Remediation Strategy for Soil and Groundwater Pollution
RemS – A decision Support Tool

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NIRAS

Remediation Strategy for Soil and Groundwater Pollution - RemS

Project holders….

The Capital Region of Denmark

DANISH MINISTRY OF THE ENVIRONMENT
Environmental Protection Agency

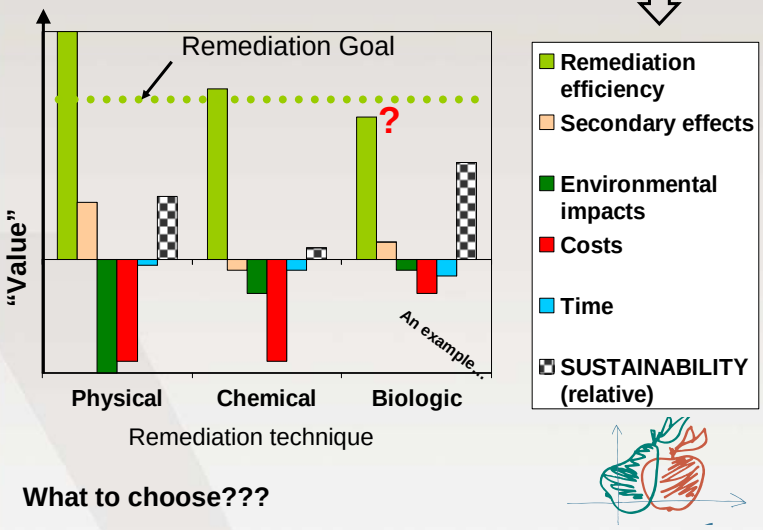
Information Centre on Contaminated Sites
DANISH REGIONS

This presentation is about….

- Decision support parameters
- A tutorial through RemS
- Perspectives

Sustainable remediation and decision support parameters…

Sustainability as aggregated parameters



What to choose???

RemS - purpose and decision support parameters

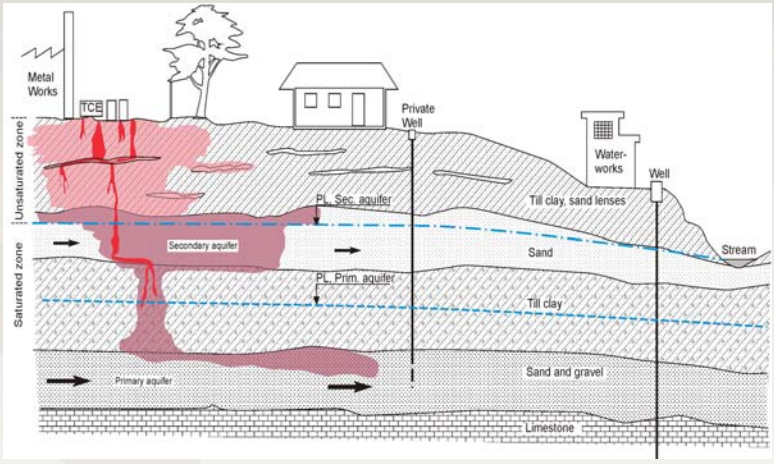
A site specific tool

Decision support parameters:

- Remediation efficiency and secondary effects
- Costs
- Environmental impact (LCA)
- Time

RemS - a tutorial

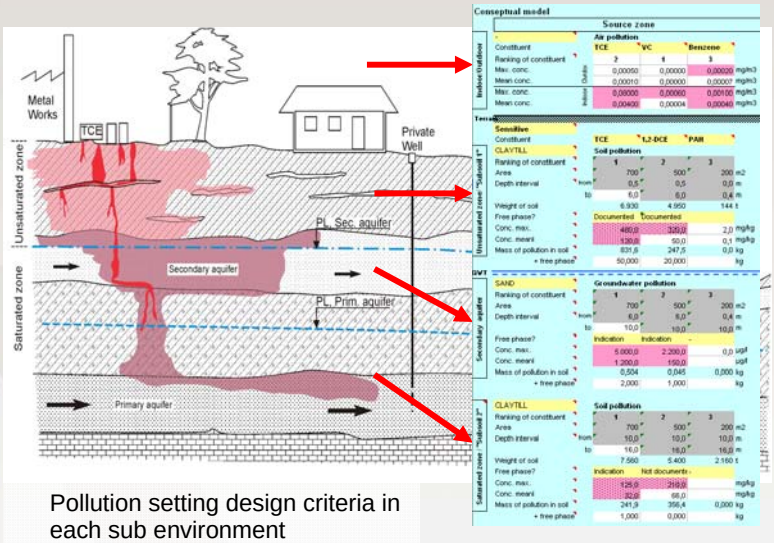
Case: Industrial pollution with TCE



Conceptual model for geology, hydrogeology and pollution

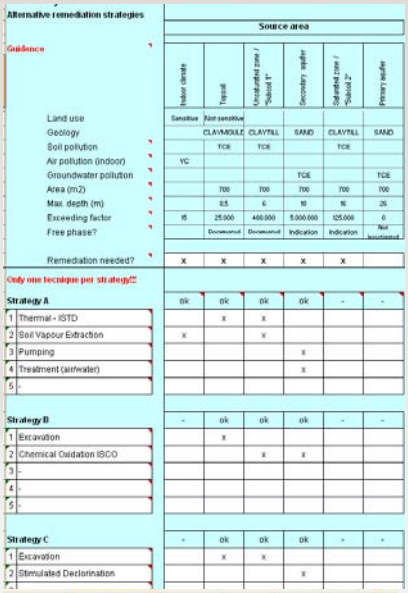
RemS – Input to conceptual model

Input data



Pollution setting design criteria in each sub environment

RemS - Identification of alternative remediation strategies



Summary of conceptual model:

- geology,
- pollution,
- threshold limits..

Remediation needed?

Identification of remediation strategy A! (treatment train)

Alternative strategy…B!

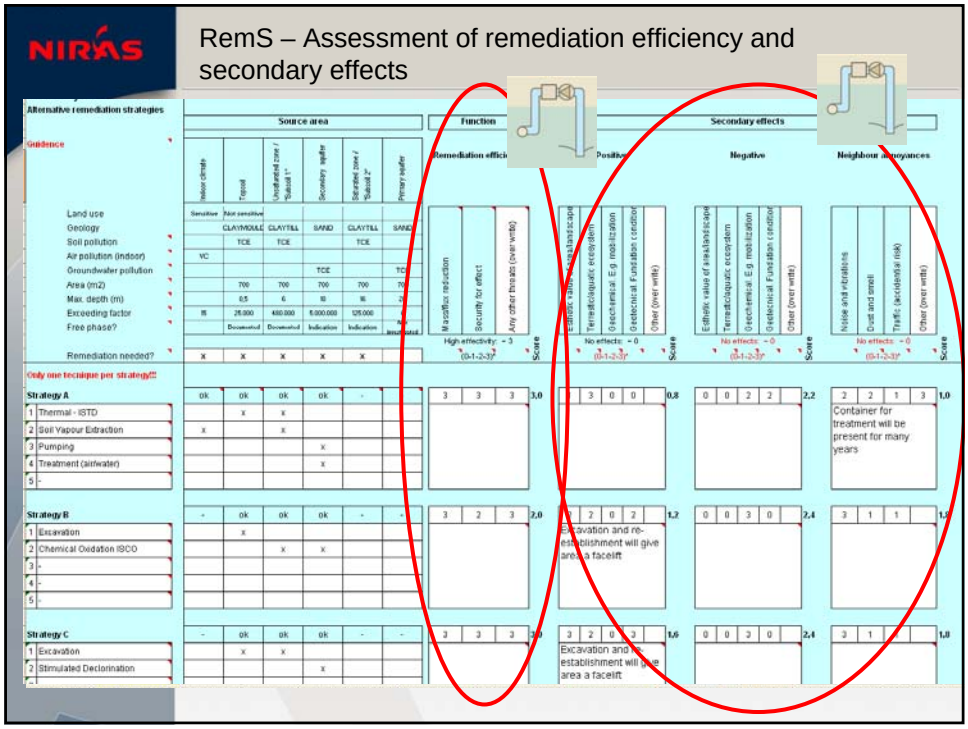
Alternative strategy…C!

LCA calculations based technique inventories

Techniques included in RemS so far:

- Excavation and off site treatment (light oils)
- Sheet piling (trapeze wall and H profiles)
- Pumping - P
- Treatment – T (water and air, GAC)
- Dual Phase Extraction - DPE
- In Situ Chemical Oxidation - ISCO (potassium permanganate)
- Natural Attenuation - NA
- Stimulated Reductive Declorination – SRD (EOS, lactate, KB1)
- In Situ Thermal Desorption – ISTD (conductive heating)
- Soil Vapor Extraction - SVE
- Passive Soil Vapor Extraction – PSVE
- Soil mixing with zero valent iron - ZVI (planned)
- Thermal - Steam (planned)

RemS – Assessment of remediation efficiency and secondary effects



RemS – Remediation efficiency and secondary effects

Assessment of remediation efficiency

Needs can be:

- Mass removal
- Reduction in massflux

It is mandatory to determine what success criteria are!!!

And to reach the goal in the most “cost”- effective way..

Uncertainties on techniques could be depending on:

- Access to site
- Remaining pollutants after remediation
- In situ contact problems when biological or chemical techniques are used
- Experiences for the involved parties
- Technology transfer between different geological and climatic conditions

RemS – Local secondary effects

Assessment of local secondary effects

Positive or negative effects:

- Esthetic value of area/landscape
- Terrestic or aquatic changes of ecosystem
- Geochemical changes (fixation or mobilization of constituents)
- Geotechnical changes (foundation conditions)

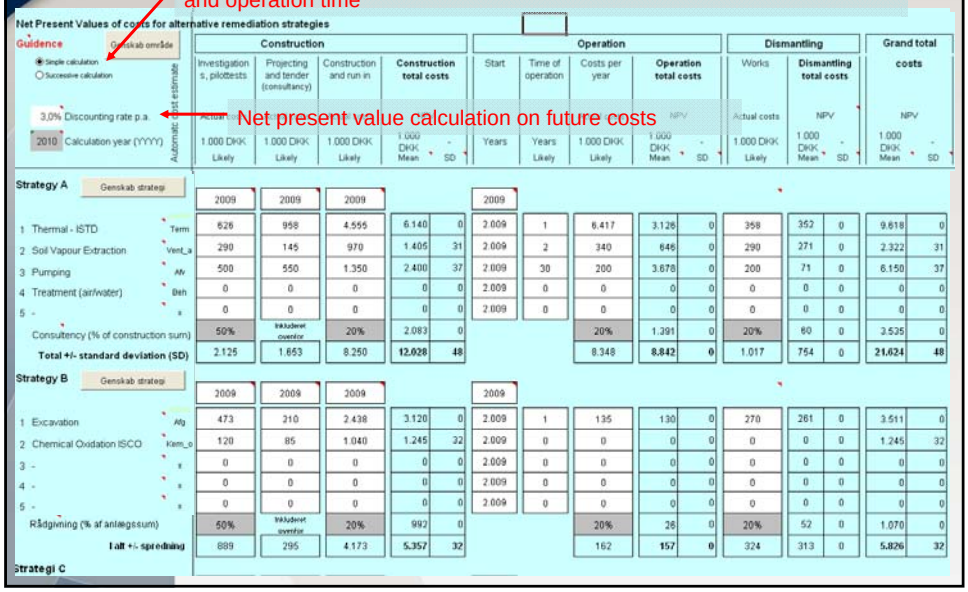
Neighbour annoyances during construction and remediation:

- Noise and vibrations
- Smell
- Traffic

RemS – Cost estimate as a simple calculation

Successive calculation to determine effects of uncertainties on unit prices and operation time

Net present value calculation on future costs



RemS – Cost estimates

Cost estimates

Comparing alternative remediation strategies:

- Each strategy can have several techniques
- Different payment schedules

Back discounting of future costs to a Net Present Value - NPV

Management of uncertainties on:

- Unitprises
- Amounts, e.g. m^3 soil
- Operation period

Successive calculations based on estimates of minimum, most likely and maximum values.

RemS – Environmental costs

Environmental impacts in a life cycle perspective

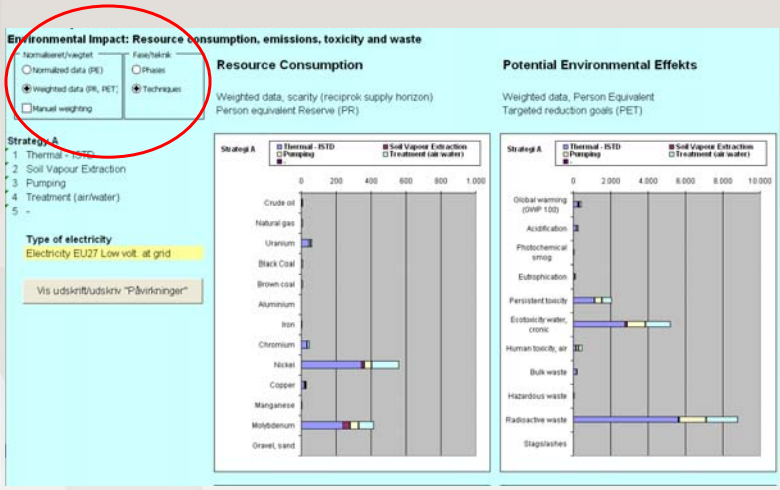
Consumption of resources

- Energy
- Metals
- Sand and gravel

Environmental impacts

- Emissions to air
- Toxic effects
- Waste generation

LCA calculation is visualized in person equivalents (PE)



Units: Impacts in person equivalents - PE

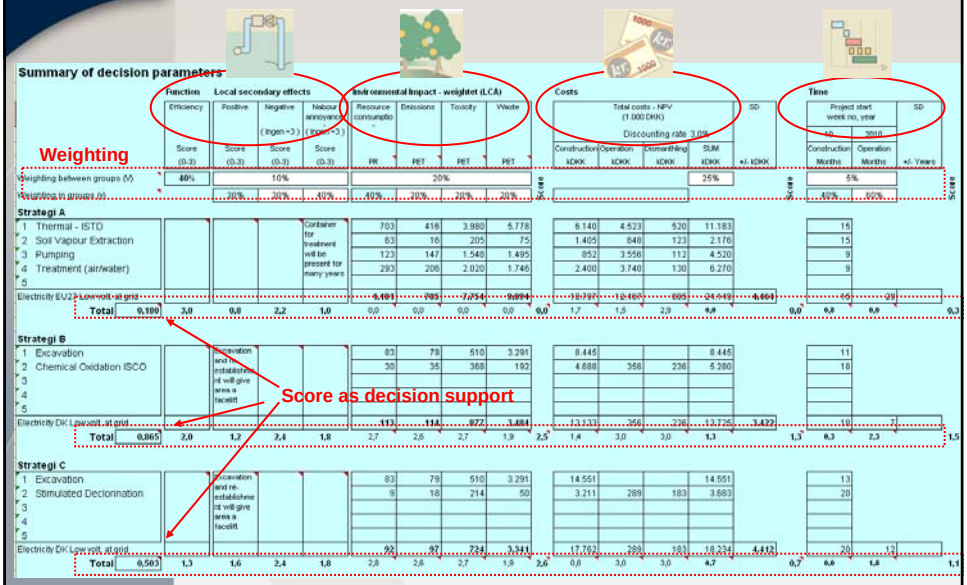
RemS – Time schedule

Time – a scarce resource?

Time schedules can be constrained due to:

- Limited time to reach success criteria
- Availability of the site for the owner/future land use
- Limitations on annoyances periods (secondary effekts)
- Preference to promote site closure (political)

Summary of decision parameters and scoring



Perspectives for RemS...

Shall consider:

- Systematize and document the decision making process
- Overview of decision parameters
- Make alternatives comparable
- Analyze uncertainty on costs and sensibility of discounting
- Ranking based on user's weighting of decision parameters

In general a qualification of the decision making

- Transparency in decision making process
- Eases communication to politicians and other stakeholders

RemS is expected to be available in English primo 2010, kwe@niras.dk


Thank you for your attention
Carbon - bootprint and soil remediation…