

Emerging substances in soil

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

TNO | Knowledge for business



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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

stof	voorgedekte normwaarde (stichtard bodem (mg/kg ds))
1. Metaal	
arsenium (As)	0,80
barium (Ba)	20
beryllium (Be)	100
calcium (Ca)	1,5
cadmium (Cd)	0,80
chromium (Cr)	15
kobalt (Co)	15
koper (Cu)	40
kwik (Hg)	0,15
lood (Pb)	50
molybdeen (Mo)	1,5
nikkel (Ni)	30
zink (Zn)	4,0
talium (Tl)	4,0
thallium (Tl)	4,0
strontium (Sr)	0,75
Sn (Sn)	6,5
vanadium (V)	50
zilver (Ag)	2,0
zink (Zn)	140
2. Overige anorganische stoffen	
borate	2,0
chloride	120
cyanide (CN)	3,0
cyanide complex (gH + S)	1,5
fluoride	100
fosfaat (sum)	6,0
nitraat	240
3. Organische stoffen	
benzeen	0,025
ethylbenzeen	0,030
tolueen	0,030
xylanen (sum)	0,025
styreen (sty/benzeen)	0,050
naftal	0,25
1-allylthiobenzeen (alkaht)	Open normering
m-allylthiobenzeen (alkaht)	Open normering
p-allylthiobenzeen (alkaht)	Open normering
orthoalkyl (sum m-, m-, p-)	0,10
diethylbenzeen	0,030

stof	voorgedekte normwaarde (stichtard bodem (mg/kg ds))
4. Organische stoffen (andere)	
1,1-dichloorethaan	0,030
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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

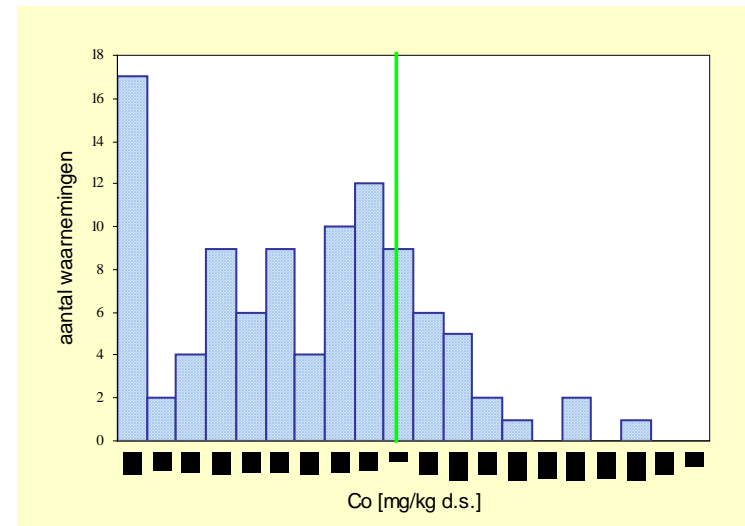
Background levels in the Netherlands

- 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



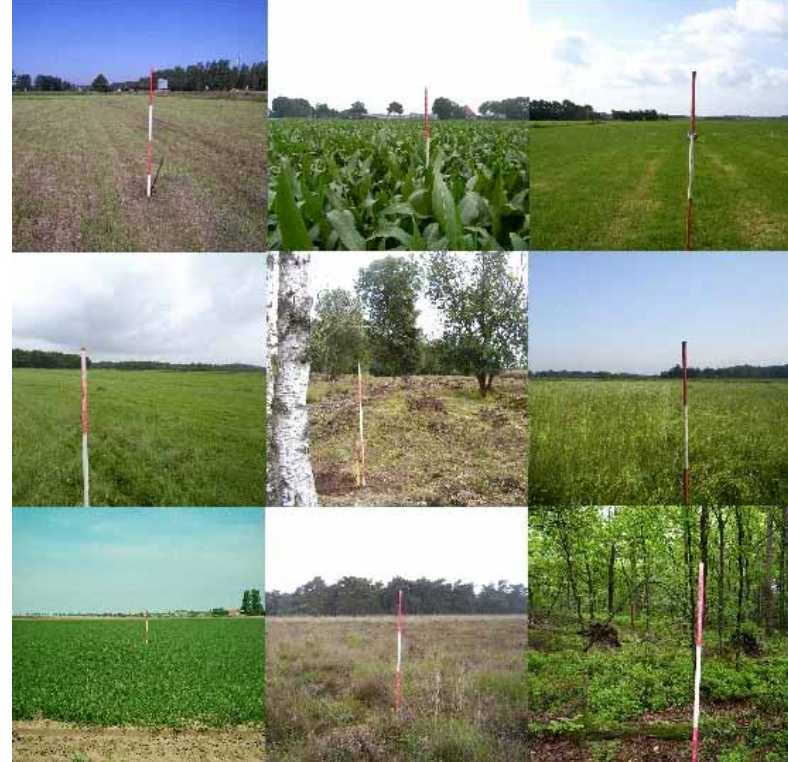
Specific problems

- 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



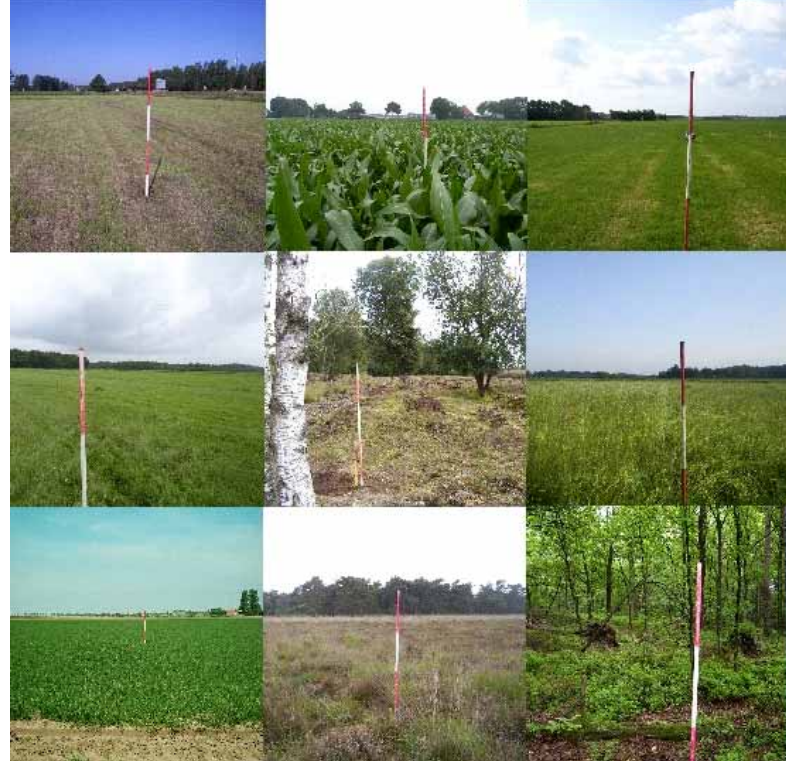
Some examples



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.
azinthosmethyl	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

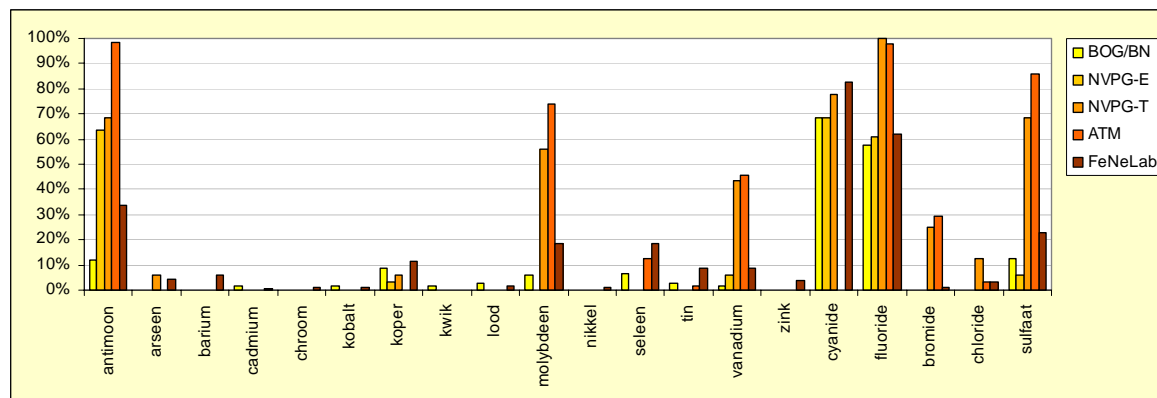
- Concentrations in urban soils often exceed target values and sometimes even intervention values
- That is: without an direct cause for soil contamination
- But to what extent?
 - Which components
 - How high are the concentrations (in relation to new background levels)
- Urban background levels / background 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, SO₄
- 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, ecosystem 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?

