Carbon footprint on soil remediation

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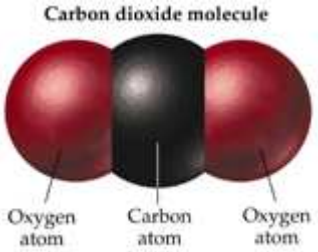
Outline presentation

- Reason to develop tool
- CO_2 as a sum parameter
- Scope of the tool
- Structure and content of tool
- Experiences so far
- Future scope



Reason to develop tool

Reason for tool

CO_2 as parameter

Scope of tool

Design of tool

Experiences

Future scope

Environmental merit of some soil remediation projects seems hard to find (length and/or intensity)

Companies conform to sustainable entrepreneurship

Dutch governments conform to sustainable purchase

Worldwide attention for climate change and energy topics

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Reason to develop tool

Reason for tool

CO_2 as parameter

Scope of tool

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"A quantified carbon footprint needs to be part of the multi criteria analysis for soil remediation projects"

CO_2 as a sum parameter

Reason for tool

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A lot of environmental aggravating factors can be expressed in CO_2:

- use of electricity
- use of fuels
- oxidation (CO_2) and reduction (CH_4) reactions
- production of materials (Process Energy Requirement) to be used during remediation

CO_2 has a market value

Reason for tool

CO_2 as parameter

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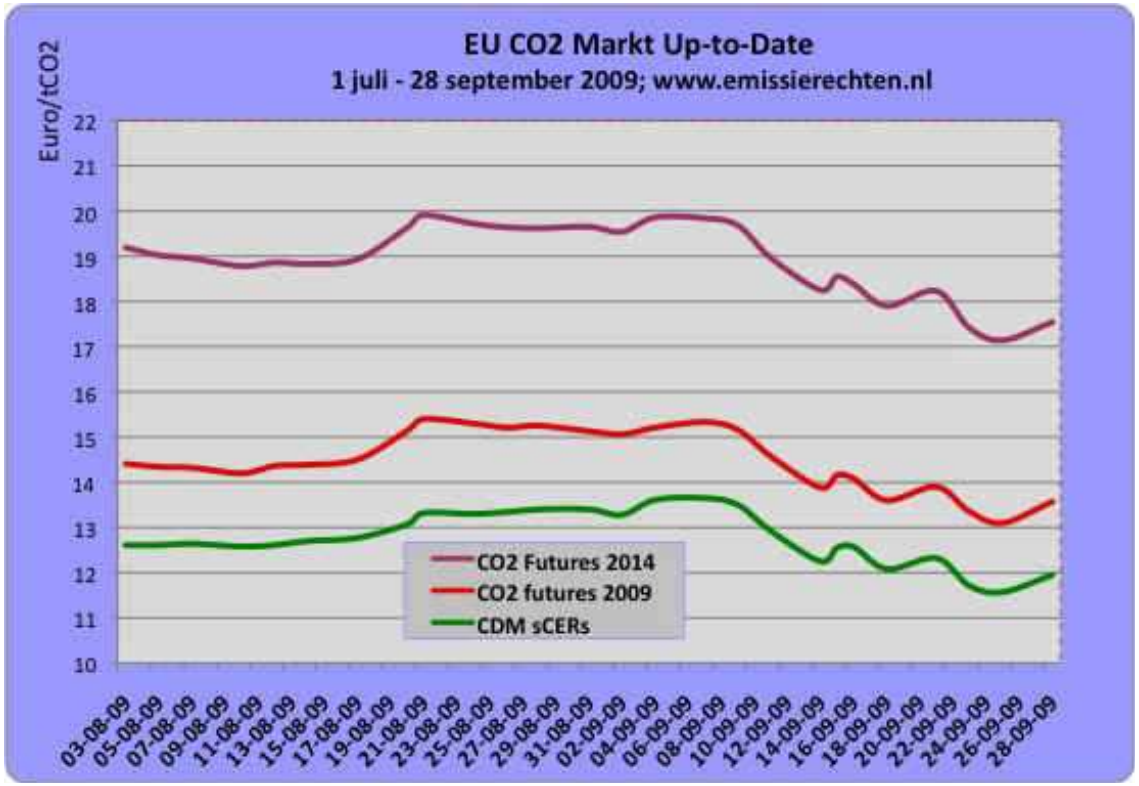
CO2 represents an economic market value (emission trade)



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Scope of CO_2 tool

Reason for tool

CO_2 as parameter

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At what moments do we screen on environmental burden?

- Remediation investigation: weighing pros and cons
- Tenders: part of allotment criteria D&C contracts
- Compensation total CO2-emission of the work
- Stop criterion operational in situ remediation

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Development by consortium

Reason for tool

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The model is broadly based

Consultants (Ecofys, Tauw)
Contractors (Heijmans, Groundwater Technology)
Soil remediators (Province Overijssel, SBNS, City Groningen)

SKB
(Dutch Centre for Soil Quality Management and Knowledge Transfer)

Design of tool

Reason for tool

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Model in MS Excel

Input screen with folding subscreens

3 Databases with quantitative resources

Calculation screen

Output screen with quantitative and graphical results

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CO2 components in tool

Reason for tool

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Several fuels (incl. production, handling, combustion)

Various forms of electricity (no zero emission)

Material (PER-values, non-machinery, application period)

Oxidation & reduction (chemical, biological, thermal)

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Limits of tool

Reason for tool

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What is not in the tool?

Other environmental issues like noise, smell and residues in soil after remediation

Non-environmental issues like costs, risk reduction and technical feasibility

Soil remediation techniques in tool

Reason for tool

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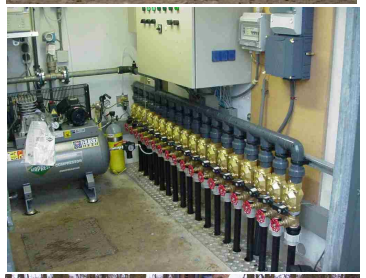
- Excavation of soil, incl. treatment
- Extraction of groundwater
- Purification of groundwater
- Air sparging and SVE
- Multi-phase extraction
- ISCO
- In situ biostimulation
- In situ thermal treatment
- Supervision and monitoring

Technique > activity > unit > value



Impression input screen

Algemene gegevens verontreinigingssituatie

Verontreinigingsomvang van de sanering

[ ] m^3 grond

[ ] m^3 grondwater

Verontreinigde bodemlaag/lagen

[ ] m -mv (bovenkant verontreinigde laag grond)

[ ] m -mv (onderkant verontreinigde laag grond)

Verontreinigde grondwaterlaag/lagen

[ ] m -mv (bovenkant verontreinigde laag grondwater)

[ ] m -mv (onderkant verontreinigde laag grondwater)

Gemiddeld gehalte verontreiniging

[ ] mg/kg ds grond

[ ] µg/l grondwater

Terugsaneerwaarde/eindgehalte

[ ] mg/kg ds grond

[ ] µg/l grondwater

- **Ontgraven Landbodem**
- **Grondwater onttrekken**
- **Grondwater zuiveren**
- **In situ saneren PLI en BLE**
- **In situ saneren MFE**
- **In situ saneren ISCO**
- **In situ saneren Biostimulatie**
- **In situ saneren Thermisch**
- **Toezicht en Nazorg**
- **Overige varianten**

Impression input screen

Ontgraven Landbodem

Ontgraven en verwerken grond op de locatie in depot

Volume te ontgraven verontreinigde grond: ____ m³

Toepassing graafmachine: ____ m³

Toepassing dumper: ____ m³

Kies berekeningswijze: Zelf details invoeren

Toepassing shovel: ____ m³

Geef aan hoeveel in depots c.q. grondstromen de ontgraven grond wordt gesplitst: ____ depot(s)

Worden de depots voorzien van scheidende laag d.m.v. folie? << maak keuze >>

Maximale depot hoogte: ____ m

Geotextiel / folie

Type kunstof: << maak keuze >>

Benodigde hoeveelheid: ____ m²

Dikte geotextiel / folie: ____ mm

Kies type brandstof in kader van duurzaamheidsaspecten: << maak keuze >>

Toepassen van een damwand

Op de locatie verwerken grondstromen

Extern verwerken grondstromen

Overige materialen

Transport grondstromen

Transport aanvoer materialen

Impression output screen

Excavation soil **9.609.004 kg CO_2**

Excavation	893.134	kg CO_2
Treatment	8.265.508	kg CO_2
Materials	78.011	kg CO_2
Transport	372.351	kg CO_2

Removed contaminant mass **155.728 kg**
Treated soil volume **315.000 m^3**

EMISSION : **10.429.817 kg CO_2**
1.146,1 household equivalents
67 kg CO_2 per kg removed contaminants
33 kg CO_2 per m^3 contaminated soil

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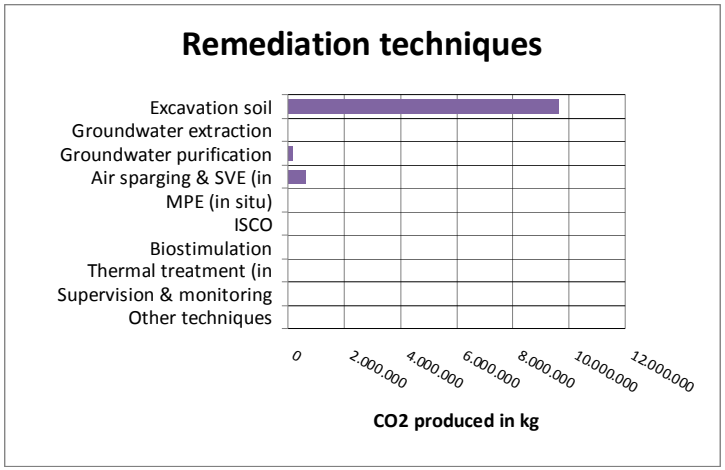
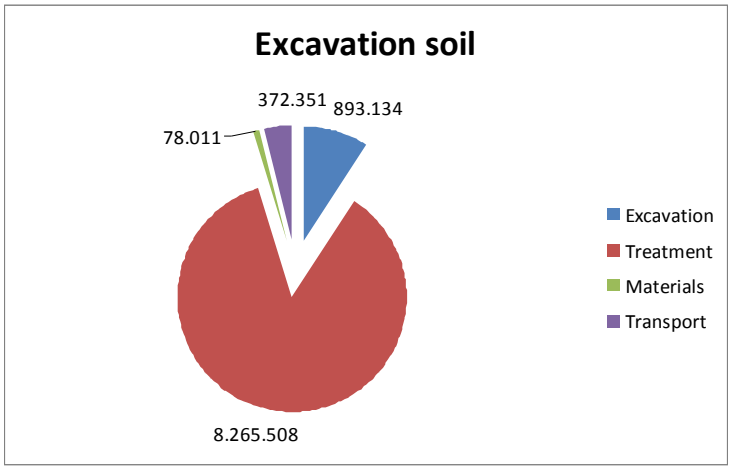
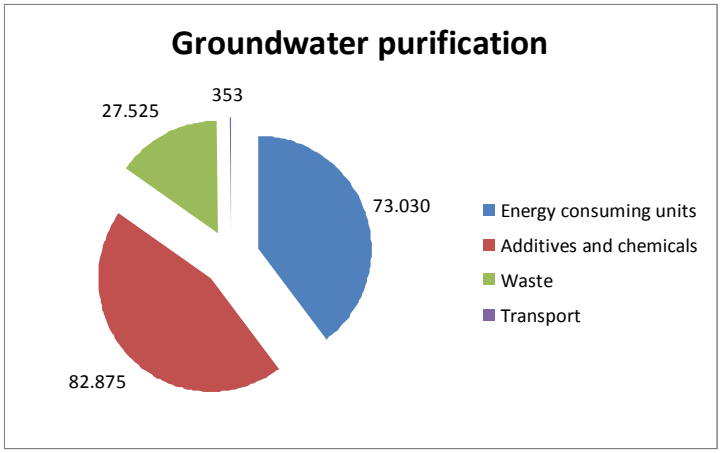
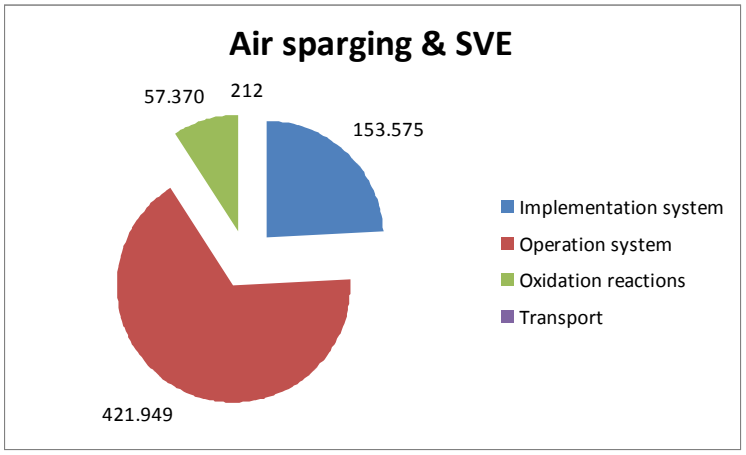
Impression output screen









Experiences until now

Reason for tool

CO_2 as parameter

Scope of tool

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Soil remediation up to 1,000 Dutch household eq CO_2

Off site thermal treatment of soil most extreme CO_2-emitting activity

Transport of material (excl soil) and personnel marginal

ISCO: production oxidizing chemicals crucial

Able to pick out crucial factors techniques

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Future scope

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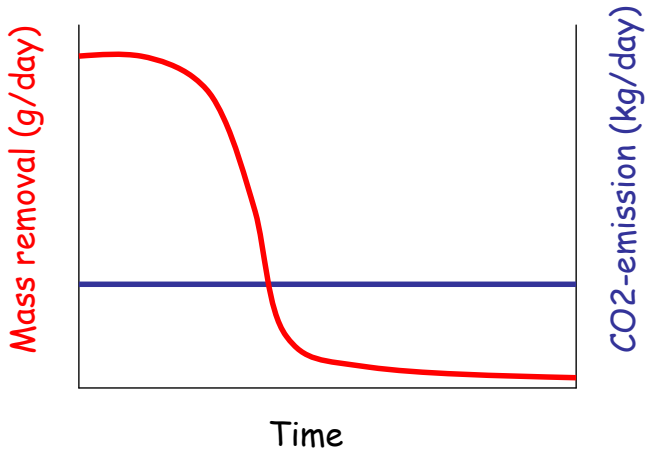
Releasing the model in The Netherlands (SKB)

Translation into English (country specifications)

Integration into multi criteria analysis

Stop criterion:



Future scope

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Ultimate challenge

'Negative' carbon footprint
by sharing facilities for remediation work with
(future) neighbourhood needs vice versa

Think of renewable energy generator (wind turbines)
or growing vegetation (helophyte filter, natural cap)

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Step forward on good housekeeping