IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

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

Markus Berges

Joint US&EU Workshop, 11th March 2011

German Social Accident Insurance (DGUV)

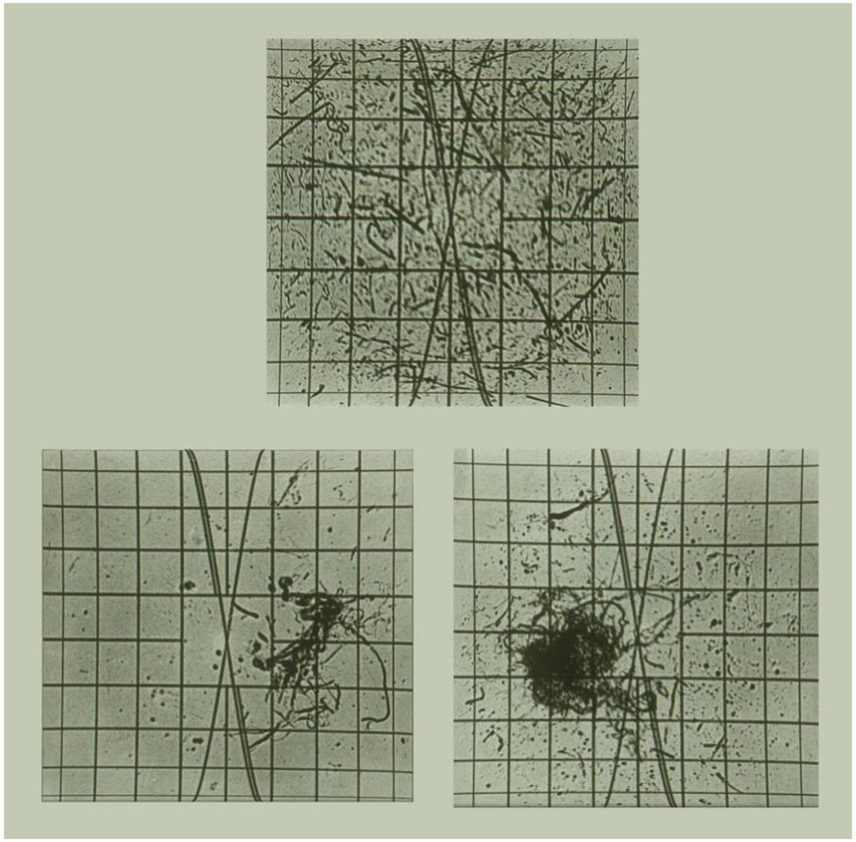
- Social Accident Insurance for more than 70 million employees, pupils and students
- More than 3.5 Million companies insured
- Rehabilitation
- Compensation
- Prevention
  - Research
  - Surveillance
  - Regulation

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 NanoKommission
  - NanoPortal: www.dguv.de/ifa/nano

History in dust research and dust battling



Konimeter

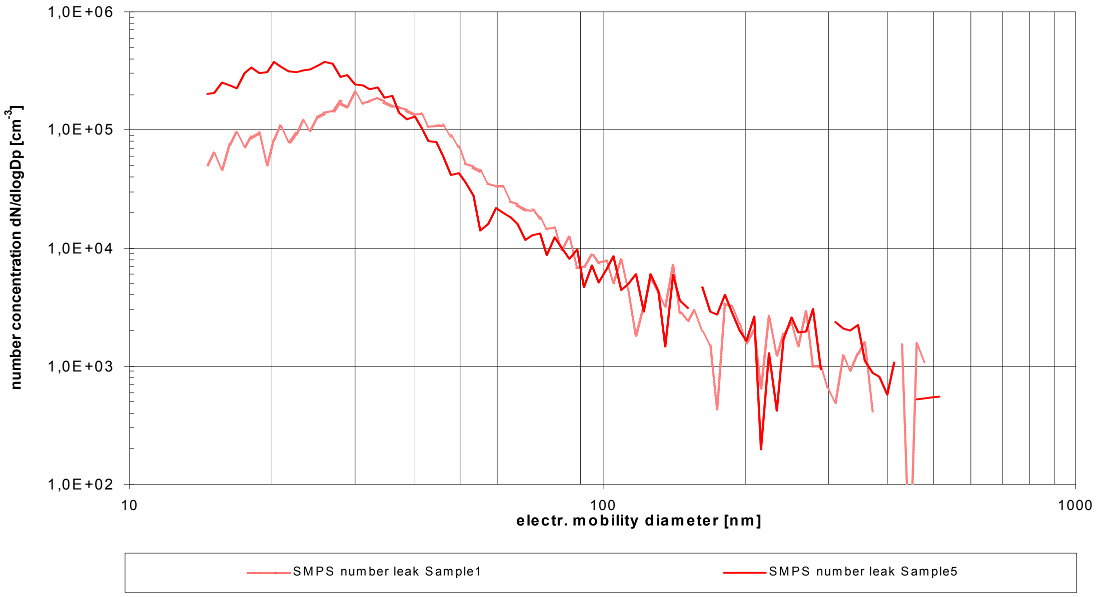
(How much progress did we really made?)

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**
  - **Schulte et al.: Occupational exposure limits for nanomaterials: state of the art, J Nanopart Res (2010) 12:1971-1987**
  - **S. Dekkers, C. de Heer, RIVM report on provisional nano-reference values, Report 601044001, 2010**

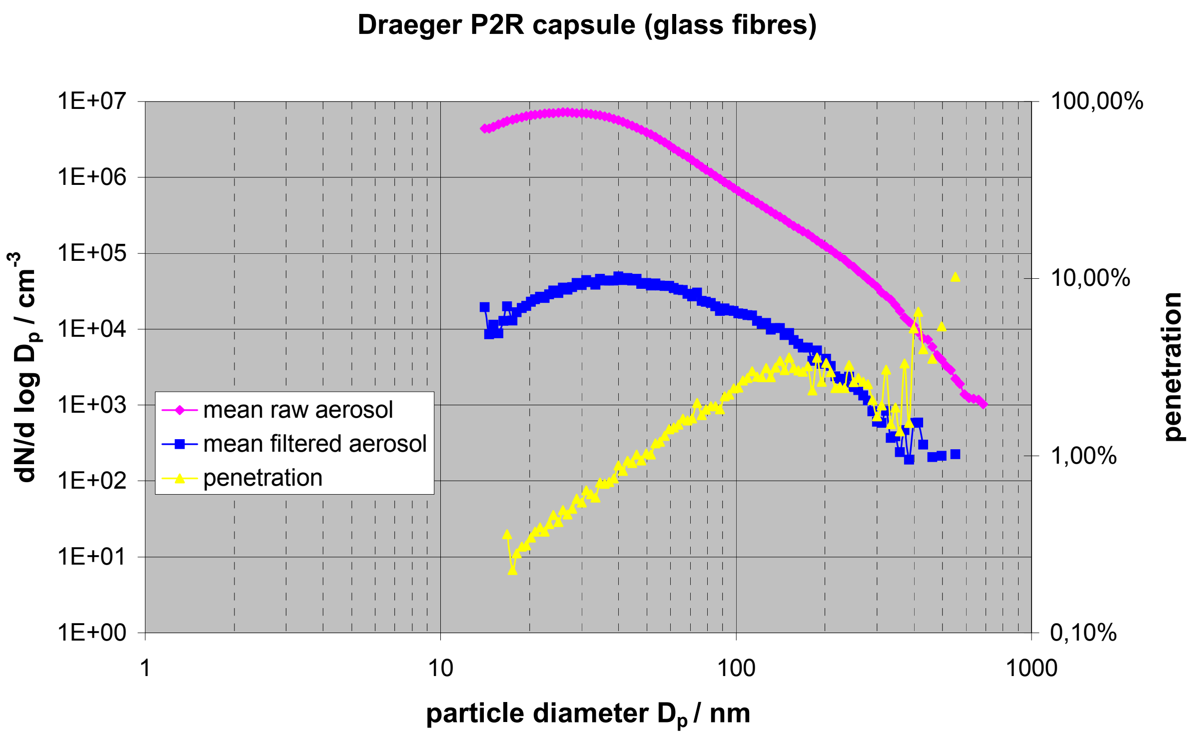
Note of caution: NOT to be discussed today !

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)

- **“Conventional engineering control measures work well”**J. H. (Han et al. Inhalation Tox. 2008, 20: 741-749)

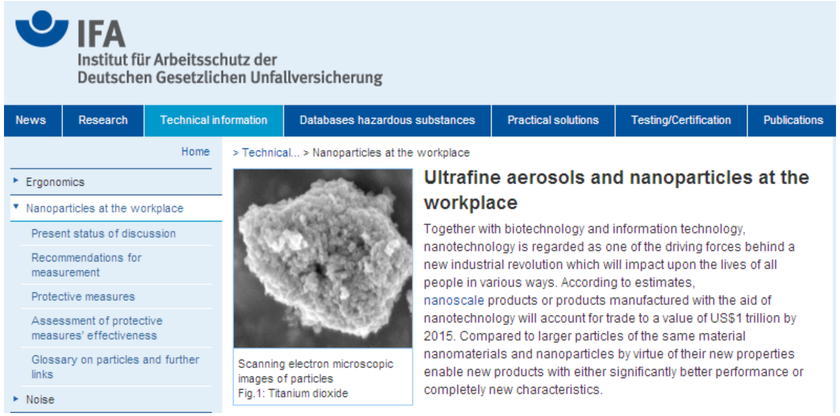
Assess the effectiveness of protective measures



See also Shaffer & Rengasamy, Respiratory protection against airborne nanoparticles: a review, J. Nanopart. Res., (2009)

NanoPortal of IFA

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



www.dguv.de/ifa/nano
Webcode: d90477

[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)

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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