

DBE TECHNOLOGY NEWS

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Vienna International Centre (Photo: Rodolfo Quevenco / AEA)

TECHNOLOGY TRANSFER PROJECT BETWEEN
UK AND GERMANY INITIATED

UPGRADE OF THE HOISTING SYSTEM FOR SHAFT 1
OF THE HADES UNDERGROUND LABORATORY

3RD SINO-GERMAN WORKSHOP

NUMERICAL ANALYSIS OF THE EDZ AROUND A SHAFT
IN A CLAYSTONE FORMATION

Verantwortung
für Generationen
Responsibility
for Generations

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Team of DBE TECHNOLOGY GmbH



Roadheader Morsleben repository (Courtesy of DBE)

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language, my managers found it relatively easy to integrate me into the company and I soon found myself working on a wide spectrum of interesting projects.

Things really kicked off in my second year, when we landed a big role on a project in Bulgaria. The project covered the full development cycle for a low-level waste repository through completion of a near-construction-ready technical design with accompanying safety assessments. At the same time, I was also integrated into several of our European Commission projects supporting the Ministries of Ukraine. Most recently, we completed the basic design for a low-level waste facility to be built at Al Tuwaitha near Baghdad, Iraq. We even landed a few small projects with my former Yucca Mountain colleagues at Sandia National Laboratories.

It is hard for me to imagine any other company where I could have gained such a wide breadth of international as well as waste management experience. While DBE TECHNOLOGY GmbH may be a "small" company, what it lacks in size it more than makes up for in ability, experience, and heart, and colleagues – among the best I have worked with. So again, I will say that although I am moving on professionally, I do so with both "einem lachenden und einem weinenden Auge."

I am looking forward to working with my DBE colleagues as well as all of you around the world in my new position at the IAEA.

See you in Vienna or elsewhere and Happy Reading!

*Gerald-Hans Nieder-Westermann
International Cooperation Department*

Dear readers,

As the saying goes, "all good things come to an end" and so it is with my time here at DBE TECHNOLOGY GmbH. In September, I will be joining the waste management group at the International Atomic Energy Agency (IAEA) in Vienna. However, as the Germans would say, my departure is with both "einem lachenden und einem weinenden Auge" (a smile in one eye and a tear in the other). Although I am very excited about my new position with the IAEA, I recognize that it was in great part made possible through the professional support and project challenges I have experienced since joining DBE TECHNOLOGY GmbH.

I first joined the International Cooperation Department of our little company in January 2011. With my fifteen years of prior US experience at Yucca Mountain as well as my understanding of German culture and

Technology Transfer Project between UK and Germany Initiated



RWM visitor group at Morsleben repository

Radioactive Waste Management Ltd (RWM) is the organisation responsible for implementing the HLW disposal programme in the UK and for providing radioactive waste management solutions. It aims at building on existing knowledge available in the world and adapts relevant solutions to the UK situation where this knowledge meets the needs of a national disposal system. As part of RWM's collaboration work to learn from the experience of other geological disposal programmes, the organisation commissioned studies to explore the benefits of sharing technologies for geological disposal concepts developed for higher strength rocks and lower strength sedimentary rocks. In order to support the current UK siting process, RWM would like to develop its understanding of the applicability of technology developed in Germany to the UK situation. To facilitate this process, RWM has tasked DBE TECHNOLOGY GmbH with a project to familiarise RWM with the relevant German technologies and approaches.

As a starting point for this endeavour, a workshop was organised by DBE TECHNOLOGY GmbH in Peine on May 23rd and 24th. Senior scientists of RWM were given the possibility to see and discuss several facets of geologic disposal of radioactive waste. A visit of the disposal facility of Morsleben showed the features of a repository in salt and also allowed exploring the processes and technologies for constructing, operating, and closing a geologic repository. Following the visit, the workshop continued in Peine with presentations of the repository projects, both in the UK and in Germany, and with an introduction into selected development and demonstration technologies, especially for repositories in salt.

Upgrade of the Hoisting System for Shaft 1 of the HADES Underground Laboratory

As a result of an open tendering procedure, EURIDICE (European Underground Research Infrastructure for Disposal of nuclear waste in a Clay Environment) contracted DBE TECHNOLOGY GmbH together with Tractebel ENGIE to renovate the shaft hoist of shaft 1 of the underground laboratory HADES in Belgium.

The existing bobbin hoist has been in operation for several decades and, according to the client, should be modernized. DBE TECHNOLOGY GmbH will essentially deliver the conceptual planning for the new hoist. Binding regulations do not exist in Belgium as those applied for the construction of the facility have now expired. Therefore, the first step in the project is to agree on a legal and normative basis for the design with the client

and the responsible regulator. During the development of the technical design for the hoist, the greatest challenge will be the guidance of the conveyance. Since the shaft is not perfectly vertical over its whole length, adjustments to the guide rails will be necessary. Rope guides will not be possible, as a prefeasibility study of DBE TECHNOLOGY GmbH has already established in 2014.

After completion of the conceptual design, the consortium of DBE TECHNOLOGY GmbH and Tractebel ENGIE will assist in the public tender to acquire an EPC contractor and finally also support the client during construction supervision.



Shaft 1 of the underground laboratory HADES (Belgium)

3rd Sino-German Workshop

From March 15 – 19, 2017, the 3rd Sino-German Workshop on Radioactive Waste Disposal, organised by CNNC (China National Nuclear Cooperation) and BRIUG (Beijing Research Institute of Uranium Geology) as well as BGR (Federal Institute for Geosciences and Natural Resources, Germany) and PTKA (Project Management Agency Karlsruhe – Karlsruhe Institute of Technology, Germany), took place in Jiayuguan, China. Numerous re-

search institutions and universities from China and Germany were invited to the conference to discuss a variety of topics, like site selection, repository concepts and technology, modelling, experiments, and safety case aspects. DBE TECHNOLOGY GmbH participated and gave a well-received and appreciated presentation about concepts and emplacement technologies for an HLW repository in Germany. The conference was a very valuable place to learn. Especially with regard to ongoing and future R&D work for radioactive waste disposal in crystalline rock in Germany, DBE TECHNOLOGY GmbH will very much benefit from the practical experience made in China, for example in the areas of drilling and blasting, TBM tunnelling and grouting.

As a conference highlight, the attendees visited the "Beishan Exploration Tunnel" (BET) in the Beishan Area of the Gobi Desert. This tunnel was an underground testing site in granite rock for validating the technologies that will be employed in the construction of the future underground laboratory at a site approximately 30 km away from the BET. The construction of the BET itself took place in 2015. Today, the experiments are already completed.



Beishan Exploration Tunnel in granite rock (Gobi Desert, China)

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Drift lining in marly formations – Konrad repository (Courtesy of DBE)

Within the scope of the existing cooperation agreement between DBE TECHNOLOGY GmbH and BRIUG, we look forward to learning more about the experience BRIUG will make in the Chinese Repository Program.

Numerical Analysis of the EDZ around a Shaft in a Claystone Formation

Within the R&D project ELSA 2 (Schachtverschlüsse für Endlager für hochradioaktive Abfälle – Shaft Seals for Repositories for High Radioactive Waste) and in collaboration with Technical University Bergakademie Freiberg, DBE TECHNOLOGY GmbH develops shaft sealing concepts for repositories in salt and claystone formations. Open questions, like the technical need for a partial removal of the Excavation Damaged Zone (EDZ) at the shaft contour or the risk of an additional damage due to the hot installation of bitumen, have been investigated using numerical analyses of a generic, 800-m-deep and 10-m-wide shaft in a claystone formation. The main goals were the prediction of the depth of the EDZ and a quantitative analysis of the permeability changes in the EDZ. The permeability was simulated as a function of effective stresses and plastic deformation.

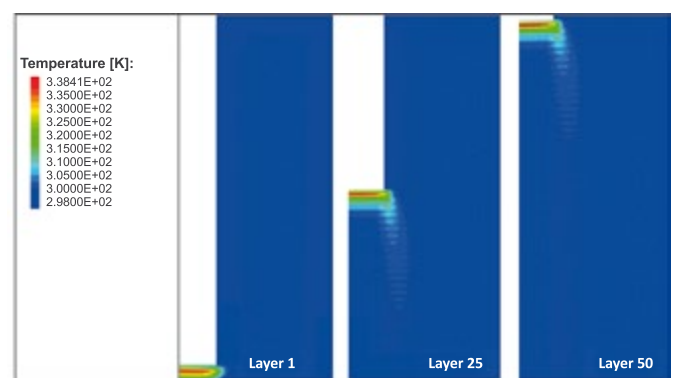
The THM analysis predicts that the EDZ extends to up to several meters into the host rock. The analysis of the permeability shows that shaft sinking changes the main characteristics of the permeability significantly. The primary status is characterized by a permeability parallel to the bedding that is at least one magnitude higher than perpendicular to the bedding.

Due to shaft sinking, the permeability within the first 10 cm increases by a magnitude of four. Inside this highly damaged zone, the main flow direction changes from parallel to bedding to parallel to shaft contour. Thus, the deformation of the rock next to the shaft has the main impact on the permeability. Due to the extension of the outer rock zone, an area of approximately 50 cm is compressed temporarily while the permeability decreases slightly during that time.

The analysis of the effects related to thermal impacts based on bitumen installation and the partial removal of the EDZ shows that the damages in-

duced by the thermal impact are marginal. The EDZ around the shaft is already characterized by a highly increased permeability due to the shaft sinking. More significant impacts are observed during the removal of rock. This is related to an additional reorientation of the stress field. The removal of the first 50 cm of rock from the contour increases the permeability inside the remaining EDZ.

The numerical analysis helps to improve the knowledge about the conditions at shafts in claystone formations and the conditions during sealing of such shafts. The extension and quality of the EDZ are mainly influenced by the deformation and the stress conditions. Additional thermal impacts have only marginal influence.



Temperature profiles during layer-by-layer installation of hot bitumen

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