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# ISO/TC 229 Nanotechnologies Standardization Needs Survey

Public Meeting on Research Needs Related to the Environmental,  
Health, and Safety Aspects of Engineered Nanoscale Materials

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Vladimir Murashov, Ph.D.  
US Expert to ISO/TC229 WG3

*"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."*

# Background

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- **Consensus:** The views of all interests are taken into account: manufacturers, vendors and users, consumer groups, testing laboratories, governments, engineering professions and research organizations.
- **Industry-wide:** Global solutions to satisfy industries and customers worldwide.
- **Voluntary:** International standardization is market-driven and therefore based on voluntary involvement of all interests in the market-place.
- **New Work Item Proposals** often based on documents developed by industry, governments, NGOs (including SDO) and put forward by a national member body.
- **Approval** by two-thirds of the ISO members that have participated actively in the standards development process, and by 75% of all members that vote.

# Background (continued)

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- ISO/TC 229 (Nanotechnologies) inaugural meeting on November 9-11, 2005 in London, UK.
- Working Group 1: Terminology and Nomenclature (Canada)
- Working Group 2: Metrology and Characterization (Japan)
- Working Group 3: Health, Safety and the Environment (USA).
- 3<sup>rd</sup> plenary meeting on December 7, 2006 in Seoul, Korea
  - Standardization Needs Survey.

# Standardization Needs Survey: Overview

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- 14 P members + 1 internal liaison responded.
- Each selection (timescale – 1-3 years, 3-8 years and >8 years - and priority – high, medium, low, not needed) for every topic was awarded one mark and the topic selections from all members were individually totalled.
- Topics were sorted and ordered according to the “scores” for high priority, followed by timescale.
- A total of 233 standardization needs were identified, including 21 in the area of materials specifications (new working group needed?) representing 77 materials and 8 additional classes of materials.
- Eliminating topics that <5 members identified as high priority leaves 111 topics including 5 materials specifications representing 40 separate materials and four “classes” of materials (2 each of “compound particles” and “functionalized particles”).

# Standardization Needs Survey: Overview (Continued)

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- Of the 111 topics that 5 or more members consider of high priority:
  - 2 are relevant to WG1
  - 55 are relevant to WG2
  - **31 are relevant to WG3**
  - 5 are relevant to a new WG for materials specifications
  - 18 are relevant to other TCs (TC 24, TC 201, TC 202 and TC 213).
- Of these 111, 28 have been identified by more members as being required on a 3-8 year timescale than on a 1-3 year timescale:
  - 12 are relevant to WG2
  - **15 are relevant to WG3**
  - 1 is relevant to a new WG for materials specifications.

# Nanoparticulates and other nanoscale materials - 1 - 3 years

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Standard Methods for Toxicological Screening of Nanomaterials

Standard Methods for Determining Relative Toxicity/Hazard Potential of Nanomaterials

Standard Guide for Controlling Occupational Exposures to Nanomaterials

Standard Template for Material Safety Data Sheet (MSDS) for Products Containing Nanomaterials

Nanomaterial Product Information For Use In Determining Health & Safety Precautions

Standard Method for Selection of Personal Protective Equipment (PPE) for Use With Nanomaterials

Standard method for determining physical hazards of nanomaterials (i.e. explosive, flammability, water reactivity, etc.)

Standard Method to Establish Occupational Exposure Limits for Nanomaterials

Standard Methods to Assess Exposure to Nanomaterials During Consumer Product Use

Standard methods for determining nanoparticle concentrations in air and water

# Nanoparticulates and other nanoscale materials - 3 - 8 years

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Standard Methods for Measuring Personal Exposure to Nanomaterials in Occupational Settings

Standard Method for Performing Risk Assessments on Use of Nanomaterials

Product Safety Standards for Consumer Products Containing Nanomaterials

Standard Methods to Determine Environmental Toxicity of Nanomaterials

Standard Method to Assess Product Degradation and Release of Nanomaterials from Consumer Products

Standard Method to Develop Nanomaterial Product Labelling

Standard Method to Assess Emissions from Handling, or Machining of Nanomaterial Containing Products

Standard Method for Reporting Toxicity of Nanomaterials in Consumer Products

Standard Methods to Determine Exposure to Nanomaterials in Food

Methodology to Determine effectiveness of Filtration Media against Nanomaterials

Standard Method of Life Cycle Analysis for Consumer Products Containing Nanomaterials

Standard test methods for measurement of nanomaterials in manufacturing discharges

# Nanotubes

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## **protocols for:**

inhalation testing

toxicology testing

safe handling

exposure determination – ambient air

exposure determination – water

safe disposal including destruction

eco-toxicology testing (3-8 years)

exposure determination - food (3-8 years)

exposure determination - cosmetics and other skin contact products (3-8 years)



**Basic Characterization**



**Basic Metrology**



**Toxicological Testing Methods**

**Particle Measurement Techniques**



**Toxicity Rating / Hazard Rating**

**Exposure Assessment Methods**



**Risk Assessment**

Toxicity x Exposure = Risk



**Exposure or Environmental  
Controls Based on Risk**



**Best Practices**

# Technical Research Needed to Develop HSE Nanotechnology Standards

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## **Instrumentation, Metrology and Analytical Methods**

- Develop methods for detecting nanomaterials in biological matrices, the environment and the workplace
- Develop methods for standardizing assessment of particle size and size distribution
- Develop methods and standardized tools for assessing nanomaterial shape, structure and surface area.

# Technical Research Needed to Develop HSE Nanotechnology Standards

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## **Nanomaterials and Human Health**

- Identify or develop appropriate *in vitro* and *in vivo* assays/models to predict *in vivo* human responses to nanomaterials exposure
- Develop methods to quantify and characterize exposure to nanomaterials
- Develop methods to quantify and characterize nanomaterials in biological matrices.

# Technical Research Needed to Develop HSE Nanotechnology Standards

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## **Nanomaterials and the Environment**

- Evaluate testing schemes for ecological effects
- Understand exposure potential in aquatic systems
- Develop standardized sampling methods relevant to nanomaterials in the environment

# Technical Research Needed to Develop HSE Nanotechnology Standards

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## **Health and Environmental Surveillance**

- Understand workplace processes and factors that determine exposure to nanomaterials
- Quantify nanomaterial exposure to the general population from consumer products, industrial processes, and products containing nanomaterials.
- Develop methods for measuring nanomaterial exposures in environmental matrices

# Technical Research Needed to Develop HSE Nanotechnology Standards

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## **Risk Management Methods**

- Evaluate the appropriateness and effectiveness of current risk management approaches for identifying those nanomaterials with the greatest potential risks
- Improve understanding of the unique challenges for process design and engineering control systems, applied to engineered nanoscale materials in air
- Understand the efficacies of PPE against nanomaterials as exposure and hazard information evolve

# Technical Research Needed to Develop HSE Nanotechnology Standards

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## **Risk Management Methods (Continued)**

- Where wastes of concern are being produced, determine the best methods for waste disposal
- Understand factors influencing flammability and reactivity
- Understand how Life Cycle Analysis may be suitable and adaptable to engineered nanomaterials

# Acknowledgements

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