# FRAC-IN

*Enabling in situ soil remediation on low-permeability sites through hydraulic/pneumatic fracturing (FRAC-IN)*

Axelle Mineur (ABO-Group – Belgium)

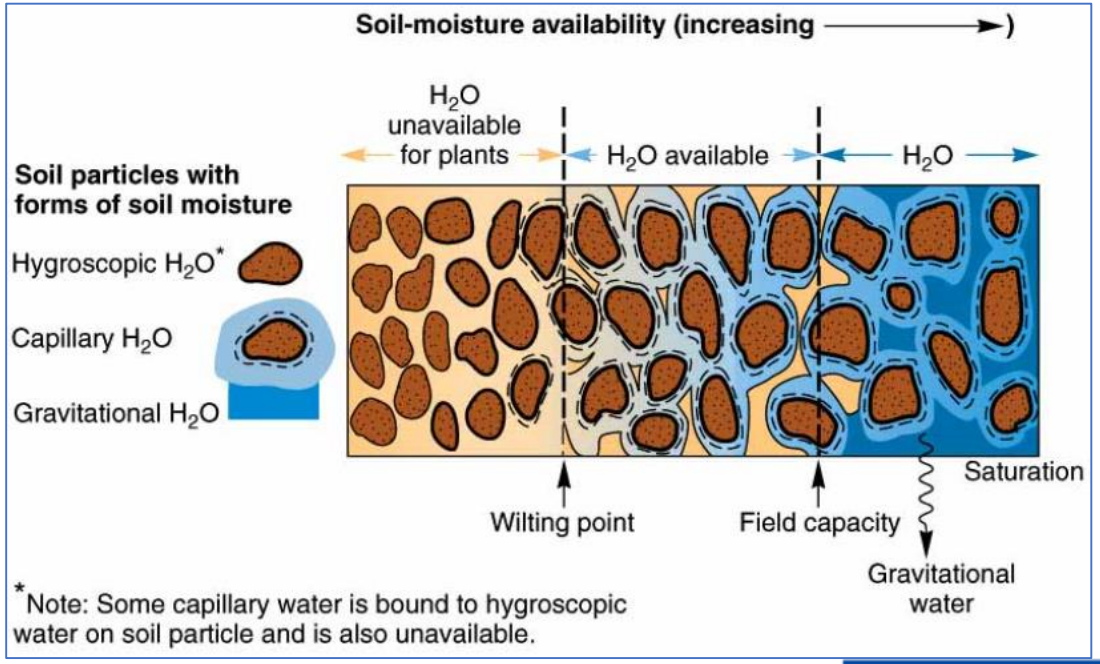
# Table of contents

- Context
  - Water-soil interactions
  - Lack of interactions & in situ remediation
- LIFE FRAC-IN
  - Aim & applications
  - Technology
  - Results
- Animation of the technology

# Context: Water-soil interactions

- Water soil interface = gradient of permeability

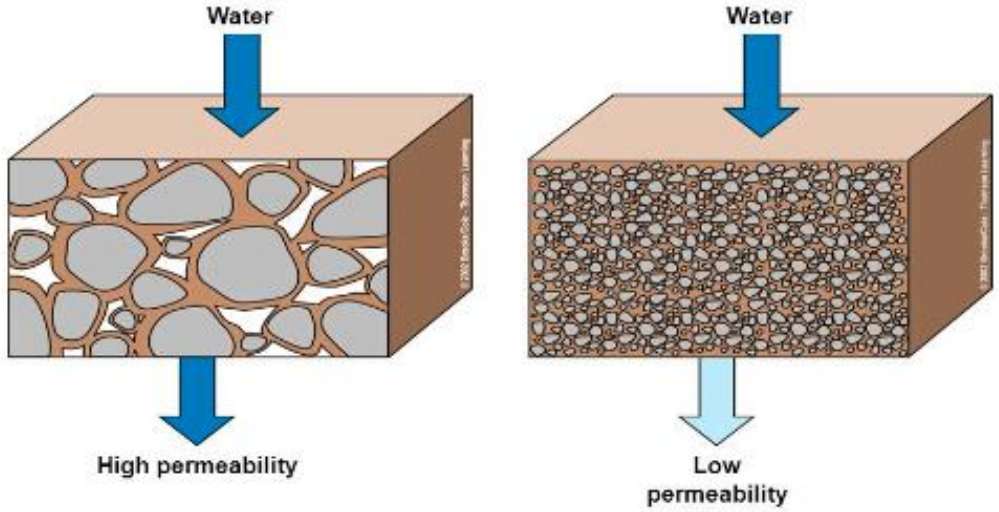
- Chlorinated solvents, mineral oils and other pollutents tend to be sorbed on the soil
  - First need to desorb them
  - Before you can treat them




(5.7: Soil-Water Relations, by Anna R. Schwyter & Karen L. Vaughan, University of Wyoming)

# Context: Lack of interactions & in situ remediation

- Remediation
  - Requires contact between
    - Remediation agents
    - Contaminants
- Remediation agents => move through water to reach the contamination
- Poor permeability: reduces efficiency of in situ remediation (chem, bio)



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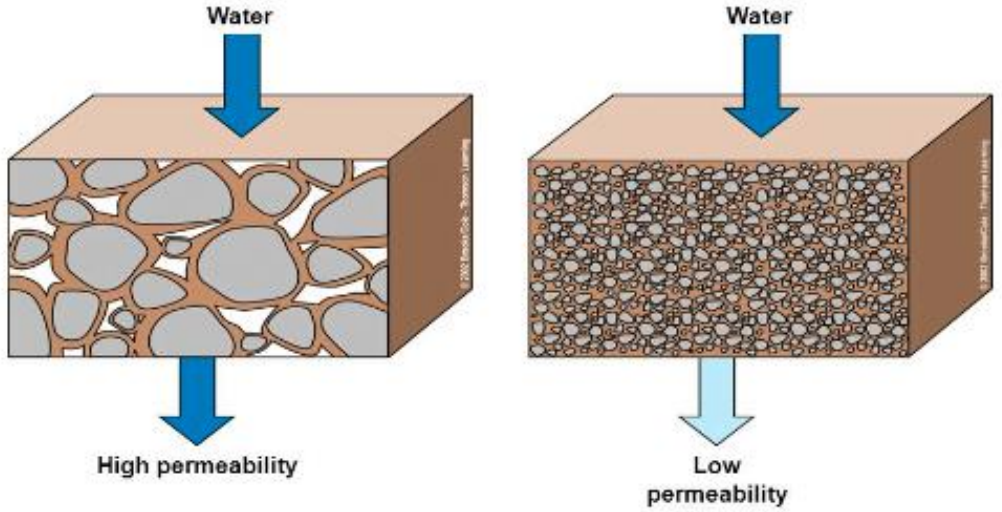
=> artificial porosity!



# LIFE FRAC-IN

Eurostars Frac-In
2017 - 2019

LIFE Frac-In
2022 - 2025

Eurostars
Frac-In-Ox
2022 - 2024

# LIFE FRAC-IN

- Duration: 2022-01-01 – 2025-12-31
- Budget: 1.786.230 €
- Partners
  - DEKONTA a.s.
  - ABO NV
- 7 sites => 3 in CZ and 4 in BE

# LIFE FRAC-IN: Aim & Applications

- Enable in situ remediation using
  - Biological reagents
  - Chemical reagents
- Poorly permeable soils
- Varied polutants
  - Mineral oils, chlorinated solvents, HM, pesticides etc.

⇒Artificial porosity

# LIFE FRAC-IN: Technology

A

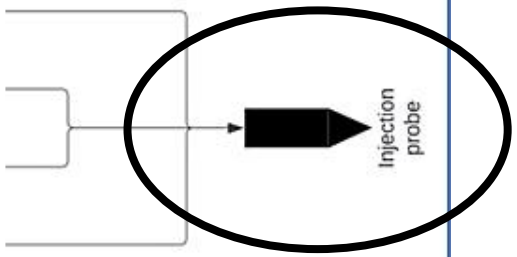
B

C

D

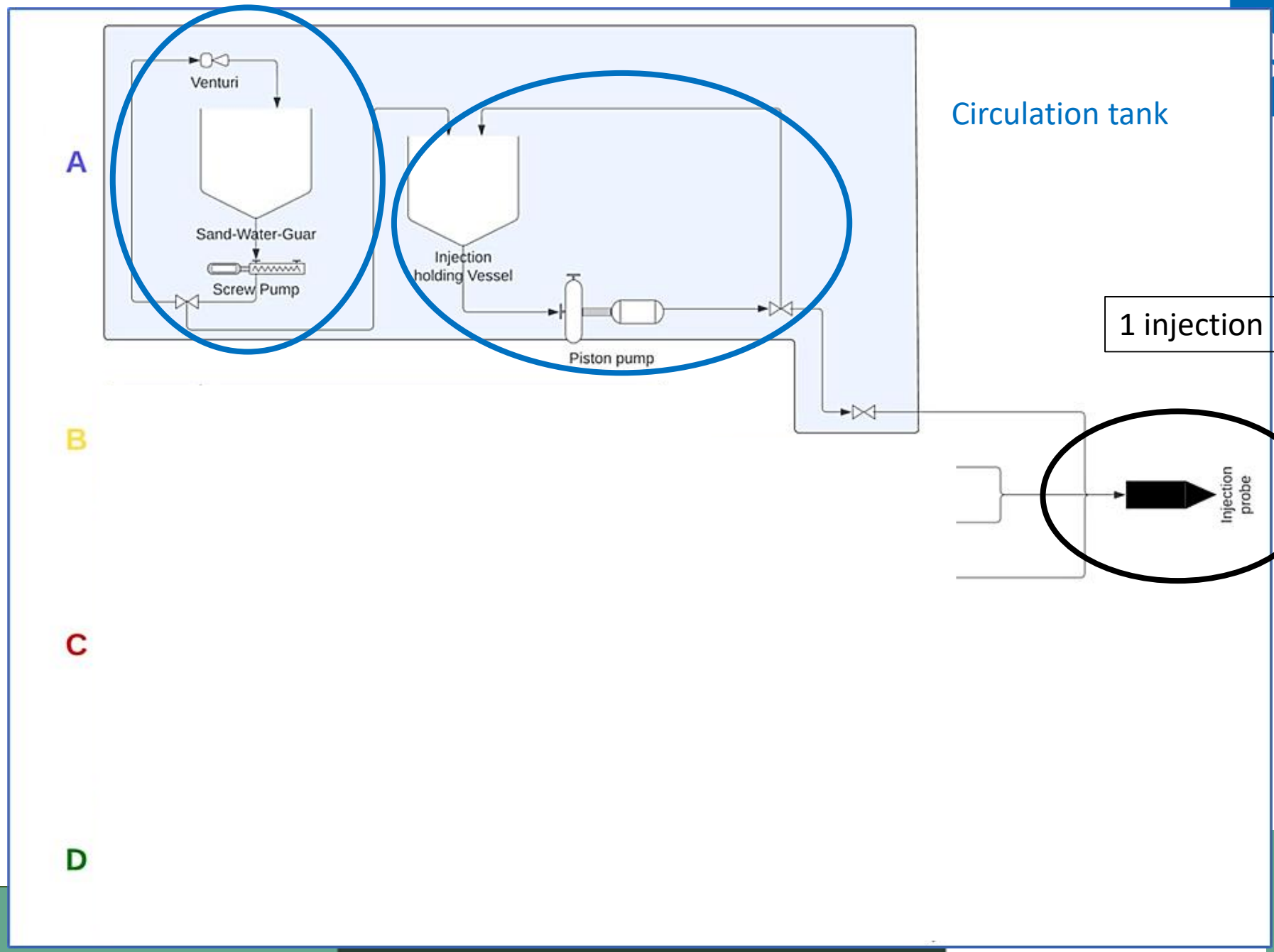
4 injection lines

1 injection probe




FRAC-IN

Mixing tank



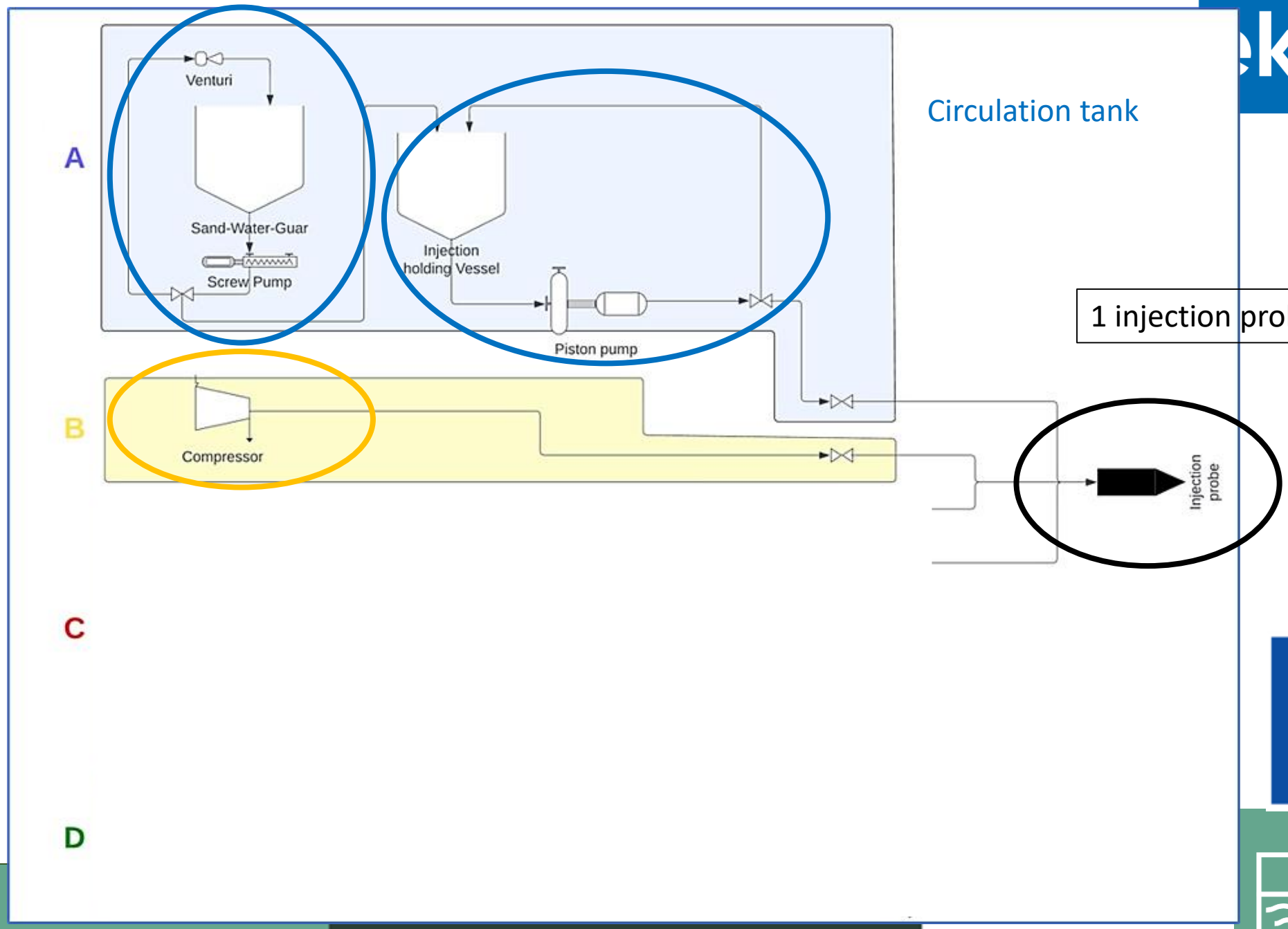

4 injection lines

1 injection probe

Mixing tank

Compressor

4 injection lines



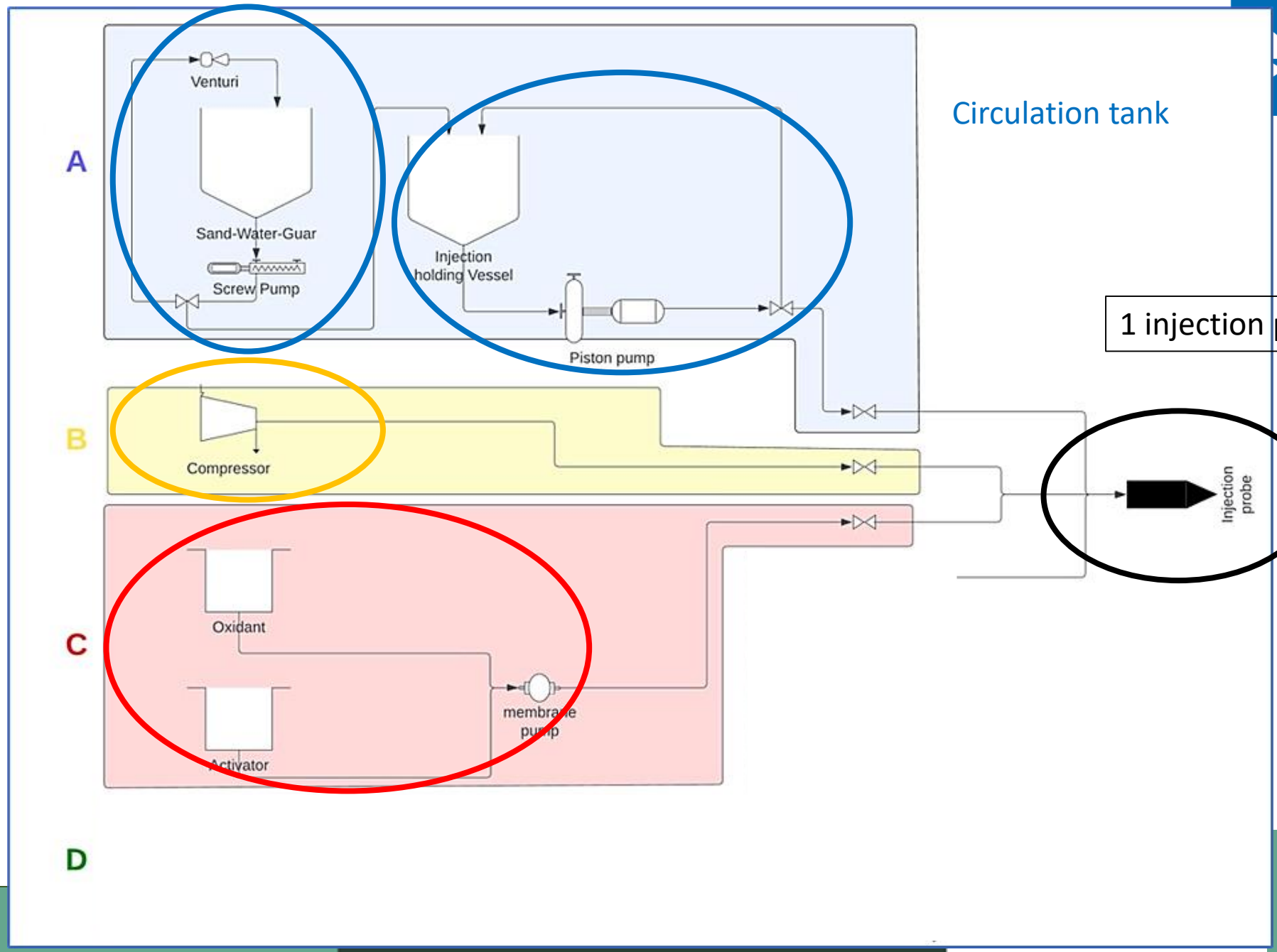

1 injection probe

Mixing tank

Compressor

4 injection lines

Reagents (optional)



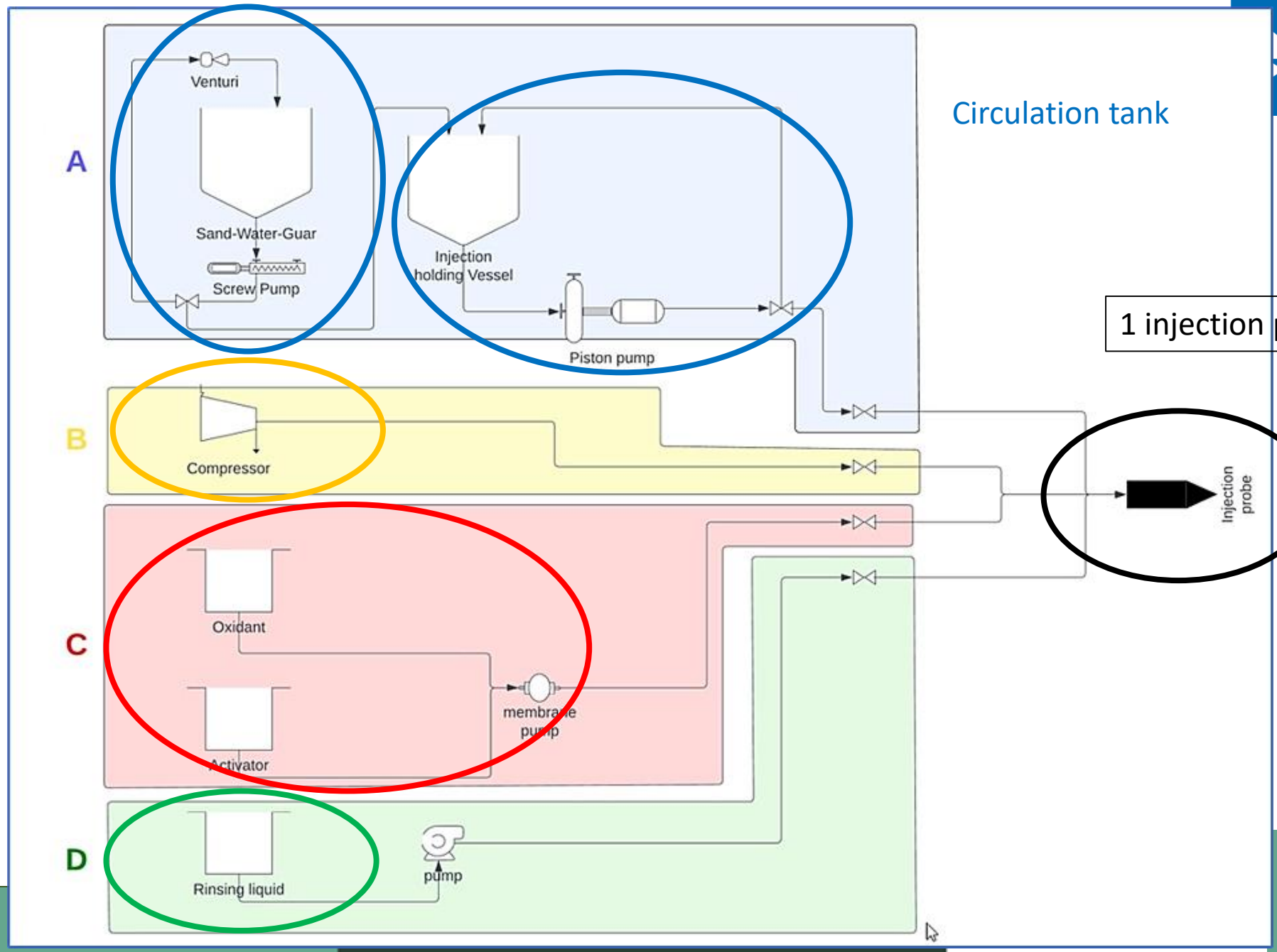
Mixing tank

Compressor

4 injection lines

Reagents (optional)

Rinsing




FRAC-IN


Water
Circulation
Mixing tank
Reagents
Valve control station

# Results demonstration - Duchcov site

- Low permeability site in Czechia
  - Historical contamination
  - Mixture of Cr6+ & chlorinated solvents

- Guar gum solution
  - With coarse sand, milled cast iron, mZVI and nZVI
  - Combined with glycerol as a remediation agent

- 3 injection campaigns with monitoring & intermediate surveys

=> In total 106 FRAC-IN injection points

# Results demonstration - Duchcov site

- Cr6+: quickly reduced within weeks after the injections
- Chlorinated solvents: gradually degraded due to the extreme activity of degrading bacteria combined with the abiotic reduction triggered by the injections

=> The remediation was completed successfully

Drilling rig

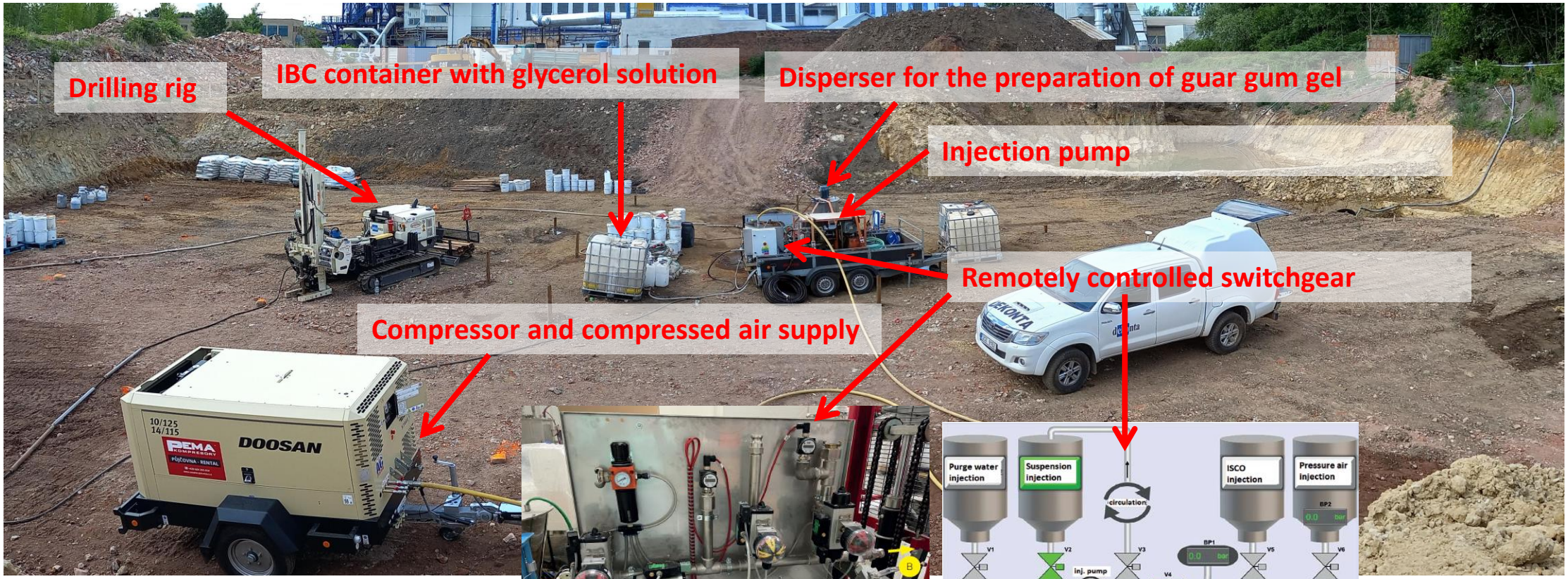
IBC container with glycerol solution

Disperser for the preparation of guar gum gel

Injection pump

Remotely controlled switchgear

Compressor and compressed air supply



# Animation of the technology

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