Opportunities for Collaboration with the OECD on Nanomaterials' Research

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Overview of Environmental and Health Activities under the OECD Environment Directorate

Programme on the Safety of Manufactured Nanomaterials:

Working Party on Manufactured Nanomaterials (WPMN)

- Established in September, 2006
- Subsidiary body of the Chemicals Committee
- Aims to promote international co-operation in addressing human health and environmental safety aspects of Manufactured Nanomaterials (MNs)
- The WPMN meets every 8-9 months

WPMN Activity Areas

- Safety Testing of a Representative Set of MNs
  - Methods for determining physicochemical properties of MNs
  - Trends in endpoint data
  - Interpretation of data for risk assessment and risk management
- Risk Assessment and Risk Management
  - Prioritization of regulatory risk assessment methodologies
  - Examination of different risk management approaches
  - Assessment of risk management needs from risk assessments
- Alternative Methods in Nanotoxicology
- Exposure Measurement, and Exposure Mitigation
- Voluntary Schemes and Regulatory Programs
- Data Bases on Manufactured Nanomaterials (MNs)
- Environmentally Sustainable Use of MNs
- Test Guidelines and Guidance
- OECD Workshops in support of Above Activities

While there are several potential areas for cooperation, such as the interpretation of the data on a representative set of MNs for risk assessment and assessment of risk management approaches for MN, this talk will focus only on Test Guidelines and Guidance

OECD Nanomaterials' Test Guidelines and Guidance

Test Guidelines and Guidance for Nanomaterials

- **New Nanomaterial Guidance now available:**
  - **Guidance on Sample Preparation and Dosimetry** (OECD ENV/JM/MONO(2012)40; December 2012)

- **Proposed Nanomaterial Guidance & Guidelines:**
  - **Updates to Guidance and Test Guidelines (TGs) for Inhalation Toxicity Testing of Nanomaterials (U.S., in cooperation with the Netherlands)**
  - **Aquatic (& Sediment) Toxicity Testing Guidance (Canada & U.S.)**
  - **Guidance on Assessing the Apparent Accumulation Potential of Nanomaterials (U.K.)**
  - **Decision Tree Guidance Document on Dissolution, Dispersion and Fate Testing in water, soils and sediments (Germany)**
  - **Test Guideline on Dispersion and Dispersion Stability (Germany)**
  - **Test Guideline on Dissolution (U.S.)**
  - **Test Guideline on Nanomaterial Removal from Wastewater (U.S.)**

Inhalation Test Guidance and Guidelines

- **Rationale for Changes:**
  - Need to better understand key lung injury biomarkers, differences in respiratory tract distributions, instrumentation for detection, and need for particle deposition and kinetics for NMs
- **Examples of Proposed Amendments:**
  - Minimum set of BAL Measurements
  - Aerosols with an MMAD of up to 2 um; size and shape confirmation by TEM/SEM; other instrumentation to assess size distribution will be specified
  - Post-administration Observation periods
  - Estimated lung burdens
  - Consider biokinetics for distal organs
  - Consider cardiovascular toxicity, neurotoxicity, and immunotoxicity
  - Consider applying weight-of-evidence approaches
- **Experts involved & Key contact:** Experts from Netherlands, Germany, U.S., Japan, Korea, JRC, and BIAC / Phil Sayre, OPPT (sayre.phil@epa.gov)
- **Timeline:** Approximately One Year
- **Opportunities for Collaboration:** Written revisions of OECD TGs, possibilities for Expert input via a Workshop

Aquatic Toxicity Decision Tree Guidance

- **Rationale for Development:**
  - Current OECD Guidelines may not be adequate when applied to particulate and colloidal NMs
  - Amendments are needed to produce and adequately characterize test media containing NMs
- **Guidance Components, and Evaluation:**
  - Decision Tree approach, with Four Phases:
    - Generation of stock media
    - Generation of exposure media
    - Conduct of the test
    - Data analysis and reporting
  - Possible Laboratory Evaluation of Guidance
- **Key contacts:**
  - Alan Kennedy, U.S. Army Corps of Engineers (Alan.J.Kennedy@usace.army.mil)
  - Greg Goss, University of Alberta (ggoss@ualberta.ca)
  - Steve Diamond, NanoSafe (sdiamond@nanosafeinc.com)
- **Timeline:** Draft Guidance completed in Spring 2015, followed by Laboratory evaluation, and finalization of the draft Guidance in 2016
- **Opportunities for Collaboration**: Drafting of Guidance; Laboratory evaluation

Guidance on Apparent Accumulation Potential of Nanomaterials

- **Rationale for Development:**
  - Current OECD Guidelines (OECD 305) may not be adequate when applied to certain NMs
  - Amendments are needed to address differences in fate and behavior of nanomaterials, relative to traditional chemicals
- **Guidance Components, and Evaluation:**
  - Decision Tree, with tiered approach:
    - Substitute triggers to octanol:water partition coefficient
    - Screening methods prior to *in vivo* testing
    - Dosing via the food, versus the water column
    - Apparent accumulation, versus calculation of a steady state BCF
  - Possible limited Laboratory Evaluation of Guidance
- **Key contacts**:
  - Richard Handy - University of Plymouth (R.Handy@plymouth.ac.uk)
  - Jukka Ahtiainen - Finnish Safety & Chemicals Agency (jukka.ahtiainen@tukes.fi)
  - José María Navas - Spanish National Institute for Agricultural, Food Research, and Technology (jmnavas@inia.es)
- **Timeline:** Draft guidance completed in 2014, followed by possible laboratory evaluation over a 6-12 month period.
- **Opportunities for Collaboration**: Drafting of Guidance; Lab evaluation

Decision Tree Guidance Document on Dissolution, Dispersion and Fate Testing in Water, Soils and Sediments ; Associated New TG on Dispersion

- **Rationale for Development:**
  - Nanomaterials exhibit different behaviors, relative to traditional soluble chemicals
  - Dispersion and dissolution behavior depend on may different physicochemical parameters related to MN, suspension media, etc.
  - Dispersion and dissolution behavior influences environmental behavior and bioavailability
  - Establishment of a Decision tree needed to target appropriate fate, & ecotoxicity, tests in a tiered fashion
- **Components, and Evaluation:**
  - Decision Tree Guidance, with tiered approach:
    - Identify the physicochemical properties that determine:
      - Dissolution rates and release kinetics. Do traditional chemical testing methods apply?
      - Dispersion behavior (agglomeration state, stability, and rate)
    - Decision Tree developed in conjunction with SPSFs on Dispersion and Dissolution
    - Expert Workshop to link the different projects involved to occur in Vienna (February, 2014)
  - New Test Guideline on Dispersion
    - Determine dispersibility in different aquatic media (media type, NOM concentrations, agitation , etc.)
    - Determine dispersion stability in different aquatic media (agglomeration kinetics, etc.)
    - Expert Workshop for scientific bases acceptance of the TG (dissolution)/GD (decision tree) in Berlin (Summer, 2015)
- **Key contacts:**
  - Kathrin Schwirn - German Federal Environment Agency - UBA (kathrin.schwirn@uba.de)
  - Petra Greiner - German Federal Environment Agency - UBA (petra.greiner@uba.de)
  - Work done in collaboration with Vienna Univ. - Frank von der Kammer (frank.von.der.kammer@univie.ac.at)
- **Timeline:** Completion in two years

- **Opportunities for Collaboration:** Drafting of Guidance and TG; Workshop participation

Test Guideline for Dissolution Rate of Nanomaterials in the Aquatic Environment

- **Rationale for Development:**
  - Nanomaterials exhibit different behaviors, relative to traditional soluble chemicals
  - Dissolution rates : relevant to predicting bioavailability, reactivity, toxicity and fate of MNs
- **Components, and Evaluation:**
  - Examine candidate methods, with a focus on metals
    - Consider approaches for agitation, varying media characteristics, particle characteristics
  - Coordination through January 2014 Workshop in Vienna
  - Drafting of TG
    - To address maximum dissolution rate in std. media; dissolved metal concentrations, and particle size and size distribution, at beginning and end of test
  - Inter-laboratory Evaluation
  - Summer 2015 Workshop to discuss results/modify TG
- **Key contact:**
  - Jeff Steevens – U.S. Army Corps of Engineers (Jeffery.A.Steevens@usace.army.mil)
  - Work done in collaboration with Leads for at least Three other SPSFs, with coordination through joint workshops
- **Timeline:** Completion in two years
- **Opportunities for Collaboration:**
  - Drafting of TG; Inter-laboratory testing; Workshop participation

Test Guideline on Nanomaterial Removal from Wastewater

- **Rationale for Development:**
  - Knowledge of kinetics, and details of association of MNs with solids, are limited; attachment mechanisms may be different than those for traditional chemicals
  - Need to provide screening-level estimates of NM removal from wastewater to address receiving stream concentrations of NMs
- **Components, and Evaluation:**
  - Consider existing protocols that may be relevant, and EPA-sponsored MN research that examined the reliability of OPPTS 835.1110 TG for determining association of MNs with sludge
  - Develop a protocol that focuses initially on MN removal in the clarifying stages of wastewater treatment
  - Inter-laboratory testing options are under discussion
  - A face-to-face meeting is under consideration for Winter of 2014
  - Progress contingent on Member Country support and partnering with the U.S.
- **Key contact**:
  - David Tobias – U.S. EPA / OPPT (Tobias.david@epa.gov)
- **Timeline:** Completion in two years
- **Opportunities for Collaboration**:
  - Paul Westerhoff is considering joining this effort (P.Westerhoff@asu.edu)
  - Drafting of TG; possible Inter-laboratory testing, and meeting participation

OECD Workshops In Support of the OECD WPMN

Horizontal Meetings Held:

- Inhalation Toxicity (Netherlands, 2011)
- Environmental Fate and Ecotoxicity (Germany, 2013)
- Physicochemical Properties (Mexico, 2013)
- Genotoxicity (Canada, 2013)

Horizontal Meetings Planned:

- Toxicokinetics (Korea, 2014)
- Categorization of NMs (U.S., 2014)

To Join these Activities:

- Please contact your Country's Head of Delegation for the OECD WPMN, or the BIAC Head of Delegation

- Further information can be obtained at:
  - http://www.oecd.org/env/ehs/nanosafety/
  - Email: nanosafety@oecd.org