Äspö Hard Rock Laboratory

Temperature Buffer Test

Data management

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Clay Technology AB

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Abstract

The Temperature Buffer Test will be installed at Äspö Hard Rock Laboratory in 2003. The test is a simulation of a part of a deposition hole in the concept for high-level nuclear waste disposal and set up by ANDRA. The test includes two heaters placed centrally with 50 cm thick bentonite blocks placed between, above and below the heaters as well as bentonite rings placed around the heaters. The wetting is made artificially from sand filters.

Measurement of temperature, total pressure, pore pressure, gas pressure and relative humidity in the buffer and heaters and stresses/strains in the rock will be done in more than 200 instruments. The measurement results will be collected and stored mainly as raw data in a PC computer at the test site. The raw data will be checked, processed and (for some data) converted to useful values each month. Each third month the data will be reported with processed values drawn as functions of time in a data report. That data will also be sent to the database SICADA for permanent storage. This report briefly describes the management of the data after storage on site.

Sammanfattning

TBT (Temperature Buffer Test) är en simulering i full skala av en del av ett deponeringshål i det franska koncept för förvaring av radioaktivt avfall som tagits fram av ANDRA. Försöket kommer att installeras i Äspö Hard Rock Laboratory år 2003. Försöket inkluderar två centralt placerade värmare, bentonitblock som placerats mellan, över och under värmarna samt bentonitringar runt värmarna. Bevätningen görs artificiellt med sandfilter.

Mätning av temperatur, totaltryck, portryck, gastryck och relativ fuktighet i buffert och värmare samt spänning/töjning i berget görs i mer än 200 punkter. Mätresultaten samlas in och lagras i huvudsak som rådata i en PC vid testområdet. Rådatan kontrolleras, processas och (avseende vissa mätresultat) omvandlas till användbara storheter varje månad. Var tredje månad avrapporteras resultaten med mätta värden plottade som funktion av tiden i en datarapport. Dessa resultat skickas också till databasen SICADA för permanent lagring. Denna rapport beskriver kortfattat hanteringen av den rådata som lagrats i testområdet.

Contents

1   Introduction

The Temperature Buffer Test will be installed in 2003. The test is a simulation of a part of the deposition hole in the concept for high-level nuclear waste disposal and set up by ANDRA. The test will be performed in Äspö Hard Rock Laboratory in the deposition hole adjacent to the hole used for the Canister Retrieval Test. The test is described in the project plan /1-1/.

The test includes two heaters placed centrally with 50 cm thick bentonite blocks placed between, above and below the heaters as well as bentonite rings placed around the heaters. Figure 1-1 shows the layout of the test. The test will run for more than 3 years and may be excavated in steps.

Measurement of temperature, total pressure, pore pressure, gas pressure and relative humidity will be done in altogether 239 instruments. The measurement results will be collected and temporarily stored in a PC computer with the data collection program *Orchestrator*.

The raw data stored with *Orchestrator* will be checked, processed and (for some data) converted to useful values each month. Each third month the data will be reported with processed values drawn as functions of time in a data report. That data will also be sent to the database SICADA for permanent storage. This report briefly describes the management of the data after storage with *Orchestrator*.
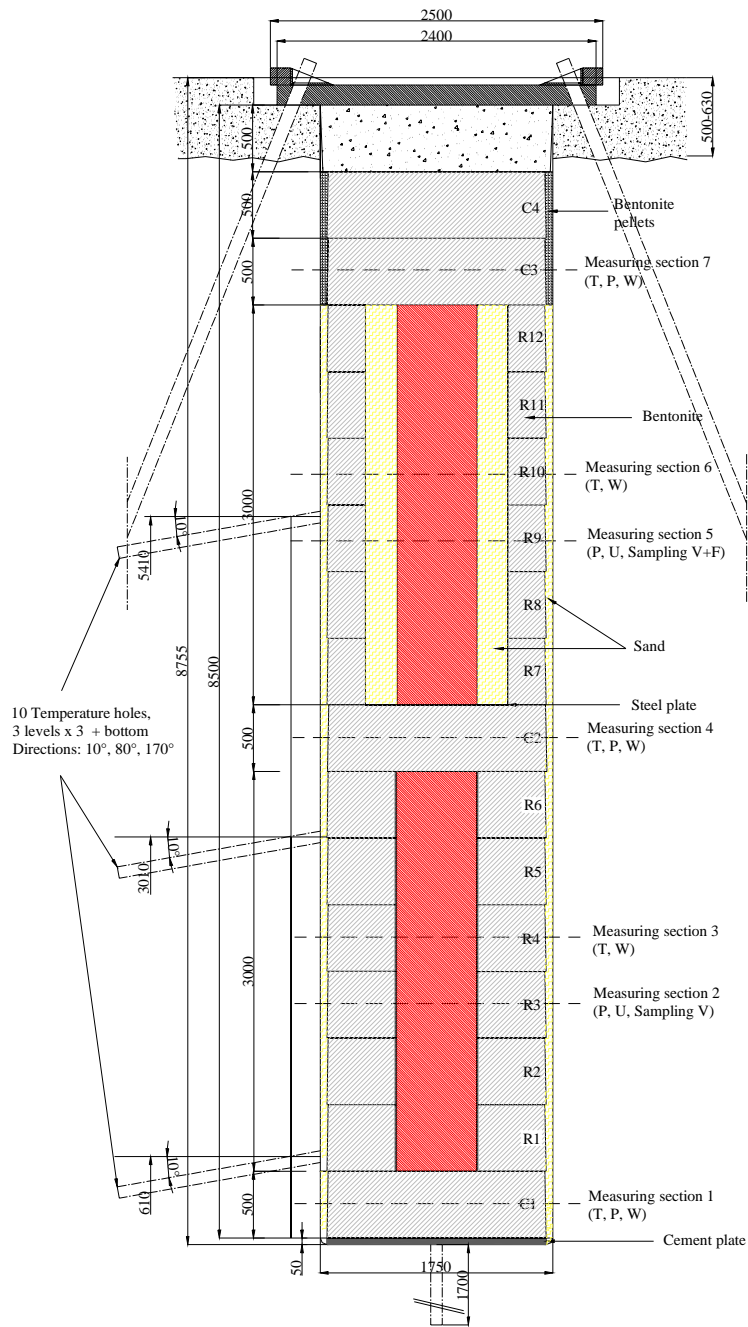
Figure 1-1. Layout of the TBT-test

2   Data description

The instruments to be installed in the buffer and sand are described in the instrumentation report R5 /2-1/. In addition to those instruments there will be temperature gauges in the heater and sensors for measuring stress/strain in the rock (installed earlier). The instruments in the buffer will mainly be installed in 7 horizontal measuring sections as shown in Figure 1-1. The instruments work according to different principles that require different treatment of the raw data stored with *Orchestrator*. Table 2-1 summarizes the instruments and measuring principles as well as the treatment required.

Table 2-1. Data to be collected

Measured variable	Measurement principle	Manufacturer	Number of sensors	Processing required	Remark
Temperature	Thermocouple	Pentronic	89	Yes	Buffer
Temperature	Thermocouple	Pentronic	11+6	Yes	Heater
Temperature	Thermocouple	Pentronic	40	Yes	Rock
Total pressure	Vibrating wire	Geokon	29	Yes	
Pore pressure	Vibrating wire	Geokon	8	Yes	
Relative humidity	Capacitive	Vaisala*	11	Yes	
Relative humidity	Capacitive	Rotronic*	12	No	
Relative humidity	Psychrometer	Wescor*	12	Yes	
Gas pressure	Piezoelectric	Druck	4		
Stress	Vibrating wire	BBK	4	Yes	Rock
Strain	Vibrating wire	BBK	6	Yes	Rock
Force	Piezoelectric	Druck	4	No	Plug
Displacem.	Inductive	Solartron	3	No	Plug
Water flow	Piezoelectric / differential pressure	Druck	1	Yes	Sand filter
Water pressure	Piezoelectric	Druck	1	No	Sand filter

Asterisk (*) means that the sensor also measures temperature
The data in "raw form" will be saved in a PC placed in the data cabin close to the test site. The computer is connected to the Äspö network and direct lines to Clay Technology and ANDRA will be established.

3   Data management

This report only deals with management of the data that has been collected and stored in the computer on site. The handling of data at the start of the test and the monitoring frequency are described in the activity plan *Start of test and operation* (AP9).

Clay Technology will perform the data management but the stress/strain data from the measurements in the rock will be treated by BBK. The basic raw data is collected by the computer on site. A backup will be made every week. Once a month the data that concerns the buffer, canister, plug and temperatures in rock will be collected by Clay Technology in Lund, converted and treated to useful format and units. Measurements considering stresses and deformations in rock will be collected by a logger on site and sent to a computer at BBK. Data on rock condition will be collected by BBK and converted, treated and distributed for storing correspondingly as in buffer, canister and plug.

The data management will consist of the following steps:

1. **Data transfer to Clay Technology with data processing and storing** in Excel data sheets. This procedure is carried out once a month.

   The data processing varies between the different data. The following data will be processed:

   Temperature measured with Pentronic: The sensors are calibrated at the factory and the calibration values will be used for correcting the data.

   Total and pore pressure measured with Geokon: The sensors are calibrated at the factory and the calibration values will be used for correcting the data.

   Relative humidity measured with Vaisala: The sensors are rebuilt and calibrated afterwards in three points, which will be used for correction of the data.

   Relative humidity measured with Wescor: The raw data needs to be processed for evaluation of the relative humidity.

   Stress and strain: This data will be processed and reported by BBK.

   Water flow with Druck: The water inflow is measured by measuring the volume of water in the tank with a differential pressure transducer. Processing according to three-point calibration and conversion to volume is required.

   Water pressure with Druck: Processing according to three-point calibration will be done.

2. **Checking of processed data** in order to find any errors in the loggers or the data collection system. This procedure is carried out once a month after the data processing.

3. **Reporting of processed data.** Every third month the processed data will be checked, quality assured and reported in diagrams as function of time from start of the project. A "quarterly report", that contains all data with comments on the function of the transducers and the development of different processes, will be published and delivered to the project participants. An example of a diagram is shown in Appendix 1 /3-2/.

4. **Transmission of reported data to the data base SICADA.** This transmission will be made every third month after the reporting.
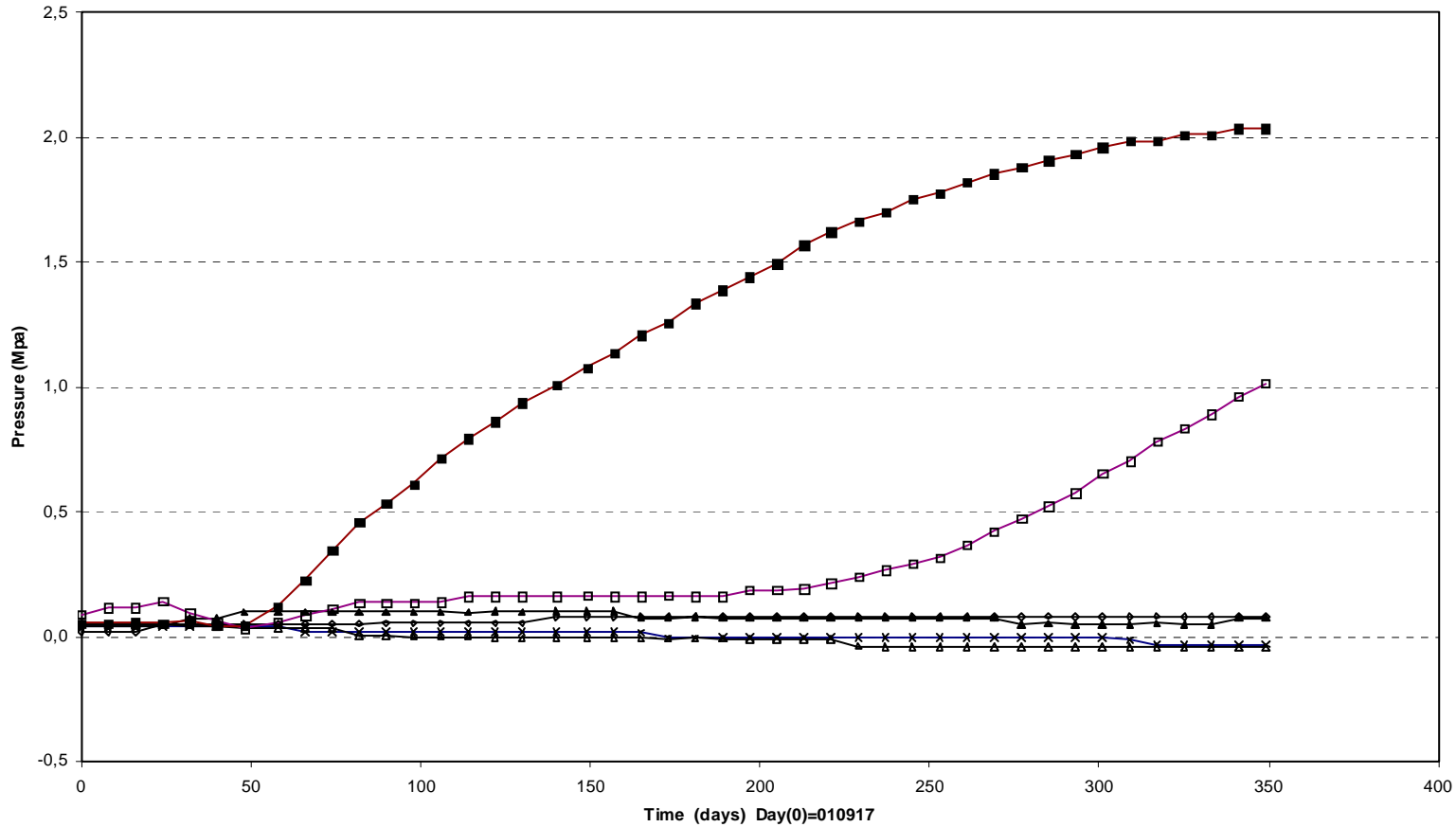
References

/1-1/   **Vignal B.**, ÄHRL. Temperature Buffer Test. Project Plan: Test installation. Internal Report F116.

/2-1/   **Sandén T**., Instrumentation. Temperature Buffer Test. R5.

/3-2/   **Goudarzi R. and Börgesson L.,** ÄHRL. Protoype Repository. Sensor data report. Report nr: 3. IPR-02-61.

Appendix 1

Example of data reporting.

Prototype\Hole 3\Ring10 and Cyl.3 (010917-020901)
Total pressure - Geokon

Legend:
- PBU30017(5.556\0°\0.050)
- PBU30021(5.556\90°\0.635)
- PBU30022(5.556\100°\0.735)
- PBU30026(6.654\5°\0.585)
- PBU30023(5.556\190°\0.735)
- PBU30024(5.556\190°\0.635)

Y-axis: Pressure (Mpa)
X-axis: Time (days) Day(0)=010917