



Drilling rig for a deep geothermal borehole, Helsinki (Finland)



BGE TECHNOLOGY GmbH

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Sealing test for underground shaft, Morsleben Repository (Germany)



Dear Readers,

As we are closing in on midsummer 2021, the Corona Pandemic is starting to lose its grip on daily life. Incidence rates decrease and vaccination rates go up. So, hopes are running high that we can soon shape our private and working lives without permanent concern of infections. At BGE TECHNOLOGY GmbH, we currently discuss how our experience with working from home will influence future manage-

ment of our workspace and communication with one another.

Some colleagues would prefer to work from home almost full-time. Others enjoy the formerly unlikely feeling to have the liberty of going to the office regularly. Personally, I very much enjoy the freelancing feeling of being mobile. However, I also miss the vibrant energy of our offices, face-to-face meetings, and the banter among colleagues. Video calls still tend to focus on essential information, after all. For our future, I am very confident that we will find ways to organise our work flexibly, choosing time and space based on work requirements as well as personal preferences. This may also allow sharing desks among colleagues and open up capacity to hire additional personnel without reducing individual space at work.

We are especially proud that mostly working from home during the past months has not led to an observable decrease in productivity or workload. Quite on the contrary, we are pursuing a large variety of fascinating projects of which we present a selection to you in this newsletter.

Happy reading!

Niklas Bertrams  
Deputy Head,  
International Projects Department

## Shaft or Ramp?

In June 2021, PTKA (on behalf of BMWi) commissioned BGE TECHNOLOGY GmbH with the R&D project LARYSSA to compare the long-term safety of closure systems in shafts and ramps. The access into a repository in a deep geological formation is, as in conventional mining as well, a crucial bottleneck for the operation of

such facilities. All personnel and material transports have to pass the surface connections and the underground facility is supplied with all the necessary media. The direct connection between the biosphere and the underground openings represents a potential inflow or outflow path for fluids after closure. Thus, the sealing system plays an important role within the multi-barrier system of a repository. Despite

this great importance, operational, operational safety-relevant, and economic criteria are usually taken into account in the selection and design of the surface connections. Within the framework of the R&D project LARYSSA, aspects relevant to long-term safety in closure are thus to be investigated and the two basic concepts of shafts and ramps are to be evaluated. The analysis will serve to compare the respective systems and will provide an additional basis for decision-making when choosing a surface connection.

## Consultancy on Deep Borehole Disposal of Radioactive Waste in Australia

An increasing number of countries are considering disposing of smaller volumes of radioactive waste in boreholes because this flexible technology allows placing the radionuclides in rock formations with a high isolation potential at low cost and time. In Australia, the Commonwealth Scientific and Industrial Research Organisation Land and Water (CSIRO), as the national agency, is in charge of the planning and development work. In addition to crystalline rock, i.e. igneous and metamorphic rock formations, clayey rock and rock salt are considered. The preliminary design for the disposal of intermediate-level waste (ILW) is based on 2-km- and 3-km-deep vertical boreholes that consist of three zones. The waste canisters are to be disposed of in the deepest zone and separated from the near-surface upper zone by an uncased seal zone, where additional seals will be positioned.

A principle of CSIRO is to partner with industry in order to develop the best possible and innovative solutions. For this reason, it was a logical consequence to use the expert services of BGE TECHNOLOGY GmbH to investigate the feasibility of borehole disposal. The work programme



Beishan exploration tunnel (China)

mainly focuses on the dimensioning of canisters and the design of a canister emplacement system. In this context, the experience of BGE TECHNOLOGY GmbH with regard to borehole disposal in mined repositories and the development of hoisting systems have to be highlighted. BGE TECHNOLOGY GmbH's expertise in deep drilling technology is particularly useful when it comes to questions about the need for a casing and the derivation of borehole diameters. BGE TECHNOLOGY GmbH's knowledge of all host rocks ensures that CSIRO receives a purposive study from a single source that can serve as a basis for the detailed planning of small- and full-scale demonstration tests.

## Support for BRIUG in Developing Their URF Programme

China plans the disposal of high-level radioactive waste in deep geological repositories. Thus, the Beijing Research Institute of Uranium Geology (BRIUG) has been commissioned with developing an Underground Research Facility (URF), potentially as part of a future repository in

crystalline rock in the Beishan region (NW China). In the past years, IAEA has supported BRIUG in identifying activities related to the construction of a URF. BRIUG plans to start URF construction in July 2021. Due to open questions, IAEA initiated a virtual workshop running from 25 February to 9 April. BRIUG had proposed a range of topics and information needs that were to be discussed by an international expert team and their Chinese technical counterparts. The two participating experts of BGE TECHNOLOGY GmbH contributed to the issues „construction technology“ and „techniques on safety case during URF construction“. BRIUG's open questions were first discussed in expert working groups – including direct interactions with the Chinese experts – and later in comprehensive discussions during 3 rounds of plenary meetings.

In the closing session, the experts provided their observations and recommendations. For the „construction technology“ issue, pre-construction measuring and modelling, the test of mining technologies during ramp construction, ventilation

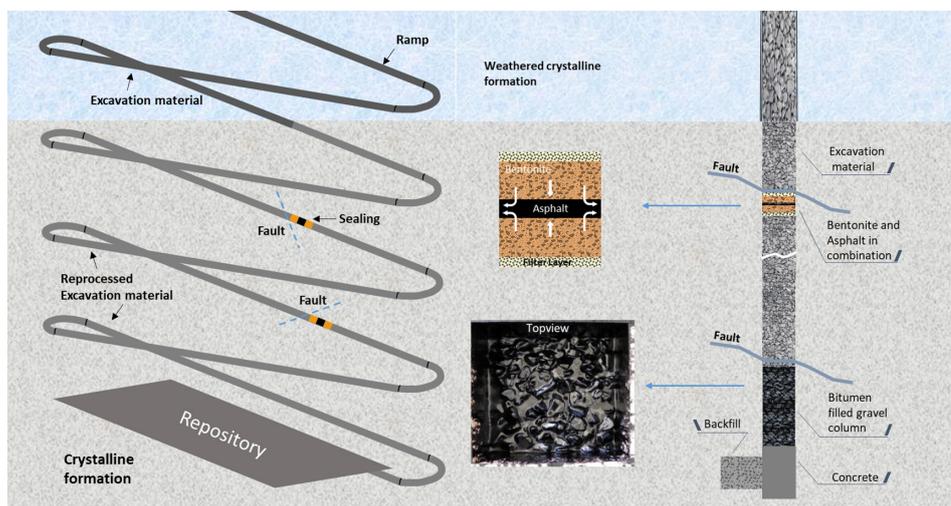
design, as well as analyses of required grouting and EDZ characterisation were intensively discussed. For the „safety case“ issue, the implementation of a safety concept, a FEP catalogue as a key for the investigation programme, implications of the Site Descriptive Model, adaptations of repository design to the respective geology, and the establishment of a data management system were highlighted by the experts.

Both BRIUG as well as IAEA were satisfied with the process and the results of the workshop. A continuation of the cooperation is planned.

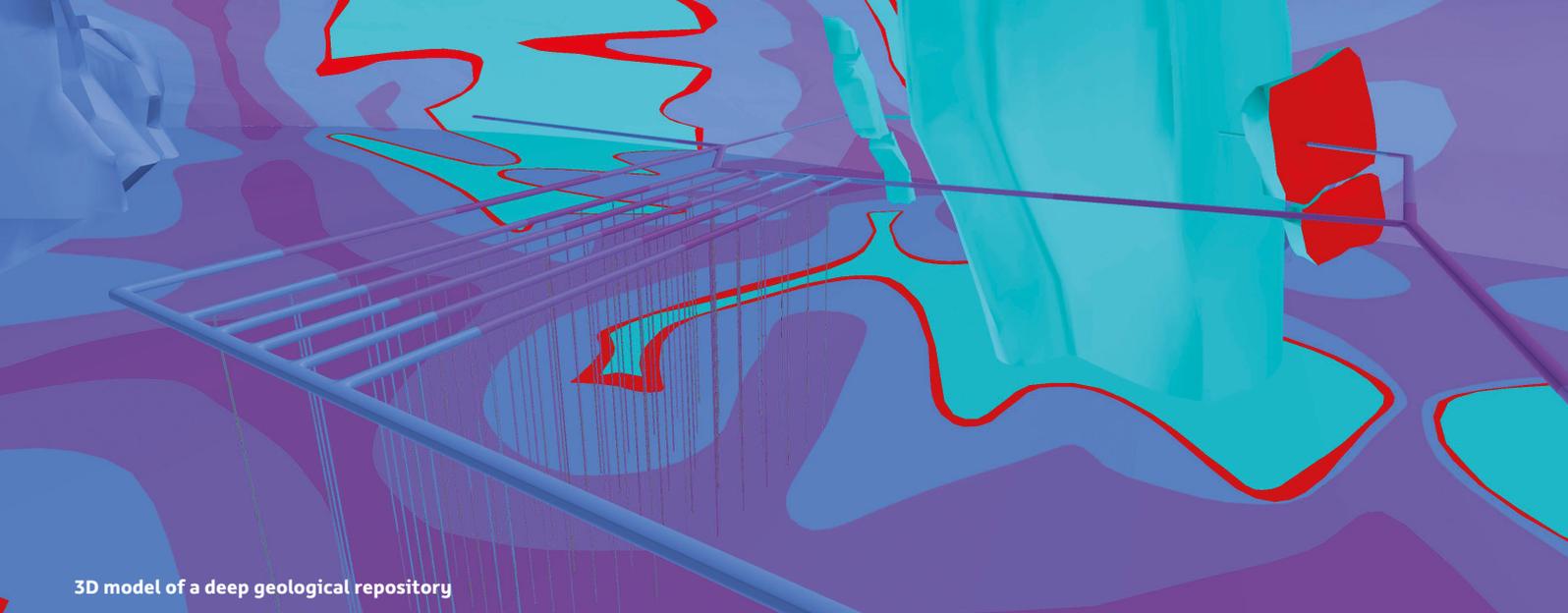
## Fire Analysis – Shaft Asse 5

One task of our parent company, BGE mbH, is the retrieval of the low- and intermediate-level waste from the Asse II mine. For this purpose, a new shaft will be sunk that will serve as a transport shaft for the waste from the underground to the surface. BGE's department for the retrieval of radioactive waste from the Asse mine has commissioned personnel of BGE TECHNOLOGY GmbH with the investigation of the thermal influence of a fire at the shaft landing station on the concrete liner of the new shaft. To address this task, a variety of simulations have been carried out with the mine ventilation software VentSim in close cooperation with retrieval operation and safety analysis specialists of BGE mbH concerning realistic model parameters and assumptions.

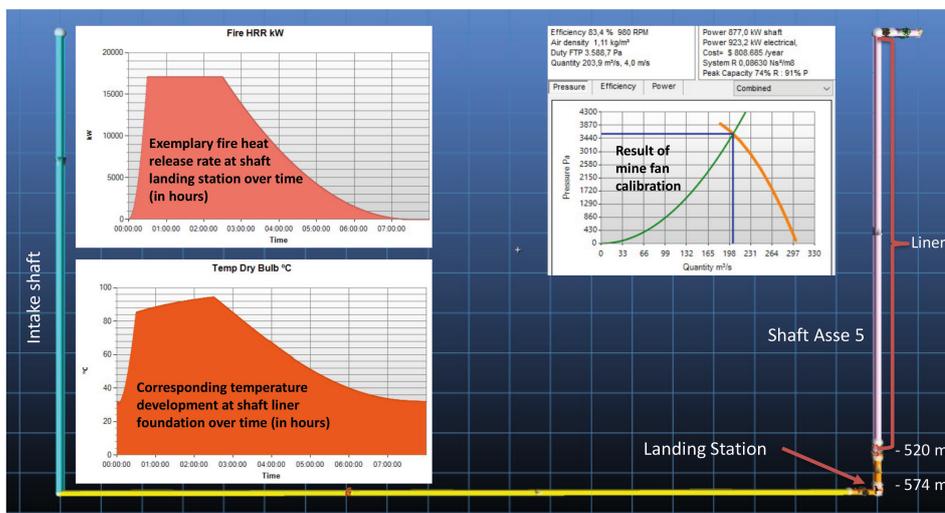
First, fires were modelled based on different design fire curves from tunnel engineering, which resulted in extremely high heat release rates in the heavily ventilated area. In a next step, BGE mbH supplied estimates for realistic fire loads that correspond to deployed machinery during the planned excavation and re-



Sealing concepts for shafts and ramps in crystalline formations (LARYSSA project)



3D model of a deep geological repository



Basic visual model for the fire simulations with VentSim with curve of the heat release rate of an exemplary fire and corresponding temperature development at the shaft liner; the model works with the mine fan and ventilation characteristics shown on the right.

retrieval operations. The calibrated design fires were run through the otherwise same model as before, with much more realistic results for underground fires. To handle uncertainties, several sensitivity analyses were carried out, for example by adjusting the duration of fire development stages and burning rates or by reducing ventilation. The final simulations are currently being run and analysed. It is very likely that the thermal impact of a fire at the shaft landing station on the shaft liner will stay below 300 °C.

### Workshop for Site Selection Department of BGE mbH

In March, BGE TECHNOLOGY GmbH organised a workshop for the site selection department of BGE mbH. The topic: repository concepts for high-level waste (HLW) repositories in different host rocks. The workshop was divided into several blocks, each taking part on a different day. The first three blocks focused on one host rock each (salt, clay, and

crystalline rock) and the current state of scientific and technical knowledge with regard to corresponding HLW repository concepts. BGE TECHNOLOGY GmbH could draw upon its significant expertise in this field and provided experts to lecture about safety concepts, waste container designs, repository designs and technology, closure concepts, and safety demonstration methods. Each presentation was thoroughly discussed with the site selection specialists of BGE mbH. The first three workshop days focused mainly on national geologic conditions and requirements and the corresponding solutions for repository concepts, while two additional days were dedicated to the presentation and discussion of international approaches. The continuous involvement in international projects allowed BGE TECHNOLOGY GmbH to illustrate the repository concepts for rock salt at the WIPP in the U.S.A, in clay rock in Belgium, Switzerland, and France as well as in crystalline rock in Sweden, Finland, Canada, the Czech Republic, and Russia. It was especially interesting and beneficial for both sides of the workshop participants to discuss the reasons for differences in international approaches and the influences of new legal requirements that have to be taken into account during the site selection steps in Germany in the future.

For further information, visit [www.bge-technology.de](http://www.bge-technology.de) or scan the QR code below.



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