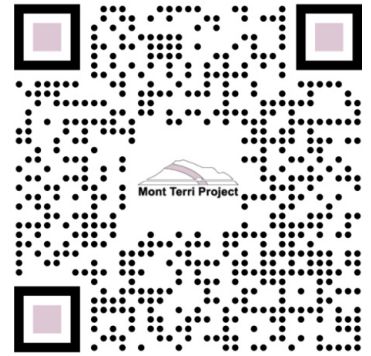
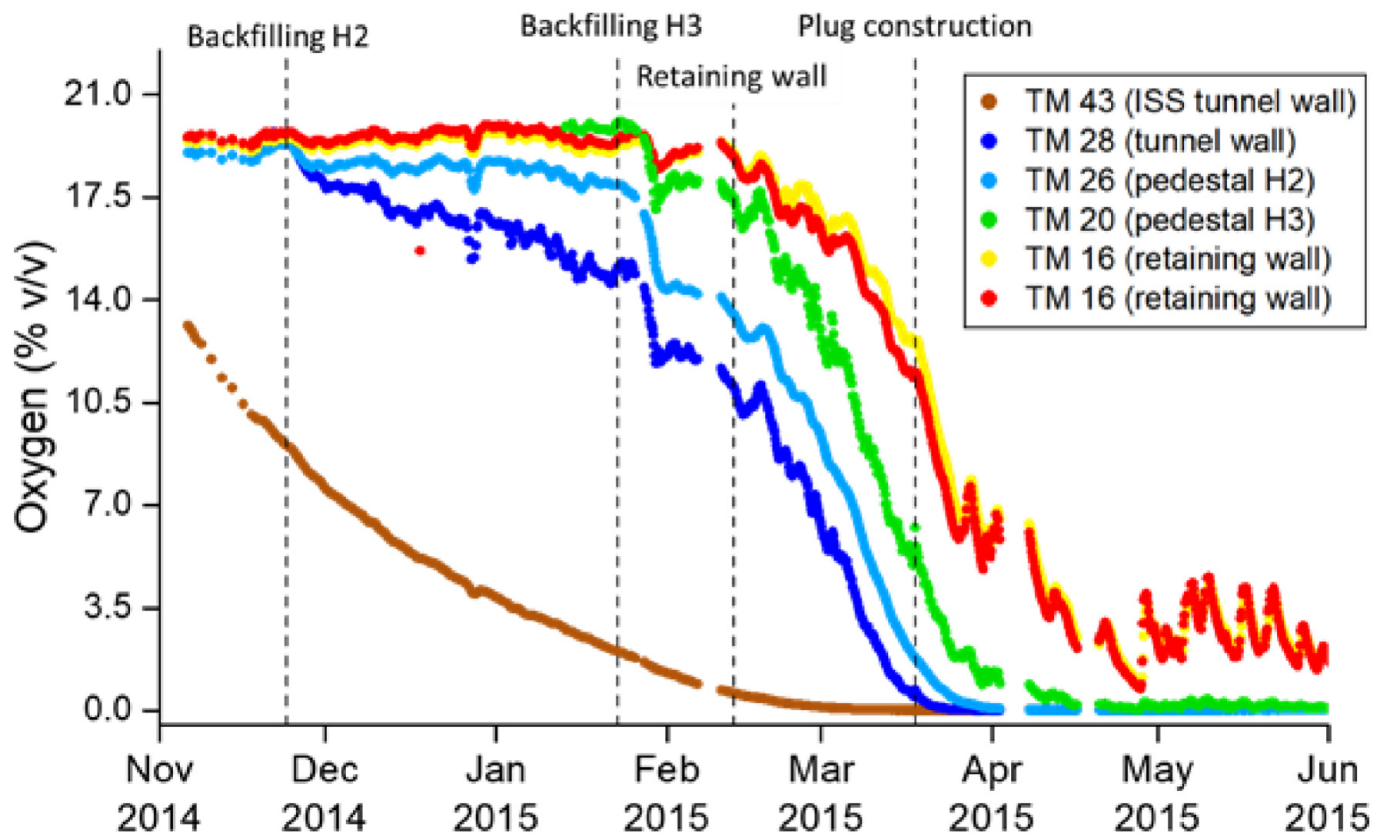


# Mont Terri Project Underground Rock Laboratory



Report period: January 29 – February 4, 2024

Assembled and edited by swisstopo, St-Ursanne



**Spotlight of the week:** The FE-G Experiment is a long-term experiment focused on the monitoring of the gas composition within the backfill of a generic emplacement tunnel for high level waste and spent fuel. Goal is to understand the processes controlling the evolution of the gas phase and spot any potential gas-related processes relevant for the safety assessment. Observations have been collected since 2014, combining several onsite and offsite gas measurements. Studies have been conducted to investigate (i) the processes related to rapid gaseous oxygen consumption at early emplacement phase (currently investigated via COMSOL modelling); and (ii) the role of bentonite backfill and the excavation damaged zone on the gas dynamics over successive years after the emplacement (currently investigated via pressure sensors data and noble gas concentrations). Image: rapid gaseous oxygen decrease measured by sensors, following the emplacement in the tunnel (from Giroud et al., 2018 <https://doi.org/10.1016/j.apgeochem.2018.08.011>).

## **CD-A (Influence of Humidity on Cyclic and Long-Term Deformations) experiment**

- From Tuesday to Friday, January 30 to February 2, M. Middelhoff, B. Zehle and V. Gillich (GRS) drilled two boreholes (BCD-A28 and BCD-A29, inclination 30 degrees) into the front of the Niche Open Twin and installed piezometers at 2.5 and 5 m, respectively. They then moved the drill rig into the Closed Twin and started drilling (**Figure 1**).
- On Thursday, February 1, A. Baeriswil, F. Richert and S. Schefer (swisstopo) performed the leveling inside both Twin Niches (**Figure 2**).

## **CL (CO<sub>2</sub>LPIE-CO<sub>2</sub> Long-Term Periodic Injection) experiment**

- On Monday, January 29, S. Schefer, J. Windisch and F. Richert (swisstopo) measured the precise location, orientation and deviation of borehole BCL-5 (**Figure 3**).
- From Tuesday to Thursday, January 30 to February 1, H. Albers, U. Nowak and T. Tietz (BGR) completed a geophysical characterization (mini-seismic) in the BCL-5 borehole. The measurement intervals were 10 cm with a borehole probe, from the borehole start to the end of the borehole (17.10 m). In addition, BGR has put a monitoring measuring system into operation for the development and model representation of the specific resistances in the BCL-3/4/5/6/7/8 boreholes. In the first step, 200 electrodes are now connected, another 360 will follow after BCL-6/7/8 are completed (**Figure 4**).
- On Tuesday, January 30, S. Schefer (swisstopo) marked the orientation for the next two boreholes BCL-7 and BCL-8.
- From Wednesday to Thursday, January 31 to February 1, T. Fritsche and S. Czerner (ZHAW), together with M. Ziegler, D. Jaeggi and J. Windisch (swisstopo) installed the first Modular Multi-Sensor Monitoring System (MMMS) in BCL-5. The MMMS was pushed stepwise and completely into the 17.43 m long borehole using the drill motor operated by S. Braunschweig and F. Durulan (Eul GmbH) (**Figure 5**).
- On Wednesday, January 31, A. Ammon and H. Geisser (Solexperts) installed the acquisition system for interval and packer pressures and temperature monitoring of BCL-5 to BCL-8 in Niche CL.
- On Thursday, February 1, T. Theurillat and D. Jaeggi (swisstopo) connected the hydraulic packer of BCL-5 and inflated it to about 30 bar.
- On Friday, February 2, M. Ziegler, D. Jaeggi and J. Windisch (swisstopo) injected 70 l resin into the annulus space of BCL-5. The resin was warmed to about 20-25 degrees Celsius prior to the injection (**Figure 6**).

## **CS-E (Mini-Fracturing and Sealing) experiment**

- On Monday, January 29, A. Rinaldi (ETHZ) performed GPR and fibre optic measurements.
- On Friday, February 2, M. Rutschi (Neubrex) measured the fiber optic loop and moved the interrogator to the CL experiment.

## **DR-E (Long-Term Diffusion Experiment in the Main Fault-Zone) experiment**

- On Friday, February 2, R. Wüst (Nagra), U. Mäder (RWC) and A. Ammon (Solexperts) switched the injection pump on BDR-E1 and cleaned all the lines due to rust coming from the pump. The setup (taken from CI-D) is now working with a steady flow of 4.5 ml/min. They also exchanged and cleaned the lines of BDR-E2, flow adjustment was not necessary (**Figure 7**).

## **PF-A (Progressive Evolution of Structurally-Controlled Overbreaks: Long-term monitoring, hydromechanical simulation and rock testing) experiment**

- From Monday to Thursday, January 29 to February 1, L. Winhausen (RWTH Aachen), C. Marone (Uni Roma), J. Windisch and M. Ziegler (swisstopo) logged the rock cores of BPF-A1 and BPF-A3 and optically logged both boreholes. The main fault was hit at the planned depth ranges and sampled for (hydro-)mechanical testing. In addition, intact and tectonically fractured rocks were sampled.
- From Monday to Wednesday, January 29–31, L. Winhausen (RWTH Aachen), C. Marone (La Sapienza University of Rome) and J. Windisch (swisstopo) did the core mapping and took some samples for determining water content and rock density. The samples were sealed in aluminium bags.
- On Monday, January 29, S. Braunschweig and F. Durulan (Eul GmbH) drilled BPF-A2 across the main fault to its final depth of 9.0 m.
- On Friday, February 2, F. Richert and S. Schefer (swisstopo) measured location and orientation of boreholes BPF-A1, BPF-A2 and BPF-A3.

## **SW-A (Large-Scale Sandwich Seal in Opalinus Clay) experiment**

- On Monday, January 29, S. Schefer (swisstopo) increased the injection pressure on shaft 2 from 7.8 to 9.1 bar.
- On Tuesday, January 30, T. Theurillat (swisstopo) refilled the HPT connected to the borehole BSW-A1. He also replaced the gas cylinder.

## Varia

- On Friday, February 2, Faustin Richert had his last day as a civil servant in Mont Terri. We thank him very much for all the great work.

## Visits

Day	Date	Group Name	Group Size	Visitors Guide
Tue	30.1.2024	Stiftung Gletschergarten, Luzern	17	H. Hauser (freelance)
Wed	31.1.2024	Collège Thurmann, Porrentruy	35	C. Boner (freelance) R. Nicol (swisstopo)

## Figures



**Figure 1: CD-A:** The GRS-team inside Niche Open Twin (S. Schefer, swisstopo).



Figure 2: CD-A: Leveling inside Niche Open Twin (S. Schefer, swisstopo).



Figure 3: CL: Measuring the orientation of BCL-5 in a special setting (S. Schefer, swisstopo).

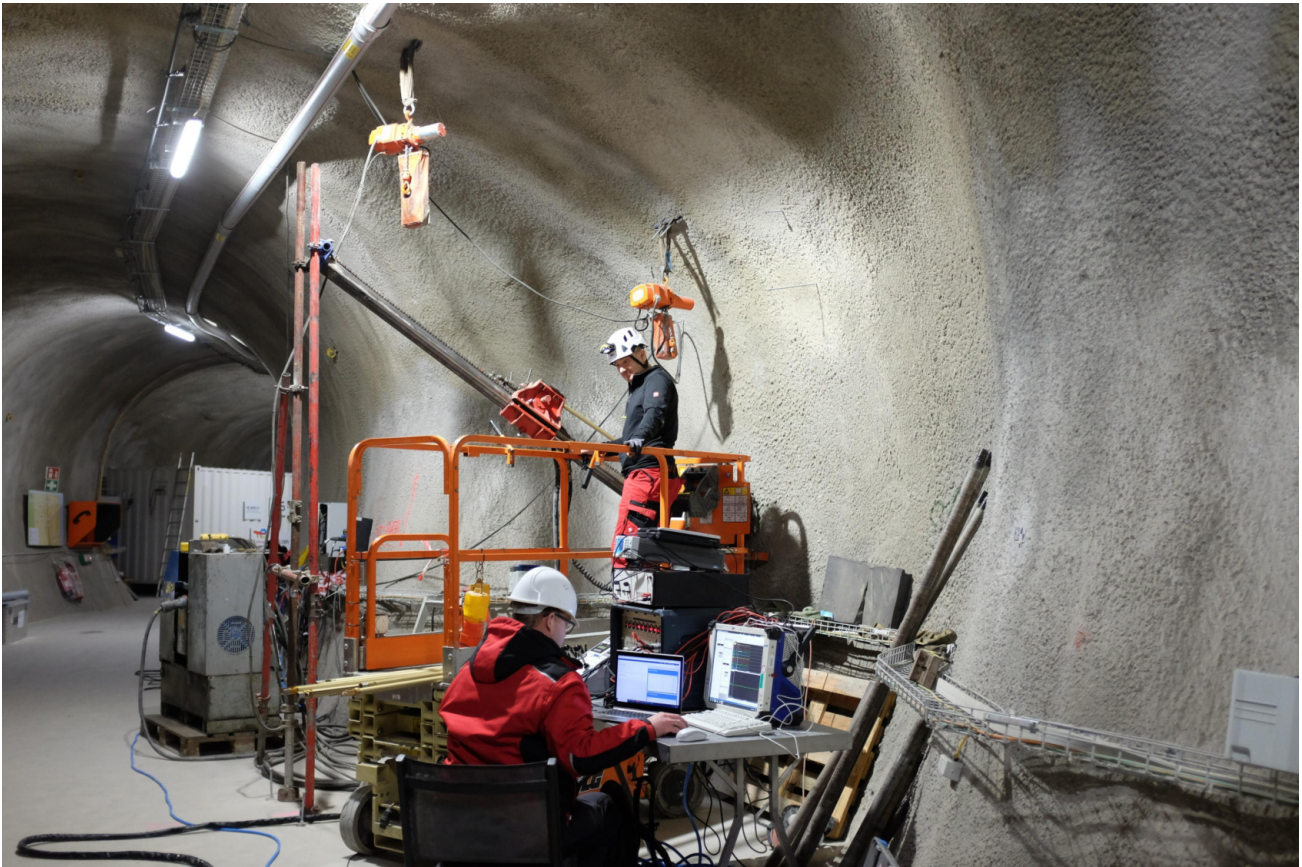


Figure 4: CL: IVM measurements inside BCL-5 (S. Schefer, swisstopo).



Figure 5: CL: Installation of the MMMS inside BCL-5 (S. Schefer, swisstopo).



Figure 6: CL: Resin injection for BCL-5 (J. Windisch, swisstopo).



Figure 7: DR-E: The pump team happily smiling in anticipation of Friday beer (R. Wüst).