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**Umeå**

## "Soil contaminants in the future"

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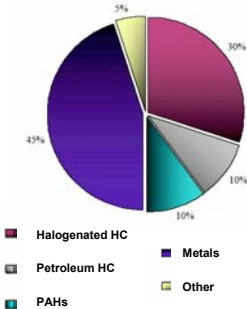
Mats.tysklind@chem.umu.se





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## The magnitude of the problem?



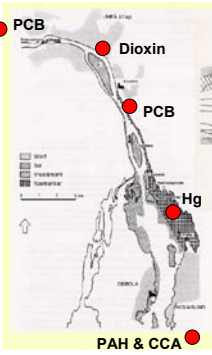
Swedish-EPA, 2006

**Sweden: 80.000 sites!**

**1.500 High Risk**

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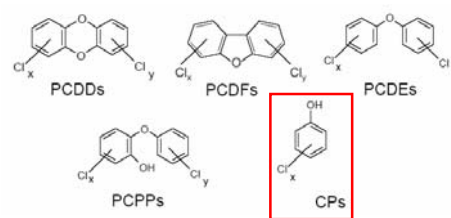
## Typical contaminants



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

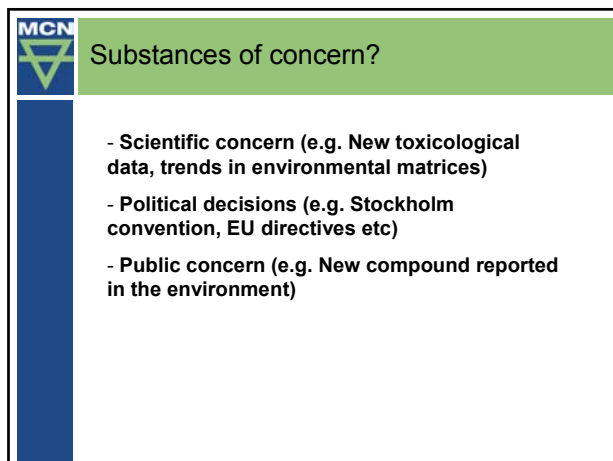
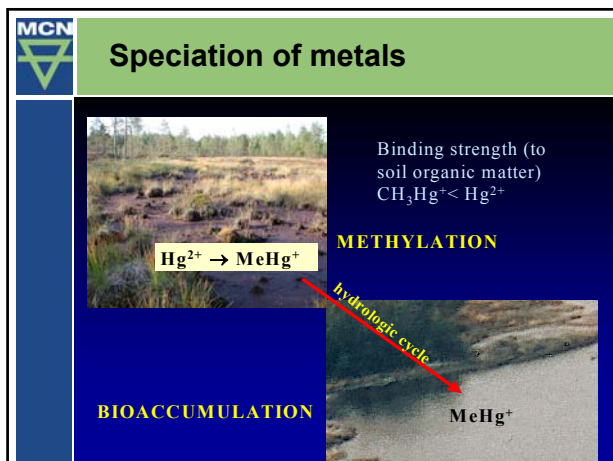
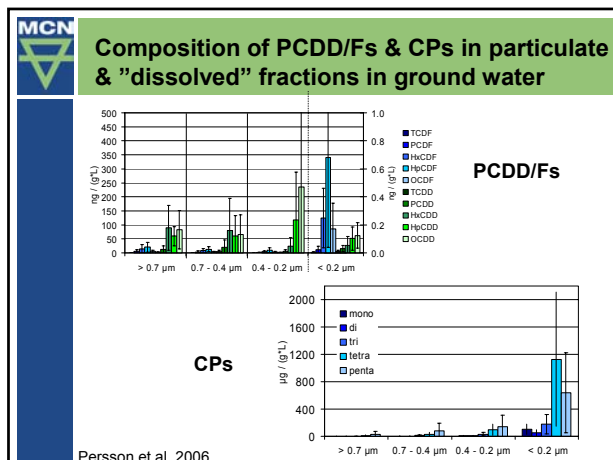
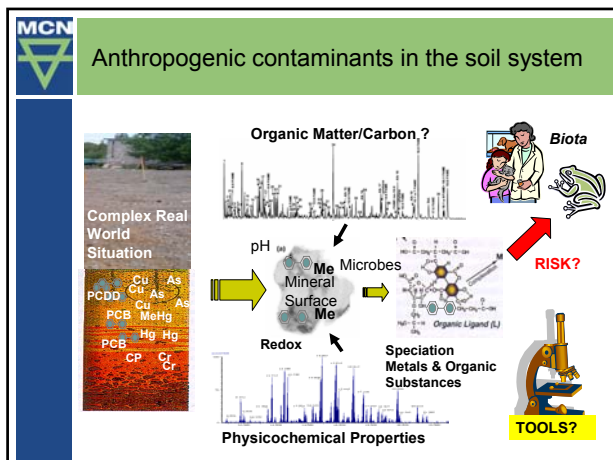
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## Example: "Known unknown" - Chloraromatics at Saw Mill sites



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:** Hg<sup>0</sup> (g) and Hg<sup>2+</sup> (g) are shown. Hg<sup>0</sup> (g) is emitted from sources and can be deposited as Hg<sup>0</sup> (part) or Hg<sup>2+</sup> (part). Hg<sup>0</sup> (aq) and Hg<sup>2+</sup> (aq) are also present in the atmosphere.
- Vatten:** Hg<sup>0</sup> and Hg<sup>2+</sup> are shown. Hg<sup>0</sup> is emitted from sources and can be deposited as CH<sub>3</sub>Hg<sup>+</sup> or (CH<sub>3</sub>)<sub>2</sub>Hg. Hg<sup>2+</sup> is emitted from sources and can be deposited as CH<sub>3</sub>Hg<sup>+</sup> or (CH<sub>3</sub>)<sub>2</sub>Hg. Hg<sup>2+</sup> is also shown being emitted from the sediment.
- Sediment:** Hg<sup>0</sup> and Hg<sup>2+</sup> are shown. Hg<sup>0</sup> is emitted from sources and can be deposited as CH<sub>3</sub>Hg<sup>+</sup> or (CH<sub>3</sub>)<sub>2</sub>Hg. Hg<sup>2+</sup> is emitted from sources and can be deposited as CH<sub>3</sub>Hg<sup>+</sup> or (CH<sub>3</sub>)<sub>2</sub>Hg. Hg<sup>2+</sup> is also shown being emitted from the sediment.

 Processes like "Emission", "Deposition", "Natural Hg emission", "Anthropogenic Hg emission", "Natural avvinning", and "Antropogen avvinning" are labeled.

From Lambertsson, 2005

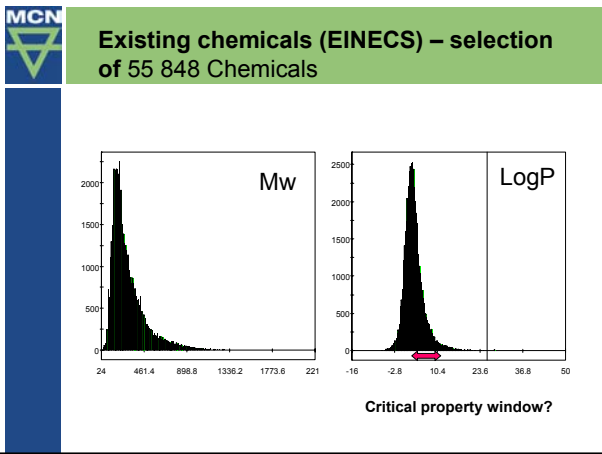
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## Persists (P) – Bioackumulation (B)

The chart shows the relationship between Persistence (P) and Bioaccumulation (B) for various substances. The y-axis is P (t/2) and the x-axis is B (BCF, log Kow). A red bar represents e.g. PCBs, which has high P and high B. Other bars are grey and orange with question marks.

**B (BCF, log Kow)**      **P (t/2)**

**PBT-criteria (vPvB)**



### Application of Sewage Sludge to Arable Land

DecaBDE

	Sweden <sup>1</sup>	Conc. (µg/kg d.w.)	U.S.A. <sup>2</sup>	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?

