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Umeå

"Soil contaminants in the future"

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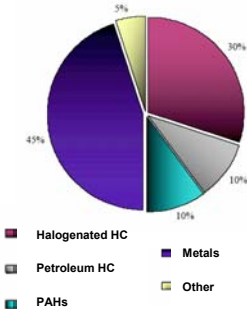
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The magnitude of the problem?



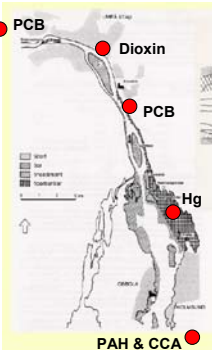
Swedish-EPA, 2006

Sweden: 80.000 sites!

1.500 High Risk

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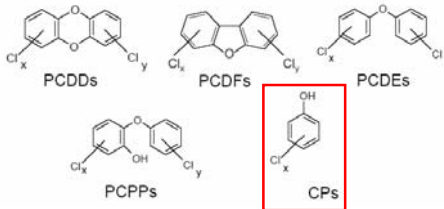
Typical contaminants



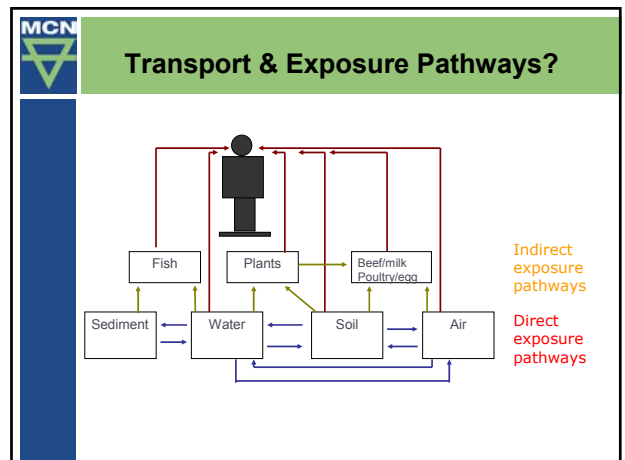
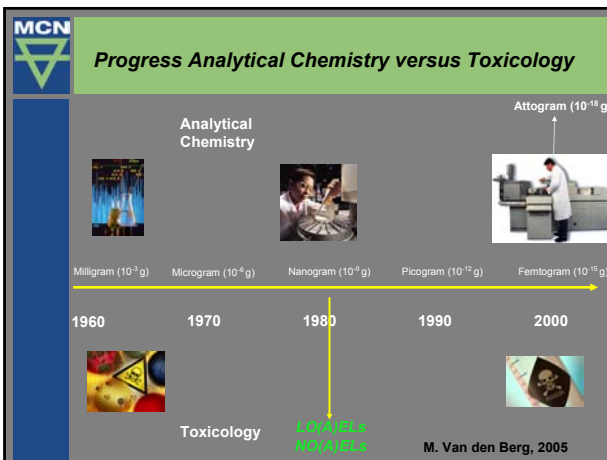
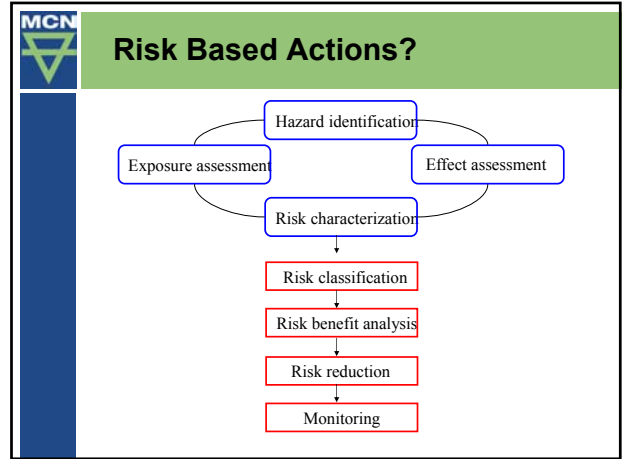
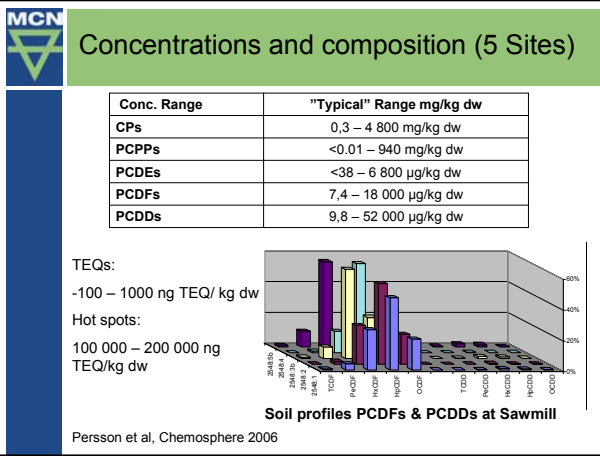
- Petroleum hydrocarbons
- BTEX
- Chlorinated solvents
- Dioxins & PCBs
- Hg
- Cu, Cr, As, Zn, Pb
- PAH
- Pesticides
- "Known unknowns"
- "Unknowns"

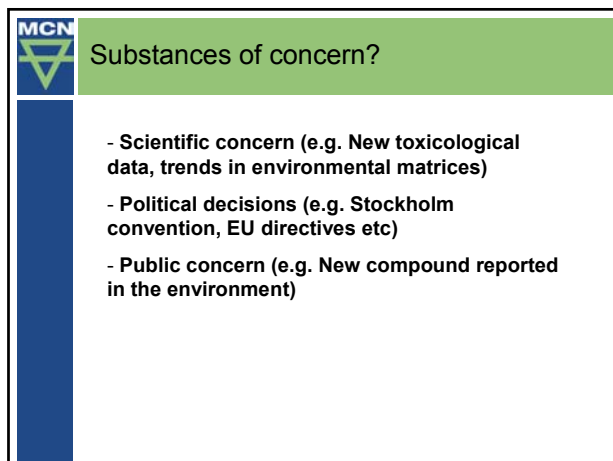
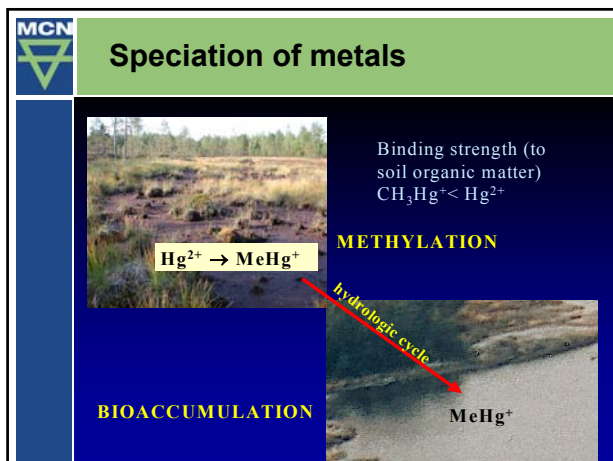
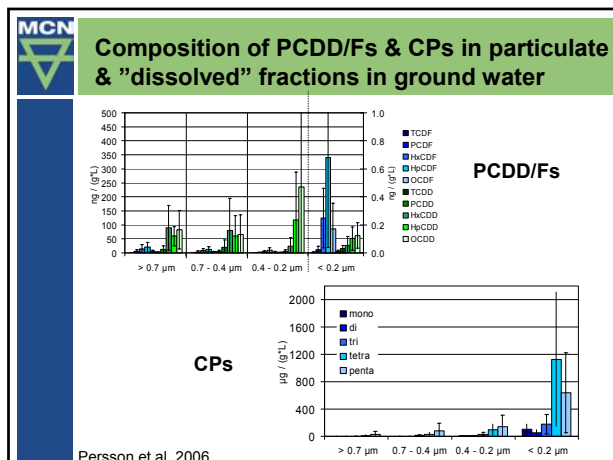
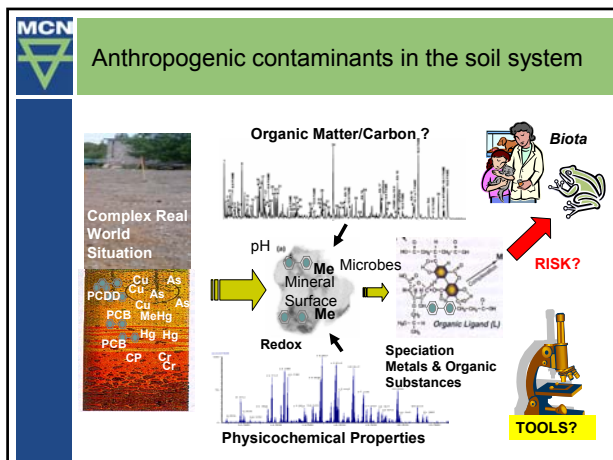
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Example: "Known unknown" - Chloraromatics at Saw Mill sites



PCDDs: Dioxins - PCDFs: Dibenzofurans - PCDEs: Diphenyl Ethers - PCPPs: Phenoxy Phenols - CPs: Chlorophenols





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Soil contaminants in the future?

Metals? Organometals? Organic compounds?

The periodic table shows color-coded elements: Metals (yellow), Organometals (green), and Organic compounds (red). Three yellow arrows point upwards from the highlighted groups to the text above.

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REACH

- The Chemical European Inventory of Existing Commercial Substances (EINECS)
100 106 Substances
- 30.000 Substances
>1 tonne/yr
- PBT criteria (vPvB)

registrerade ämnen
100 106

officiellt klassificerade ämnen
3 000

volym över 1000 ton per år
2 500

ingår i EU:s riskvärderingsprocess
141

riskvärdering inom EU klar
57

bedömda var i behov av restriktioner
46

reglerats till följd av riskvärdering
<5

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Biogeochemical cycle of Hg

The diagram illustrates the biogeochemical cycle of mercury (Hg) across three main compartments: Atmosfär (Atmosphere), Vatten (Water), and Sediment. Key processes include:

- Atmosfär:** Hg⁰ (g) and Hg²⁺ (g) are shown. Hg⁰ (g) is emitted from sources and can be deposited as Hg⁰ (part) or Hg²⁺ (part). Hg⁰ (aq) and Hg²⁺ (aq) are also present in the atmosphere.
- Vatten:** Hg⁰ and Hg²⁺ are shown. Hg⁰ is emitted from sources and can be deposited as CH₃Hg⁺ or (CH₃)₂Hg. Hg²⁺ is emitted from sources and can be deposited as CH₃Hg⁺ or (CH₃)₂Hg.
- Sediment:** Hg⁰ and Hg²⁺ are shown. Hg⁰ is emitted from sources and can be deposited as CH₃Hg⁺ or (CH₃)₂Hg. Hg²⁺ is emitted from sources and can be deposited as CH₃Hg⁺ or (CH₃)₂Hg.

 Processes like "Naturlig avvinning av Hg", "Antropogen avvinning av Hg", "Deposition", and "Antropogena Hg-emissioner" are also indicated.

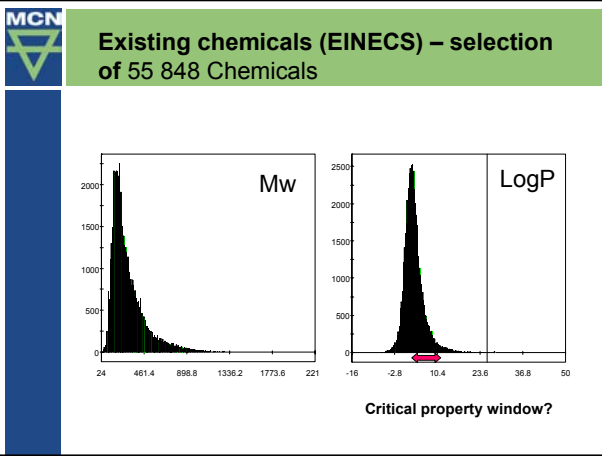
From Lambertsson, 2005

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Persists (P) – Bioackumulation (B)

The graph plots Persistence (P) in t/2 on the y-axis against Bioaccumulation (B) in BCF, log Kow on the x-axis. A red box labeled "e.g. PCBs" is positioned in the bottom right corner, indicating high bioaccumulation and low persistence. Other areas are marked with question marks, suggesting unknown or variable properties for other substances.

B (BCF, log Kow) PBT-criteria (vPvB)



Application of Sewage Sludge to Arable Land

DecaBDE

Sweden ¹	Conc. (µg/kg d.w.)	U.S.A. ²	Conc. (µg/kg d.w.)
PentaBDE	100-240*	PentaBDE	1100-2300
DecaBDE	150-350	DecaBDE	85-4900
TBBPA	3-80	TBBPA	-
HBCDD	10-120	HBCDD	-

From 1: Stockholm Water, Report 41, 1999
2: Hale *et al.*, Nature 412 (2001) 140

Future: E-waste?

Climate Change?

- Increased run off water (Land to Sea Transport – Soil to Sediment)
- Flooding agricultural land
- Temperature changes

Pollution - in which perspective?

Micro-scale?

Local?

Regional?

Global?



Aspects for the future

- Increased knowledge of transport and fate processes in the soil system
- Improved knowledge of exposure pathways (availability, bioavailable fractions etc.)
- New methodology for estimation of risk (inkl. Mixture toxicity, validation of test systems etc)
- Priority tools (between compounds, between sites)
- Soil pollution in a broader perspective (relation other sources & exposure)
- Remediation alternatives for low and moderately contaminated soils
- Shorter delay times between new scientific knowledge and implementation



Risk Assessment – Remedial Actions - Costs?

Example Remediation Costs one site:
2,4 g TEQ ≈ 1 Million EURO
Total Sweden 5-50 kg TEQ
Costs 400 – 500 sites?



Acknowledgements



I. Funding EU Regional Development Funds (ERDF), Objective 1

II. Co-workers MCN Research Cluster



www.chem.umu.se/mcn