CO_2 CONTAINMENT ASSURANCE – MONT TERRI

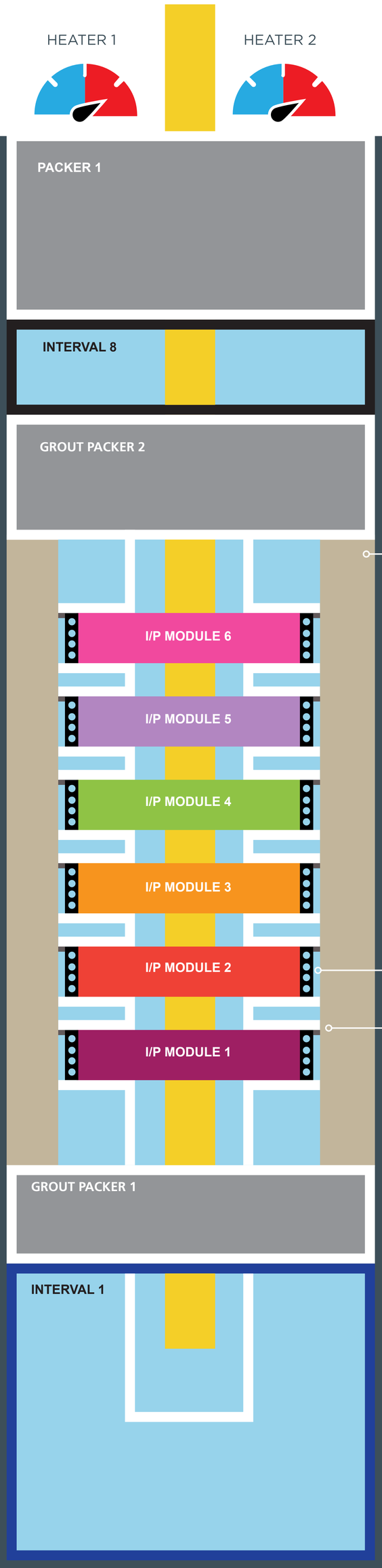
The CO_2 Capture Project (CCP) along with the Swiss Topographic Survey (Swisstopo) who operates the Mont Terri laboratory, are engaged in CO_2 containment assurance experiments.

CCP

PARTICIPANT ORGANIZATIONS

The CCP is a group of major energy companies working together to advance the technologies that will underpin the deployment of industrial-scale CO_2 capture and storage.

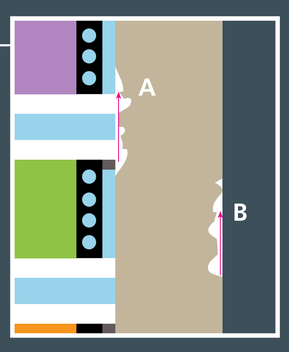
For further information on CCP and its projects, visit www.co2captureproject.org



A mock completion system that mimics injection well components in the field and access to specific well intervals along the wellbore for controlling temperature.

EXPERIMENT 1:

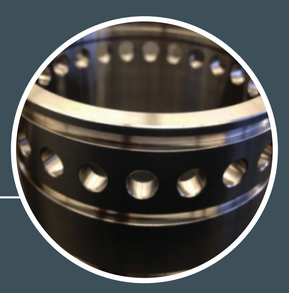
An active experiment that focuses on the mitigation of pressure leakages associated with CO_2 containment using novel sealants in wellbore injection well systems



Origins of pressure leakage

A. Cracking from temperature cycles and micro-annulus by casing contraction

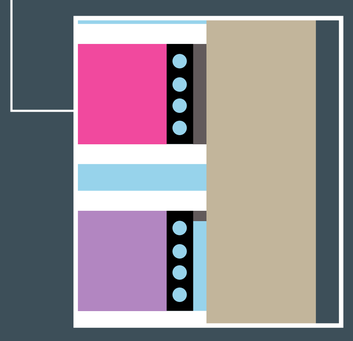
B. Cement sheath channel development



One of six Injection/Pressure (I/P) modules

Operational requirements

- Cased and cemented borehole test section to allow three independent sealant tests
- Possibility to create various types of leaks
- Possibility to inject sealants and fluids or gases

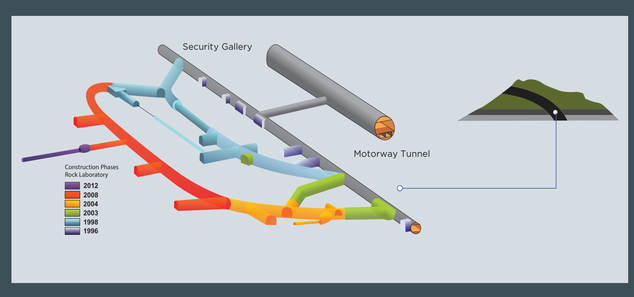


Slider mechanism

The top I/P module shows a closed observation chamber

The bottom I/P module shows an open observation chamber

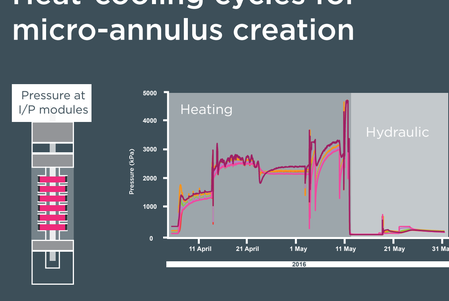
MONT TERRI UNDERGROUND RESEARCH LABORATORY



The Mont Terri Underground Research Laboratory provides an intermediate scale approach between the bench and field for experimentalists to control boundary conditions directly; to observe large-scale rock mass driven reactions that mimic full field-scale conditions. The laboratory is located near St Ursanne, Switzerland 300m underground with access via the security gallery of the A16 motorway tunnel.

DIAGNOSTIC TESTING

Re-saturation and hydraulic testing

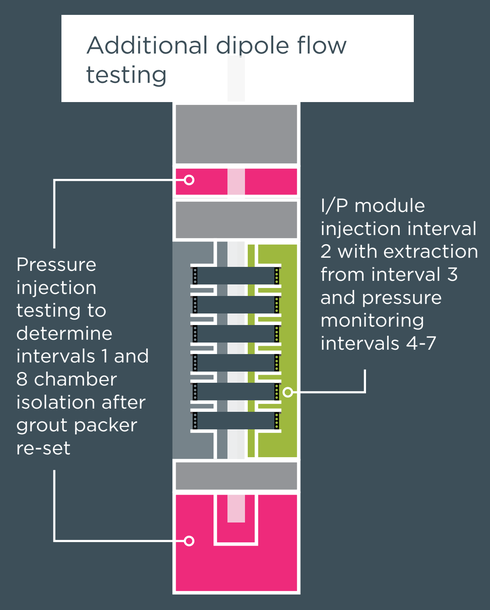


Ambient temperature at around 16°C

Heat-cooling cycles for micro-annulus creation

- Cyclic heating followed by cooling to ambient laboratory conditions
- Heat measurement data acquired in interval 1, in the cased and cemented section between I/P modules 1 and 2, and interval 8
- Upper and lower chamber intervals 1 and 8 in pressure communication
- Micro-annuli development at the outer cement sheath/ formation boundary

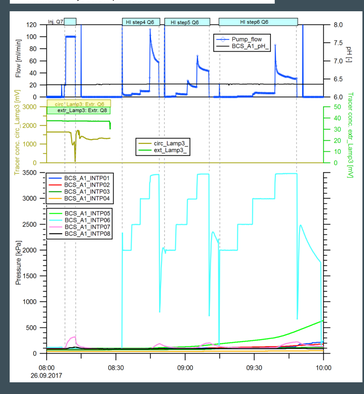
Define flow characteristics between I/P modules



- Findings enabled sealing experiment to proceed as well as elucidating the possibility of such defects and how they can be characterized in hydrocarbon wells

Date 26.09	Injection flow rate [ml/min]*		
Pressure [kPa]	HI step4	HI step5	HI step6
20 bar	2.8	0.8	0.2
25 bar	4.6	4.3	1.1
30 bar	9.5	16.4	6.1
35 bar	57.0	43.3	30.0

* 4 minute injection period



SEALANT TESTING – INITIAL RESULTS AND NEXT STEPS

- First sealant trial (low pH-triggered) achieved sealing to 35 bar in upper module. Deemed a successful test with the potential for providing a successful seal in a reservoir environment
- Next: injection and performance assessment of second sealant (high pH-triggered); possible test of third sealant (e.g. commercial product)
- Over-core mock completion system
- Assessment of complications experienced a reflection on real well integrity and whether sealants may be suitable for O&G well mitigation