Scenario 3: Nano-Remediation

- Key results:
 - Nanoscale iron treatment can cost 30 to 50 percent less than pump-and-treat technology
 - Iron apparently degrades without long-term groundwater impacts
 - Effective against difficult contaminants (PCE, TCE, PCBs, halogenated aromatics)

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