BGE TECHNOLOGY NEWS

4
2019

Underground Drilling Equipment (Photo: Max Hayart)

BGE TECHNOLOGY GmbH

Signature of the German–Russian Cooperation Agreement


Participants of the URL network meeting at Xinchang (China)

Dear Readers,

As those of you who are regular readers of our Newsletter or who are well acquainted with BGE TECHNOLOGY GmbH know, we focus on three main areas: the German geological repository projects that are implemented and operated by our parent company BGE mbH, the field of general R&D on radioactive waste disposal in Germany, and international projects.

International activities have always been an important part of the work of BGE TECHNOLOGY GmbH since its foundation in 2000 (then named DBE TECHNOLOGY GmbH). They have been an important part, not so much in regard to gaining additional revenue from outside of the German market, but mainly in regard to the associated increase in experience and know-how of our multi-disciplinary team of experts. The development of general concepts and specific solutions for foreign disposal programmes, which differ significantly from the current German geological repository programme, and the related necessity to look beyond our own backyard have strongly broadened our area of expertise.

Another reason for assigning an important role to our international projects is the responsibility that we feel to share our know-how and experience with foreign radioactive waste management organisations through such projects to support a general increase in radiological safety. This overall objective leads us to support international organisations that work in this area like IAEA or OECD/NEA by providing experts for international training missions or by participating in international working groups of these organisations.

I would like to repeat what I wrote here already several years ago: we believe that the exchange of experience through international cooperation is highly beneficial to all participating partners and supports all of us in our common endeavour to find safe and technically feasible solutions for the disposal of radioactive waste.

In twenty years of executing international projects to find such solutions we have not only worked hard to fulfil the expectations of our partners and clients but also tried to establish long lasting relations with them, relations that are built on mutual trust and respect. This has been rewarded by the development of well-proven successful business relations with a large number of them. I would like to use the opportunity of writing this editorial to thank our partners and clients for this trustful cooperation in the past and to express our hope for a continuation of our good relations in the future.

This edition focusses on international projects, that we executed recently. However, they represent only a small part of the work that we have carried out in the last 20 years. Should you be interested in learning more about the projects mentioned in this newsletter or our experience and capabilities in general, please do not hesitate to contact me and I will be glad to give more detailed information.

Happy Reading!

Dr. Bernt Haverkamp
Head of International Projects
BGE TECHNOLOGY GmbH

German–Russian Cooperation Agreement Signed

On September 5 and 6, 2019, the tenth coordination meeting of the scientific and technical cooperation of the Russian Federation and the Federal Republic of Germany in the fields of nuclear safety research and research into the disposal of radioactive waste took place in Dresden. At the invitation of the State Corporation for Atomic Energy (ROSATOM) and the Federal Ministry for Economic Affairs and Energy (BMWi), experts from both countries met at the Helmholtz Research Centre. Within the framework of this meeting, the Federal State Unitary Enterprise "National operator for radioactive waste management" (FSUE NO RWM, Russia), the Nuclear Safety Institute of the Russian Academy of Sciences (IBRAE RAN, Russia), BGE TECHNOLOGY GmbH (Germany), the Federal Institute for Geosciences and Natural Resources (BGR, Germany) and Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH (Germany) signed an international cooperation agreement in the field of research on radioactive waste management. The participating organisations investigate and develop approaches and methods for the management of radioactive waste and for the disposal of radioactive waste in deep geologic formations.

The aim of this Cooperation Agreement is to define a general framework for cooperation of the organisations in the field of radioactive waste management research (including interim storage, design, characterisation, construction, operation, and closure of repositories for radioactive waste). In addition to this, a common understanding concerning the issue of long-term forecasting for radioactive waste repositories in deep geologic formations is to be developed. The focal point of the joint activities under the new cooperation is the planned underground research laboratory near Krasnoyarsk, Russia.

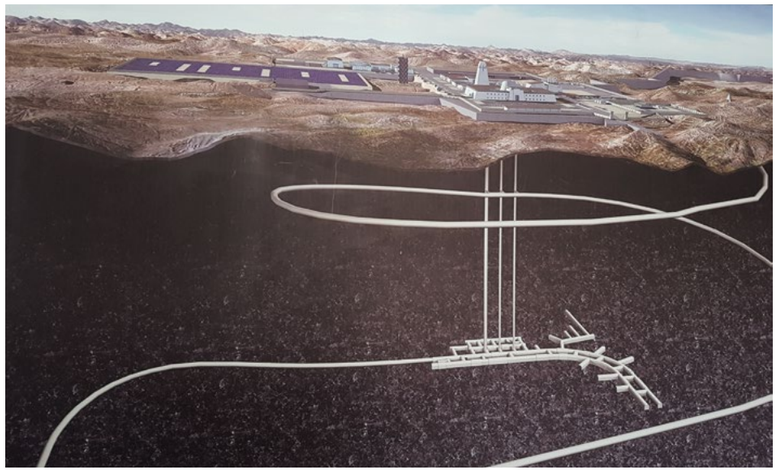
IAEA URL network meeting in Dunhuang (China)

From September 9–13, 2019, a "Technical Meeting of IAEA on Global Progress in Developing Geological Disposal Solutions using Underground Research Facilities (URF)" took place in Dunhuang (China). 24 representatives of 19 nations participated at this meeting and reported about their national statuses of radioactive waste management. For a long time BGE TECHNOLOGY GmbH has been an active member of this board. Countries with URFs in operation gave an overview of their respective R&D work in 2018/2019 while other nations described their strategies with regard to R&D work in URFs.

Currently, there is no URF in operation in Germany. For decades, host rock-specific R&D work focused on salt formations. Due to the restart of the site selection procedure in Germany, BGE decided to intensify R&D work in international, generic URFs in clay and crystalline rock. The intention of this work is to deepen and broaden the German knowledge about disposal systems in other host rocks.

In China, crystalline rock is the most favoured host rock option. China started to investigate the properties of this host rock in the Beishan Exploratory Tunnel (BET). Several investigations and in-situ tests to analyse the host rock properties and to optimise construction and monitoring techniques have been carried out. A URF will be constructed in Xinchang. Both sites were shown to the members of the URF network during a field trip.

On one day of the IAEA meeting, a workshop to analyse and discuss the site selection criteria and strategies in the different countries was held, where BGE TECHNOLOGY GmbH described and explained the German site selection procedure. The national examples and the results of the discussions were compiled in an IAEA paper, which also identified common and differing siting criteria and strategies. This working paper may be a starting point for a future IAEA report on recommendations for site selection criteria and strategies.


3D model of the planned Chinese URL in Xinchang (courtesy of BRIUG, China)

Development of a Design of a Radioactive Waste Repository in Iraq

In the past, Iraq used to have a complex nuclear programme. As a result of military attacks and subsequent looting, extensive damage occurred at the nuclear sites, particularly at the most important site Al-Tuwaitha, where 18 different nuclear facilities were operated.

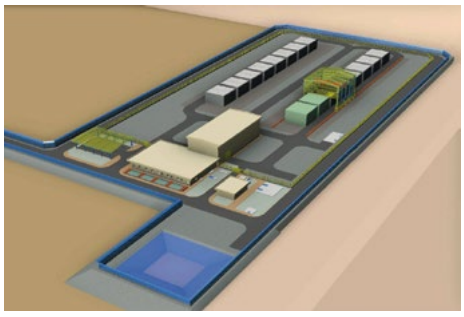
With international support, significant progress has been made in the decommissioning of a number of these facilities and the general decontamination of the site. With regard to the radioactive waste that has been produced in the course of these activities and the waste that will arise from future decommissioning and remediation work in the country, an urgent need for a repository has arisen in order to provide for the safe disposal of this waste.

As part of their ongoing support to Iraq in regard to radiological safety, the European Commission launched an INSC project (Instrument for Nuclear Safety Cooperation) for the development of the technical design of a national Low-Level Waste (LLW) disposal facility in Iraq and the preparation of the associated safety assessment report. In 2015, this project was granted to a consortium of NUKEM Technologies GmbH as leader, BGE TECHNOLOGY GmbH, and the Slovak radioactive waste management organisation JAVYS a.s. The specific tasks that were primarily carried out by BGE TECHNOLOGY GmbH were the selection of the best suited disposal concept, the conceptual design of the disposal facility, its technical design, and the preparation of a Pre-Construction Safety Assessment Report. The latter two documents, which are supposed to build up the main part of the documentation needed for the application of a construction license, were finalised in spring 2019.

The Large Scale Gas Injection Test (LASGIT) proposed for the calibration of numerical models in the scope of EURAD WP GAS (Courtesy of British Geological Survey – BGS)

The design of the future Iraqi disposal facility and its safety assessment belong to the most interesting and challenging tasks BGE TECHNOLOGY GmbH has carried out in this field of work so far, especially due to the large uncertainties in regard to the future inventory, which required specific approaches and solutions to guarantee the present and future operational and long-term safety of the site.

Another important aspect was the location of the future disposal facility at Al-Tuwaitha site, which had been preselected by the responsible Ministry of Science and Technology before the start of the project due to ongoing security concerns in Iraq. This choice of Al-Tuwaitha with its location near Baghdad and the Tigris River entailed a number of technical measures that had to be implemented in the design, e.g. to mitigate potential risks from flooding etc. The picture below shows an artist's view of the future disposal facility in accordance with the final technical design.



3D sketch of the planned national disposal facility for LLW in Iraq

Constitutive Material Modelling for Clay Materials (EURAD)

EURAD stands for European Joint Programme on Radioactive Waste Management, an ongoing pan-European research project with the aim to coordinate research activities on outstanding issues in the area of disposal of radioactive waste in deep geological formation. It is based on agreed priorities of common interest between European Waste Management Organisations, Technical Support Organisations and Research Entities. BGE is member of EURAD and, beneath others, will participate in the work packages GAS and HITEC. On behalf of BGE mbH, BGE TECHNOLOGY GmbH intends to develop constitutive material models for clay materials in the frame of these work packages.

The work package GAS has the objective to improve the mechanistic understanding of gas transport processes in natural and engineered clay materials and to evaluate the gas transport regimes that can be active at the scale of a geological disposal system and their potential impact on barrier integrity and repository performance. In this work package, BGE TECHNOLOGY GmbH plans together with its partners from the Centre for Environmental Research – UFZ (Leipzig) and the Federal Institute for Geosciences and Natural Resources – BGR to develop constitutive material models for advective transport of gas in clayey materials. The developed models will be combined with existing mechanical models for expansive clays in order to describe the general TH²M behaviour of bentonites. The results will increase the confidence on model-based long-term safety and integrity proof of geotechnical barrier systems.

The work package HITEC deals with the influence of temperature on clay-based material behaviour. The main objective is to improve the understanding of the THM behaviour of clay rock and engineered clay material under high temperature and provide suitable THM models for both clay host rock and buffer materials. In this context, BGE TECHNOLOGY GmbH aims to develop a time dependent anisotropic THM model for argillaceous rock which incorporates strength and stiffness anisotropy, time-dependent deformation, dependency of permeability on irreversible strains, hydro-mechanical coupling for saturated and/or unsaturated conditions and thermo-mechanical coupling able to predict the thermally induced opening of fractures in claystone. The validation of the developed THM constitutive model will be performed based on in situ benchmark experiments in order to check the performance of the model at repository scale. The developed models will be accessible freely in the state of the art process level code OpenGeoSys. OpenGeoSys is a parallelized numerical tool for coupled THM processes under the open source license.

For further information, visit www.bge-technology.de or scan the QR code below.

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