

The NIOSH Nanotechnology Research Program

Occupational Implications and Applications

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The findings and conclusions in this presentation have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy



NIOSH – *Introduction*

- National Institute for Occupational Safety and Health, *part of:*
Centers for Disease Control and Prevention
U.S. Department of Health and Human Services
- **Occupational Safety & Health Act (1970) established OSHA & NIOSH**

... *To assure safe and healthful working conditions for all working men and women.*

NIOSH - research & recommendations

OSHA - regulatory & enforcement : Part of the Department of Labor

- NIOSH Nanotechnology Research Center & Steering Committee (since 2004):
Strategic planning on research to fill research gaps on occupational health and safety implications & applications of nanomaterials



NIOSH, Cincinnati

The Challenge

- **Nanotechnology has great potential**
 - Revolutionary technology, driver of innovation
 - New material properties may yield great benefits
- **But there is risk**
 - New hazards and risks with heightened reactivity
 - Early results raise concern
- **Moving forward**
 - Minimize the risk
 - Cover the broad extent of exposure: R&D to uses

The Concern: Effects Observed in Some Early Studies

■ Lung

- Up to 50% of inhaled nanoparticles may deposit in gas exchange region
- Lung fibrosis in rats exposed to ultrafine particles (TiO₂)
- Small doses of SWCNT— fibrosis

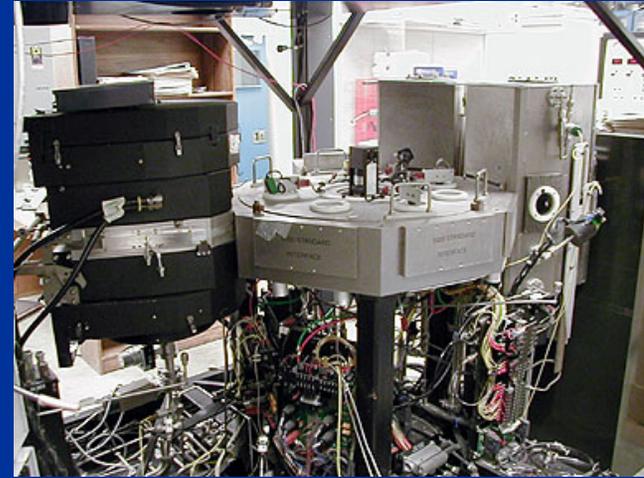
■ Cardiovascular

- Air pollution epidemiology
- Inflammatory effects, platelet aggregation in animals

■ Brain/CNS

- Nose to Brain
 - Graphite rods accumulate in olfactory lobe of brain
 - Uptake of metals via olfactory pathways

Engineered Nanoparticles are being produced and used today.

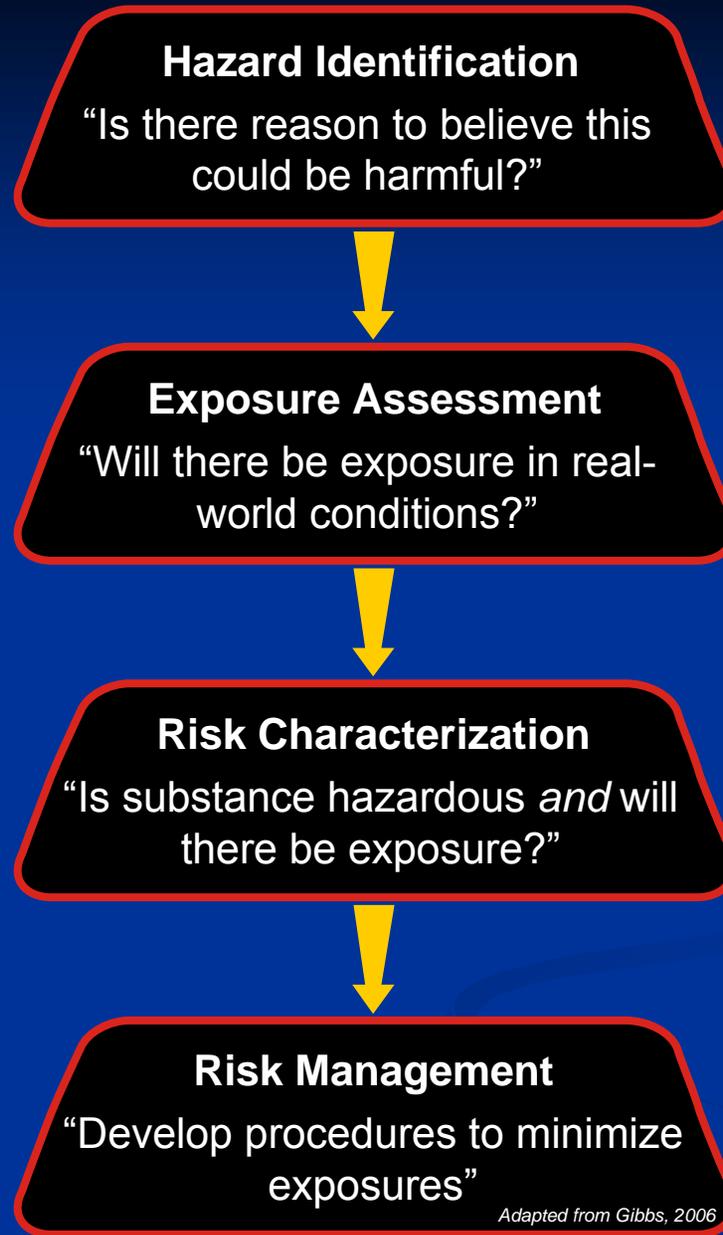


The Three “Grand Questions”

1. *Are engineered nanoparticles hazardous?*
2. *Can nanoparticles be measured?*
3. *Can nanoparticles be controlled?*

(How do I approach these questions?)

Steps to Protect Nanotechnology Workers



What is NIOSH doing to help answer these questions?

Toxicity Studies: Pulmonary and Dermal
Aerosol Generation and Characterization
Dosimetry and Risk Assessment Methods
Exposure Methods Development
Filter Efficiency
Ultrafine TiO₂
Web Page Development
Field Research Team: **Open for Partnerships**
Medical Evaluation and Surveillance

NIOSH researcher measuring nanopowder release



What We Know and Don't Know

- A. Identify hazard potential
- B. Evaluate real world exposure
- C. Characterization risk
- D. Risk mitigation strategies

A. Hazard Identification

What we know

- Health effects from industrial ultrafines, fibers, and air pollution
- Some SWNT caused fibrosis in mice lungs
- Cardiovascular response from SWCNT and TiO₂
- SWCNT effects on skin
- Some explosive and flammability potential

What we don't know

- Applicability to engineered nanoparticles
- Nature and severity of effects on lungs
- Extent of translocation
- Properties of nanoparticles influencing body response
- Extent of skin absorption
- Extent of explosively and flammability

B. Exposure Assessment

What we know

- Nanoparticles can be measured
- Engineered nanoparticles can get into workplace air
- Specific tasks may increase risk of exposure
- Maintenance work can result in skin and inhalation exposure

What we don't know

- What are the best measures
- What is the extent of exposure
- Sampling techniques not readily applicable
- Personal breathing zone monitoring techniques need development

C. Risk Characterization

What we know

- Greater risk from nanoparticles on a mass basis than larger particles of the same material
- Using animal data on ultrafines: lifetime risks to workers at current OELs may be $>1/1000$
- Animal models can describe human risks

What we don't know

- What are the hazards beyond experimentally characterized range
- How chemical and physical factors influence risk
- Extent of exposure
- Long term health effects

D. Risk Management

What we know

- Airborne exposure to nanoparticles can be controlled
- Good work practices can minimize exposures
- Respirators should be effective
- Current OELs are probably not protective

What we don't know

- Limits of controls
- No OELs specifically for engineered nanoparticles
- Limits of respiratory and PPE
- Focus for medical surveillance

NIOSH Information Resources

Nanotechnology topic page:

www.cdc.gov/niosh/topics/nanotech

- **NIOSH Position Statement – Jan 2005**
- **NIOSH Nano Strategic Plan – Oct 2005**
- **Nanoparticle Information Library – Oct 2005**
- **TiO₂ Current Intelligence Bulletin – Nov 2005**
- **Approaches to Safe Nanotechnology: 2nd version, Aug 2006**
- **NIOSH exposure field team site visits**
- **NIOSH Nanotechnology Research Progress Report – February, 2007**
- **Ongoing research studies and publications**

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NIOSH National Institute for Occupational Safety and Health

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NIOSH Safety and Health Topic:
Nanotechnology

Nanotechnology at NIOSH

NIOSH is the leading federal agency conducting research and providing guidance on the occupational safety and health implications and applications of nanotechnology. This research focuses NIOSH's scientific expertise, and its efforts, on answering the questions that are essential to understanding these implications and applications:

- How might workers be exposed to nano-sized particles in the manufacturing or industrial use of nanomaterials?
- How do nanoparticles interact with the body's systems?
- What effects might nanoparticles have on the body's systems?

As part of this effort, NIOSH is conducting [strategic planning](#) and research, partnering with public and private-sector colleagues from the United States and abroad, and making the information and interim recommendations widely available. As observers generally agree, research to answer these questions is critical for maintaining U.S. competitiveness in the growing and dynamic nanotechnology market.

Critical Topic Areas

NIOSH has identified [10 critical topic areas](#) to guide in addressing knowledge gaps, developing strategies, and providing recommendations.

Each topic provides a brief description of the research that NIOSH is conducting in the area of nanotechnology and the applications and implications of nanomaterials in the workplace.

Interim Recommendations

In "Approaches to Safe Nanotechnology," NIOSH invites information and comment from stakeholders. This information exchange will advance our shared understanding of the current scientific knowledge related to occupational safety and health issues. This living document also makes recommendations for interim steps in employing the range of control technologies, work practices, and personal protective equipment demonstrated to be effective with other fine and ultrafine particles. These recommendations will be refined as more data become available.

Nanotechnology

Topic Index:

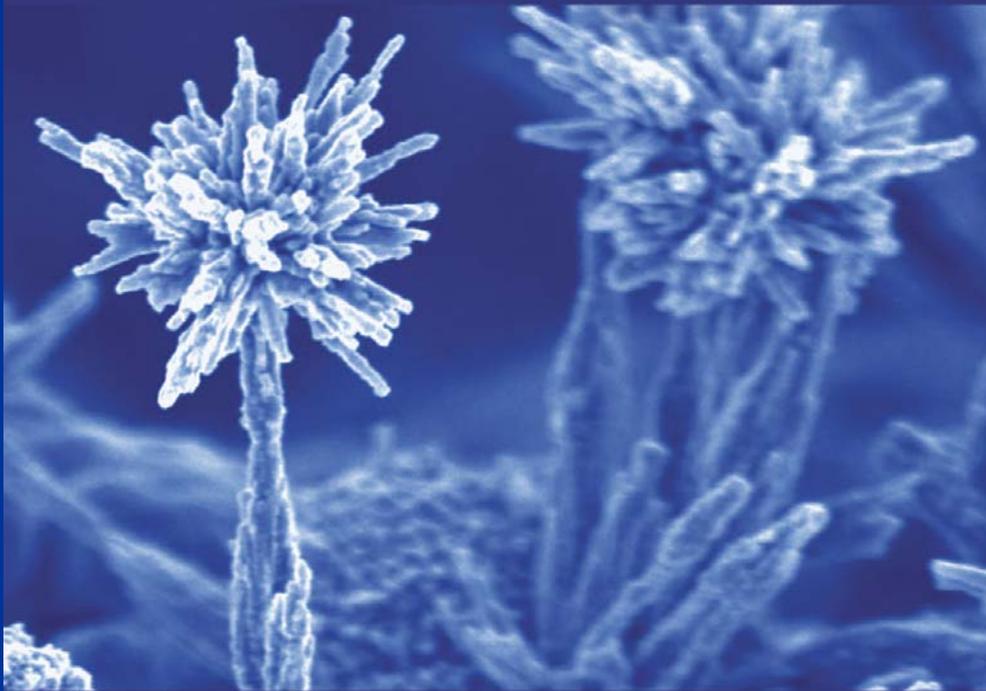
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Draft for Public Comment

Approaches to Safe Nanotechnology:

An Information Exchange with NIOSH



DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health



NIOSH

Recommendations from NIOSH

- Summary of issues
- Approaches to consider
- Basic Guidance
- Updated as new information comes on-line
- Input requested

www.cdc.gov/niosh/topics/nanotech



- Research progress in 10 key areas
- Continuing project plans
- Opportunities for collaboration

VOLUNTEER PARTNERS NEEDED FOR THE NIOSH NANOTECHNOLOGY FIELD RESEARCH EFFORT

NIOSH has a field research team available to visit and assess processes involving research, production, and use of nanomaterials. The team will characterize materials, processes, potential worker exposures, work practices, and control procedures. Information and recommendations will be shared with the business partner and will be used by NIOSH to update the guidance that appears on the Nanotechnology Topic Page. There is no cost to participate.

If your organization is interested in volunteering to participate, please contact us.

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Thank You

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