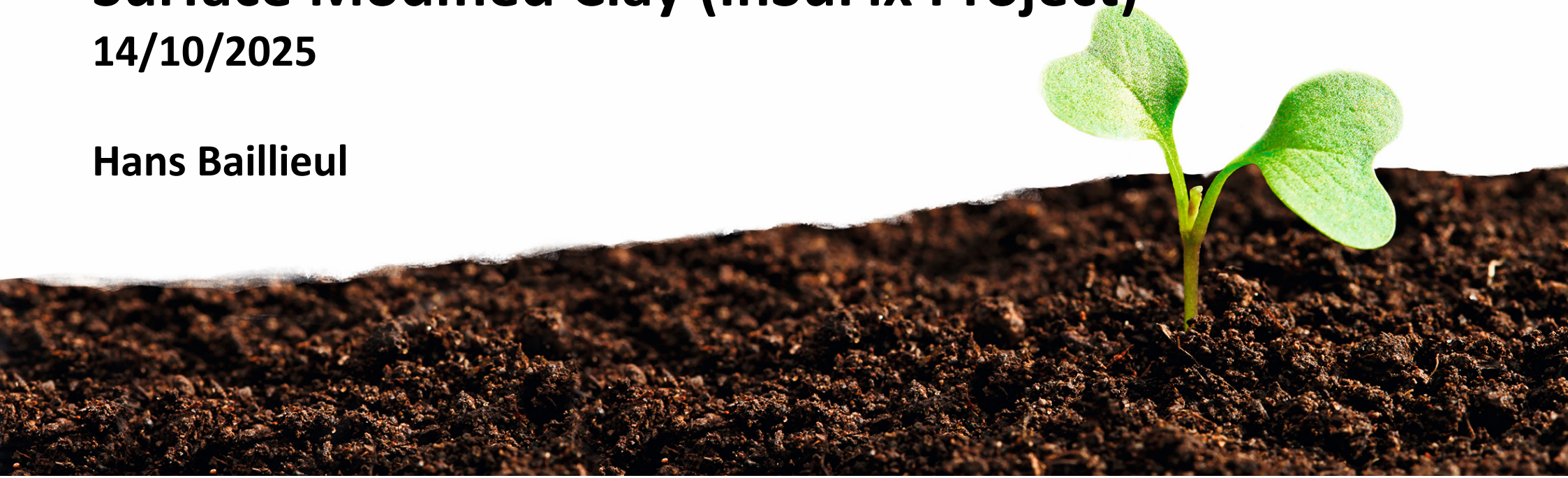
SODECON

SUSTAINABLE SOIL REMEDIATION

In-situ PFAS stabilization by injection of Surface Modified Clay (InSuFix Project)

14/10/2025

Hans Baillieul




Port of Antwerp Bruges
brussels airport
the heart of Europe
site owner
site owner
NJECTIS
technology provider of innovative SPIN injection technology
vito
flemisch research institute with PFAS expertise
SODECON
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remediation contractor
PARTNERS
SUBCONTRACTORS
InSuFix project
expert in High resolution Site Characterization
EnISSA
enhanced in-situ soil analysis
soil remediation consultant
ABO
CONSULTANCY
expert in monitoring groundwater & dynamics
iFLUX
soil remediation consultant
Witteveen + Bos
SAMEN MAKEN WE MORGEN MOOIER
OVAM
KIS
Kenniscentrum
Innovatieve
Saneringstechnieken

InSuFix

WHAT IS THE TECHNOLOGY?

WHEN USE THE TECHNOLOGY?

HOW INVESTIGATE TECHNOLOGY?

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WHAT?

In-situ stabilisation (ISS) of PFAS by injection of surface-modified clay (SMC) into the soil using the SPIN injection technology

→Reduce PFAS migration in groundwater by immobilization

→Challenges:

- Adsorption PFAS
- Homogeneous distribution of SMC in soil
- Long term stability

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WHAT?

Surface Modified Clay

- High adsorption capacity for PFAS
- FLUORO-SORB

SPIN injection

- Innovative injection technology
- Homogeneous distribution in heterogeneous soils

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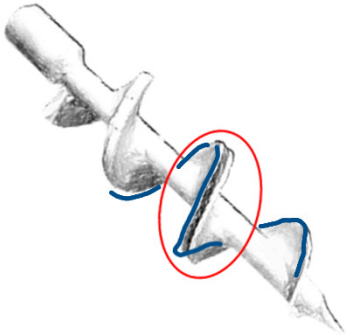
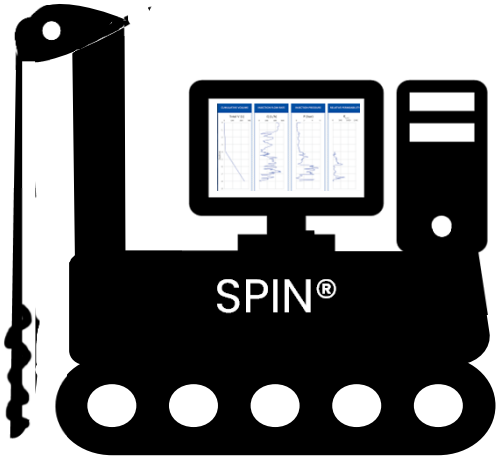
How do we make it work ?
SPIN® injection technology





1. Innovative drill and injection bit

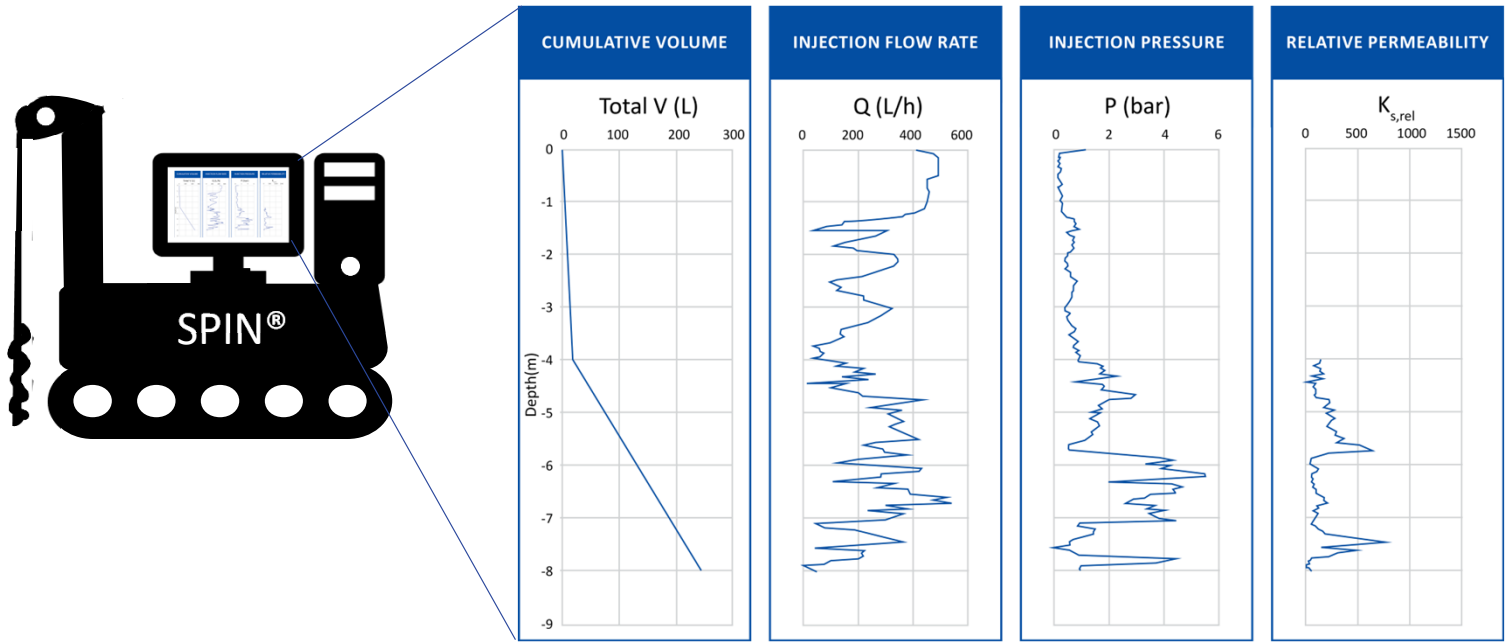
- ✓ Prevents compaction
- ✓ Opens the soil progressively
- ✓ K_{sat} not altered (natural porosity)
- ✓ Larger contact surface (Q en V)
- ✓ Allows to work with lower injection pressures
- ✓ Automatically seals injection points (no reflux)

2. Coupled to a processor and pressure regulator system

- ✓ Can detect permeability in real time
- ✓ Injection pressure can be adjusted cm/cm
- ✓ High accuracy and homogeneous distribution

How do we make it work ?
SPIN® injection technology

Knowledge is the weapon …



Transparant reporting

Possibility to redirect

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WHEN?

P&T is not possible/feasible/preferable

- low permeability soils
- attract other contamination
- longlasting remediation

Excavation is not possible/feasible/preferable

- site infrastructure - buildings
- too deep
- silty/clayey soils
- capacity of landfills

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WHEN?

Soil mixing is not possible/feasible/preferable

- Site infrastructure: inside buildings
- Too deep
- Stability

Advantages of injection

- No depth limitation
- No effect on stability
- Possible inside buildings
- No aboveground treatment of water and soil
- Possible in low permeability soils

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HOW?

2 sites with different PFAS compounds and geology

	Brussels Airport Company	Port of Antwerp-Bruges
PFAS compounds (>100 ng/L)	PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFPeS, PFHxS, PFOS, 6:2 FTS, 8:2 FTS, PFOSA	PFBA, PFHxA, PFOA, PFPeS, PFHxS, PFHpS, PFOS
Geology	Sand and sandstone	Sand with glauconite
Other	Anti-freezing agents	Salts (brackish water)
Depth interval (m-mv)	5-10	2-7

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HOW? – laboratory tests

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- Dosing tests

LEACHING TESTS SMC DOSING (ng/L)					
Dosing (%)	PFH_xS	PFHpS	PFOS	PFH_xSA	Sum PFAS
0,00	69	80	2900	170	3200
0,10	<50	<10	<50	<10	<50
0,25	<50	<10	<50	<10	<50
0,50	<50	<10	<50	<10	<50
1,00	<50	<10	<50	<10	<50
2,00	<50	<10	<50	<10	<50

VITO

- Non-target PFAS
- Influence of various environmental factors - pH, salts, weathering - with batch tests
- Simulation long term stability with column tests

INJECTIS

- Influence of particle size SMC

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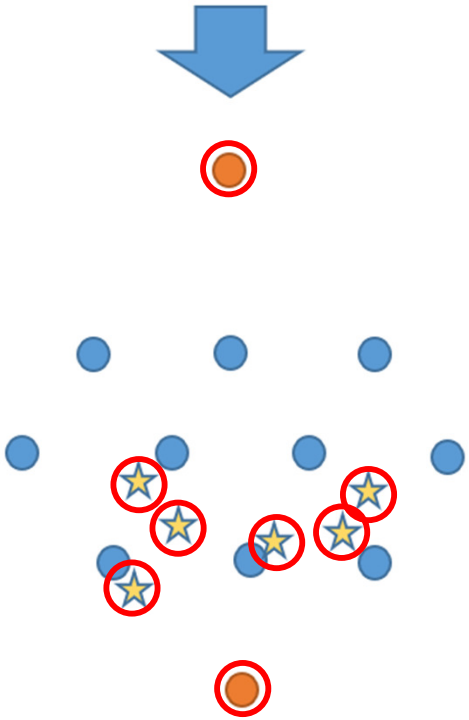
HOW? – pilot tests

10 injection points: 5-10 m (BAC) en 2-7 m(PoAB)



Short term effect: PFAS analysis 18 monitoring wells in injection area:

- 3 different depths
- 3 different distances to the injection points

Mid term effect: 2 upgradient and downgradient monitoring wells

- PFAS concentrations
- Flux

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Timeframe

Activity	BAC	PoAB
Dosing tests	October 2024	May 2024
SMC particle size tests	April 2025	April 2025
Installation MW	April 2025	May 2025
Baseline monitoring (HPT, concentrations, flux)	May 2025	June 2025
Start lab tests VITO	June 2025	June 2025
Injection	June 2025	August 2025
Short term monitoring 1	October 2025	November 2025
Mid term monitoring 1	January 2026	February 2026
Short term monitoring 2	June 2026	August 2026
End lab tests VITO	June 2026	June 2026
Mid term monitoring 2	January 2027	February 2027

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