



Intergovernmental Forum on Chemical  
Safety  
*Global Partnerships for Chemical Safety*

*Contributing to the 2020 Goal  
Sixth session – Forum VI*

# Nanotechnology and Manufactured Nanomaterials: Opportunities and Challenges

## IFCS Forum VI

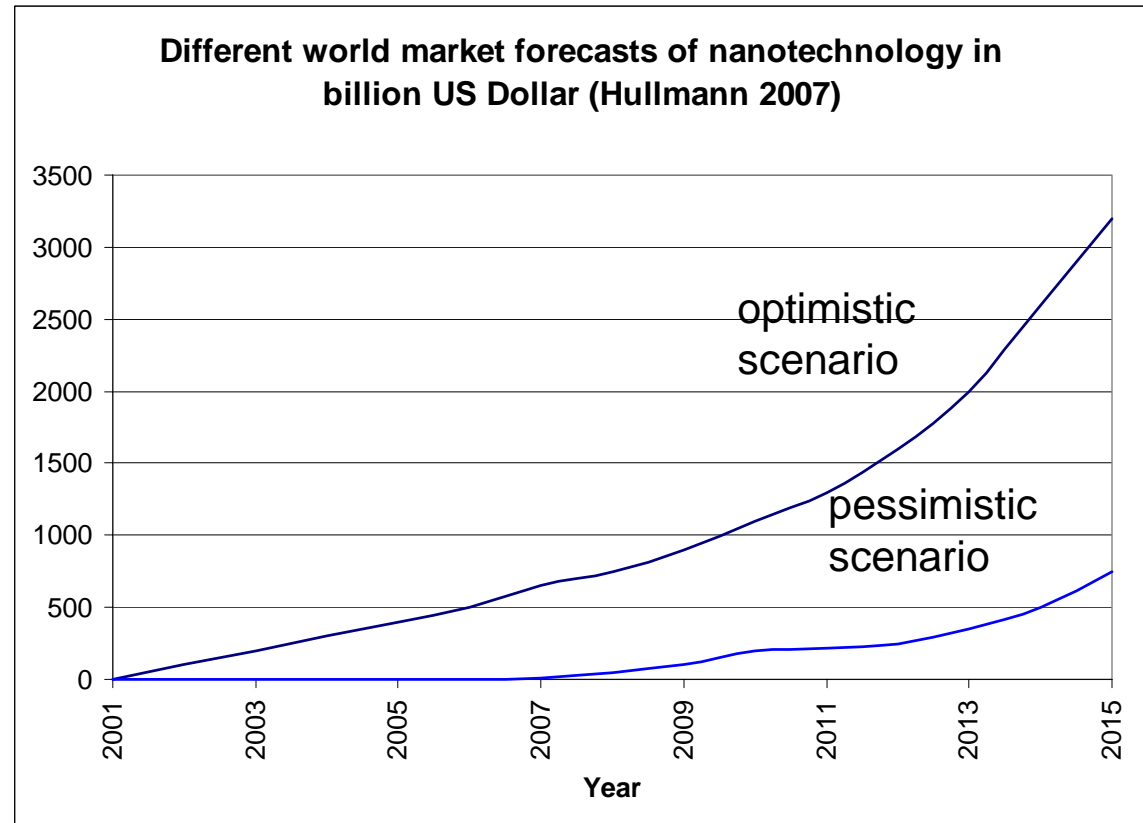
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Georg Karlaganis  
Federal Office for the Environment FOEN  
Switzerland

# High Expectations

Nanotechnology is an enabling technology that is expected to result in major changes across many industry sectors

Estimations on the economic potential of the new technology are high



First generation products are already on the market such as paints, coatings and cosmetics. More products such as pharmaceuticals, diagnostics and applications in energy storage and production are in development

Further generations of nano-enabled products based on active nanoscale structures and nanosystems will be developed in the future

# Nanotech's Potential for Sustainable Development (I)

## Water

Access to clean water is an urgent and growing need in many countries. Nanotechnology could allow for

- physical filters with nanoscale porous membranes: desalination of ocean water, removal of contaminants
- nanoscale biofilters remove bacteria and viruses
- removal of contaminants with Fe-nanoparticles: magnetic iron oxide nanoparticles strongly bind arsenic in drinking water. The arsenic can afterwards be removed using magnets

# Nanotech's Potential for Sustainable Development (II)

## Energy

The world's high consumption of fossil fuels causes many ecological and social problems. There is a growing need for renewable energy sources. Developments in Nanotechnology could lead to

- cheaper **photovoltaic cells** (thin film cells, organic photovoltaic cells)
- novel **hydrogen storage systems**
- new **fuel cell** catalyst materials

# Health and Environmental Risks of Nanomaterials

- Various studies have shown:
  - Unbound particles can be inhaled and enter the blood-stream via the lungs
  - Some manufactured nanoparticles can be damaging to cells and be harmful to organisms
  - There is a need for data on toxicity, release, environmental behavior.
- No conclusive requirements for the safety of manufactured nanomaterials can yet be formulated
- There is need for validated toxicological, ecotoxicological and analytical methods to test and measure nanomaterials.  
International Organizations play a key role (e.g. OECD, ISO)

# Ethical Considerations

- The precautionary approach needs to be discussed in nanotechnology (Which conditions must be met for adoption of precautionary measures?)
- Other priority issues:
  - common understanding on socially acceptable or unacceptable risks
  - social and global distribution of benefits and risks
  - ownership/patent issues

# Social Utility of Nanotechnology

Technological innovations such as nanotechnology can play an important role in more efficient use of natural resources and the protection of human health

## However

Factors such as availability of alternative solutions, side effects on economy and potential risks (e.g. occupational health and safety standards, disposal infrastructure) needs to be taken into account

# Communication and Public Dialogue

- Information on opportunities, risks, ethical issues and social impacts of nanotechnology and nanomaterials is important for public opinion making
- Communication should reflect the current state of social, scientific and political knowledge and of public engagement
- The involvement of industry, authorities and the public in the debate on nanotechnology must be an integral part of technical development

# Activities of International Organizations

- OECD Working Party on Manufactured Nanomaterials (WPMN). Aim: promote human health and environmental safety implications of manufactured nanomaterials in order to assist in their safe development (8 projects)
- OECD Working Party on Nanotechnology (WPN): Aim: look at potential benefits of nanotechnology for society
- ISO Technical Committee 299. Three working groups have been established: terminology and nomenclature; measurement and characterization; health, safety and environmental aspects of nanotechnology
- UNESCO Ethics of Science and Technology Programme. Aim: promote consideration of science and technology in an ethical framework by initiating and supporting the process democratic norm building

# ISO TC 229 – Nanotechnologies

## Standards development

**JWG\* 1**  
**Terminology and Nomenclature**  
 (Convened by Canada)

- **ISO/TS 27687: Terminology and definitions for nanoparticles – Published August 2008**
- Terminologies under development:
  - Framework and core terms
  - Carbon nanomaterials
  - Nanostructured materials
  - Nanoscale measurement and instrumentation
  - The bio-nano interface.
- **New areas under ballot:**
  - Medical, health and personal care
- applications of nano;
- Nanomanufacturing
- Committee resource document:
  - Outline of Nanomaterials Classification ("Nano tree")

\*JWG – Joint Work Group (with IEC TC 113)

**Other structures:**

**Task Groups on:**

- Nanotechnology and sustainability
- Business Planning
- Material specifications

**Study Groups on:**

- Metrology
- Measurement and characterization strategy

**JWG 2**  
**Measurement and characterization**  
 (Convened by Japan)

- Characterization of single walled carbon nanotubes by:
  - Transmission Electron Microscopy;
  - Scanning Electron Microscopy and Energy Dispersive X-ray Analysis;
  - UV-Vis-NIR absorption spectroscopy;
  - NIR-Photoluminescence (NIR-PL)
- Spectroscopy
- Thermo Gravimetric Analysis;
- Evolved Gas Analysis-Gas Chromatograph Mass Spectrometry (EGA-GCMS);
- Raman Spectroscopy;
- Characterization of Multi-Walled Carbon Nanotubes;
- Meso-scopic shape factors of multiwalled carbon nanotubes;
- Determination of Nanoparticle Content in Nanomaterials by Generation of Aerosols;
- Joint developments with CEN (CEN lead) -Guides to:
  - nanoparticle measurement
  - nano-tribology measurements

**TC 229 has:**

- 30 "P" members
- 10 "O" members and
- 20 liaison members

Nanotechnologies Liaison Coordination Group

**WG 3**  
**Health, Safety and Environment**  
 (Convened by USA)

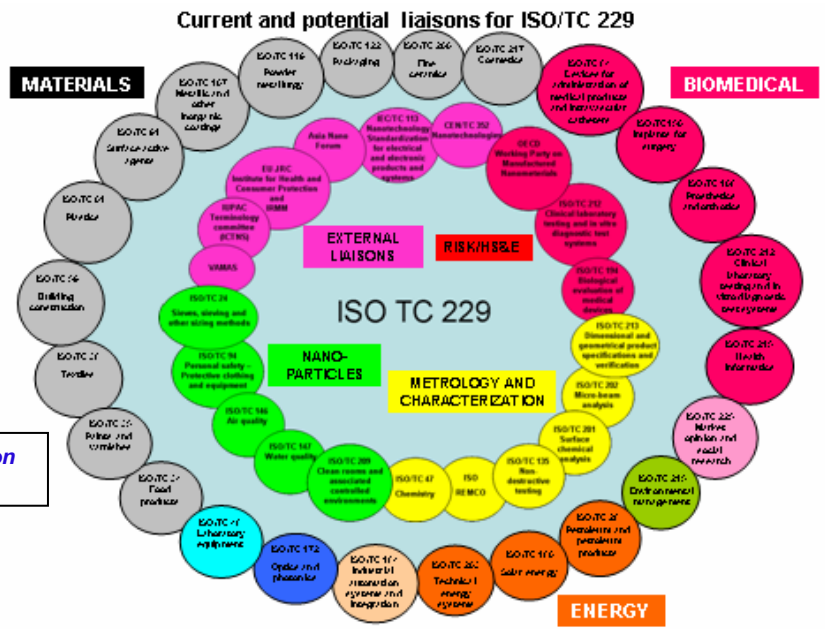
- **ISO/TR: Safe Practices in Occupational Settings Relevant to Nanotechnologies – completed**
- **Endotoxin test on nanomaterial samples for in vitro systems; Standards for Generation and characterization of Metal Nanoparticles for inhalation toxicity testing;**
- **Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment.**
- **New work under ballot:**
  - Guide to safe handling and disposal of manufactured nanomaterials

**WG 4**  
**Material Specification**  
 (Convened by China)

- **Guide to specifying manufactured nanomaterials**
- **Specifications for Titanium Dioxide and Calcium Carbonate.**

**Challenges:**

- Diversity of c
- impacted by
- to nanotech
- Global impac
- Speed of dev
- Coordination
- harmonizati
- standards d
- stakeholders



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# Activities of Non-Governmental Organizations

- NGO's and its networks play an important role in supporting governmental actions, distribution of knowledge and facilitating democratic participation in decision-making regarding new technologies, including nanotechnology
- Some NGO's work globally to carry out education and outreach to professionals and the general public. Further they provide technical support in policy development for countries in all stages of economic development

## Conclusion

- Nanotechnology and nanomaterials offer opportunities but create although new risks
- We need to explore both in parallel
- As a result of nanotechnology's rapid growth, communication and discussion it is important
- All stakeholders should be engage in discussions to identify and address policy issues (e.g. health, safety, moral, ethical, societal, legal and social utility concerns)

## Objective of the Plenary Session:

The objective is to exchange information in order to help raise the awareness of participants to the potential new opportunities, the new challenges and the new risks posed by nanotechnology.

The meeting will provide a forum to share information on known and emerging issues, on the work of the OECD, ISO and UNESCO on nanotechnology and to foster an understanding of issues (applications and implications).

The Forum will also be an opportunity to discuss the potential contributions of nanotechnology to sustainable development and pollution prevention, and to discuss how to achieve an equitable distribution of benefits and risks and role of responsible stewardship in addressing nanotechnology.

# The Dakar Declaration on Nanotechnology and Manufactured Nanomaterials (Proposal)

The IFCS Forum recommends actions, taking into account the special situation of developing countries and countries in economic in transition, including international cooperation for capacity building and technology transfer

These actions include:

- Encourage governments and industry to consider the application of the precautionary approach in the development of nanotechnology and manufactured nanomaterials
- Invite governments, international organizations and nongovernmental organizations to consider the possibility of developing a Global Code of Conduct