

Carbon footprint on soil remediation

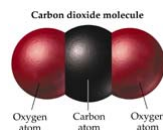
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Outline presentation

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



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Reason to develop tool

Reason for tool	Environmental merit of some soil remediation projects seems hard to find (length and/or intensity)
CO ₂ as parameter	
Scope of tool	
Design of tool	Companies conform to sustainable entrepreneurship
Experiences	
Future scope	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	"A quantified carbon footprint needs to be part of the multi criteria analysis for soil remediation projects"
CO ₂ as parameter	
Scope of tool	
Design of tool	
Experiences	
Future scope	



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CO₂ as a sum parameter

Reason for tool

CO₂ as parameter

Scope of tool

Design of tool

Experiences

Future scope

A lot of environmental aggravating factors can be expressed in CO₂:

- use of electricity
- use of fuels
- oxidation (CO₂) and reduction (CH₄) reactions
- production of materials (Process Energy Requirement) to be used during remediation



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CO₂ has a market value

Reason for tool

CO₂ as parameter

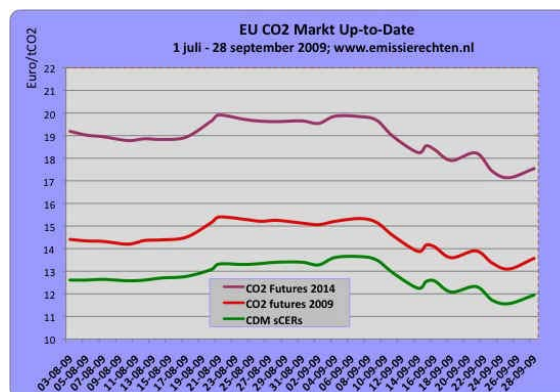
Scope of tool

Design of tool

Experiences

Future scope

CO₂ represents an economic market value (emission trade)



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Scope of CO₂ tool

Reason for tool

At what moments do we screen on environmental burden?

CO₂ as parameter

Scope of tool

Design of tool

- Remediation investigation: weighing pros and cons

Experiences

- Tenders: part of allotment criteria D&C contracts

Future scope

- Compensation total CO₂-emission of the work

- Stop criterion operational in situ remediation



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Development by consortium

Reason for tool

The model is broadly based

CO₂ as parameter

Scope of tool

Consultants (Ecofys, Tauw)

Design of tool

Contractors (Heijmans, Groundwater Technology)

Experiences

Soil remediators (Province Overijssel, SBNS, City Groningen)

Future scope

SKB

(Dutch Centre for Soil Quality Management and Knowledge Transfer)



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Design of tool

Reason for tool	Model in MS Excel
CO ₂ as parameter	
Scope of tool	Input screen with folding subscreens
Design of tool	3 Databases with quantitative resources
Experiences	
Future scope	Calculation screen
	Output screen with quantitative and graphical results



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CO₂ components in tool

Reason for tool	Several fuels (incl. production, handling, combustion)
CO ₂ as parameter	
Scope of tool	Various forms of electricity (no zero emission)
Design of tool	
Experiences	
Future scope	Material (PER-values, non-machinery, application period)
	Oxidation & reduction (chemical, biological, thermal)



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Limits of tool

Reason for tool

What is not in the tool?

CO₂ as parameter

Scope of tool

Design of tool

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

Experiences

Future scope

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



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Soil remediation techniques in tool

Reason for tool

- Excavation of soil, incl. treatment

CO₂ as parameter

- Extraction of groundwater

Scope of tool

- Purification of groundwater

Design of tool

- Air sparging and SVE

Experiences

- Multi-phase extraction

Future scope

- ISCO

- In situ biostimulation

- In situ thermal treatment

- Supervision and monitoring

Technique > activity > unit > value



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Impression input screen

Algemene gegevens verontreinigingssituatie

Verontreinigingsomvang van de sanering

m³ grond

m³ 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



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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 kunststof

<< 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



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Impression output screen

Excavation soil	9.609.004 kg CO₂
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 m³

EMISSION : 10.429.817 kg CO₂
 1.146,1 household equivalents
 67 kg CO₂ per kg removed contaminants
 33 kg CO₂ per m³ contaminated soil

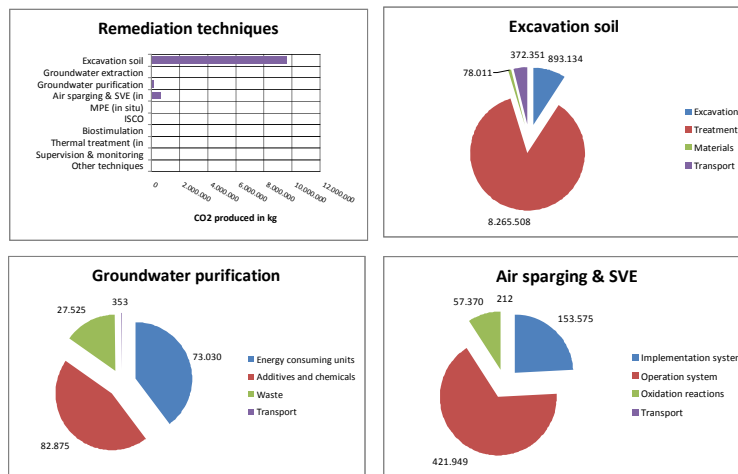


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Impression output screen



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Experiences until now

Reason for tool	Soil remediation up to 1,000 Dutch household eq CO_2
CO_2 as parameter	
Scope of tool	Off site thermal treatment of soil most extreme CO_2 -emitting activity
Design of tool	
Experiences	Transport of material (<i>excl soil</i>) and personnel marginal
Future scope	ISCO: production oxidizing chemicals crucial
	Able to pick out crucial factors techniques



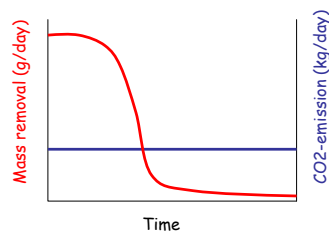
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Future scope

Reason for tool	Releasing the model in The Netherlands (SKB)
CO_2 as parameter	
Scope of tool	Translation into English (<i>country specifications</i>)
Design of tool	
Experiences	Integration into multi criteria analysis
Future scope	Stop criterion:



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Future scope

Reason for tool	Ultimate challenge
CO ₂ as parameter	
Scope of tool	
Design of tool	'Negative' carbon footprint by sharing facilities for remediation work with (future) neighbourhood needs <i>vice versa</i>
Experiences	
Future scope	Think of renewable energy generator (<i>wind turbines</i>) or growing vegetation (<i>helophyte filter, natural cap</i>)

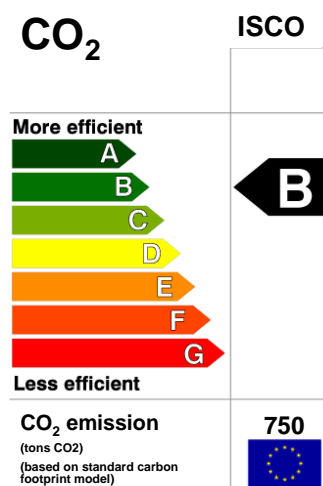


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Step forward on good housekeeping



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