

Nanotechnology and Pesticides

Pesticide Program Dialogue Committee
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Session I



Today's Presentation

- Review of nanotechnology
 - Definition
 - Why is OPP concerned?
 - Pesticides employing nanotechnology
 - Scientific Advisory Panel meeting on Nanotechnology and Pesticides
 - Future Notices from OPP on Nano
 - Interagency and International Coordination
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Nanotechnology- What is it?

- Research and technology development at the 1 to 100 nanometer range
- Creation and use of structures that have novel properties due to their small size
- Ability to control or manipulate matter on an atomic scale



The Scale of Things

■ Object	Size (nm)
■ Carbon nanotube (eng.)	2
■ Width of DNA	2.5
■ Virus	100
■ Width of Human Hair	75,000
■ Thickness of a dollar bill	100,000
■ Head of a pin	2 million
■ Shaquille O'Neal	2.1 billion



Nanomaterials and Applications

- Nanomaterials are applied in almost all fields. Examples include:
 - Conductors and semi-conductors
 - Medical devices
 - Sensors
 - Coatings
 - Catalytic agents
 - Pesticides



OPP's Working Definition

- Nanoscale material
 - An ingredient that contains particles that have been intentionally produced to have at least one dimension that measures between approximately 1 and 100 nanometers



What we know

- Nanomaterials behave differently
- Size can influence toxicity

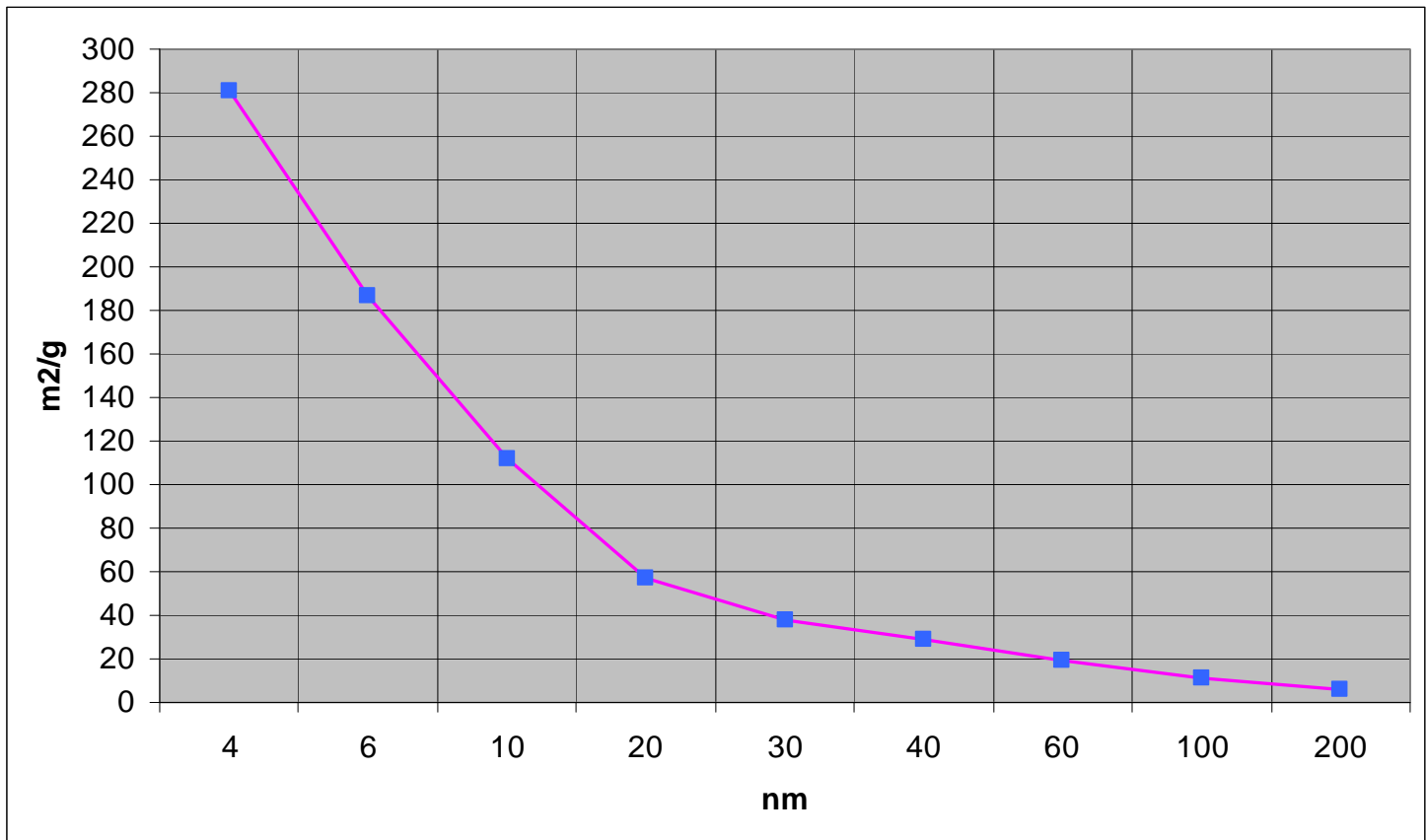
Gold has very different toxicities when nanosized

Nano copper is more acutely toxic than micro copper

- Shape may also influence exposure and toxicity
- We still have a lot to learn



Size vs. Surface Area



Why is OPP Concerned?

- Potential Human Health Concerns:
 - Dermal absorption (so small they may pass through cell membranes)
 - Inhalation (go to the deep lung and may translocate to the brain i.e, could cross the blood brain barrier)



Why is OPP Concerned?

- Potential Environmental Concerns:
 - High durability or reactivity of some nanomaterials raises issues on the fate in environment
 - Lack of information to assess environmental exposure to engineered nanomaterials



Nanotechnology and pesticides

- Currently, there is at least one product on the market that contains a nanoscale material....nano-silver
 - This product was approved without the knowledge that it contained a nanomaterial
 - Registered as a material preservative similar to the many registered silver products



Nanotechnology and pesticides

- There are likely other registered pesticides that contain nanoscale materials
- OPP is taking steps to identify these products and will take the appropriate action to ensure that they meet the FIFRA standards for safety



Pending Nanopesticide Applications

- Several contain nanosilver
 - Use as material preservatives/additives for textiles, polymers, coatings, and/or plastics to protect the treated products from microbial degradation – similar to registered silver products
- Another product pending with nanotube-like clay (halloysite) ingredient



FIFRA Scientific Advisory Panel Meeting

- Held November, 2009
- Questions on the evaluation of hazard/exposure from nanosilver and other nanometal pesticide products
 - Exposure to silver ions from nanosilver
 - Exposure to nanosilver particles



SAP Recommendations

- General message from the SAP – more data is needed in all disciplines
- OPP should determine data needs for products on a case-by- case basis
- Life Cycle Analyses (LCA) can be adopted for nanoproducts



Future Federal Register Notice

- OPP is preparing a Federal Register Notice on nanomaterials and pesticide products
- Expected to be issued in June
- Announces a new interpretation of FIFRA/regulations and proposes a new policy



Future Notice (continued)

- New Interpretation:
 - The presence of a nanoscale material in a pesticide product is reportable under FIFRA section 6(a)(2)
 - Applies to already registered products as well as products pending registration
 - This constitutes an interpretation of FIFRA and elaboration on the regulations governing reporting of unreasonable adverse effects



Future Notice (continued)

- Basis for the decision to use the 6(a)(2) mechanism

There are many studies that raise concerns that nanoscale materials may potentially affect human health and the environment adversely

Places burden of reporting on the registrants who are responsible for proving the safety/continued safety of their products



Future Notice (continued)

- Proposed New Policy:
 - An active or inert ingredient would be considered “new” if it is a nanoscale material (FIFRA and PRIA)
 - Would apply even when a non-nanoscale form of that same active or inert is already in a registered product
 - Example: Nanosilver would be considered new even though silver is a registered pesticide



Citizen Petition on Nanosilver

May 2008

- International Center for Technology Assessment (CTA) and 13 other Organizations
 - Request to take action on an estimated 600 unregistered nanosilver products marketed in US (Not all subject to EPA FIFRA regulation)



Citizen Petition (continued)

- **Products include:**

- air and water purifiers and filters
- cleaning sprays and wipes
- children's toys, baby bottles and infant products
- food storage containers, cutlery, cutting boards
- clothing
- soaps, personal care and hair products
- refrigerators, washing machines, computer hardware

- **Example claims of antimicrobial properties**

- Antibacterial, Antibiotic effect
 - Eliminates 99.9% of bacteria, fungi and hundreds of other disease causing microorganism
 - Renders material "permanently anti-microbial and anti-fungal"
 - Sterilizes bacteria of over 650 species
 - Control air free from bacteria, virus germs, fungus or even avian influenza
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Citizen Petition (continued)

- Products are manufactured around the world (US, UK, Canada, Korea, Japan, Taiwan, China, New Zealand, Germany)
 - Makes enforcement more challenging
- Petition response expected in June 2010



Agency Coordination

- Office of Research and Development and Office of Pollution Prevention & Toxics in OCSPP lead EPA efforts



ORD Activities

- **2007 *Nanomaterials Research Strategy***
- Research allocations:
 - 50% Sources, Fate, Transport and Exposure
 - 30% Human Health, and Ecological Effects
 - 10% Risk Assessment Methods and Case Studies
 - 10% Preventing and Mitigation Risks
- Guidelines for testing nanomaterials
- Case Studies
 - Titanium Dioxide and Carbon Nanotubes (2007/2009)
 - Draft Case Study on Nanosilver (2010)



OPPT Activities

- The 2008 Nanoscale Materials Stewardship Program, a voluntary reporting program for nanoscale materials:
 - 31 companies submitted reports
 - 132 unique nanoscale materials
- TSCA New Chemicals Program
 - 100+ notices for nanoscale materials since 2005
 - Has led to requirements to prevent human and environmental exposure



OPPT Future Activities

- TSCA Significant New Use Rule (SNUR)
- TSCA § 8(a) Rule
- TSCA § 4 Test Rule



National Nanotechnology Initiative Organizational Structure

NNI Coordination

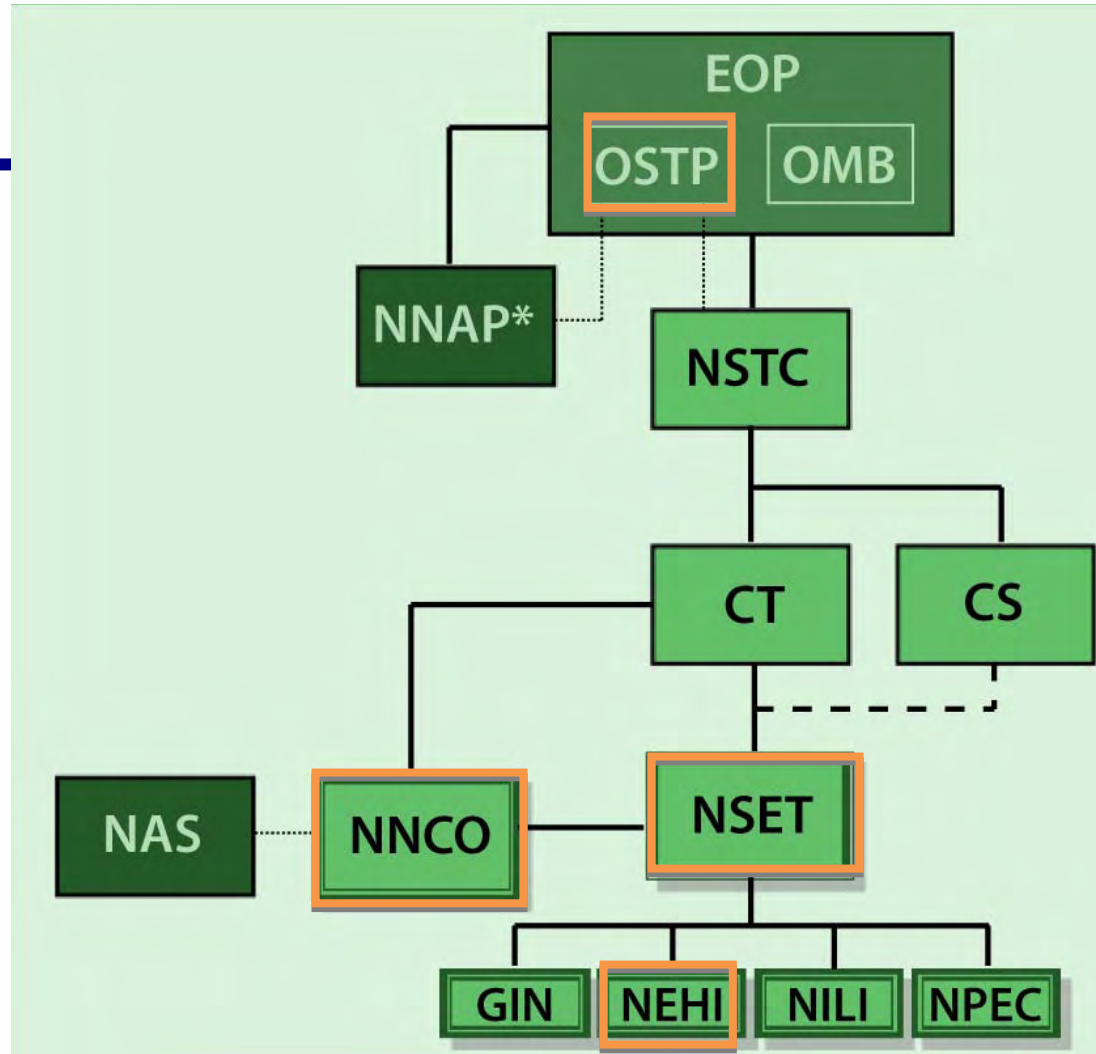
EPA operates primarily with the orange-framed groups:

OSTP coordinates NNI for the White House.

National Nanotechnology Coordination Office (NNCO) staffs NNI coordination.

Nano-scale Science, Engineering, and Technology (NSET) subcommittee is the coordination venue for the 25 NNI agencies.

Nanotechnology Environmental and Health Implications (NEHI) working group is the committee where EPA coordinates with other agencies on nanotechnology environmental research.



International Coordination

- Close Working Relationship with OECD
 - Working Party on Manufactured Nanomaterials (WPMN) established in 2006
 - Six meetings, 5 chaired by USA; 6th meeting in 2009, chaired by EU
 - *Objective: “ to promote international cooperation in health and environmental safety related aspects of manufactured nanomaterials, in order to assist in their safe development”*
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OECD WPMN Project – testing 14 representative nanomaterials	Lead sponsor(s)	Co-sponsor(s)	Contributor
Fullerenes (C60)	Japan, US*		China, Denmark
SWCNTs	Japan, US*		Canada, France, Germany, EC, China, BIAC
MWCNTs	Japan, US*	Korea, BIAC	Canada, Germany, France, EC, China, BIAC
Silver nanoparticles	Korea, US	Australia, Canada, Germany, Nordic Council	France, EC, China
Iron nanoparticles	China, BIAC		Canada, US, Nordic Council
Carbon black			Canada, Denmark, Germany, US
Titanium dioxide	France, Germany	Austria, Canada, Korea, Spain, US*, BIAC	China, Denmark
Aluminium oxide			Germany, US
Cerium oxide	US*, UK/BIAC	Australia, Netherlands, Spain	Germany, Switzerland, EC
Zinc oxide	UK/BIAC	Australia, Spain, US, BIAC	Canada
Silicon dioxide	France, EC	Belgium, Korea, BIAC	Denmark
Polystyrene			Austria, Korea
Dendrimers		Spain, US*	
Nanocleves			Denmark, US