

# DBE TECHNOLOGY NEWS

2015

CONTRIBUTION TO REPOSITORY SAFETY:  
SEALING OF THE EDZ IN ROCK SALT

DEVELOPMENT OF A DESIGN OF A RADIOACTIVE  
WASTE REPOSITORY IN IRAQ

INTEGRITY OF A SHAFT SEAL UNDER EARTHQUAKE  
IMPACT

APPROVAL OF TECHNICAL DESIGN OF THE BULGARIAN  
REPOSITORY BY NATIONAL CENTER FOR RADIOBIOLOGY  
AND RADIATION PROTECTION

Verantwortung  
für Generationen  
Responsibility  
for Generations

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Members of the French consultancy and engineering company INGERÖP (red) visiting the Konrad mine



For DBE TECHNOLOGY GmbH the activities of its International Cooperation Department provide far more than increased business opportunities outside the German markets. More importantly, international

cooperation brings increased experience and know-how as well as international perspectives and new ideas to the company and our pool of experts.

The experience gained through working for clients all over the world has significantly enhanced our capabilities related to developing technical solutions for other disposal concepts and geological and/or political environments than those considered in Germany so far. This international cooperation with clients and business partners ensures that the qualifications and competencies of our experts remain state-of-the-art in the area of radioactive waste disposal, thus continuously expanding DBE TECHNOLOGY GmbH's area of expertise.

One particular field of work where DBE TECHNOLOGY GmbH has gained extensive know-how through its international activities is the development of innovative technological solutions for near-surface and surface disposal facilities and their safety assessments. Since its founding DBE TECHNOLOGY GmbH has been involved in the planning and/or safety assessment of ten such facilities located in eight different countries and has estab-

lished itself as a recognized leader in this area. The technical design and safety assessment of the future National Disposal Facility near Kozloduy in Bulgaria, which is described in more detail in this newsletter, is one of the most recent examples from this area.

There is another reason for us to participate in international projects: In the same way we profit from working together with other institutions, our international partners benefit from the sharing of our know-how and experience as well. This is very important to us because we feel we have the obligation to increase the level of radiological safety, and for us this obligation does not end at the borders of our home country. In addition, poor practices in radioactive waste management in other countries are likely to cast a bad light on the entire industry. We have therefore a strong interest in supporting the successful implementation of waste disposal projects around the world. Consequently, we welcome international cooperation activities that allow us to provide such support.

To summarize, we believe that the exchange of experience through international cooperation is highly beneficial to all participating parties and supports all of us in our common endeavor to find safe and technically feasible solutions for the disposal of radioactive waste.

Some of the international projects, where we have recently contributed to the development of such solutions, are described in more detail in this newsletter. Should you be interested to learn more about our role in these projects or other projects that we carried out in the past, just contact us via our website.

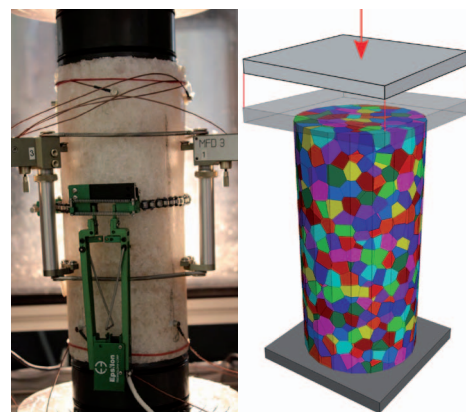
Happy reading!

Dr. Bernt Haverkamp

Deputy Head of  
International Cooperation Department  
DBE TECHNOLOGY GmbH

## Contribution to repository safety: sealing of the EDZ in rock salt

The integrity of the host rock is a fundamental issue with regard to the retention of radionuclides in a deep geological repository. But the construction of the repository will impair the host rock. Therefore, with regard to long-term safety, special attention has to be paid to mine openings and the excavation damaged zone (EDZ) at their contour. The EDZ is a disintegrated zone around mine openings that is characterized by microfractures forming a highly connected fracture network. Compared with tight host rock, the EDZ has a significantly increased permeability thus compromising the post-closure safety of deep geological repositories.



Left: Mechanical measurement of a salt rock sample, Right: 3 D-model of a rock salt sample for re-calculation of laboratory test for calibration.

The objective of a corresponding R&D project founded by BMWi / Project Management Agency Karlsruhe is to develop a modelling approach that can be used to simulate the mechanical deterioration of rock salt at grain scale. Many methods used to describe the hydro-mechanical processes inside the EDZ are based on continuum mechanical approaches where several

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DBE TECHNOLOGY GmbH booth at the Annual Meeting on Nuclear Technology 2015

The model and the demonstration concept for the investigation were based on the "Preliminary Safety Analysis for the Gorleben Site". The shaft seal, composed of salt concrete type Asse, was assumed to be located in Leine-rock salt at a depth of 650 m to 780 m. The numerical simulation is based on the loads (velocity-histories, i.e. stress-histories) of the design earthquake of the Gorleben site. To obtain information about the integrity of the sealing system during the earthquake impact, the dilatancy criterion according to Cristescu/Hunsche, the fluid pressure criterion, and the Drucker-Prager yield criterion were examined for the excavation damaged zone (EDZ) and for the sealing element itself.

The numerical analyses were carried out with static material properties, which can be up to ten times lower than dynamic properties. The results showed that an earthquake would have only little influence on the barrier and would not impair its integrity. If dynamic properties are used for the simulations, higher loads (i.e. stress-amplitudes)

can be expected. Dynamic material properties derived from ultrasonic measurements were used in a further investigation. The corresponding results showed much more fluctuation in the state variables during the earthquake, but again the integrity of the sealing system was not affected negatively. These calculations show exemplarily that earthquake loading does not affect the integrity of a geotechnical barrier. Thereby, a gap in the quantitative verification of the functionality of geotechnical barriers was closed.

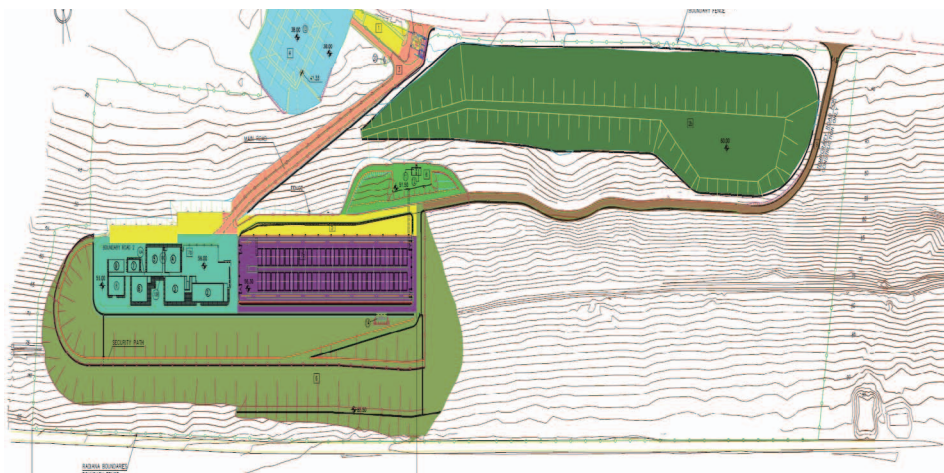
### Approval of Technical Design of the Bulgarian Repository by National Center for Radiobiology and Radiation Protection

A noteworthy highlight of DBE TECHNOLOGY GmbH's current project portfolio, the development of the technical design and the interim safety report for the Bulgarian low- and intermediate-level radioactive waste repository (National Disposal Facility – NDF) lo-

cated adjacent to the Kozloduy Nuclear Power Plant, has reached a major milestone. The technical design has been approved by a relevant authority, the National Center for Radiobiology and Radiation Protection. The design and licensing project for the Bulgarian State Enterprise Radioactive Waste (SERAW) is carried out by a consortium of DBE TECHNOLOGY GmbH, Westinghouse Electric Spain SAU as consortium leader, and the Spanish radioactive waste management agency ENRESA, with local expert support provided by EQE Bulgaria AD.

The NDF design work initially focused on the conceptual design of the repository. In December 2012, the Bulgarian Nuclear Regulatory Agency (BNRA) and SERAW approved the conceptual design and authorised the consortium to start developing the technical design of the repository. Under the responsibility of DBE TECHNOLOGY GmbH and in close cooperation with the consortium's Bulgarian subcontractor, EQE Bulgaria AD, the technical design work was completed and summarised in 19 separate chapters, filling about 50 folders and totalling approximately 7,000 pages. Despite the tight time schedule and various challenges, e.g., new regulatory requirements in the course of the design development, SERAW was able to accept the technical design in spring this year and to submit it formally to the relevant authorities.

Currently, SERAW is planning to finish the project in order to start building the repository in about one year. For this purpose, the consortium will be tasked with preparatory activities, like the necessary work to define the design for just the first construction phase.



First construction phase of Bulgarian NDF (Source: SERAW)

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