European Large Scale Demonstration Projects: ROAD in the Netherlands (here with a focus on storage)

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6th CO2GeoNet Open Forum, May 9th 2011

Venice, San Servolo Island, Italy

Who is ROAD?

Joint Venture:

e·on Benelux

Electrabel GDF SUEZ

Financial support:

Co-financed by the European Union
European Energy Programme for Recovery

Government of the Netherlands

Co-operation partners:

GDF SUEZ

TAQA

With technical support from:

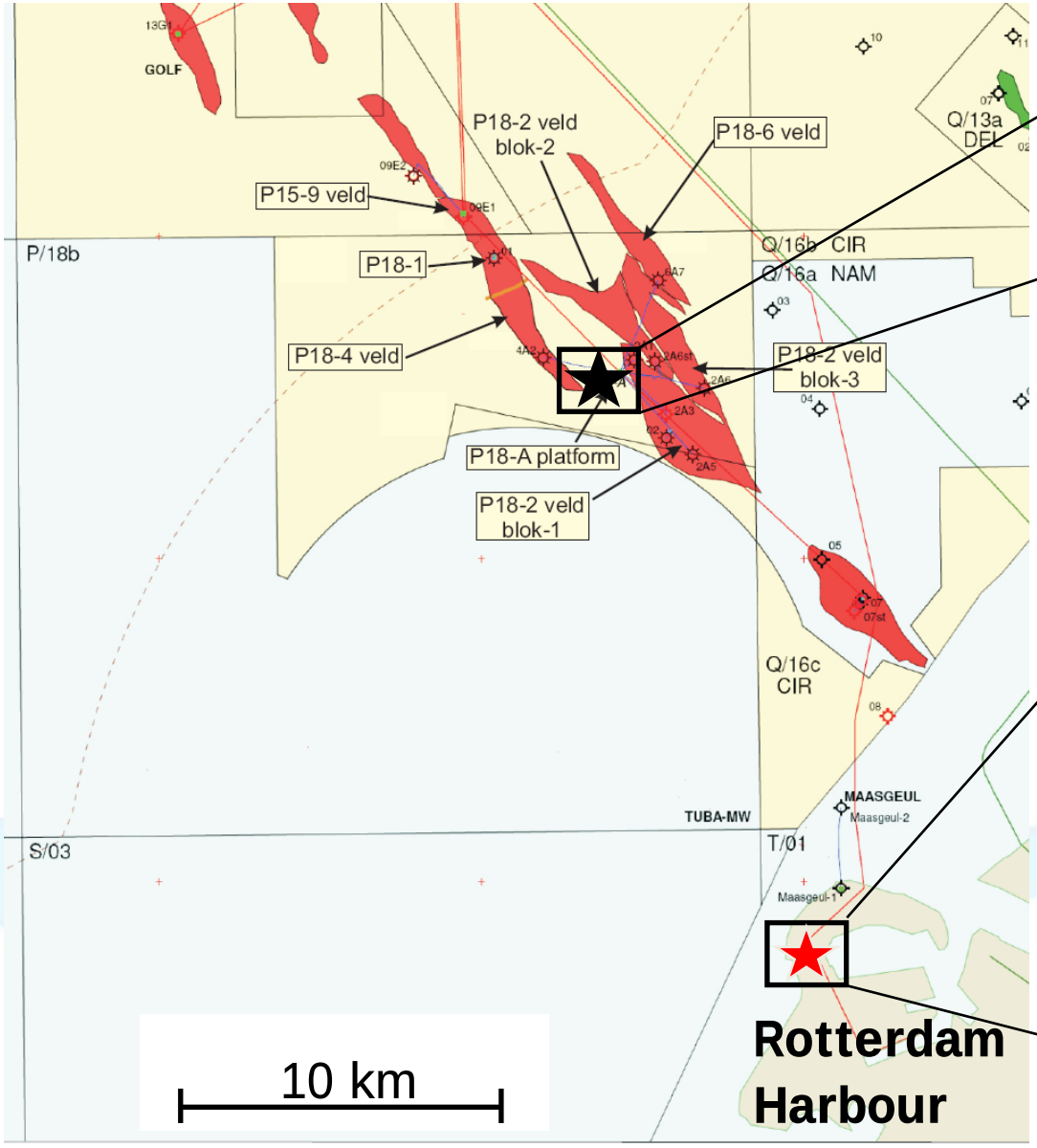
Rotterdam Climate Initiative RCI

CATO-2 Research Program

Tractebel Engineering (GdF-SUEZ)

E.ON Gas Storage GmbH, etc.

Location and facilities

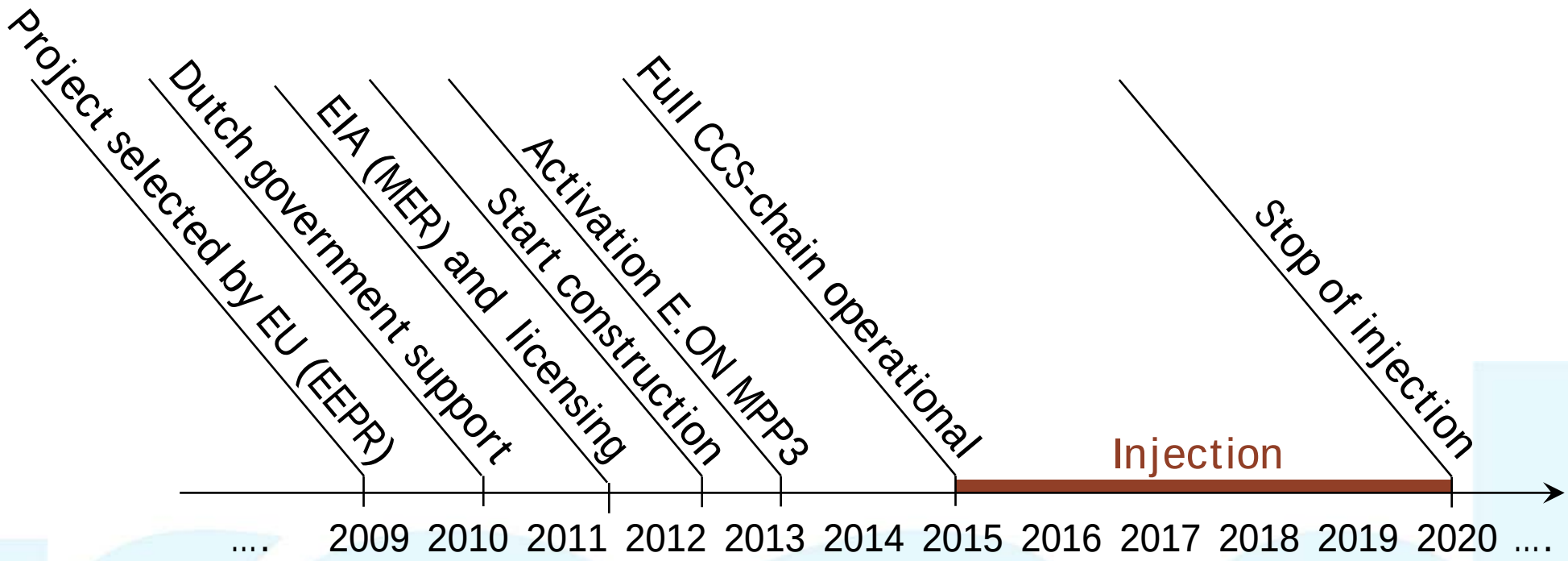


TAQA P18-A

GDF SUEZ

e·on MPP3

Planning and Milestones



Power Plant: Situation in February 2011

Technical key statistics

Capture:

- 250 MW_{el} power plant; post-combustion; CO_2 captured at 90% efficiency
- Capture approx. 1.1 Mt/a @ 6300 ops.hrs/a
- Capture provider selected, start with detailed engineering
- Drying and compression processes in design phase

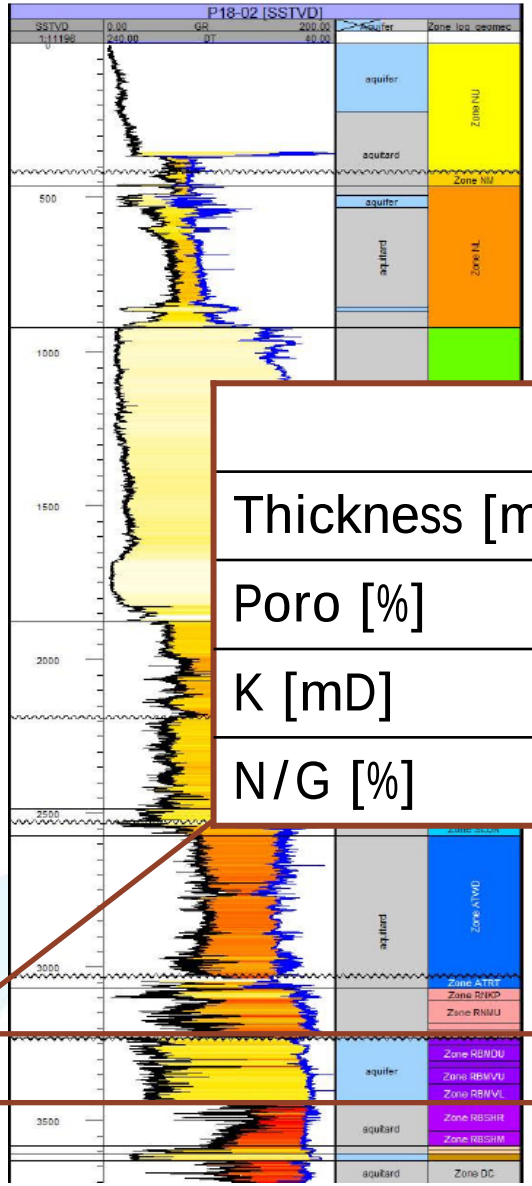
Transport:

- Rate at 18.8 – 47 kg/s
- 16“ pipeline
- incl. HDD and harbor x-ing
- 5 km onshore / 20 km offshore
- Pipeline design sufficient for 5 Mt/a (dense phase)
- Insulated pipeline

Storage:

- Into depleted gas field P18-4 & P18-6

Geology



Upper North Sea Group

Middle North Sea Group

Brussels Sand

Lower North Sea Group

Basal Dogen Sand

	H	DU&DL	V
Thickness [m]	25	70	100
Poro [%]	7-13	5-10	3-5
K [mD]	2-207	1	0
N/G [%]	95	85	50

Altena Group

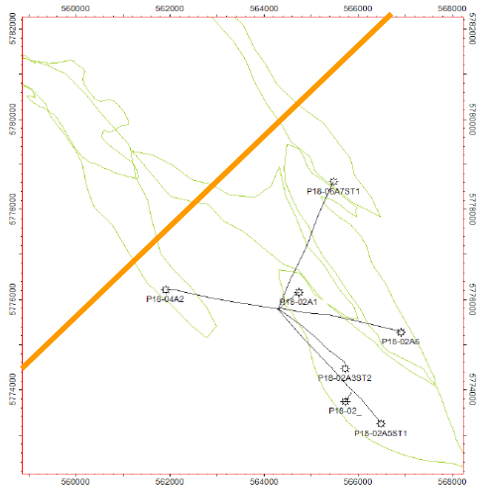
Upper Germanic Trias Group

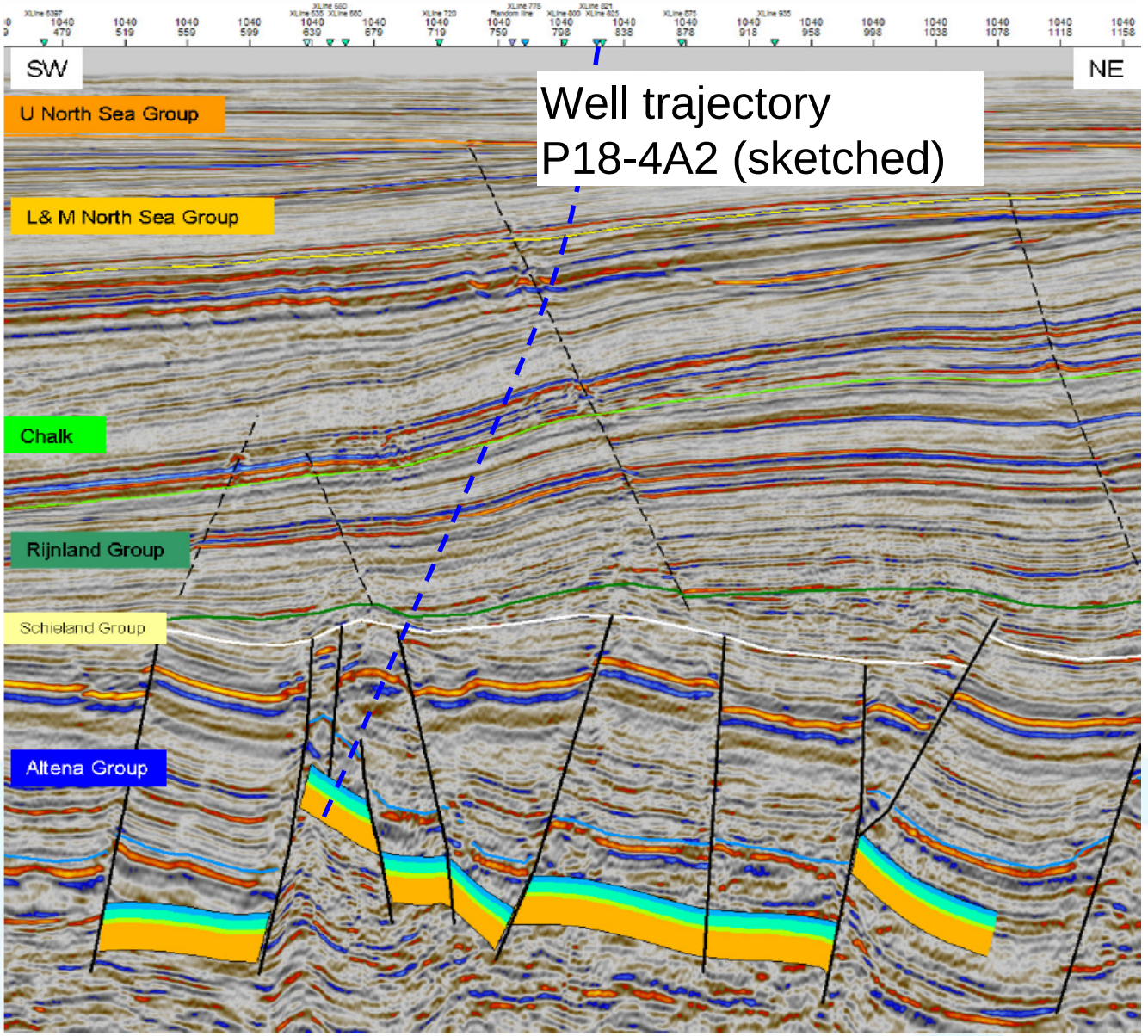
Main Buntsandstone

Lower Germanic Trias Group

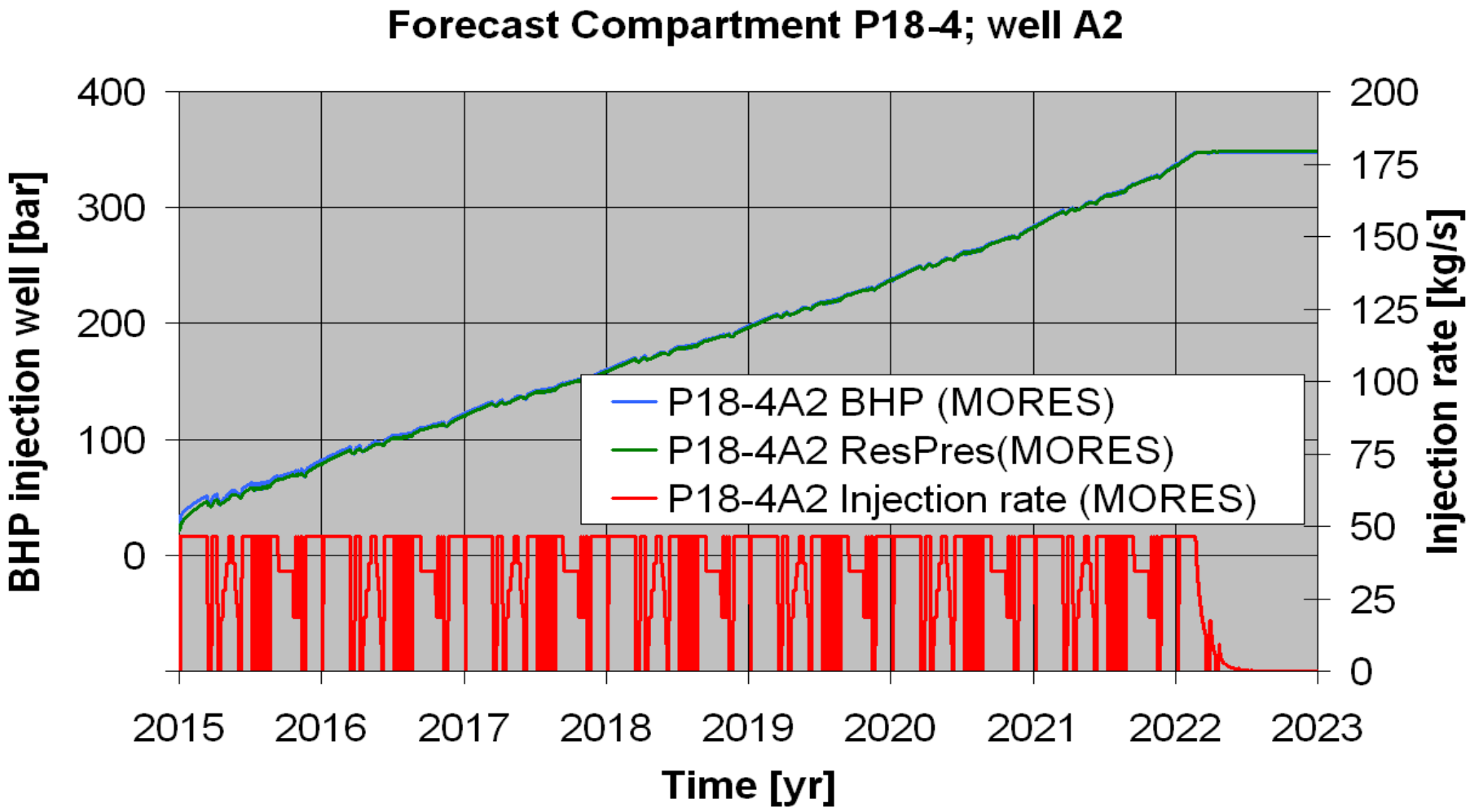
SSTVD 3500 m

Geology


P18-04A7ST1
P18-04A2
P18-02A1
P18-02A5
P18-02A3ST2
P18-02_
P18-02A5ST1


SW
NE
Well trajectory
P18-4A2 (sketched)
U North Sea Group
L& M North Sea Group
Chalk
Rijnland Group
Schieland Group
Altena Group

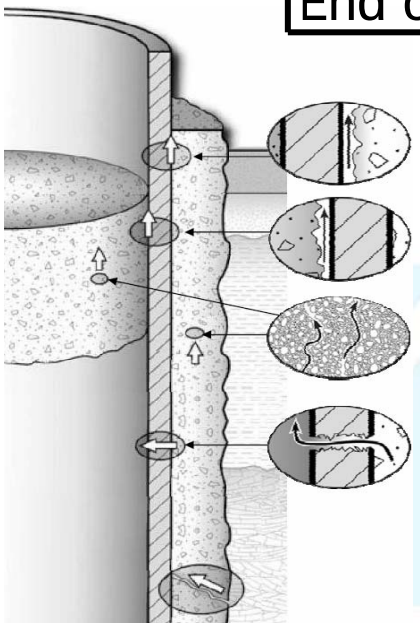
Non-isothermal / compositional simulator from Shell: MoReS



Well integrity analysis

Evaluation: well P18-4A2

Cement sheath across primary caprock	Indirect evidence suggests OK
Cement sheath across secondary caprock	Ind. evidence suggests not OK
Production casing and liner	Not pressure tested / No Cr13
Production tubing and completion	OK (L80Cr13)
Production packer	?
Wellhead	?
Abandonment plug	N/A (still producing)
End of well report	Available

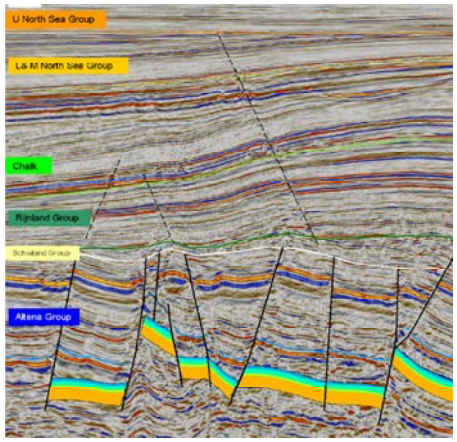


Next steps:

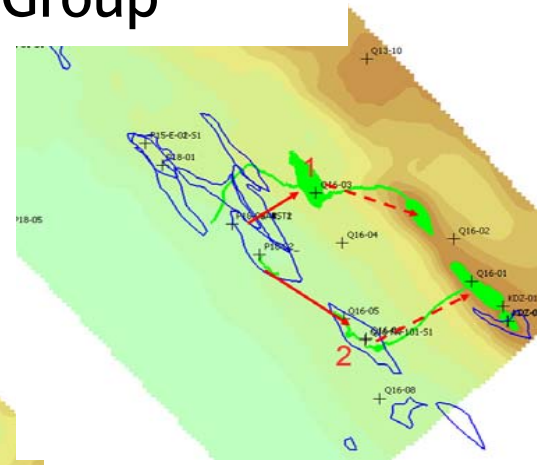
ITT submitted on selection of logging tools, work-over plan, and abandonment plan

- Run wireline logs
- check packer operating envelope (by tubing stress analysis)
- check elastomers and wellhead information

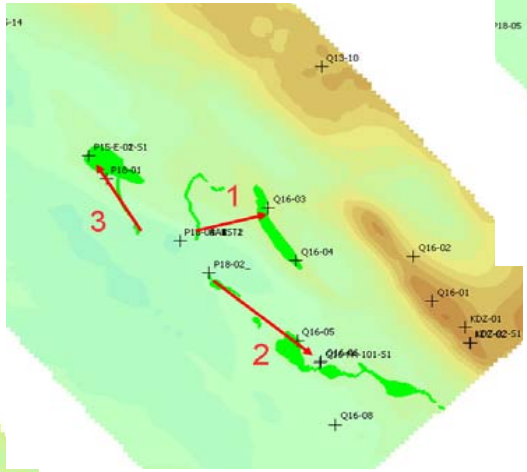
Potential migration path analysis



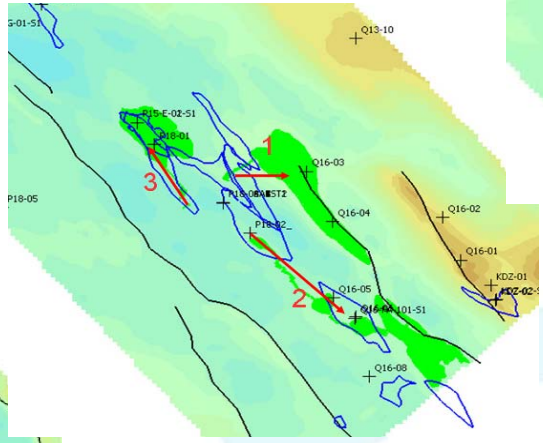
Base Chalk Group



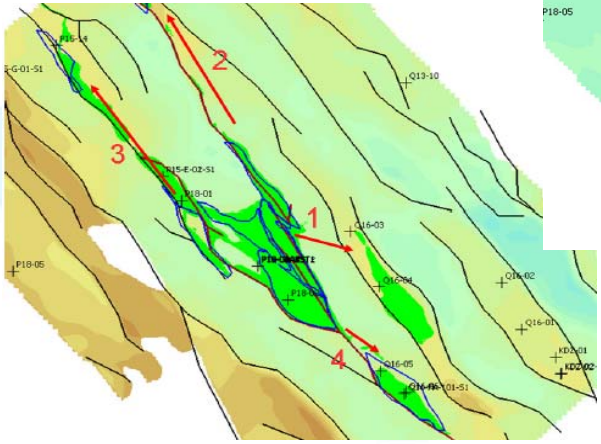
Holland Greensand



Base Rijnland Group



Top Buntsandstone



→ Definition of storage complex

Monitoring plan

Developed a risk-based monitoring plan considering

- The different phases of the project (injection, post-closure, etc)
- Different categories (mandatory, contingency, etc.)
- Different alert levels (normal, alert-1, alert-2)
- Frequency of measurements

Philosophy of the monitoring plan:

- Crucial to monitor the reservoir pressure and temperature
- If irregularities are witnessed additional monitoring is proposed concerning:
    - The well integrity (eg. logs)
    - The overburden (eg. seismic)
    - The seabottom (eg. acoustic and/or via sampling)
- In the current plan no monitoring wells are absolutely required
- To regularly investigate pockmarks at the sea bottom is the suggested methodology for long-term monitoring (after transfer of liability)

Storage Challenges

- Injectivity
  - Some fields/wells do provide too little injectivity
  - Injectivity might decrease due to hydrate/ice/salt formation
  - Hydro-/themal-fracturing needs to be prevented by all means
- Monitorability
  - Does the monitoring plan find acceptance with the competent authority?
  - Is the reservoir section too deep for seismics
  - Lack of wells for monitoring
  - Unknown (long term) costs
- Contractual and legal / permit items
  - Field availability after production cease
  - Unknown liabilities and abandonment costs
  - Procedure/timing of handover of responsibility to government to be defined
- Integrity
  - Reactivation of faults
  - Impact of geo-chemical effects on geo-mechanical properties
  - Well integrity status to be explored
  - Storage complex to be defined

Questions?

Thank you for your attention.

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