



Evaluation of stress and saturation effects on seismic velocity and electrical resistivity – laboratory testing of rock samples

Jan Vilhelm (1), Jaroslav Jirků (1), Lubomír Slavík (2), and Jaroslav Bárta (3)

(1) Charles University in Prague, Faculty of Science, Institute of Hydrogeology, Engineering Geology and Applied Geophysics, Prague, Czech Republic (vilhelm@natur.cuni.cz), (2) Technical University of Liberec, Faculty of Mechatronics, Informatics and Interdisciplinary Studies, Institute of Systems Control and Reliability Management, (3) G IMPULS Praha

Repository, located in a deep geological formation, is today considered the most suitable solution for disposal of spent nuclear fuel and high-level waste. The geological formations, in combination with an engineered barrier system, should ensure isolation of the waste from the environment for thousands of years. For long-term monitoring of such underground excavations special monitoring systems are developed.

In our research we developed and tested monitoring system based on repeated ultrasonic time of flight measurement and electrical resistivity tomography (ERT). As a test site Bedřichov gallery in the northern Bohemia was selected. This underground gallery in granitic rock was excavated using Tunnel Boring Machine (TBM). The seismic high-frequency measurements are performed by pulse-transmission technique directly on the rock wall using one seismic source and three receivers in the distances of 1, 2 and 3 m. The ERT measurement is performed also on the rock wall using 48 electrodes. The spacing between electrodes is 20 centimeters.

An analysis of relation of seismic velocity and electrical resistivity on water saturation and stress state of the granitic rock is necessary for the interpretation of both seismic monitoring and ERT. Laboratory seismic and resistivity measurements were performed. One series of experiments was based on uniaxial loading of dry and saturated granitic samples. The relation between stress state and ultrasonic wave velocities was tested separately for dry and saturated rock samples. Other experiments were focused on the relation between electrical resistivity of the rock sample and its saturation level. Rock samples with different porosities were tested.

Acknowledgments: This work was partially supported by the Technology Agency of the Czech Republic, project No. TA 0302408