Institut universitaire romand de Santé au Travail
Institut für Arbeit und Gesundheit
Institute for Work and Health
Pour que santé et travail soient compatibles

Nanoparticles and occupational health: exposure, hazards and research coordination

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Nanotechnologies

Energy

Electronics

Many new processes and products Some with nanoparticles

Mechanics

Textiles

Environment

Food

Medicine

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5 steps for control of risks

1 - Gather information

2 - Assess risk

3 - Apply control strategies and hierarchies (STOP)

4 - Do health surveillance
Establish health status and watch out for "the unusual"

5 - Do product stewardship
Know what your customers are doing - reduce their risk

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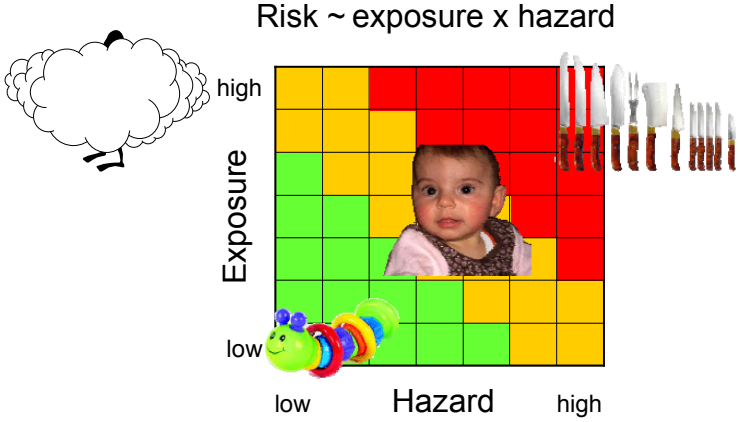
Assess risks = Assess exposures and hazards

Risk ~ exposure x hazard



efficiency to cause damage x Gravity of outcome

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From Exposure to Dose

– How much is taken up?

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Uptake routes for nanoparticles

High uptake potential for powders and aerosols in lungs

Route / Form	Lungs	Skin	GI-track
Powder			
Aerosol			
Liquid			
Brittle solid			
Solid			

Estimation of occupational uptake-potential

- High
- Medium
- Low

Cave: "no uptake" does not mean "no contact"

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The IST mobile measurement unit

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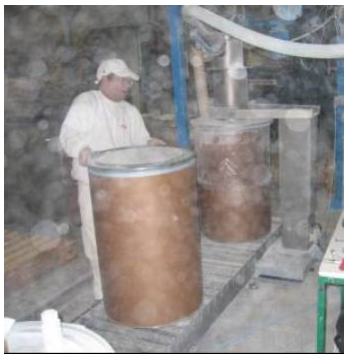
Observation of industrial activities



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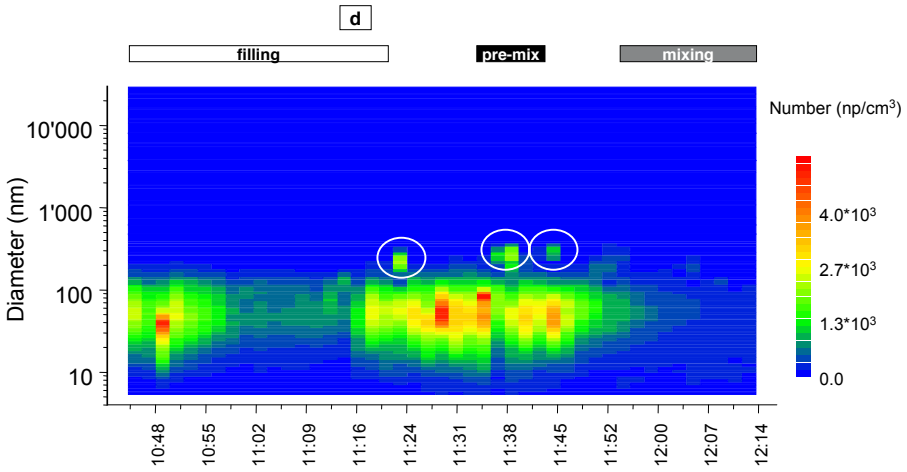
Concentrations in hall with open process



Average concentration of all measurements during campaign:
Inhalable dust: 7.1 mg/m³ (0.7 * TLV) Alveolar dust 0.40 mg/m³ (0.1 * TLV)

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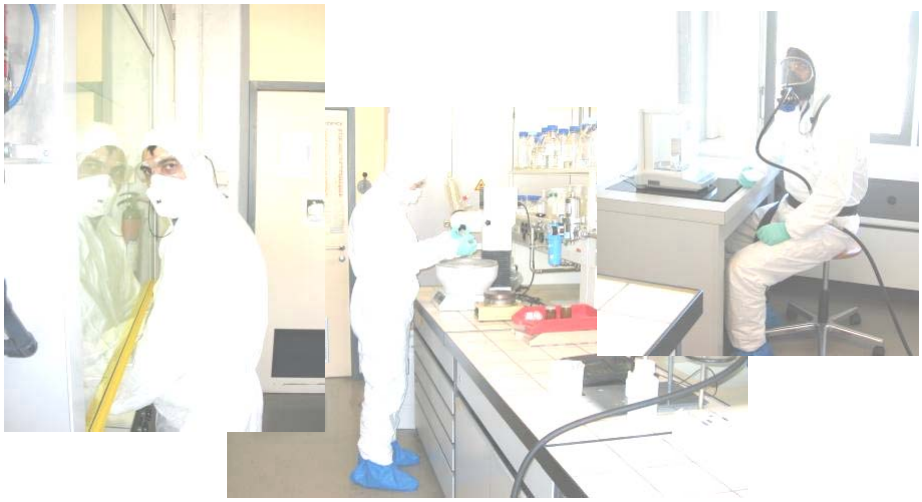
Observations in research laboratories



Photos courtesy Heinrich Hofmann, EPFL

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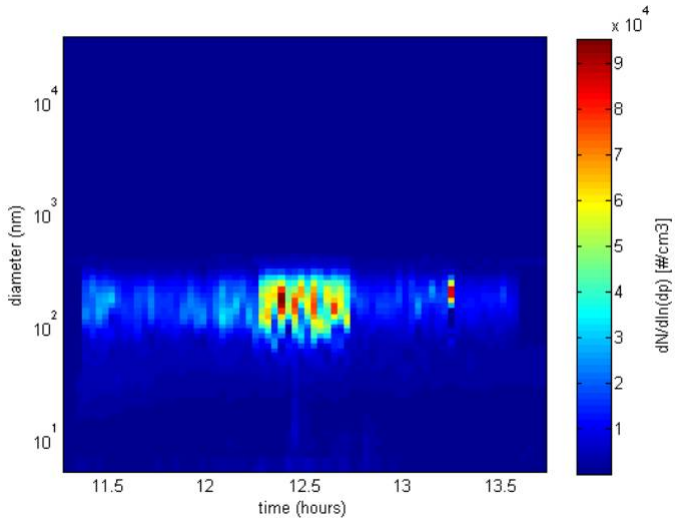
"non-suspicious" process in research lab



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Hazards - main issues

Toxicological hazards
- Oxidative stress
- Fibre paradigm
- Interactions with protein folding and fibrillation

Physical and chemical hazards
- Explosion
- Altered (faster) kinetics

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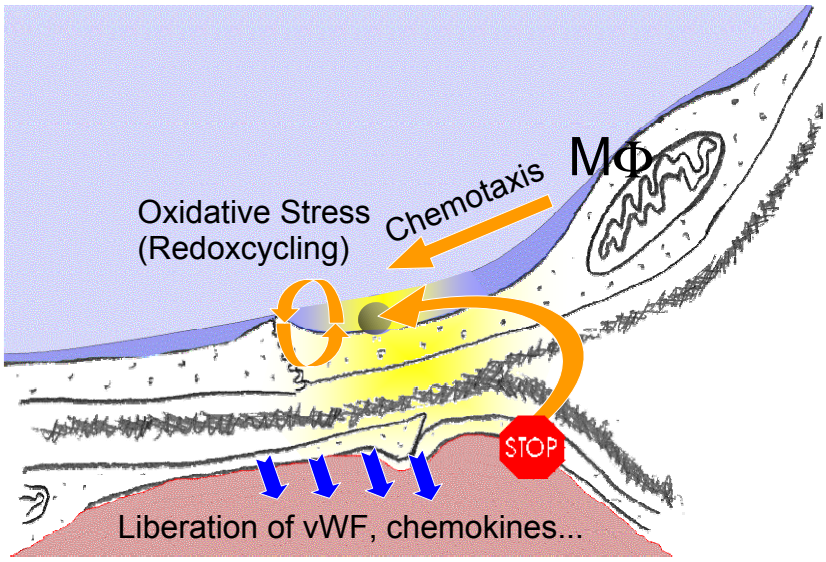
ROS-paradigm



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CNT-study: fibre-structure paradigm confirmed

Slide with graphics from Poland et al. Nature Nanotechnology 2008
(removed for copyright reasons)

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Nanoparticles enhance protein fibrillation rate

Slide with graphics from
Linse, Sara et al. (2007) Proc. Natl. Acad. Sci. USA 104, 8691-8696
(removed for copyright reasons)

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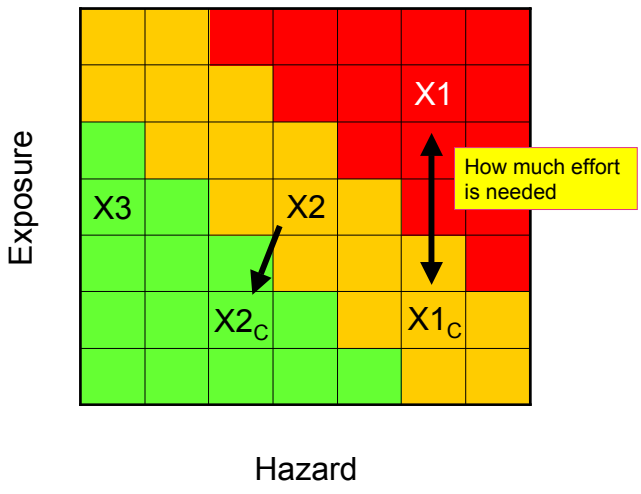
Combine exposure and hazard



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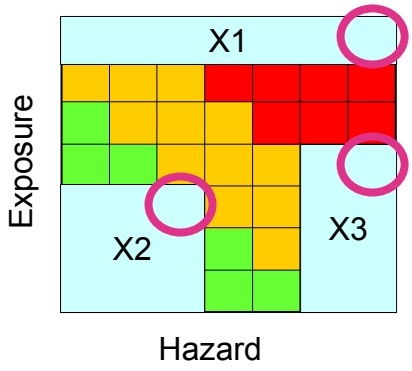
How to deal with uncertainties?

Estimate bands of likely hazards and exposures



Safety measures always then consider the worst-case

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How to assess occupational health effects?

Prospective health studies for exposed workers should start now!

But:

How many workers are exposed?

To which type of particles, at what level, how long and how often?

In which companies and industries?

And:

How shall we assess the health effects?

Which effects - endpoints and pathways?

Using which methodologies?

NanoImpactNet

NanoImpactNet

The European Network on the Health and Environmental Impact of Nanomaterials

Coordinator: Michael Riediker
Institute for Work and Health, Lausanne, Switzerland

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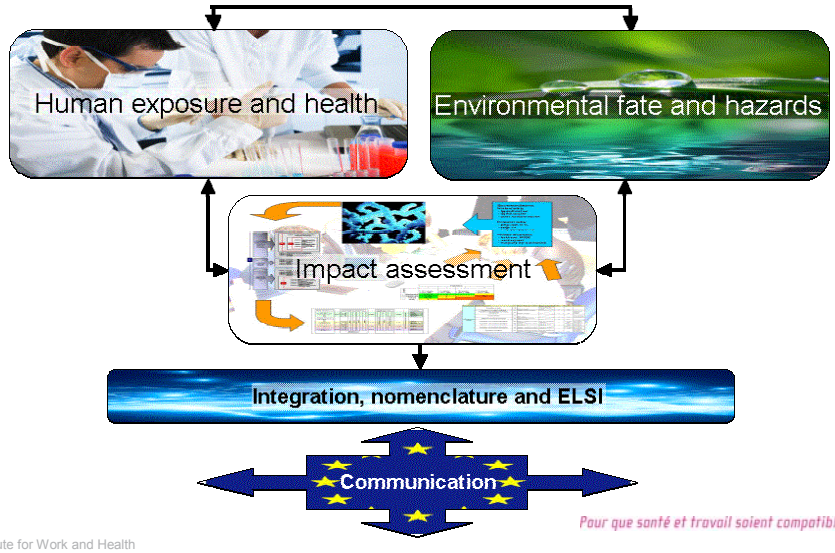
Focus of NanoImpactNet:

European Network on the Health and Environmental Impact of Nanomaterials*

* European funding, but open for all to participate at their own cost



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NanoImpactNet is a network for researchers

Bring together researchers to…

- Identify knowledge gaps
- Define joint strategies and protocols
- Facilitate collaboration between projects
- Network and Communicate

→ Collaborate to achieve excellence in science
(good for industry, workers, consumers and the environment)

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Next event

March 23-27, 2009 Conference in Lausanne, Switzerland

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Merci pour votre attention

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