Overview of completed and ongoing activities in the field: Safety and Risks of Nanotechnology

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Introduction: Nano Safety and Risks

The implementation of nanotechnology poses **unknown risks** which are difficult to assess with respect to their impact on

- The environment
- Human health
- Ethical, legal and societal issues

Main source of unknowns:

Material properties **can** change on the **nano scale**!

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Impact on the environment

- Nanomaterials are already released into the environment
- Because of their small dimensions nanomaterials can be largely distributed within the environment in water streams, soil and air
- Like other chemicals nanomaterials can accumulate in the environment, but their effects are still unknown
- The persistence or degradation of nanomaterials in the environment is still unclear and can have enormous impacts

Impact on human health

Nanomaterials can have a huge impact on human health:

- they can be absorbed in many ways by the human body (skin, lung, gastro-intestinal tract)
- They are distributed within the whole organism via blood and lymphatic systems
- They accumulate in organs (e.g. brain, kidney, liver)
- Because of their small size they can reach every place in the body

Ethical, legal and societal implications

- Public perception of nanotechnology is a crucial determinant for its successful establishment as a future driving force in the economies worldwide
- As nanomaterials have different properties compared to the bulk materials new legislation and regulation will be necessary on an international level
- Ideas like toxic particles that can go everywhere and self-replicating nanorobots can produce fear and uncertainty in the broad public and can lead to severe societal problems

Approach

1. The current State-of-the-Art about safety and risks of nanotechnology is assessed by
    - collecting key publications of both proponents and critics of nanotechnology
    - summarizing international programs and projects supporting research on nano risks
    - identifying key players in the field of risk assessment of nanotechnology are listed
    - Organizing events with key players and stakeholders

Approach

2. The need for actions is analysed and specified from the data obtained

3. Recommendations for immediate actions to be taken are elaborated

Some Key Players

- Borm, Paul J.A., The Netherlands
- Chen, H.H., Taiwan
- Colvin, Vicki, USA
- ETC Group, Canada
- Gehr, Peter, Switzerland
- Howard, Vyvyan, UK
- Oberdörster, Günther, USA
- Oberdörster, Eva, USA
- Welland, Marc, UK

Selected Key Publications

- ETC Group (Action Group on Erosion, Technology and Concentration):
  Nano's Troubled Waters
  April 2004, http://www.etcgroup.org/search.asp?slice=recent

- Günther Oberdörster:
  Pulmonary effects of inhaled ultrafine particles
  November 2000, Int. Arch. Occup. Environ. Health. 74(1): pp 1-8

- Mihail C. Roco:
  Societal Implications of Nanoscience and Nanotechnology
  March 2001, http://www.nsf.gov/home/crssprgm/nano/nsfnnireports.htm

- Vicki Colvin:
  The potential environmental impact of engineered nanomaterials
  October 2003, Nature Biotechnology, Volume 21, Number 10, pp1166-1170

- Vicki Colvin:
  The Differential Cytotoxicity of Water-Soluble Fullerenes
  November 2004, Nano Lett. (2004) **4** (10), 1881 - 1887

Selected EU Projects Supporting Research on Nano Risks

Projects:

- NANO-PATHOLOGY
- NANODERM
- NANOSAFE I+II
- NANOLOGUE
- NANODIALOGUE

CA, SSA:

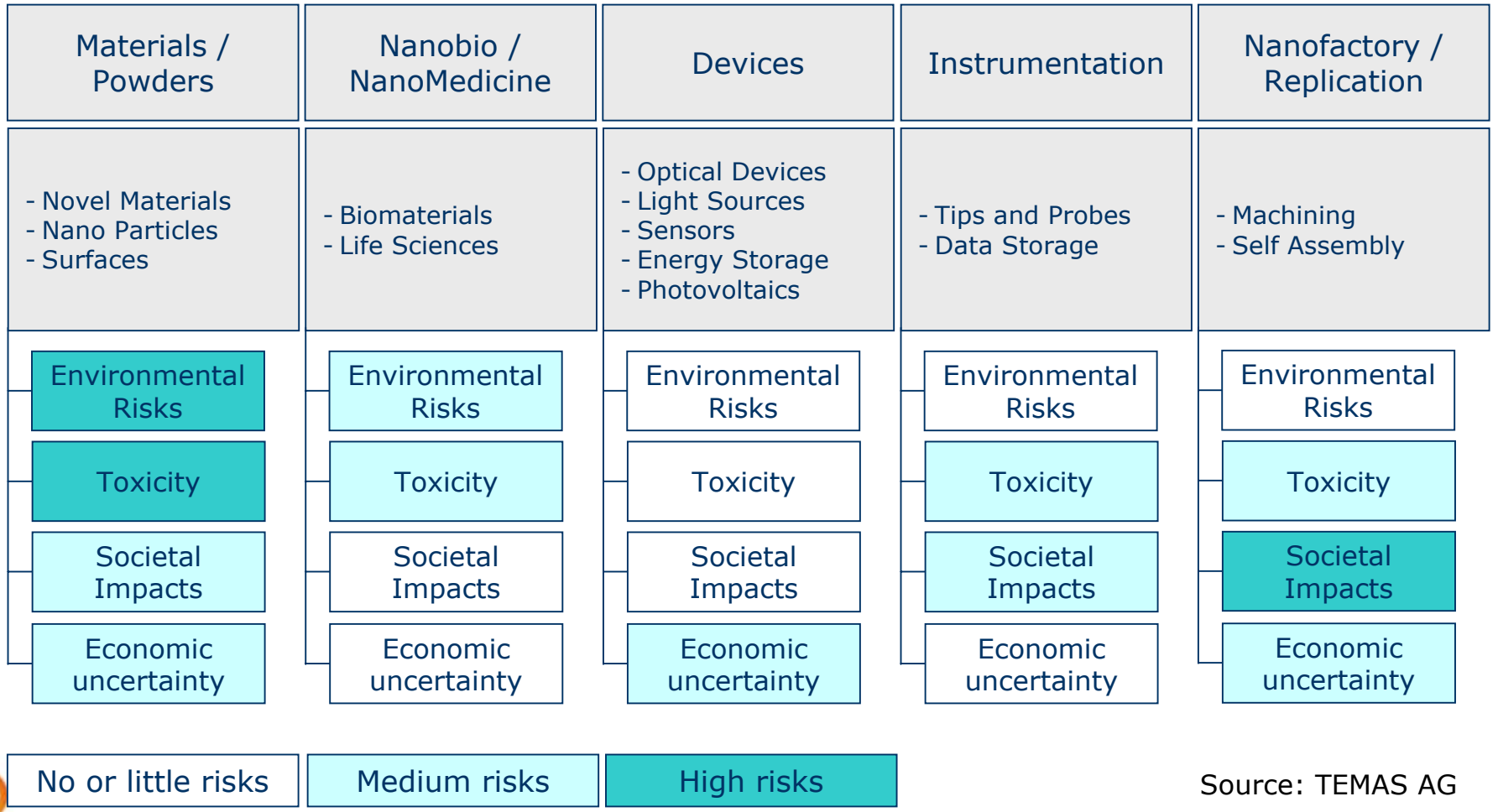
- IMPART
- NANOTOX

Need for Actions

Conclusive data on the health and environmental effects of nanomaterials will be a key in building the public's trust for nanotechnology

- Gaps in the knowledge about health risks and environmental consequences of nanotechnology must be filled by high level research
- Ongoing and future research must be restructured to address safety issues of nanotechnology
- Research efforts must be coordinated
- Adequate research funding must be provided
- Dialogue with the public must be enhanced and moderated
- Risk assessment must be made according to the different fields of nanotechnology on programme as well as on project level

Different fields of nanotechnology and inherent risks



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Recommendations for Immediate Implementation

Evaluation and Recommendations,
active Accompaniment and Coaching of Projects:

- Give the applicants clear advice to handle S&R issues
- Elaboration of solution plans for known and unexpected risks
- Research of latest and updated literature about nano risks
- Regular reviewing of obtained results about nano risks
- Aiding in the publication of the results

Example: Austrian Nano Initiative, Assessment of Safety and Risk issues at project level

Procedure:

a. Verification of

- Impact on the environment
- Impact on human health
- Ethical, legal and societal implications

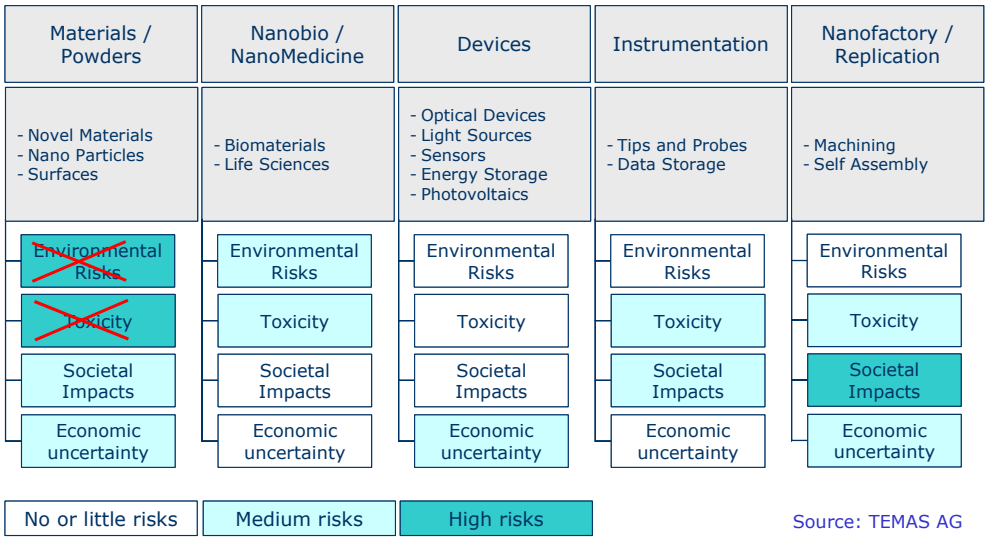
b. Specific recommendations for actions to be taken

Evaluation Safety and Risks of Nanotechnologies

Example of an S&R evaluation form

Cluster:
Project No. | Project Acronym

1. Risk field (Classification)



Source: TEMAS AG

2. Recommendations

Before project start a statement should be given, in which the proposed ways to store and dispose materials containing metal nano clusters or metallic nanocrystals are described.

A review with experts 6 months after project start is recommended to discuss and evaluate the measures taken to address possible environmental hazards associated with the project.

In addition to these specific issues we recommend to take the general measures given in the document General_Recommendations.pdf, which are the same for all possible risk issues.

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Date:
Signature:

Thank you for your attention

More information about Nano S+R are available at
http://www.temas.ch / current topics

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Recommendations of the example

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