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Workers Safety and Nanoparticles

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Curriculum

- study of food chemistry
- since 1982: expert in AUVA for chemical safety on workplaces
- since 1991: environmental manager (until 2007)
- since 1995: quality manager of the testing laboratory of AUVA (until 2007)
- since 2001: auditor of OSH-MS in industry
- since 2005: member of ISSA, dealing e.g. with nanotechnology
- since 2006: head of working group OHS-MS in ON
- since 2007: deputy head of the testing laboratory

Prevention Work of AUVA - Structure

1 Headquarters

~145 experts in safety and health

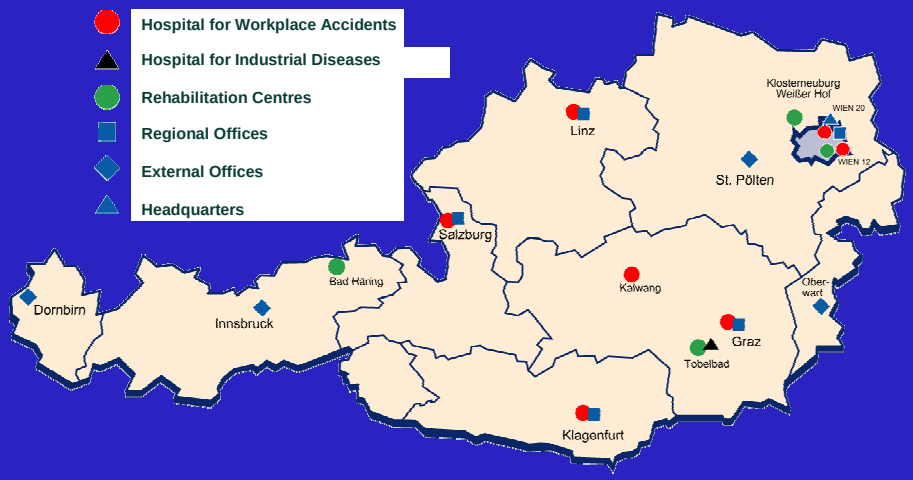
4 Regional Offices

5 External Offices

9 Prevention-Centres

~ 270 safety technicians and occupational hygienists for SME

Work Accident Insurance – Locations of AUVA



AUVA - Fields of Activity

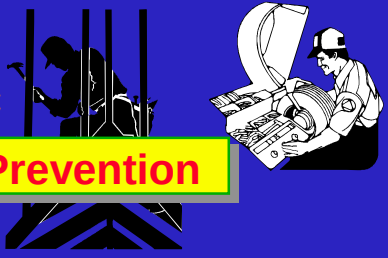
~350 Mio €

Medical Treatment and Rehabilitation

Compensation Payments

~450 Mio €

~50 Mio €



Prevention

Support in First Aid

~1 Mio €

Total: 1.038 Mio €

Success of preventive work?

	2008
Workplace Accidents	134.142 (193†) +16,1%
Industrial Diseases (listed in an annex to the basic law ASVG)	1.574 (70†) +17,1%

but also

Workplace Related Diseases	?

exposure to nanoparticles: (not listed as) industrial disease?

OEL (MAK) in Austria

- OEL(occupational exposure limit) = MAK (maximum tolerable concentration on a workplace) fixed by MAK-commission
- MAK-commission at ministry of labour and social affairs (chair: labour inspectorate)
- guidance taken on international OELs, mainly German and Northern European OELs
- lubricants, N,N dimethylisopropylamine: MAK only in Austria
- MAK are published in a decree (GKV 2006)

General MAK (OEL) for dust mg/m3

	MAK Austria (GKV 2006)	MAK Germany	MAK proposed by DFG
Total inhalable dust median of diameter ~10µm	10	10	4
Fine particles median of diameter ~5µm	5	3	1,5
Ultrafine particles diameter < 0,1µm	?	?	?

BSI: 0,066xOEL insoluble
0,5xOEL soluble

NIOSH USA: 0,1 TiO_2

Deposition and clearance of inhalable dust

diameter of particles	Deposition in respiratory tract	clearance
> 15µm	nose, throat, larynx	some hours
>7µm	nose, throat, larynx, thorax (with cilia)	about one day
fine particles	as above + bronchia + alveoli (without cilia)	some months, may be years
ultrafine particles	as above + bronchia + alveoli + direct to blood	?

Ultrafine particles < 0,1µm position of DFG

- these particles are primarily generated in combustion processes and in gas phase reactions
- the deposition in the respiratory tract depend upon Brownian motion
- the impacts on the respiratory tract increase with surface and numbers of particles (not with the mass)

Measurements in workplace air

- AUVA/ÖSBS carry out such measurements
- at the time it is possible to detect the number and the size of particles
- no costs if the reason for the measurements is to prevent the exposed persons from getting ill
- investigation is carried out on future measurements of surface area and reactivity of ultrafine particles

Research projects of AUVA concerning ultrafine particles

1. Detection of nanometer sized particles in living cells using modern fluorescence fluctuation methods (published 2005 BBRC)
2. Health effects of occupational exposure to ultrafine particles (to be published soon)
3. Toxicological examinations of ultrafine particles – effects on human cell cultures (published as poster on a congress 2007)
4. Nanotechnology: exposure profiles in nano - producing and nano - processing industry and effects on human cells (in progress)

Conclusions Project 1

1) Detection of nanometer sized particles in living cells

- It is possible to detect nanoparticles in human cells
- nanoparticles (<0,1µm) penetrate directly into cells (translocation process)

Conclusions Project 2

2) Health effects of occupational exposure

Policemen on a shooting stand (~500.000/cm3;~75nm diameter):

There are no significant changes in

- **lung function parameters**
- **blood parameters**

after a single high exposure to CDNP (combustion derived nanoparticles)

Conclusion Project 3

3) Effects on human cell cultures

- cell viability testing showed a negative effect at high exposure (WST-1 assay)
- in cells exposed to workplace atmosphere containing nanoparticles (shooting stand) an increased oxidative burst was detected (DHR assay)
- exposure of co-cultures resulted in significant enhanced pro-inflammatory cytokine levels (BDTH CBA assay)

Tasks of AUVA (focus nanotechnology)

- research on potential risks to health of employees
- measurements in workplace air (OELs?)
- compensation payments in case of occupational deseases (e.g. asbestos, quartz, welding fumes)
- risk communication (AUVA-magazine: Sichere Arbeit 6 times a year, congress: Forum Prävention once a year)

Contact

- for more toxicological details and for project 4 contact: Dr. Eva Valic; AUVA (eva.valic@auva.at)
- for measurements in workplace air contact: DI Alexander Graff; ÖSBS (alexander.graff@auva.at)

Summary

- be careful – exposure to ultrafine particles should be as low as possible
- use exhaustors or masks with the marking FFP3 or P3 if there is a chance for inhalation
- tell your manager, occupational hygienist or physician if you feel uncertain or even sick
- safe handling should be discussed regularly
- research is a great job – but don´t forget your own personal health