Preparation for a pilot project of a CO_2 geological storage in Czech Republic

Roman Berenblyum on behalf of Activity 3 team

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Project and the team

CZECH GEOLOGICAL SURVEY

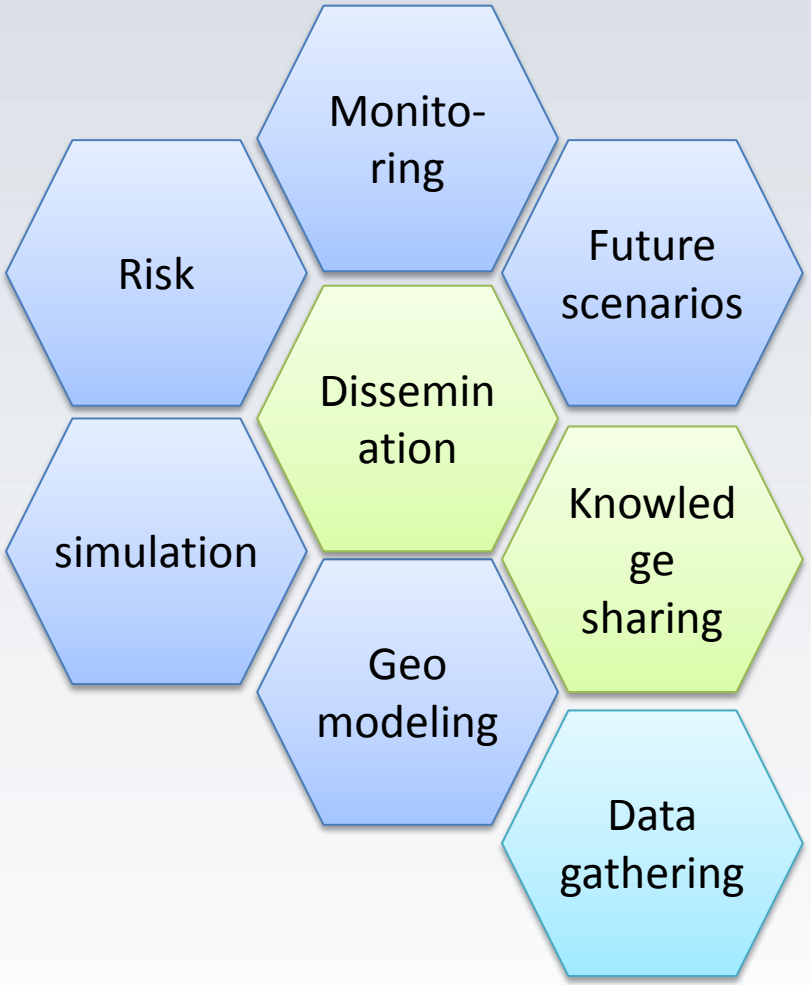
IRIS

Centrum výzkumu Řež s.r.o.
Research Centre Rez

Miligal, s.r.o.
Pozemní a letecké geofyzika
Ground & Airborne Geophysics

INSTITUTE OF PHYSICS OF THE EARTH MU BRNO

ÚJV



100 researchers and technicians from 7 institutions

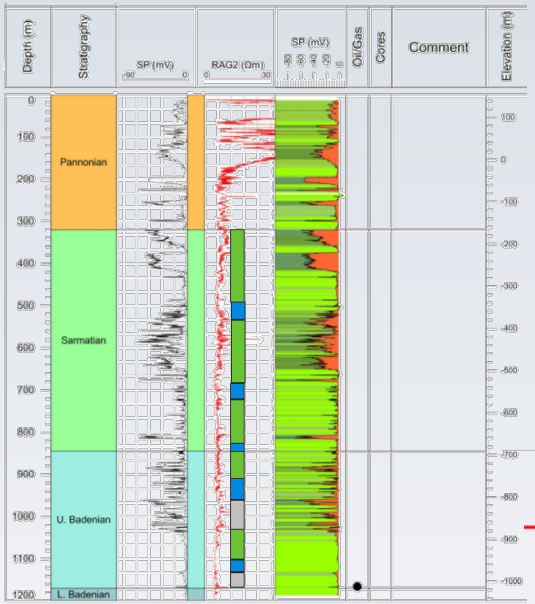
IRIS

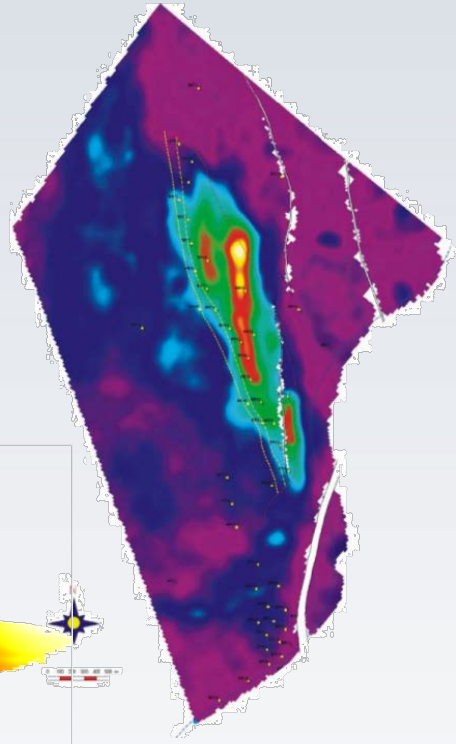
Lbr-1

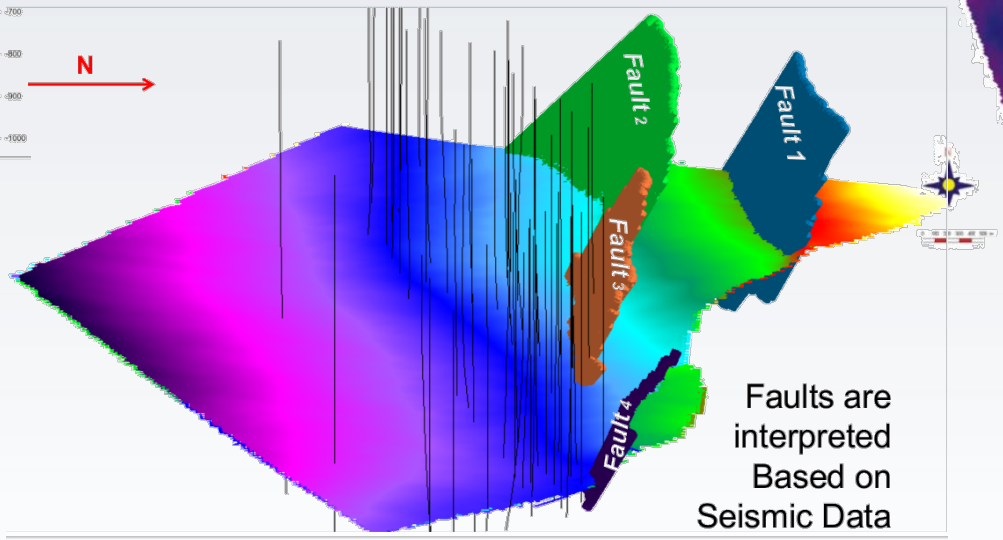
- Field under production in 60's and 70's
  - Scarce and often uncertain data…
    - Yet its still more than what we might know about "common" aquifer
  - Small field, yet representative of Vienna basin
  - Recent re-abandonement
  - Recent re-view of restarting production
  - Old abandoned fields are likely storage candidates

Starting point: G&G

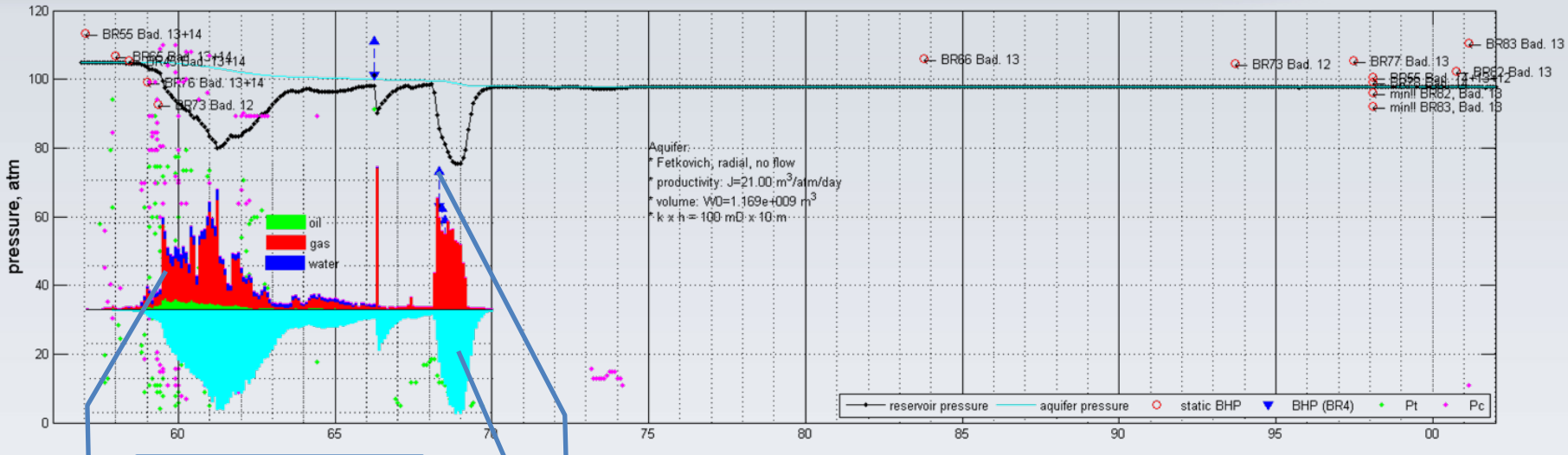
Re-intrepretation of existing data – new 3D seismics – new geological model







Mass balance study



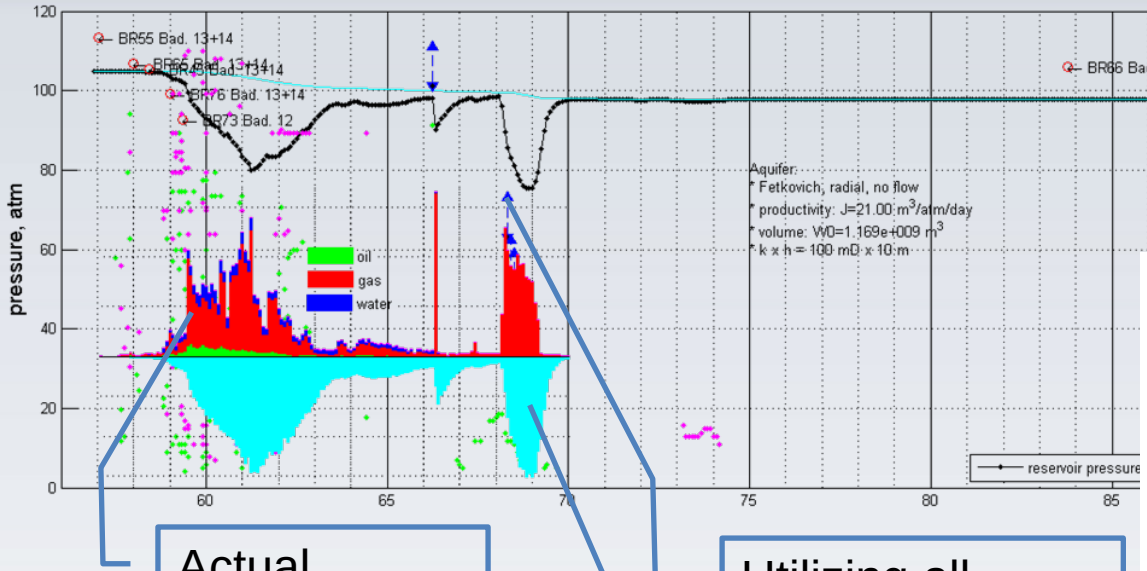
Actual production data

Utilizing all available pressure data

Matching aquifer behavior using the same model as in full field runs

- Screening uncertainty in reservoir properties
- Injection prediction capability
- Fast screening of various risk scenarios

Mass balance study



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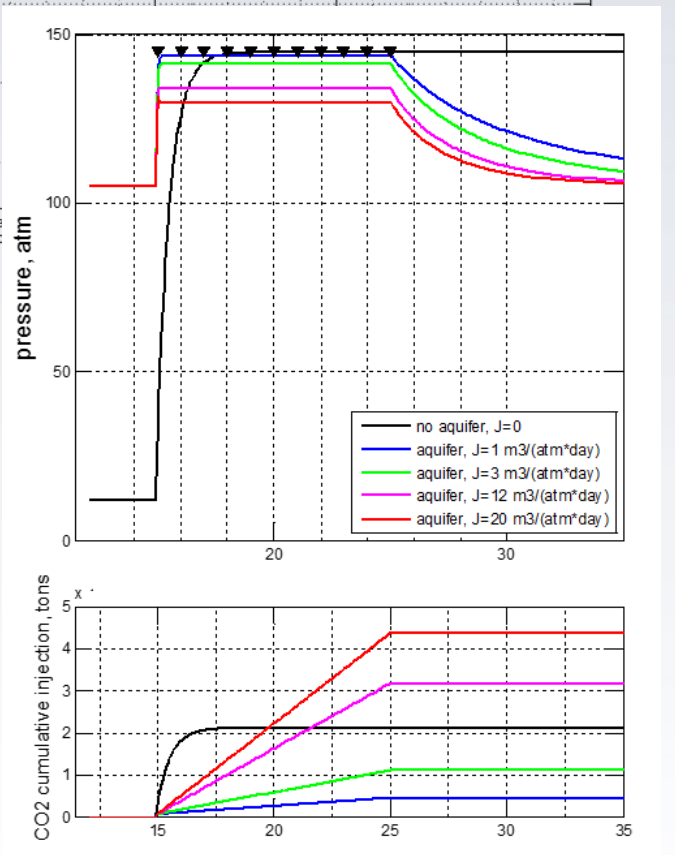

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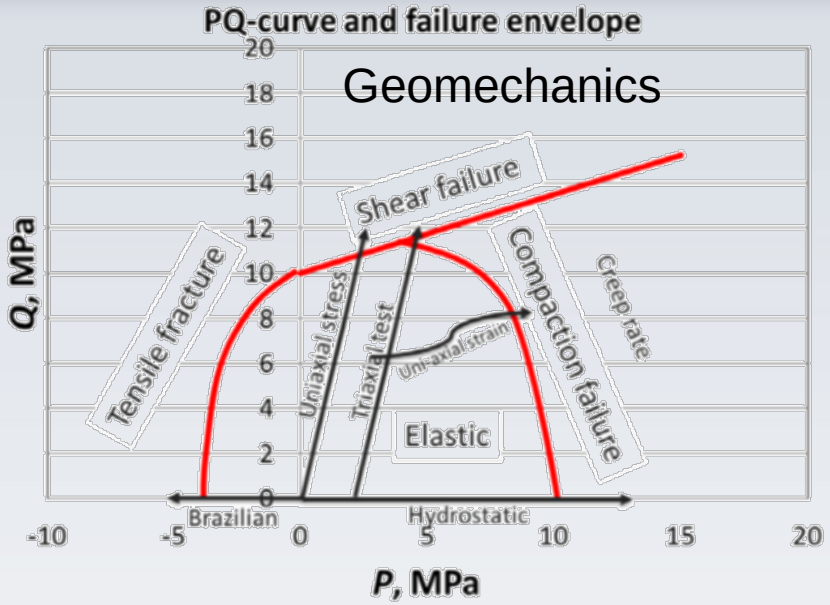
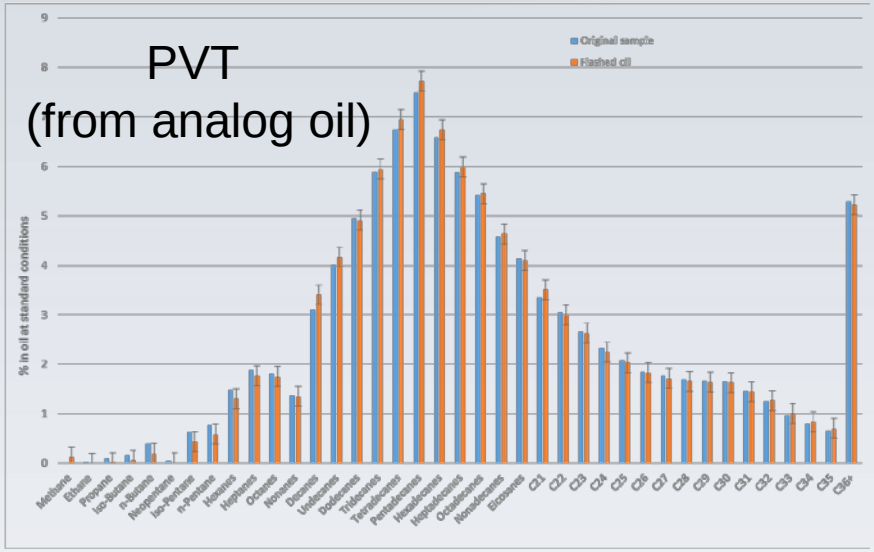
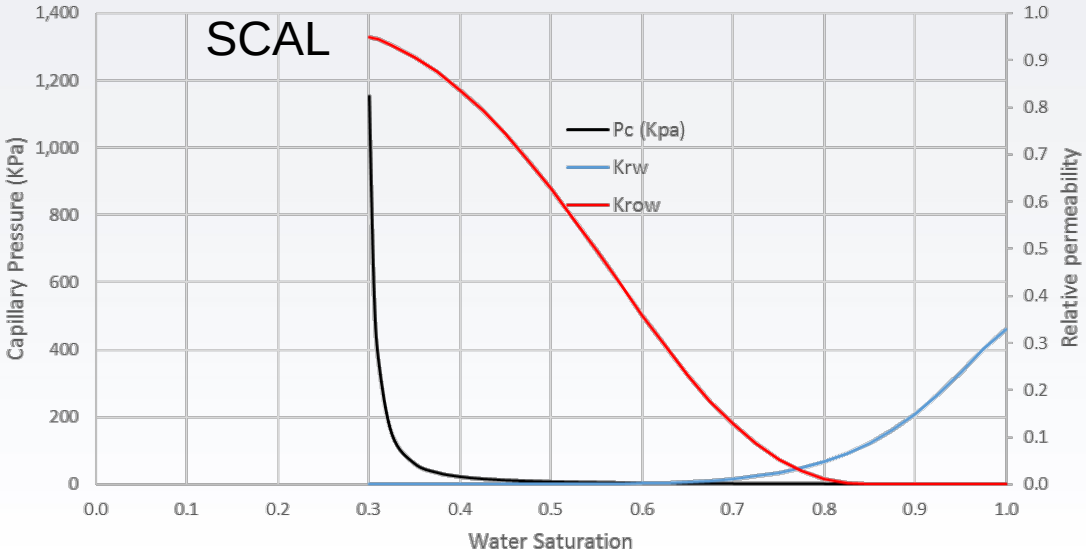
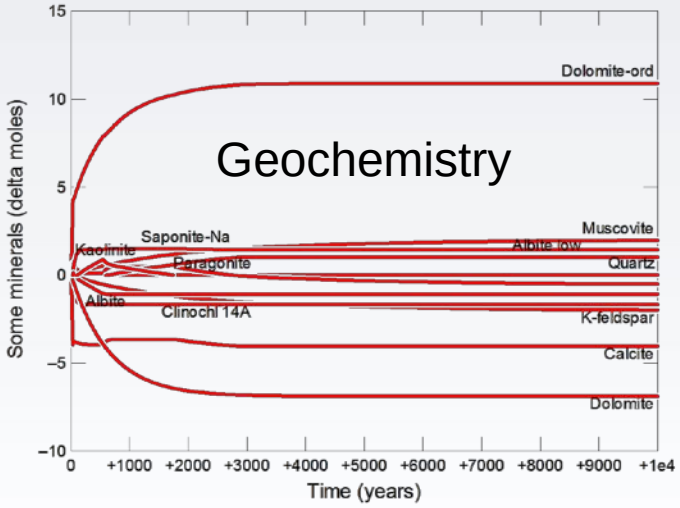
Some new data









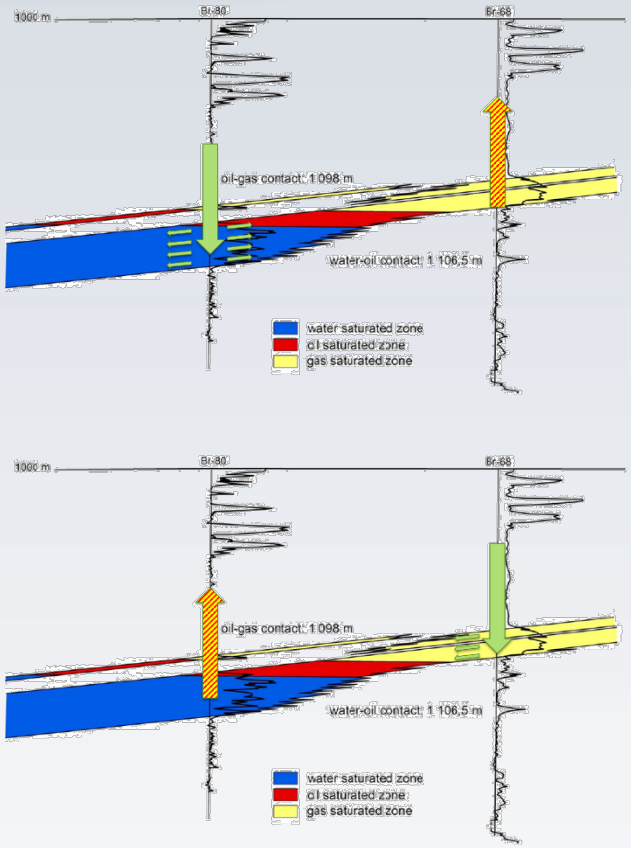
Scenarios

Evaluation of a pilot – up to 70 000 ton during 6-7 years. One vertical well

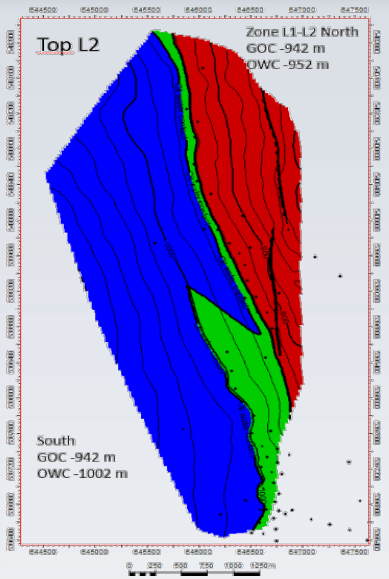
Storage – injection through two new horizontal wells

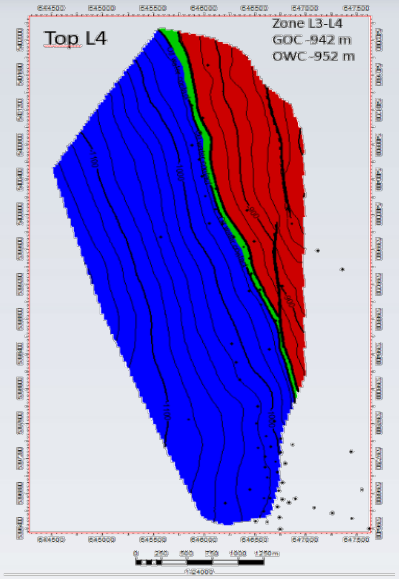
~~Pressure relief~~ - active aquifer and risk of reaching the spill points

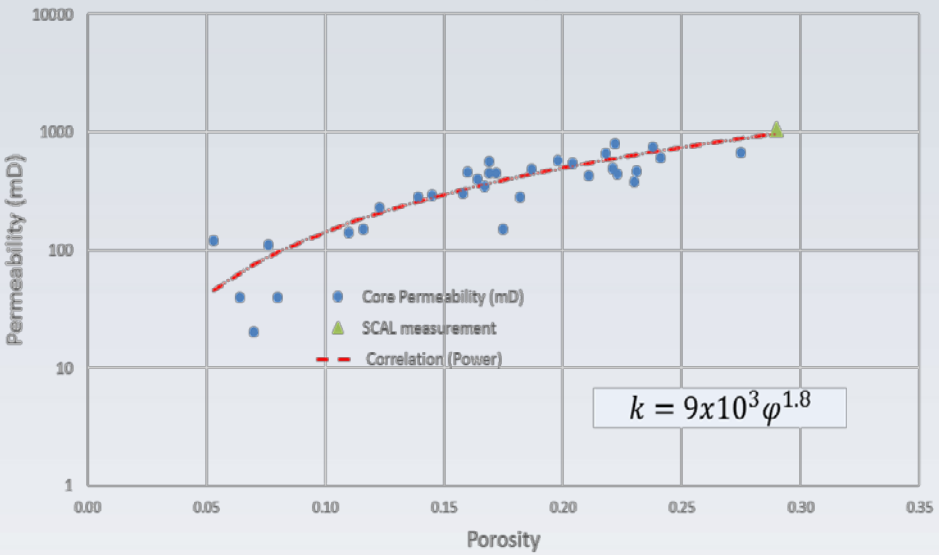
EOR – carbon neutral oil production?

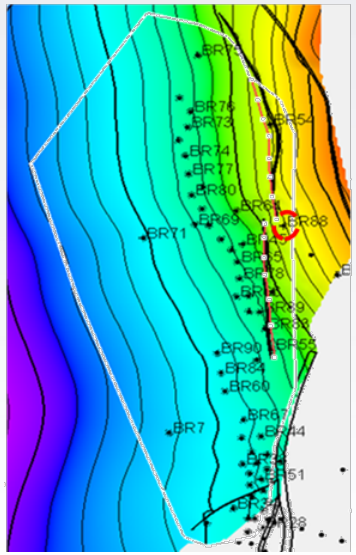


Initialisation





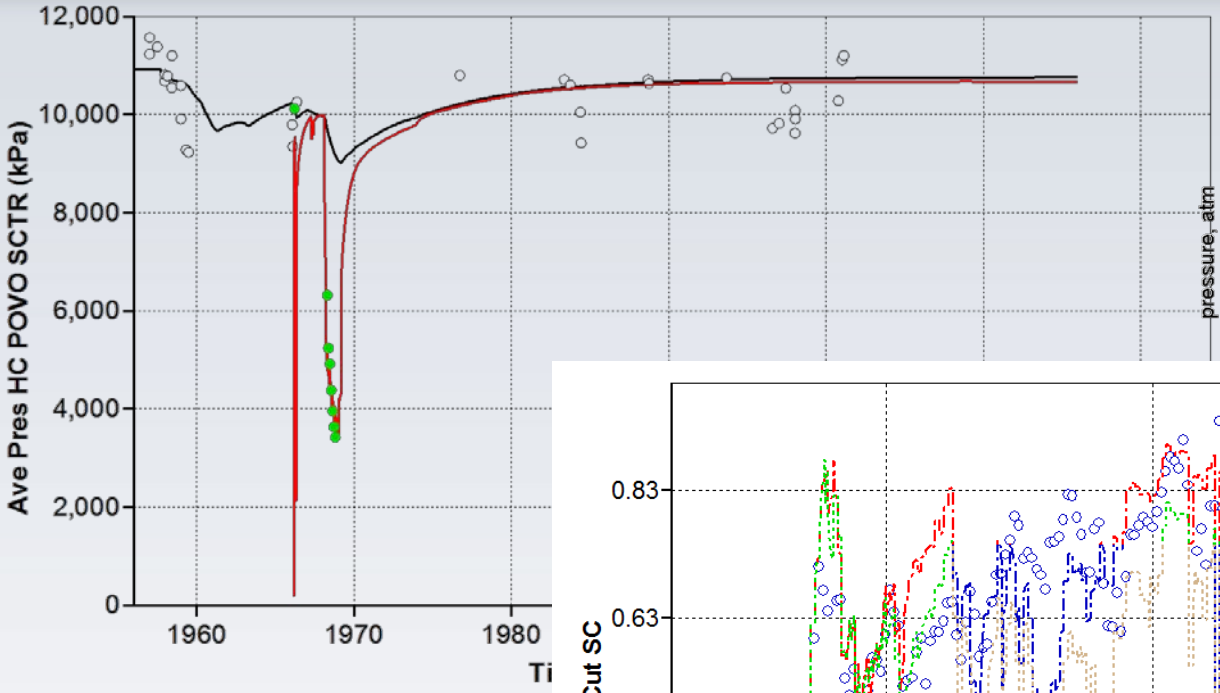


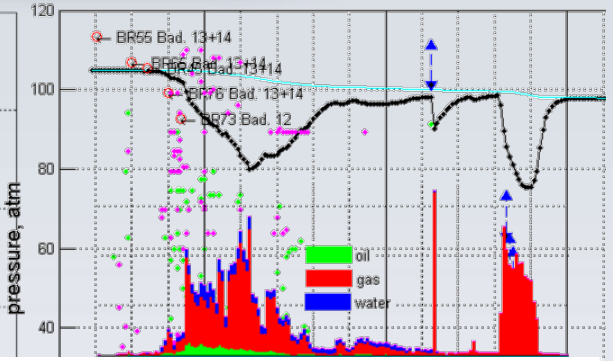


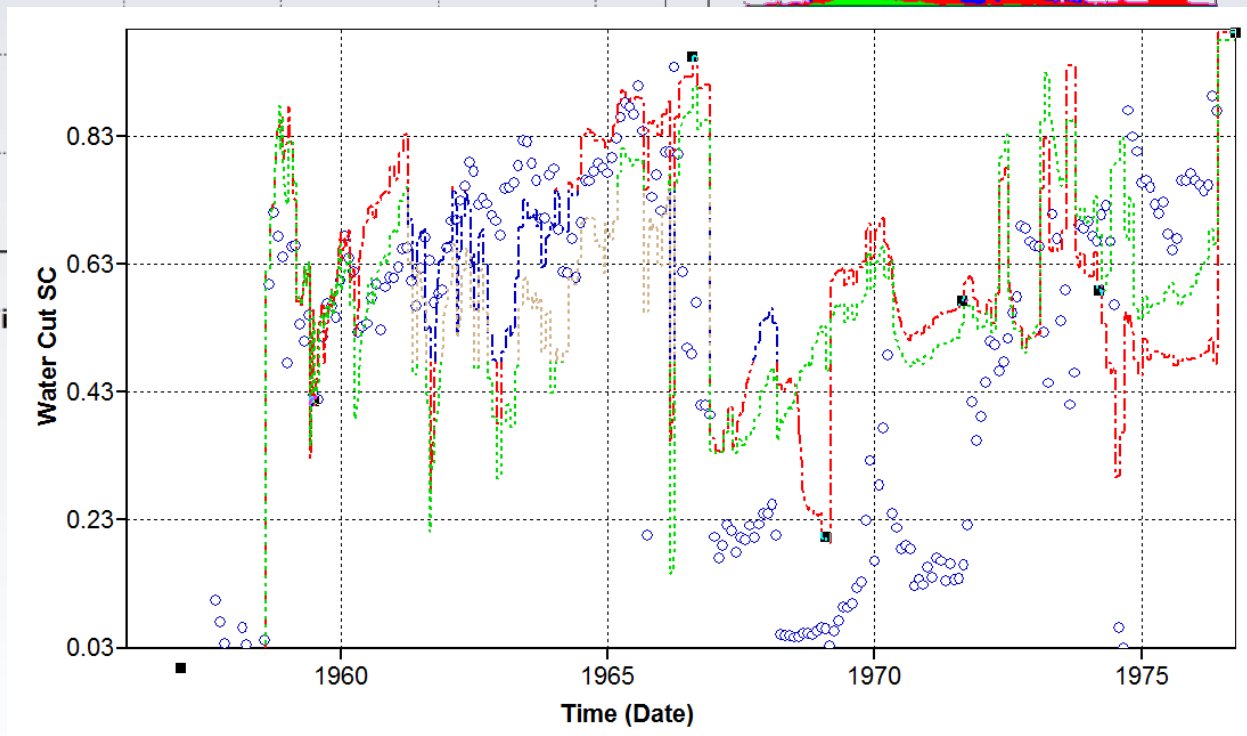
Zone	Oil zones		Gas cap		Oil segment split (STOOIP)	
	HCPV	STOOIP	HCPV	GOIP*	North (All)	South (L1&L2)
L1	58.0	53	250.0	26.7	53.0	N/A
L2	309.0	284.0	372.0	39.8	84.0	200.0
L3	67.0	61.2	302.0	32.2	61.2	N/A
L4	70.0	64.2	172.0	18.3	64.2	N/A
Total	504.0	462.4	1096.0	117.0	262.4	200.0

* Gas-in-place is noted in M m^3 – other volumes are in K m^3

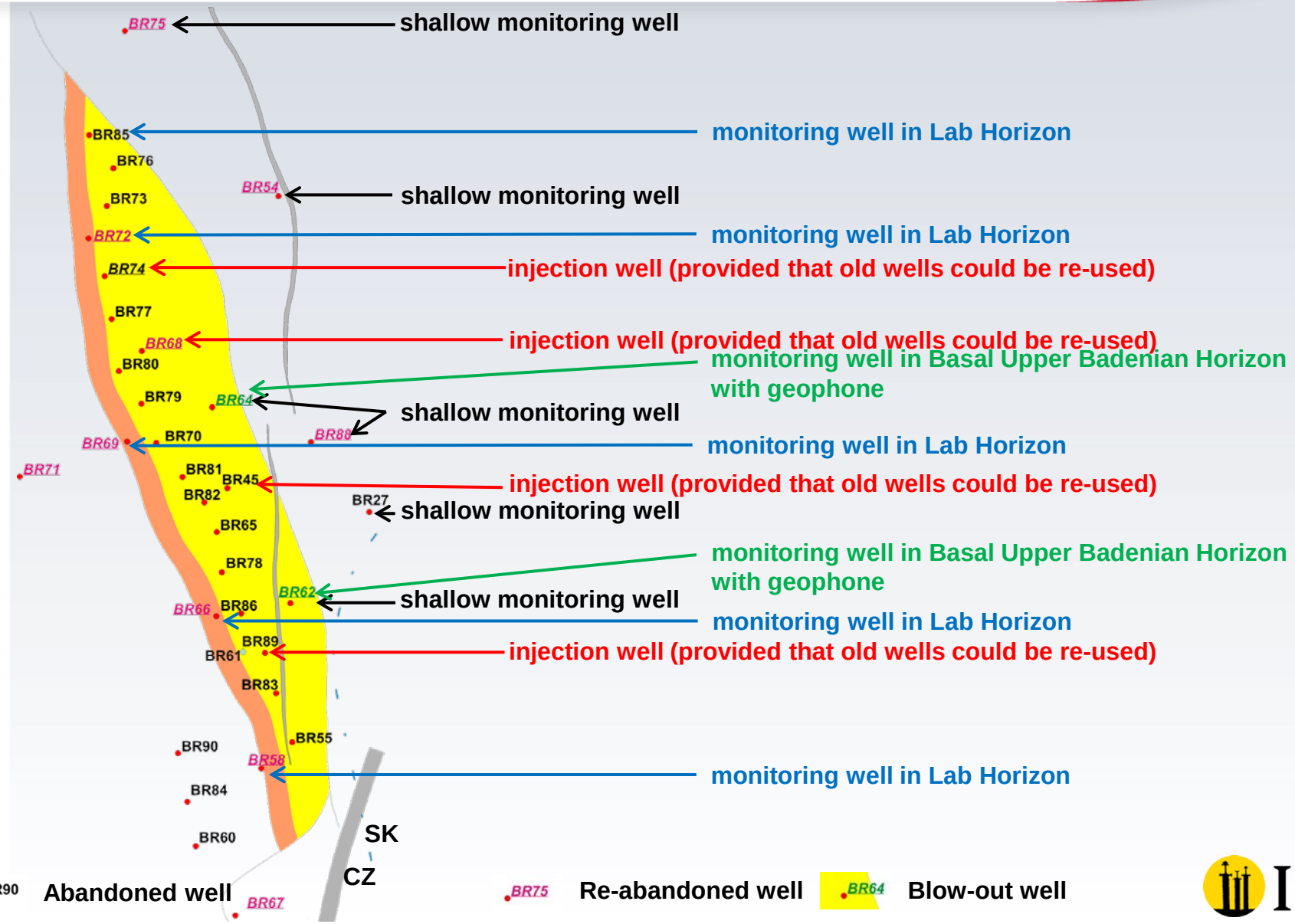
History match





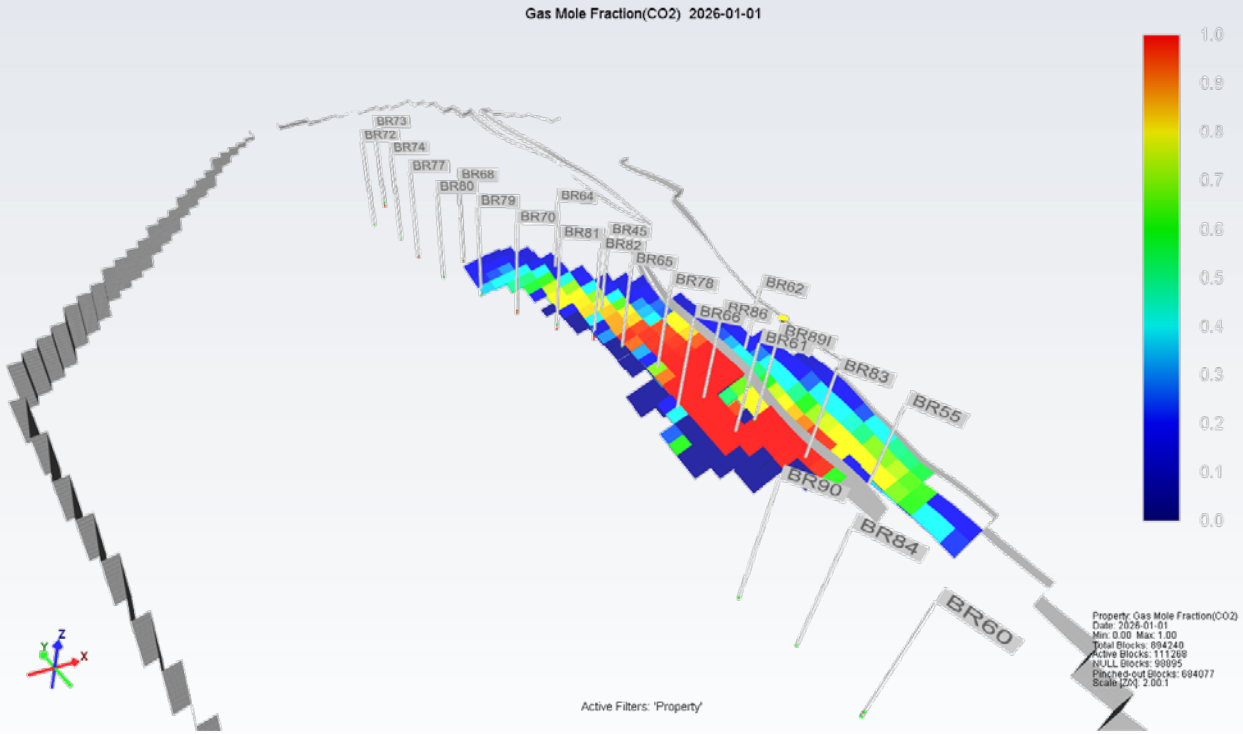


Wells suggestions



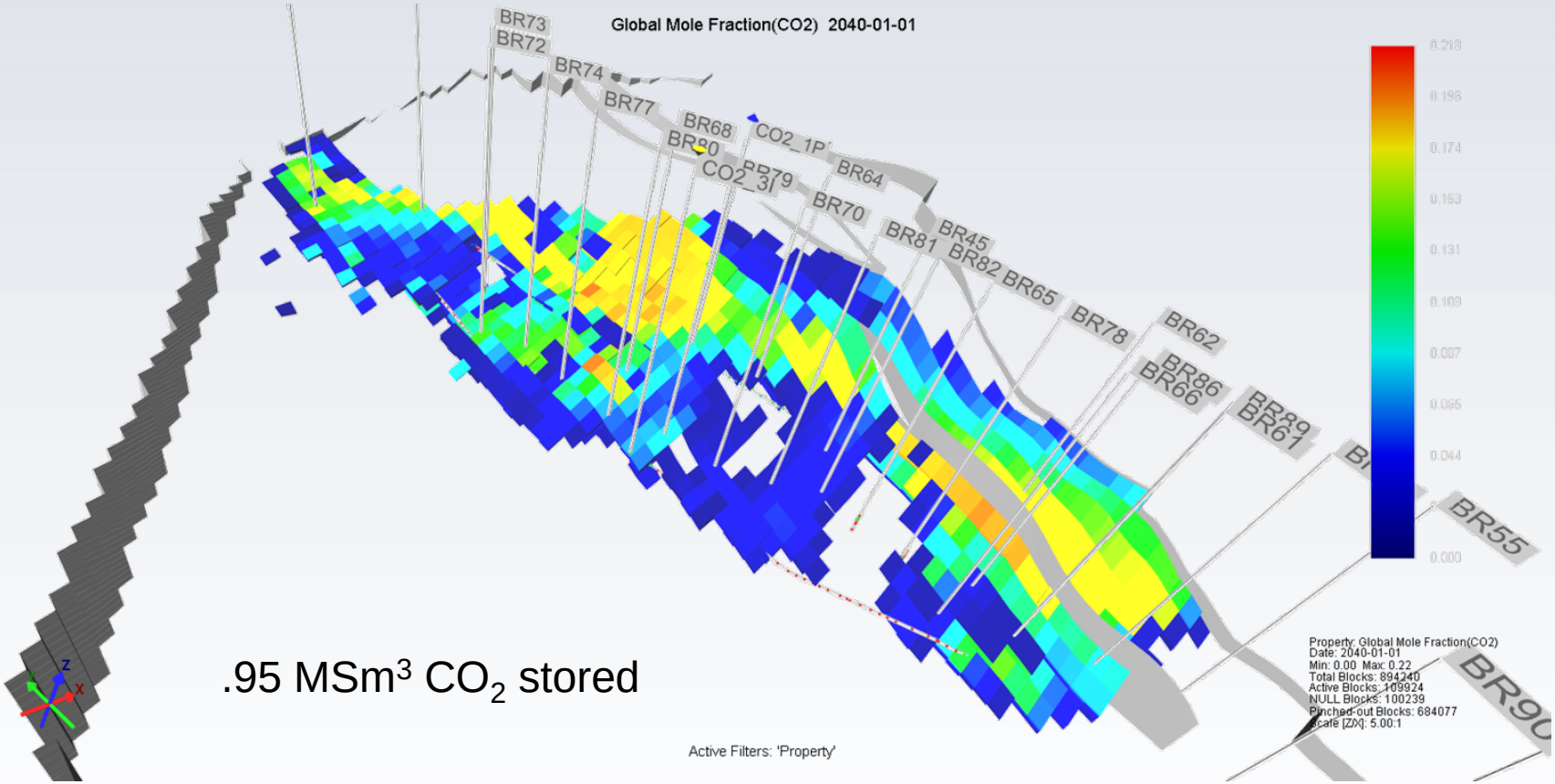
Pilot case

- 2020-2026, 70 000 tons: 17 600 sm^3/day
- No injection issues expected, pressure increase is small and local



Storage case

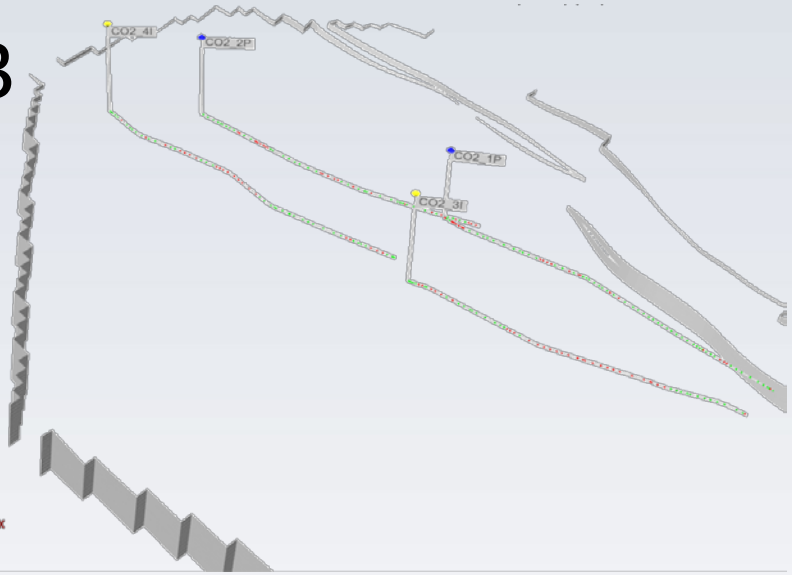
- Pilot in 2020-2026 followed by full scale storage through two horizontal wells

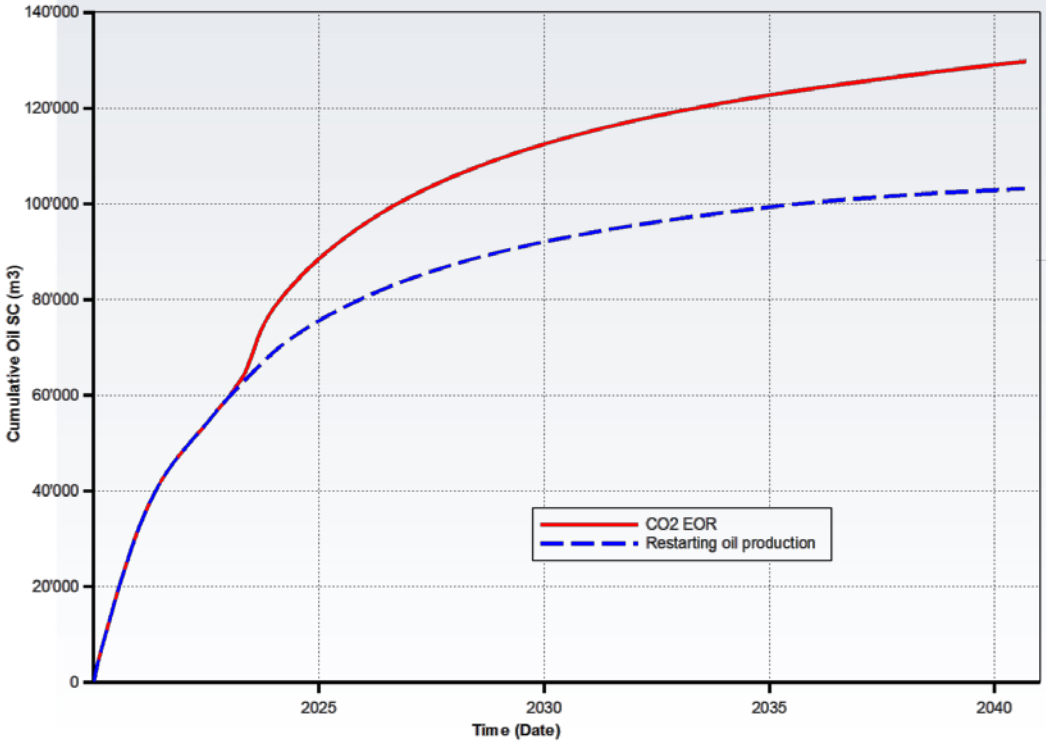


.95 MSm^3 CO_2 stored

CO_2 EOR

- No pilot. Oil production restarts in 2020
- CO_2 injection starts in 2023





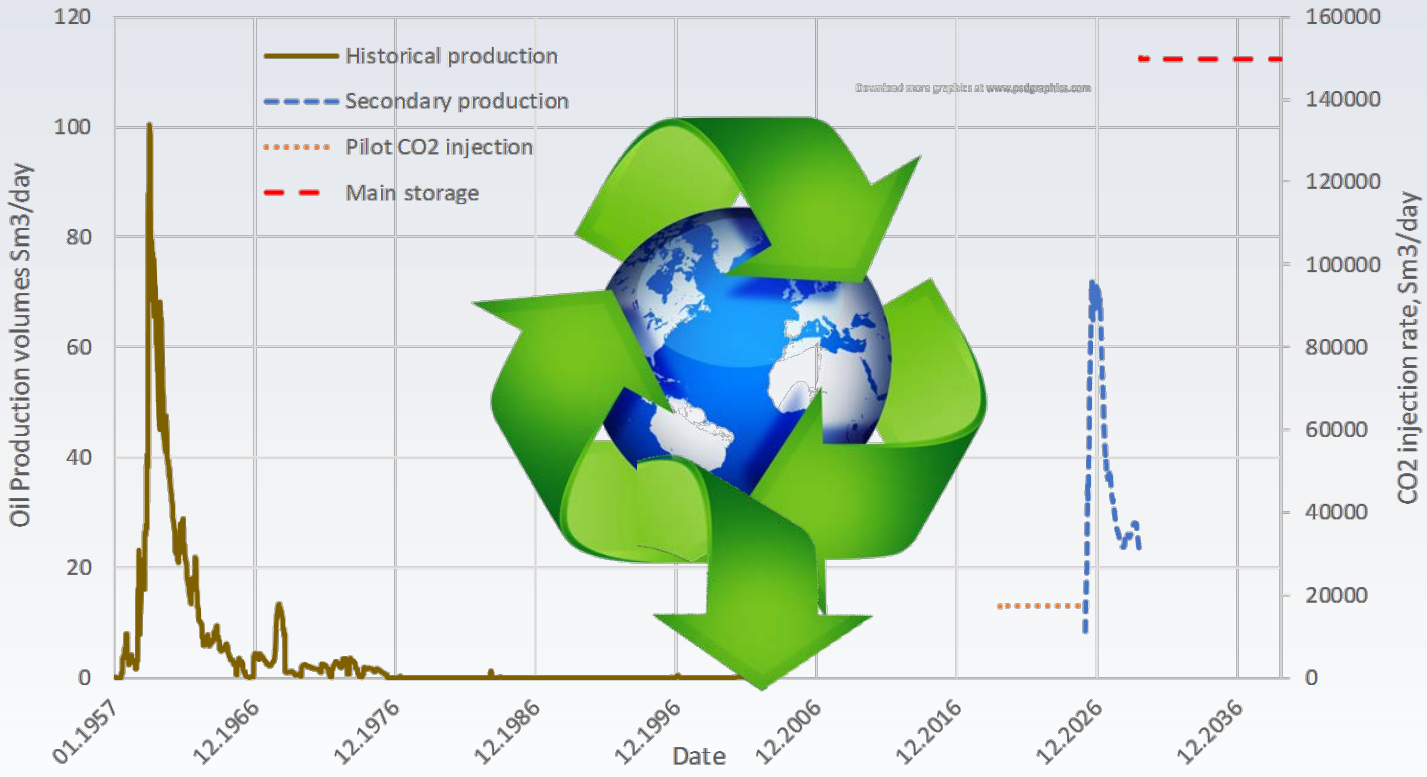
Additional oil recovery ~ 26 kSm^3
Total stored CO_2 ~ 63 ktons

If burned as fuel oil will generate ~ 72 kons CO_2

Almost carbon neutral EOR without storage!!!

Combined case

- Pilot 2020-2026; EOR 2026-2029
- Storage 2030 – 2040



Total oil recovery : 180 kSm^3

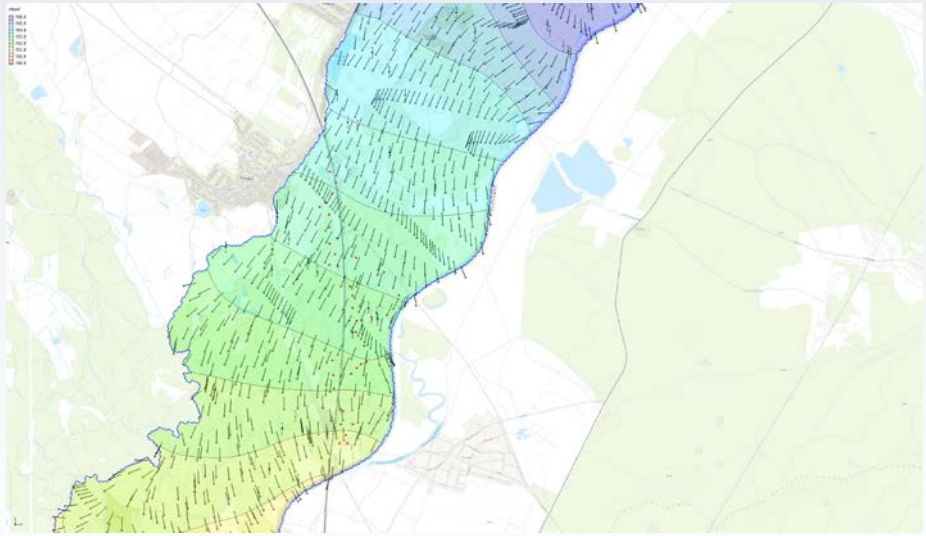
If used entirely to fuel cars it would produce around 495 ktonns CO_2

Total stored volume 523 ktonns CO_2 (more storage volume available)

Leakage paths?

Generally risk are identified as low!

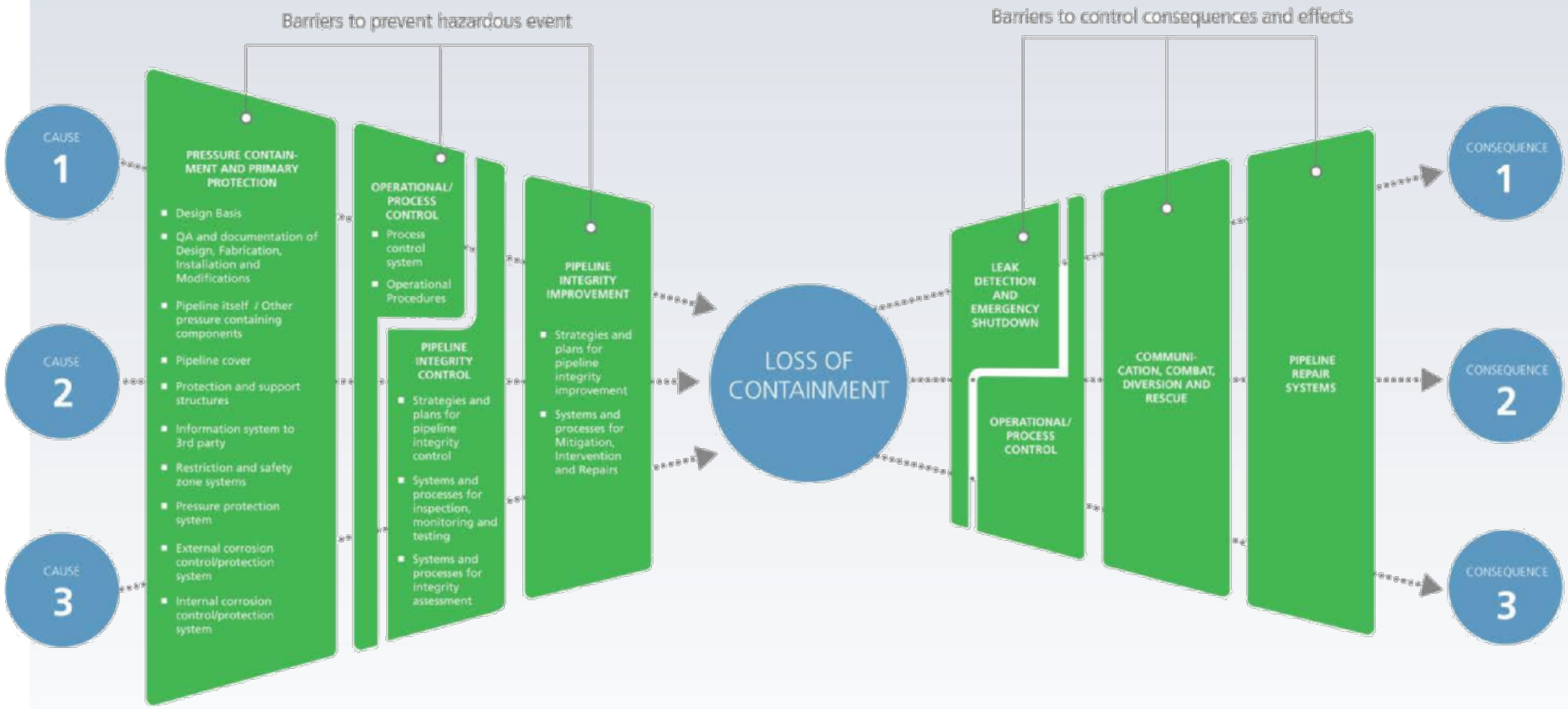
- Old wells, faults, cap rock integrity failures?
  - Reservoir simulation model to evaluate risks and rates
  - Chemical models to evaluate CO_2 reactivity and elements on its path (rock? Cement? Salts in water?)
  - Detailed surface model to analyze migration of pollutants.



Next stage: risk

Prevention: pro-active

Mitigation: re-active



Reliability

Vulnerability