Nanotechnology Industries Association – NIA

…the sector-independent, responsible voice for the industrial nanotechnologies supply chains…

…the only global industry-focused trade association for the nanotechnology sector…

…proactively supports the on-going innovation and commercialisation of the next generation of technologies and promotes their safe and reliable advancement…

…cooperates with regulators and stakeholders on national, European and international levels so as to secure a publically and regulatory supportive environment for the continuing advancement and establishment of nanotechnologies…
Key Enabling Technology

Nanotechnology

green technology
automotive
medicine
construction
cosmetics
agriculture
electronics
communication
material
energy
packaging
transportation
sensors
paints
textile
instrumentation
health care
food
Information technology

Fate and Ecotoxicity of Nanoparticles in the Environment
7th SETAC Europe Special Science Symposium, 2-3 October 2013, Brussels
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… the message nine years ago:

- three papers on carbon nanotube safety, but no corresponding results:
  - One found evidence of inflammation
  - One had a very low LD50
  - One had a very high LD50 (… and said in the small print that this was due to suffocation of the test animals)

- No standardised characterisation of the nanomaterial applied (neither before nor during the tests)
- No agreed (let alone standardised):
  - Measurement methods
  - Dosimetry
Recent scientific papers suggests that a ‘nanospecific toxicity’ is not present

Focus on risk assessment process; avoid additional precautionary risk management measures
Assessment methods

- Assessment of hazards and risks based on the testing methods and guidelines for conventional chemicals that OECD WPMN has concluded are also applicable to nanomaterials.

- Environmental risk assessment of nanomaterials does not start from scratch. Experience exist!
Challenges for using the EC nanomaterial definition

• Need suitable standards for calibration and validation purposes

• JRC is working to release a fully characterised aqueous dispersion containing a known number-size distribution of silver nanoparticles

• Measurement techniques not fully identified and or/standardised and validated

• Measurement methods need to be specific for the nanomaterial and matrix in question

• Sample (pre-)treatment is complex

[JRC Reference Reports: Requirements on measurements for the implementation of the European Commission definition of the term nanomaterial, Linsinger et al (September 2012)]
Entry of nanomaterials to the environment from manufacturing and waste

1. Waste produced during manufacturing of nanomaterials and nanotechnology-derived products

2. Waste generated during product use (e.g. rinse off, degradation, abrasion, grinding or cutting of products containing nanomaterials or the nanoproduct itself)

2. Waste from the waste handling process (e.g. incineration, shredding for recycling, sewage sludge used in agriculture)
Nanowaste management

- Nanowaste management is not fundamentally different from conventional chemical waste management
  a) Reduction in the amount of waste produced
  b) Reuse of the material
  c) Recycling
  d) Resource recovery
  e) Energy generation
  f) Disposal (landfill)

- Nanomaterials does not represent a new type of waste category in such that current methods dealing with waste would be inappropriate to the handling of nanowaste
Nanomaterial production and waste process

Manufacturing processes of NMs and non-NMs

NM containing Product

Reuse

Recycling

Production waste containing NM

Solid waste

Liquid waste

On-site treatment

Environmental nanomaterial entries

Solid waste → Landfill

Solid waste → Incineration

Liquid waste → MWWT

Recovery

Sludge → Incineration
Waste processes and environmental considerations

• Presence of nanomaterials in waste streams
  – Reactivity, aggregation/agglomeration status? Persistence, bioaccumulation, toxicity at realistic exposures
  – Impact of nanomaterial properties on waste treatment processes? (composition, form, shape, surface charge, solubility, surface functionality…)

• Reuse, recycling, recovery – development and optimisation of processes

• Incineration – generation of incidental nanomaterials irrespective of size/composition of input materials
Environmental considerations

- Fate of nanomaterials once they are in the environment?
  - Preference for specific sinks? Air, water, sediment, soil?
  - What properties drives the fate?
- Environmental transport processes of nanomaterials
- Trophic transfer and biomagnification
- Identification and verification of relevant indicator species
- Relevant endpoints
- Impact of aging on nanomaterials
- Long time effects of nanomaterials in the environment

However... not nanospecific...
Industry needs – Continued harmonisation

- Development of globally harmonised hazard and risk assessment procedures and approaches

- Continue information and knowledge gathering and generation on ecotoxicity and environmental behaviour of nanomaterials

- Evaluation, validation, standardisation of methods to measure nanomaterials in the environment

- Metrology and dosimetry
Issues for industry

- Relevant, reliable, reproducible and realistic methods
  - For hazard, exposure, fate

- *In vitro* to *in vivo* extrapolation

- Resource optimisation – time, cost

- Methods that cover broad applications
  - Simplification of worst case scenarios

- Guidance, decision trees
Industry considerations

• Focus on realistic environmental exposures and concentrations

• Dissolution kinetics for soluble metals – bulk, ionic, metallic form

• Stability of pristine particles, aggregates/agglomerates under realistic conditions

• Background levels of nanomaterials in the environment

• Is there a nanospecific effect?
Fundamental aspects to consider for testing methods

- OECD Guidance on sample preparation and dosimetry for the safety testing of manufactured nanomaterials (December 2012). Update when appropriate.
  

- Preparation of test solutions
  - Stock/stem solutions, exposure solutions (stability)
  - Aim for solutions that can be used in several types of testing (aquatic/soil/sediment)
  - Measurement of mass and surface area, ion release
  - Assessment of bioavailable fraction
Examples of test guidelines

- Assess applicability of available guidelines and if relevant, provide nanorelevant modifications

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Industry needs for regulatory purposes

- Tiered methods, test batteries
- Modelling
- Development of alternative methods, their validation, interpretation and standardisation
- Consideration if there is a need for particle number size distribution data
- Guidance
- Development of ranking/grouping/categorization for testing
  - Based on materials
  - Based on solubility/dissolution
- Read-across
Industry activities

- Industry is actively performing safety research, and participating in public-private partnerships and in EU funded research projects for nanomaterials

- Management of waste streams during processing
- Measurement of nanoparticle emissions at manufacturing plants
- Measurement of emissions from products
Environmental benefits of nanomaterials

- Stronger and longer-lasting materials
- Reduction in amounts of raw materials used
- Nanotechnologies/nanomaterials can result in lower amounts of some waste types being generated
- Nanotechnologies for waste treatment processes (recovery of precious materials, use of filters etc...)
Thank you!

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