

# BGE TECHNOLOGY NEWS

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Visit to the Site of the Chinese Underground Research Laboratory in the Gobi Desert



BGE TECHNOLOGY GmbH

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- KNOWLEDGE TRANSFER IN TRAINING COURSES
- STUDY ON WASTE RETRIEVAL FROM STOCAMINE
- OPTIMISATION OF LINING AT KONRAD REPOSITORY





Visit to a conditioning plant in Chişinău (Moldova)



Wang Xuhong (Vice Director CNPE) handed over a CNPE edition of chinese stamp collection to Dr. Thilo von Berlepsch (Managing Director BGE TECHNOLOGY GmbH)



Dear Readers,

"What has happened over the past 12 months?" is a question often heard in the context of radioactive waste disposal. The question arises against the background of what appears to be slow progress. Simple solutions seem to exist and yet, Germany still does not have a repository for low- and intermediate-level radioactive waste. And not even a region, not to say a site, for a high-level radioactive waste disposal facility is in sight.

This simplistic view completely blends out that there are no two similar radioactive waste disposal projects. Each single one is defined by the particular waste inventory and the geologic formations, which, despite generic names – in Germany, these are clay, crystalline, and salt – differ from site to site. To be able to ensure safety for a time span that goes far beyond mankind's experience, safety cases have to be developed with a high level of scrutiny and a robust scientific background. Operational safety measures should not contradict long-term safety and vice versa. Quality control for the construction of repositories is key to ensure safety.

Against this background, it becomes clear that "haste makes waste". BGE currently assesses all geologic data available in Germany, which first have to be brought into a suitable format before they can be published in a first report about potentially suitable regions in the second half of next

year. Konrad repository, the site for low- and intermediate-level waste, has passed important milestones in the underground facilities in 2019. Plans for the closure of Morsleben repository and for the retrieval of radioactive waste from the Asse mine are coordinated with the main stakeholders of the projects.

I am proud to say that BGE TECHNOLOGY GmbH is involved in all of the above mentioned activities of BGE. We are supporting BGE especially in endeavours that involve a high degree of development or the experience of research and development activities outside the projects of the German national radioactive waste programme. We also offer this know-how to our foreign customers, and BGE in turn benefits from the experience gained in these external projects. I am very thankful to my colleagues at BGE TECHNOLOGY GmbH that they very reliably did great jobs, despite sometimes rough boundary conditions, and also to our customers and partners with whom we are keeping up friendly, trustful, and fruitful relationships.

What is left from the initial question? A lot has happened over the past 12 months. In this newsletter we provide a small excerpt of our activities, showing you where we provided our knowledge to our partners in terms of training experts from China and, on behalf of the IAEA, from Pakistan. We apply our knowledge to external projects in France for the retrieval of waste from Stocamine and in Moldova, again for the IAEA, to ensure safe radioactive waste disposal. We also provided our experience to BGE, in this case for the development of materials for the Konrad mine.

But let the experts speak for themselves. Happy Reading!

Yours sincerely,  
Dr. Thilo von Berlepsch  
BGE TECHNOLOGY GmbH

## Pre-Feasibility Study on the Disposal of Radioactive Waste in Moldova

Moldova is a small country between Romania in the west and Ukraine in the east, partly bordering on the Black Sea. It has no current or past nuclear power plants or research reactors. The radioactive waste in Moldova originates mainly from medical applications, research projects, education, and industrial activities.

The majority of the radioactive waste is stored near the capital city of Chişinău. The waste is stored in a facility in surface-based reinforced concrete vaults. The vaults were constructed in the 1960's. The current surface storage facility does no longer satisfy the current international understanding of safe long-term isolation of radioactive waste. There is a need to develop a safe final disposal solution for the radioactive waste in Moldova.

Thus, the International Atomic Energy Agency (IAEA) commissioned a consortium of BGE TECHNOLOGY GmbH and JAVYS to carry out a pre-feasibility study on final disposal options for the radioactive waste in Moldova. The high-level study will look into the waste inventory and classification and then potential disposal solutions for the waste.

The consortium will develop general site selection criteria and a siting process for the Moldovan radioactive waste amounts and types. Furthermore, advice will be given on the principles for successful and systematic safety assessments and safety cases. The consortium will be working together with the relevant Moldovan counterparts to

make sure that the developed solutions are suited for their specific needs. Naturally, the approaches and procedures will be based on international best practices and on the IAEA safety standards and guidelines.

The project will be the basis for the next step in developing a national disposal programme in the Republic of Moldova.

## Knowledge Transfer in Training Courses

As part of our services provided, BGE TECHNOLOGY GmbH offers training courses to interested waste management organisations.

From November 11 to 16, 2019, two employees of BGE TECHNOLOGY GmbH and one employee of Bundesgesellschaft für Endlagerung (BGE) held a training course in Beijing, which was organised by China Nuclear Power Engineering Co., Ltd. (CNPE) and was attended by more than 30 participants. CNPE is responsible, among other things, for the planning of the repository technology for high-level radioactive waste, for the safety assessments of the repositories for low- and intermediate-level radioactive waste, and for the conceptual planning of the potential use of an existing mine as a repository.

Accordingly, the training initially focused on the status of the site selection process for a repository for high-level radioactive waste in Germany and the necessary research and development work. Another important component of the course was the introduction to the Konrad repository for low- and intermediate-level radioactive waste

in Germany. In particular, the work and principles necessary for the conversion of the mine into a repository were highlighted, and the planning for the transport and disposal processes was explained. Finally, the comprehensive work of BGE TECHNOLOGY GmbH on the disposal of low- and intermediate-level radioactive waste was presented, in particular based on examples of repository designs for Bulgaria and Iraq.

The second recently conducted training was a course on long-term safety analyses. As part of the International Atomic Energy Agency (IAEA) Technical Cooperation Programme, BGE TECHNOLOGY GmbH organised a training course for two staff members of the Pakistan Atomic Energy Commission (PAEC) and one staff member of the Pakistan Nuclear Regulatory Authority (INRA) from November 18 to 29, 2019.

The main focus of the training course held at BGE TECHNOLOGY GmbH was the transfer of knowledge and experience in the field of long-term safety analyses for near-surface repositories for low- and intermediate-level radioactive waste. Within the framework of this practice-oriented training course, a first rough mathematical model was developed, which is to be used as a basis for a safety analysis of the planned Pakistani repository.

In addition to the mere transfer of knowledge, these training courses enable a lively exchange of information beyond the scope of the training contents. Very good and fruitful relationships are established between the organisations and the employees, which outlast the training period and are beneficial to both sides.

## Study on Waste Retrieval from Stocamine

In September 2019, BGE TECHNOLOGY GmbH was invited by Tractebel Engie, Belgium, to take part in a technical and financial study on the feasibility of partial retrieval of waste from the Stocamine, all the while not endangering the construction of seals for closing the underground site.



Hoisting tower of shaft Else at Stocamine (France)

Stocamine is a geological repository for hazardous and highly toxic waste and was operated between 1999 and 2002. A fire in the so-called block 15 put an end to the operation in 2002, and in 2003, it was decided to irrevocably stop operations. Following several studies, a license for closure of the site was obtained but it was decided to retrieve the mercury waste from the underground before closure. Between 2014 and 2017, 97 % of this waste was retrieved from the mine.





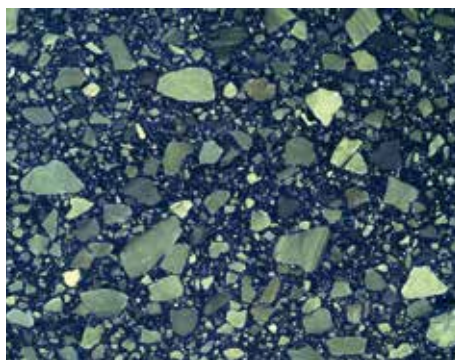
Lining at the shaft landing station at Konrad repository (Germany)

However, the retrieval of the other waste continued to be in the focus of the public. Hence, further retrieval options have been investigated in several studies since 2018. These studies all take into account the requirement that retrieval has to be realised parallel to the closure operations without impeding them. Another major constraint is the continuous geo-mechanical degradation of the rock salt, which progressively leads to an enclosure of waste casks in the converging rock. Based on this process, it is assumed that retrieval will only be possible until 2029 at the latest.

BGE TECHNOLOGY GmbH develops proposals for securing the underground openings for a maximum operating period of 10 years. Several ideas concerning the renovation of the shaft hoisting systems to prepare them for regular operation during retrieval have already been developed, e.g. it is recommended to analyse the inner state of the reinforced concrete of the hoisting tower of shaft Else (s. figure). In addition, BGE TECHNOLOGY GmbH supports Tractebel Engie in detailing retrieval procedures within the emplacement drifts. Cost estimates for all proposals will also be part of the project.

## Optimisation of Lining at Konrad Repository

Unstable mine excavations have to be supported with a lining system in order to ensure the required safety of work. In the Konrad mine, which is currently being converted into a repository for low- and intermediate-level radioactive waste, this lining consists of reinforced shotcrete shells and layers. High temperatures (due to geothermal boundary conditions) and the intense use of machines require a powerful mine ventilation. In order to prevent damage of the fresh shotcrete due to drying shrinkage, the surfaces are regularly moistened with water or a so-called curing agent is used to seal the shotcrete surfaces. Before a new layer is



Thin section of shotcrete in UV light

applied, this curing agent must be removed and a defined surface roughness produced. Moreover, it is essential for the bonding of the layers that the technique for surface treatment does not damage the shotcrete base.

With the aim of identifying a suitable technique and for defining the work procedures, BGE TECHNOLOGY GmbH planned a comprehensive investigation programme in coordination with the responsible mining companies. The measurements of the surface roughness were carried out by the Federal Institute for Materials Research and Testing in Berlin, and tensile and shear strength tests by the Civil Engineering Materials Testing Institute, Braunschweig. Wet blasting of slag granules with subsequent water cleaning gives the best results, is effective, and meets the requirements of occupational safety. Due to the determined dependencies, specifications were made for the particle size of the granules and the machine technology. This way, the lining meets the exceptionally high demands of a geological repository for radioactive waste at large depths. Thus, an essential prerequisite for the successful operation of the mine workings could be created.

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

