EU-U.S. Joint Workshop: European Research Strategies on Nanotechnologies

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Horizon 2020

- Horizon 2020 is the financial instrument implementing the [Innovation Union](#), a [Europe 2020](#) flagship initiative to promote and secure Europe's global competitiveness
- Nanotechnology included in the [Competitive Industries of the Horizon 2020](#) proposal;
- Horizon 2020 will have a strong focus on developing European industrial capabilities in [Key Enabling Technologies (KETs)](#). Nanotechnology identified as one of the six Key Enabling Technologies
Horizon 2020 & Nanotechnologies

- *Horizon 2020* emphasizes the safety of NT and its applications with a focus on the safe use of knowledge in the assessment of impacts (safety/risks) of ENM on human health and the environment.

- *Horizon 2020* also aims at promoting science-based governance of nanotechnologies, and providing scientific tools and forums for hazard, exposure and risk assessment and management of ENM considering LCA of ENM.

- **Timeline for Horizon 2020:**
  - **1/1/2014:** *Horizon 2020* would start; launch of first calls
EU RTD investment in nanosafety research in FPs in total
(source: EC)

- The EC has funded nanosafety projects since the 5th EU Framework Programme (1998-2002), with a regular budget increase.
- Until 2012, 46 nanosafety projects have been funded, representing a total EU investment of 138 M€ (corresponding to total projects costs of 185 M€).

In addition to FP, Member States annual funding efforts have been recently estimated about 70 M€; hence the European (EU + EU MS) nanosafety funding exceeds 100 M€ annually
EU RTD investment in nanosafety research in FP7
(source: EC)

- 2007: € 25 M
- 2008: € 14 M
- 2009: € 14 M
- 2010: € 29 M
- 2011: € 21 M
- 2012: € 35 M
- 2013: € 30 M (estimated)

Total FP7 (estimate): 168 M€
EU funding
The Nanosafety Cluster
a projects and scientists forum

- To maximise the synergies between the existing FP7 projects on nanosafety.
- To improve the coherence of nanosafety studies.
- To be a forum for dialogue on R&D activities in Europe.
- To facilitate the formation of a consensus on nanosafety.
- To provide all with appropriate knowledge on the risks of ENM for human health and the environment.
- To produce **Strategic Research Agenda for Nanosafety**
Strategic Research Agenda for NanoSafety

• Nanosafety Cluster: contribution to the preparation and implementation of the new Framework Programme, *Horizon 2020*

• Consolidation of the status of nanosafety research in Europe and globally, and to strengthen the EU leadership

• Cluster work, produced by the nanosafety research community – creates a common interface and interests with the nanotechnology community

• Working document: updated every 4-5 years as more knowledge becomes available

• Implementation plan to follow - concerted efforts are needed: integration of national efforts and global cooperation

• Contributes to prerequisites of reliable and transparent risk management
Nanosafety for Innovation and Sustainability

Predicting of nanospecific risks

Research on Process Level
- Material identity
- Transformation & Exposure
- Hazard mechanisms
- Risk prediction tools

Research Testing and Regulation

New Technologies and Products
- Facilitating Innovation

All subaims shall feed to the overall aims of predicting and controlling possible nanospecific risks.
Providing the environment for safe and sustainable use of nanotechnologies

- Regulation
- Innovation
- Infrastructure
- Collaboration
- Communication

Material → Exposure → Hazard → Risk

Research priorities and road map
Theme 1. Material identity

Research priorities:

• Develop systematic sets of NMs with properties varied in a stepwise manner that allow assessment of significance of each property for toxicity

• Describe “reference” states and agreed media compositions to enable identification of biomarkers of impact and move towards predictive toxicity assessment

• Understand the longer term fate of particles following interaction with living systems and the role of the corona in this (e.g. corona may delay toxicity / dissolution of NMs etc.)
Theme 2. Exposure, Transformation and the Lyfe Cycle of Engineered Nanomaterials

Nanomaterial life-cycle and release

Nanomaterials from release to exposure
Exposure models

Development, set up and validation of integrated release to exposure models for ENM in workplaces, consumer applications and the environment.

• Mechanistic understanding of processes determining the release of ENM
  Research priorities:
  • Process knowledge to allow the set-up of realistic laboratory simulations
  • Database on emission (per time) and release (per material unit) factors

• Understanding the transformation and transport of nanoobjects
  Research priorities:
  • Gain process level knowledge on environmental mobility and transformations for computer simulation of environmental behaviour
  • Effects of ageing on nanoobjects, including e.g. changes in shape, coatings, surface morphology and chemistry induced by environmental factors (linked to hazard assessment)
Exposure models

• Understanding and mimicking workplace, consumer and environmental exposure

Research priorities:
  • Comprehensive, harmonized exposure inventories, which allow for the construction of - and serve as a control for - exposure models
  • Evaluation of exposure scenario models by comparisons with real world measurements
Theme 3. Hazard mechanisms

Concern-driven Testing

Identification of “Nanomaterial”
- Nanomaterial Definition

Identification of “Nanomaterial of Concern”
- Solubility / Dispersability
- Use, Release, Exposure

Identification of “concerns”
- General concerns
- Exposure route
- Properties of bulk material and modifications of the NM

Identification of “concerns”
- Biopersistence
- ADCE
- Early biological effects
- Apical biological effects

Targeted Testing
Hazard Mechanisms

Recommendations:
Research priorities:

• Fundamental research on biological and chemical interactions of ENM – important underlying questions
• ‘Blue skies’ research where new ideas and developments can be tested
Theme 4. risk prediction tools

• Risk Assessment & Management: Development of integrated risk assessment and decision frameworks
  
  Research priorities:
  • Integration of LCA into RA and RA into decision /risk governance
  • Integration of safe-by-design, closed systems and green NT into the new ENM and their applications

• Risk Governance: Development of NT specific Risk Governance framework for next generation nanomaterials
  
  Research priorities:
  • Development of guidance on “concern” assessment, evaluation and management
  • Development of most effective risk communication strategies
Risk prediction tools

• Development of Nano QSAR Data base:
  Research priorities:
  • Infrastructure
  • Ontologies

• Harmonized Framework for Human Health Studies/ Epidemiology:
  - Research priorities:
  • Quantitative exposure assessment
  • Biological markers of short/long term effect
  • Epidemiological designs and pilot studies
Knowledge reduces uncertainty

Risks, benefits–time relationship

(Source: M.R. Wiesner, J.-Y. Bottero / C. R. Physique, 2011)
NANOfutures, European Technology Integrating and Innovation Platform on Nanotechnology

• Integrated Research and Industrial Roadmap for European Nanotechnology - open working document:
  • addresses cross-sectorial needs;
  • aims at reducing fragmentation, aligning research and innovation efforts for the competitiveness of European NT;
  • aims at meeting grand societal and economical challenges through encouraging sustainability in the nano-enabled products

(http://www.nanofutures.info/sites/default/files/NANOfutures_Roadmap%20July%202012_0.pdf)
Thank You!