Is green remediation equal to sustainable remediation
An introduction

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Sustainability

‘Development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (1987, Brundtland)

Three pillars:
1. People / Social
2. Profit / Economics
3. Planet / Environment
Players

Nicole (see Nicole roadmap on www.nicole.org)

Common Forum / CLARINET

Sustainable Remediation Forum (SURF) (US, UK, NL,....)
- US : [www.sustainableremediation.org](http://www.sustainableremediation.org)
- UK : [www.claire.co.uk/surfuk](http://www.claire.co.uk/surfuk)
- NL:

Individual states/regions
Evolution of contaminated land policies at national level

First generation: the early days 1980
  - Focus on concentrations (e.g. Dutch ABC values)
  - Systematic approaches (protocols, national inventories)

Second generation: contaminated land risk assessment 1990
  - Possibilities for tailor-made approaches with cost effective investigations
    - Land use becomes very important in assessment and decision making

Third generation: Risk Based Land Management and solution design 2000 (based on CLARINET concept)
  - Integration with spatial planning, water management, socio-economy
  - Economic development vs. protection of Environment & HH
The Underground journey
or the evolution of soil policy

- Awareness beginning
- Multifunctionality square
- Risk management road
- Society street
- Sustainability place
- Profit lane
- Green close

Ground level

ARCADIS
The needs

Social & economic needs

Sustainable landuse

Redev

Prioritization based on present risks

Prioritization based on the need to reuse the land

Serious pollution

Environmental problems

Priority based on the need to reuse the land

Environmental needs
Needs of evolution to meet new challenges
4th generation of policy framework

Sustainable use of natural resources:
  consumption of resources should not exceed the carrying capacity
  of the environment,
  de-coupling of resource use and waste generation from economic
  growth.

Verification of environmental technologies (eco-efficient, evaluated
against ‘indicators)

Life cycle thinking integrated to sector policies

EU climate and energy targets (“20-20-20”-targets): highly energy-
efficient, low carbon economy.
Sustainability in Land Management

Environment protection

No problem shifting
Protecting Environment and Health against risks on the long term
Reducing Emissions and footprints in land remediation and management
(water, energy, soil & land, …)

Social

Fostering local employment opportunities in communities where sites are reclaimed and reused.
Integrating reuse in land development needs Ethics & Equity

Economics

Decrease Direct costs & Increase benefits
Rising property values
Project lifespan & flexibility
<table>
<thead>
<tr>
<th>Risk</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>origin / use</td>
<td>economy/science</td>
</tr>
<tr>
<td>based on ...</td>
<td>mental construct</td>
</tr>
<tr>
<td>objective</td>
<td>transparency</td>
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</tbody>
</table>
| important    | • single target
|              | • accountability
|              | • effectiveness    |
| question     | Should we act?     |
| support to   | better decisions   |
| strategy     | prevent or limit   |
|              | ecology/policy     |
|              | ethical construct  |
|              | fairness           |
|              | • multi-objective
|              | • interdependency  |
|              | • efficiency       |
|              | How can we act?    |
|              | better action      |
|              | synergy            |
Stepwise approach to check feasibility and create trust
Three levels

Policy level:
• What is allowed by legislation?
• What is stimulated by regulator?
• Is there an area issue (several sites impacting same targets)?

Site strategy:
• What is the optimal remediation strategy?
• Try to include all aspects (perhaps an energy intensive thermal remediation can be sustainable)

Implementation (= green remediation):
• What is the optimal implementation strategy?
Three levels: Site strategy level

- Comparison of two remediation scenario’s
- In both cases a cold-heat pump is in place:
  - In the first scenario, the focus is on the optimal remediation, and the recuperation of C/H is secondary
  - In the second scenario, the focus is on the optimal use of C/H of the aquifer, and the remediation is secondary
Scenario with focus on remediation

- injection wells
- extraction wells

80 m
Scenario with focus on sustainability

- injection wells
- extraction wells

80 m
Three levels : Implementation level

On a site, a pump & treat containment system is in place

To heat the treatment building :
- 4m³/h of the groundwater is deviated to a C/H pump (22 kW)
- Building is about 1000 m³
- Goal is to keep the building > 5°C
- Cost is about 60 kEUR
- Pay back after 6 years

And…. it worked well this winter !
Conclusion and remark

Sustainable remediation is the next step, but don’t go too far in one direction or another, be aware of the pendulum!
Imagine the result

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