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Soil remediation in The Netherlands

Progress, costs and benefits, new policy



rivm

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My (past) and present experience

- Work on soil remediation since 1986
- (Tackling large polluted sites)
- (Development of remediation techniques)
- (Feasible use of soil remediation techniques, chief editor of Handbook)
- (Sampling protocols for polluted and cleaned soils)
- (Uptake of pollution in consumed vegetables)
- Monitoring progress of soil remediation, annual reports
- Analysis of cost benefit of soil remediation
- Regional analysis of level of local pollution (costs, risks)

Introduction to some highlights

- Annual report on the progress of soil remediation
- The inventory of all potentially polluted sites
- The societal cost-benefit analysis on soil remediation

- Paralel developments
 - *The new Soil quality regulation*
 - *The criterium for remediation*
 - *Local soil ambitions*

Annual report on the progress of investigation and remediation of soil pollution (1/3)

- *National monitoring of the number of sites remediated started in 1995 for the RIVM State of the Dutch environment*
- *Since 2000 report to parliament with figures based on independent research by RIVM*
- *The provinces and assigned municipalities are the budgetholders for soil remediation and the main responsible parties of the report*

Annual report on the progress (2/3) – Main figures

- *Annually about 1200 -1500 remediations (200 -300 hectare),*
- *Annually 1400 -1600 main site investigations (60% follow up)*
- *Annual spending of 400 million EURO (50% government, 50% private parties),*
- *50% of remediations on surface and groundwater, 40% surface only, 10% groundwater only,*

Annual report on the progress (3/3) – The impact of soil remediation on society

- *Reasons to start action: 40% building activities, 30% risk or soil damage, 10% restructuring the area, 10% land sale*
- *40% remediations on sites with high risk susceptibility (living areas with gardens, areas where children play, home gardens), 20% nature and agriculture, 40% other buildings, industry and infrastructure.*
- *65% of remediations in urban area, 20% in rural area, 15% on industrial parks*






The inventory of all potentially polluted sites (1/2)






















- *Main question: when is the soil remediation operation ready?*
- *Answer: the definitive inventory, appointing site locations of all historical activities suspect of soil pollution*
- *Survey based on agreed list of activities in archives of Chambers of commerce, Nuisance Act permits, supplemented with aerial analyses*

The inventory (1/2) - Results

- *Results (2004):*
 - *1,700,000 activities;*
 - *710,000 sites;*
 - *after grading 400,000 sites where a follow up is intended*
- *Expected number of remediations 60,000*
- *Setback: about 20% of the remediations monitored are not met in the inventory (illegal or nonregistered activities, lost archives)*

Segments = groups of polluting activities, with risk level, main pollutants[1/3]

-    Human,  groundwater and  ecological risks
 - Red = high, orange = middle and green = low (but not neglectable) risk level
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-    Local dry cleaners [*Cl-HC*]
-    Other textile cleaning [*Cl-HC, BTEX*]
-    Gasworks (for former city lighting and cooking gas) [*PAH, phenols, cyanides, BTEX*]
-    Petrol and car service stations [*Cl-CH, BTEX*]
-    Other fuel and petrol related activities [*Cl-CH, mineral oil, PAH, metals, BTEX*]
-    House heating oil tanks [*mineral oil, PAH, metals, BTEX, other*]
-    Other (industrial) tanks [*mineral oil, PAH, metals, BTEX*]

Segments [2/3]

- 🌆🌊🏠 (Urban) raised terrains [metals]
- 🌆🌊🌳 Filled ditches and waterways with known materials [metals]
- 🌆🌊🌳 Filled ditches and waterways with unknown materials [PAH, metals]
- 🌆🌊🏠 Military grounds [mineral oil, metals]
- 🌆🌊🏠 Large industrial complexes [metals, mineral oil]
- 🌆🌊🏠 Smallscale activities of trade and industry with high cleaning costs [mineral oil, metals]
- 🌆🌊🏠 Smallscale activities of trade and industry with low cleaning costs [mineral oil, PAH, metals]
- 🌆🌊🌳 Activity not expected to give serious soil pollution [mineral oil, metals]

Segments [3/3] –distribution of sites with a follow up

Segment	Number of sites	Estimated surface	Estimated costs
•Local dry cleaners	0,7%	0,4%	7,7%
•Other textile cleaning	0,4%	0,3%	0,3%
•Gasworks (for former city lighting and cooking gas)	0,1%	0,3%	4,4%
Petrol and car service stations	6,2%	2,7%	12,4%
Other fuel and petrol related activities	5,7%	2,9%	5,2%
House heating oil tanks	11,7%	5,0%	6,5%
Other (industrial) tanks	14,2%	7,4%	6,8%
Largescale activities of trade and industry	13,3%	16,7%	24,2%
Smallscale activities of trade and industry with high cleaning costs	4,8%	2,7%	4,2%
Smallscale activities of trade and industry with low cleaning costs	10,1%	6,9%	3,2%
Military grounds	0,1%	0,6%	0,1%
(Urban) raised terrains	3,3%	1,9%	1,1%
Activity not expected to give serious soil pollution	2,7%	2,8%	0,9%
Filled ditches and waterways with known materials	2,7%	2,5%	1,7%
Filled ditches and waterways with unknown materials	24,0%	46,9%	21,2% (?)

The inventory (1/3) – The impact on the budget

- *Expected budget needed 10 -12 billion euros*
- *The once intended end of the operation in 2015 is not realistic with the current annual budget of 0,4 billion euros. With current practice a more realistic finish is 2040-2045.*
- *Should we go on and is soil remediation really worth the money ?*

The cost-benefit balance of soil remediation for society (1/3)

- *Some members of parliament think the money is not well spent and we are hunting ghosts where no real risk exists*
- *Can we show that costs and benefits to society are in balance?*
- *The costs are clear, the benefits are:*
 - *Avoidance of adverse effects on health,*
 - *Avoidance of adverse effects on real estate prices*
 - *Avoidance of closing drinking water wells*
 - *Avoidance of adverse ecological effects*
 - *Avoidance stagnation of economic potential*

Cost -benefit to society (2/3) – Health

- *From medical decision making we lent the concept of the relation of DALYs – disability adjusted lost life years – to an amount of money, about 30 k€/DALY*
- *To obtain national soil pollution levels we collected data on pollution levels, related these to the types of polluting activities and extrapolated to sites without measurements.*
- *To relate pollution levels to risks we made a catalogue of the combinations with soil use (risk related classes) and calculated expected exposure levels for each site and the number of people remaining on the site.*
- *The relation of DALYs to exposure levels proved to be difficult, only for cancer–inducing substances a clear relation exists. For all other substances literature found was under discussion.*

Cost -benefit to society (3/3) – The balance

- *Health – incomplete, partially unreliable but substantial costs*
- *Real estate values – substantial costs*
- *Closing of drinking water wells- not crucial to drinking water supply, but still substantial costs*
- **Overall:** *calculated benefits slightly under costs*

- *Several alternative scenarios were used with capitalisation based on standard discount rates. With lower discount rates for substantial effects we can play even.*

- *Conclusion in parliament: **continuation***
 - *The public concern on soil pollution is high. Therefore the operation cannot be stopped.*
 - *At least the money spend appears not to be a big loss.*
 - *More epidemiological studies are needed and will be supported.*
 - *The Ministry of Finance is asked to reconsider the standard discount rate to be used in calculations for a sustainable effect.*

What next ? – Comments in parliament

- The rightwing fraction commented that they consider ecological effects only not as important enough to justify the high costs of remediation. (This is estimated by us to be applicable to about 13% of the sites and current practice is that remediation of such sites stagnates.)
- They urged to concentrate on the priority sites.
- The leftwing fraction commented that protection of workers on the floor may be more effective than soil remediation.
- And also they commented that without firm action to polluters, the governmental and societal spending on soil remediation gives room to make money with bad practices.

What next ? – The current policy goals on soil remediation in the Netherlands

- All new soil pollution (after 1987) will have to be cleaned immediately.
- Government spendings on soil remediation of historical soil pollution stops in 2030, after that site developers will have to cope with soil pollution on their own account.
- All priority sites [with unacceptable (human) risk in the present situation] will be tackled (remediated, managed, at least safeguarded with temporarily measures) before 2015.
- The tackling of other sites will be left to local land quality ambitions.
- The tackling of groundwater pollution on a regional scale will be stimulated.

What next ? Use of instruments developed

- Budget calculations for priority sites.
- Selection of priority sites on the basis of known and expected pollution levels using GIS-data for soil use and soil types – (Source–path-receptor analysis) – coupled with strategic preliminary studies and investigations
- As an aid for decision making site numbers, characterisation and estimated budget calculations will be determined in a number of areas
 - with planned changes in land use,
 - with political priority (i.e. underdeveloped living areas and industrial parks; areas with agreements on groundwater protection or habitat protection)
 - with high economic potential
 - with clustering of sites with groundwater or soilsurface pollution
- Beside that the actualisation of the state of the sites in the inventory and the extension of data in cost models and pollution level models is a continued effort.