Worker protection and exposure RM strategies for NM production, use and disposal

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German Social Accident Insurance (DGUV)

- Social Accident Insurance for more than 70 million employees, pupils and students
- More than 3.5 Million companies insured
- Rehabilitation
- Compensation
- Prevention
  - Research
  - Surveillance
  - Regulation
IFA activities

- Started survey on workplaces concerning UFP in 1998
- Since 2006 additional focus on nanoparticles

- Research
  EU projects: Nanosafe 2, NANOSH, NanoImpactNet, NANODEVICE and QNano
- Regulation: Participation in WGs of the advisory panel (AGS) of the Federal Ministry of Labour and Social Affairs
- Standardization: ISO TC 229 Nanotechnology
- Stakeholder dialogue
  - Participation in the German NanoDialogue
    Drafting the “five basic principles for the responsible use of nanomaterials” of the German Federal Government’s NanoKomission
  - NanoPortal: [www.dguv.de/ifa/nano](http://www.dguv.de/ifa/nano)
History in dust research and dust battling

(How much progress did we really made?)
The balancing act in the field of Nanotechnology

- Ensure workers safety **today** in view of knowledge gaps
- Strategy for risk assessment and management is
  - based on the precautionary approach with respect to the principle of proportionality
  - and in the absence of health-based OELs targeted to “minimize” exposure and thus risk of workers
- complemented by
  - Information for companies and stakeholders
  - Research to close knowledge gaps
  - Standardization activities to ensure quality and level the playing field
Assess workplace exposure to MNM by employing state-of-the-art technology

Leakage of primary TiO2 NP
Give measurements a meaning: Proposal for Benchmark levels

- No health-based workplace limit values!
- For metal, metal oxides and other biopersistent granular nanomaterials
  - Not for ultrafine particles

Boundary Conditions
- Averaged over 8-hour work shift value
- **Above** background
- Size range 1 - 100 nm

- 20,000 particles /cm³ for density greater than 6,000 kg/m³
- 40,000 particles /cm³ for density smaller than 6,000 kg/m³

See also

Note of caution: NOT to be discussed today!
Assess the effectiveness of protective measures

- Effectiveness of Local Exhaust Ventilation (LEV) in Controlling Engineered Nanomaterial Emissions During Reactor Cleanout Operations (Methner et al., JOEH. 5 D63-D69, 2009)

Assess the effectiveness of protective measures

Draeger P2R capsule (glass fibres)

NanoPortal of IFA

- Information and Advice on: Nanoparticles at the workplace
  - Recommendation for measurement
  - Protective measures
  - Assessment of protective measure’s effectiveness

Responsible use of nanomaterials: The position of the German Social Accident Insurance

- [http://www.dguv.de/inhalt/praevention/themen_a_z/nano/Positionspapier_Nano_englisch.pdf](http://www.dguv.de/inhalt/praevention/themen_a_z/nano/Positionspapier_Nano_englisch.pdf)
Gaps – Workplace exposure assessment

• Background distinction !!!
  (NANODEVICE: CNT monitor and fibre monitor? / Sensor for catalytic properties)
• Monitoring strategy
  (2 WS with participation of NIOSH devoted to this within NanoImpactNet)
• Size range of NP: Regulation ↔ Measurement techniques
• Validation of sampling for imaging techniques
• Data throughout the life cycle are nearly absent
  • Characterization of emissions from materials containing ENM by mechanical forces (might occur decades after implementation!)
• Burning issue: HARN and MNM containing HARN
  Will regulators be outpaced?
Tiered-Type Approach to an Exposure Assessment

• Common initiative by a working group of:
  • BAuA - Federal Institute for Occupational Safety and Health
  • BGRCI – BG: Raw materials and Chemical Industry
  • IFA
  • VCI - German Chemical Industry Association

• Goal:
  • Harmonized strategy for an efficient, reliable but also pragmatic exposure assessment
  • As a starting point for an effective risk management
  • But not the basis for further scientific and research oriented studies

• Tiered-type approach appears to be the most appropriate strategy
  • Tier 1: Information gathering according to established best practices in industrial hygiene
  • Tier 2: Basic exposure assessment using a limited set of easy-to-use equipment
  • Tier 3: Expert exposure assessment applying latest state-of-the-art knowledge and technology.
Problem: HARN (Nanotubes, Nanowires, Nanorods)

- Most prominent species: CNT
- Benchmark levels ???:
  - BSI PD 6699-2:2007: 10 000 fibres/m³
  - Germany: TRGS 910
    Exposure-risk-relation for asbestos: 10 000 fibres/m³
- Problem: no standardised sampling- and counting methods for CNT by electron microscopy
  - Scope of the asbestos threshold value are free fibres in the air
  - Limit of detection way higher than 10 000 fibres/m³ depending on diameter of the CNTs

What are the tox properties of “pieces”? e.g. PU+CNT emitted by a mechanical process?
(Picture courtesy of Albert Hellmann)
Gaps – Protective measures

• Despite the common belief of e.g. NIOSH, IFA, SUVA and other international institutions that common protective measures against dust are effective for MNM…
• …the question of appropriateness is NOT resolved
• Demand by companies and other stakeholders for the certification of control measures against MNM
  • Might be addressed by EC mandate M/461”for standardization activities against NT and NM”
• More testing of
  • Materials (“pure” ENM, materials containing ENM)
  • Filter materials and machines