

Workplace exposure *to nanoparticles* *Literature survey*

Chemical substances at work:
facing up to the challenges
Brussels
2 - 3 March 2009

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- Emerging chemical risks report
 - One of the most important emerging chemical risks
 - Brief presentation of nanotechnology

- Literature survey - Workplace exposure to nanoparticles – 2008

- OSH Outlook

Workplace exposure to nanoparticles

AIMS

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- To provide the Risk Observatory target audience with a comprehensive picture of the risks associated with workplace exposure to nano-size particles, and of the ways in which they are being addressed across Europe;
- Identify areas where the level of knowledge is not sufficient, for future actions and research.

Workplace exposure to nanoparticles

SCOPE

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- General description of nanoparticles, including their generation and properties;
- **Current** state of the knowledge in relation to manufacturing and use of nano-size particles;
- Present and predicted future development of nanotechnologies, the size of the exposed workforce;
- Identify involved sectors, workplace factors;

Workplace exposure to nanoparticles

SCOPE - cont

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- Describe risks to health and safety identified so far both in research and through workplace exposure assessments, and directions of current osh research;
- Methods used to evaluate and control risks resulting from exposure to nano-particles;
- Describe available European and national policies, projects or initiatives addressing exposure to nano-particles;
- Future directions of safety and health research related to nanotechnologies.

Project team

Topic Centre Risk Observatory

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- **BAuA** (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin): Bruno Orthen, Judith kleine Balderhaar, Simon Kaluza
- **INRS** (Institut National de Recherche et de Sécurité pour la prévention des accidents du travail et des maladies professionnelles): **Bertrand Honnert**
- **CIOP-PIB** (Centralny Instytut Ochrony Pracy - Państwowy Instytut Badawczy): **Elżbieta Jankowska, Piotr Pietrowski**
- **INSHT** (Instituto Nacional de Seguridad e Higiene en el Trabajo): **Maria Gracia Rosell, Celia Tanarro, José Tejedor, Agurtzane Zugasti**

➤ Literature survey

- articles, conference and workshop proceedings, project reports
- Studies published world-wide up to November 2008 have been included in the review
- **341 references were used**
- Project duration – February-November 2008

Main findings – respiratory exposure

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- Most important respiratory effects – chronic toxicity and carcinogenicity
- Inflammation, fibrosis, tumours
- Increased surface area in combination with decreased particle size increase toxicity
- No clear evidence of toxic effects on other than lungs organs

Main findings – dermal exposure

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- Less research material available
- Effects on healthy skin – none observed, except from sensitization
- Barrier function of the skin can be breached – mechanical strain, lesions

Main findings — safety hazards

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- Acknowledged insufficient volume of research
- Fire and explosion – main risks described
- Nano-sized particles – large surface area, easily electrostatically charged, longer airborne
- Some metals – Al – minimum ignition energy so low that can be ignited by static electricity; agglomeration and surface oxidation reduce explosive properties
- Presence of flammable materials would increase risk level

Main findings — risk management

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- Classic principles of 'hierarchy of control' apply
- Engineering: enclosure, local and general exhaust ventilation (design, use and maintenance!)
- Efficacy of filtration medium — penetration of particles through the filtering material
- Respiratory protection — respirator's fit to the face has to be considered along with filter efficiency
- Protective clothing — air-tight non-woven textile is superior to cotton, polypropylene or paper

Main findings – exposure management

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- Most often – exposure to aggregates/agglomerates
- Background level to be considered
- Difficulties in assessment of workplace exposure – equipment
- Risk-based guidance – not sufficient
- Usual recommendation: use of the same control methods as for aerosols from fine dust
- Precautionary principle
- Work conducted on development of nanomaterial-specific control banding approach
- No evidence-based foundation for nano-specific occupational medical screening

International projects

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- Community Framework Programmes
- OECD projects
- WHO
- Joined EU-US

National research activity

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Country	No	Title (examples)
Belgium	1	RA - nanoparticles on human health using in vitro and in vivo models
Czech	1	Study of transport of inhaled nano-sized particles (Ag, Pb, Cd) and their distribution in organs
Denmark	12	Evaluation and control of occupational health risks from nanoparticles
		NanoKem: nanoparticles in the paint and lacquer industry. Exposure and toxic properties
		Risk analysis and governance of nanomaterials
Germany	3	Research project to study the safe handling of nanomaterials
Greece	1	Technology development for optimising air quality in industrial buildings: Characterization of air quality in industrial buildings
Italy	1	European center for the sustainable development of nanotechnology
Finland	3	Nanosafety in Finland
United Kingdom	46	Reference materials for engineered nanoparticle toxicology and metrology
		Scoping study to determine whether high aspect ratio nanoparticles (HARN) should raise the same concerns as do asbestos
Switzerland	24	Nanotechnology and health. Technical options, risk evaluation and preventive strategies
		Assessment of adequacy of safety measures for manufactured nanoparticles
		Total – 92 projects

New Standards

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Committee	Reference	Title	current state
ISO/TC 146/SC 2	ISO/TR 27628	Workplace atmospheres. Ultrafine, nanoparticle and nano-structured aerosols. Inhalation exposure characterization and assessment.	published
	ISO/CD 28439	Workplace atmospheres. Characterization of ultrafine aerosols/nanoaerosols. Determining the size distribution and number concentration using mobility particle sizers/differential mobility analysers.	under dev.
CEN/TC 137	prEN ISO 28439	Workplace atmospheres. Characterization of ultrafine aerosols/nanoaerosols. Determining the size distribution and number concentration using mobility particle sizers/differential mobility analysers.	under dev.
CEN/TC 352	CEN ISO/TS 27687	Nanotechnologies. Terminology and definitions for nano-objects. Nanoparticle, nanofibre and nanoplate (ISO/TS 27687:2008).	published
ISO/TC 229	ISO/TR 12885	Nanotechnologies. Health and safety practices in occupational settings relevant to nanotechnologies.	published
	ISO/TS 27687	Nanotechnologies. Terminology and definitions for nano-objects. Nanoparticle, nanofibre and nanoplate.	published
	ISO/AWI TS 11751	Terminology and definitions for carbon nanomaterials.	under dev.
	ISO/AWI TR 11808	Nanotechnologies. Guide to nanoparticle measurement methods and their limitations.	under dev.

Priorities for future actions and activities:

- Identification of nanomaterials and description of exposure
- Measurement of exposures to nanomaterials and efficacy of protective measures
- Risk assessment of nanomaterials - in line with the current statutory framework

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CONCLUSIONS cont

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- In vivo studies for assessment of the health effects of nanomaterials
- Validation of the in vitro methods and methods to determine physico-chemical properties as tools to determine health effects
- Training of employees and practical handling guidelines for activities involving nanomaterials in the workplace.

Future activities

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- 2010 – possible topics:
ERO: Risk communication and perception –
nanotechnology
- 2012-13 – Dangerous substances – one of
the topics considered for the European Campaign

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-  **Environmental and Safety Impacts of Nanotechnology: What Research is Needed?**
<p>US House of representatives Committee on Science hearing, November 17, 2005. For the emerging field of nanotechnology to reach its full economic potential, ...</p>
-  **National nanotechnology initiative**
A top priority of the NNI is support of R&D leading to a detailed understanding of the health and safety impacts of nanotechnology for researchers, workers, ...
-  **OSHmail 60 - 2006**

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-  **Leitfaden für Tätigkeiten mit Nanomaterialien am Arbeitsplatz. Draft Guidance for handling and use of **nanomaterials** at the workplace.**
Die Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA) und der Verband der Chemischen Industrie (VCI) haben im Frühjahr 2006 gemeinsam eine Umfrage ...
-  **Nanotechnologie - Nanotechnology**
Die Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA) engagiert sich auf nationaler und internationaler Ebene in Fragen der Sicherheit und Gesundheit ...
-  **Report of the OECD Workshop on the Safety of Manufactured **Nanomaterials**. Building Co-operation, Co-ordination and Communication. Washington D.C., United States, 7th-9th December 2005**
The OECD's Joint Meeting of the Chemicals Committee and Working Party on Chemicals, Pesticides and Biotechnology, held a Special Session on the Potential ...
-  **Principles for characterizing the potential human health effects from exposure to **nanomaterials**: elements of a screening strategy.**

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and for your attention

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