Emerging substances in soil

But do we have sufficient knowledge about the more common pollutants?

TNO | Knowledge for business

Frank P.J. Lamé

TNO Built Environment and Geosciences

How exotic do we want to get?

- Surfinol-104
- 2,6-Di-tert-butylphenol
- Irgarol
- Chloropicrin
- Ethenediamintetraacetic acid
- Naphthalene sulphonic acid
- LAS
- Cyanoformaldehyde
- 17-alpha-Estradiol
- Dibutyl tin
- Di-n-butylphthalate
- 4-Nonylphenol mono-ethoxylate
- Methyl-paraben
- 2,4-Dihydroxybenzophenone
- Technical Pentabromodiphenyl ether
- Tris(2-chloroethyl)phosphate
- Tetrabromo bisphenol A
- 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8- hexamethylcyclopenta[g]-2-benzopyran
- Methyl-tert-butyl ether
- Buckyballs
- N-ethylperfluorooctanesulphonamide
- Benzophenone
- N,N-diethyl-m-toluamide

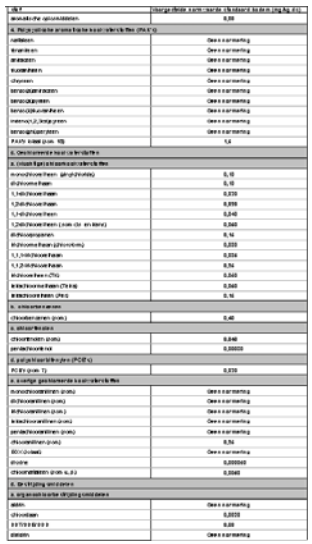
Do we have sufficient information about more common ‘exotics’?

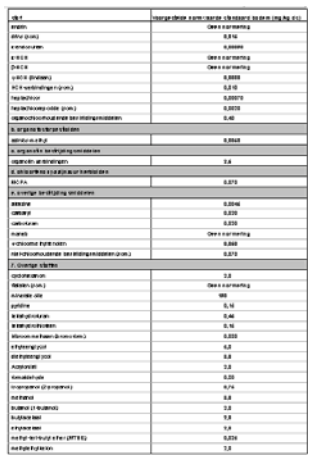
Soil quality in the Netherlands

- ‘The Dutch approach’:
  - Measure only contaminants for which legislative values are defined

Soil quality criteria in the Netherlands

- Environmental definition
- Dutch Soil Protection Policy
  - The target and intervention values (originally A-, B- and C-values)
  - 113 components in different groups
    - (Heavy) metals, volatile organics, chlorinated organics, PAH's, pesticides, etc.)
  - Partly sum-parameters
  - In total 233 components





Soil quality in the Netherlands

- 'The Dutch approach':
  - Measure only contaminants for which legislative values are defined
  - Measure only contaminants that are considered 'usual'
  - Specific components related to the (expected) soil contamination
- Result:
  - Soil investigations mainly targeted on 11 components (or less)
  - As, Cd, Cr, Cu, Hg, Pb, Ni, Zn, mineral oil, PAH and EOX
- But what about the other 200-something contaminants?
  - Limited information on PCB's, drins, some chlorinated organics, etc.
  - Nothing for the largest part of contaminants

Soil reuse

- The reuse of soil stipulates that certain soil quality criteria are met
- ‘Clean soil’ is defined for the 11 most common components

However:

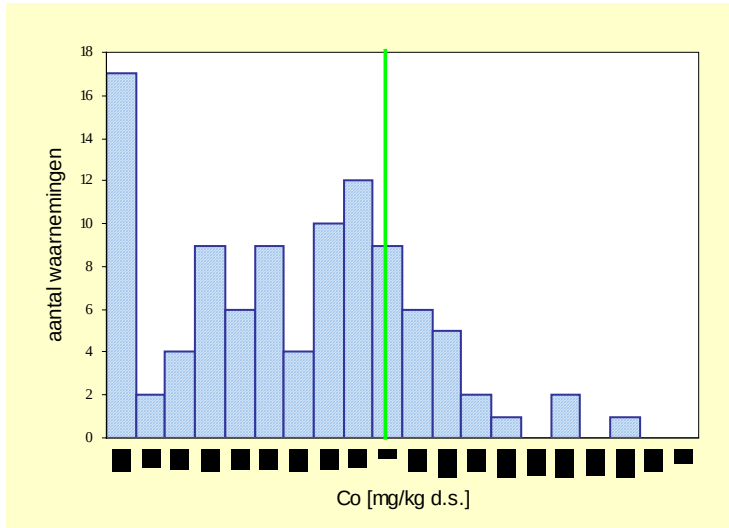
- Control on reuse of soil showed other listed components exceeding limit values!
- How often do these components exceed the target or even intervention values?
- What concentrations of these components might we expect?
- Background levels: - in nature and rural areas
  - in reused soils

Background levels in the Netherlands

- The background levels are determined:
  - For *all* listed components
  - For 100 locations over the Netherlands
  - In top soil (0 – 0.1 m) and deeper soil (0.5 – 1.0 m)
  - With a statistically sound basis
- Providing knowledge on what concentration might be expected when there is no direct input to soil
  - There is input from atmospheric deposition
  - There is input from common agricultural practice
- The current (2004) background soil quality of the Netherlands

Specific problems

- Background levels often exceed target values
  - When testing against target values these uncontaminated soils might appear to be contaminated … but are only part of the background population
- Often the background concentration are below the level of detection … but sometimes the level of detection exceeds the target value
- In general it was concluded:
  - That target values should be set at the 95-percentile of the distribution of background concentrations
  - Or on the detection level



Implementation in Soil Protection Policy

- Per 1 January 2007 a new Soil Protection Policy will be published
- Target levels will be based on the results of the background levels

Some examples

Component	Old target value	New target value	Motivation
As	29	20	95-perc.
Cr	100	55	95-perc.
Co	9	15	95-perc.
Zn	140	140	95-perc.
toluene	0,01	0,03	det. level
heptachloroepoxide	0,0000002	0,002	95-perc.
azinphosmethyl	0,000005	0,005	det. level

Implementation in Soil Protection Policy

- Per 1 January 2007 a new Soil Protection Policy will be published
- Target levels will be based on the results of the background levels
- More focus on a larger number of contaminants

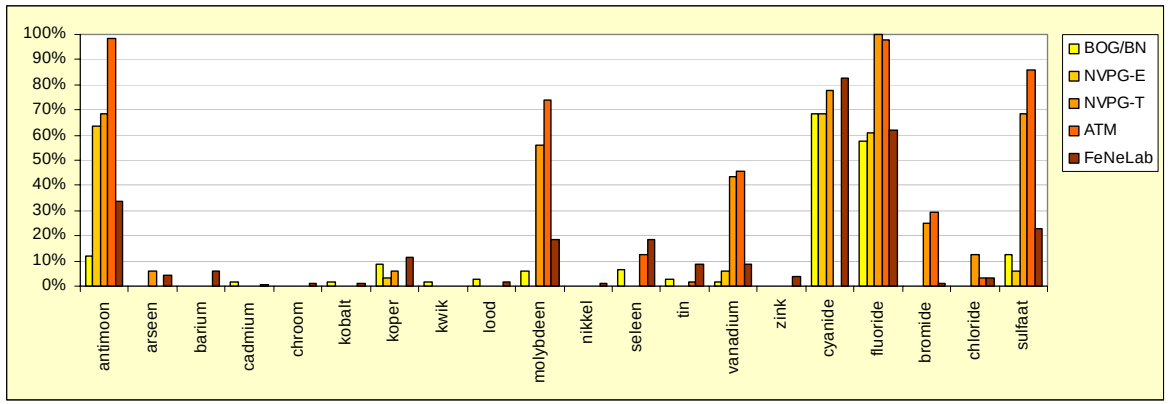
- But which contaminants often exceed the new target values?
  - In background soils this will per definition be 5% or less
  - However, what concentrations might be expected in urban areas?
- Policy: routine measurement of components that exceed the target values in more than 5% of samples from urban areas

Second study on urban soils

- Concentrations in urban soils often exceed target values and sometimes even intervention values
- That is: without an direct cause for soil contamination
- But to what extent?
  - Which components
  - How high are the concentrations (in relation to new background levels)
- Urban background levels / background levels for reusable soil
  - Most soils for reuse originate from urban areas
  - Urban areas are in general densely populated and often used for decades of even centuries

Concentrations and leachability of urban soils

- New data was gathered for urban soils
- Both concentrations and leachability were determined for 26 respectively 20 components
- Exceeding the target values in more than 5% of the measurements implies routine measurement
- Some of the original components (As, Cr) do not exceed the (new) target values in more than 5% (even far less!)
- Some of the rarely measured components (Sb, Ba, Co, V) do exceed the (new) target values in more than 5% (or even much more!)
- Emission values are frequently exceeded by Sb, Mo, V, CN, F, Br, SO_4
- More common metals exceed emission values far less frequently



Conclusions 1

- In the Netherlands the focus on components in soils was:
  - Too narrow
  - Partly besides the real problems
- Despite a long list of components for which quality levels are set, we did not know the background concentrations
  - And still missing systematic information on background levels in urban areas
- In general focus in Europe is on the same limited number of components

→So even part of the ‘old’ substances appear to be new emerging substances in soil!

Conclusions 2

In relation to new emerging pollutants

- What do we have to know?
  - (Background) concentrations
  - Potential effects to humans, eco-system and the environment
- When poses a pollutant a (serious) threat?
  - Background concentrations
  - Availability
- And if it poses a serious threat, routine analysis will be necessary
  - In which situations?
  - For which part of the environment?