

# DBE TECHNOLOGY NEWS

## Closing the Gap - The Back End as Important Part of Nuclear Program

2015

Nuclear program

Commitment Preparation Operation Decommissioning

Radioactive waste management

Training

Policies & Strategies

Regulation & Organisation

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**CIGÉO – HOISTING SYSTEMS FOR MATERIAL AND PERSONNEL SHAFTS**

**SAFETY ASSESSMENTS FOR THE RADIOACTIVE WASTE FACILITIES IN GEORGIA**

**ASSESSMENT OF THE GEOTECHNICAL AND GEOPHYSICAL INSTRUMENTATION FOR SALT DEFENCE DISPOSAL INVESTIGATIONS (SDDI)**

**STATUS OF RESEARCH AND DEVELOPMENT CONCERNING THE DISPOSAL OF RADIOACTIVE WASTE IN CLAY AND CRYSTALLINE ROCK FORMATIONS IN GERMANY**

Verantwortung für Generationen  
Responsibility for Generations

**DBE TEC**  
DBE TECHNOLOGY GmbH





Asse Support Team



Dear readers,

The Asse II mine is located near the village of Remlingen, about 20 km southeast of Braunschweig in the North of Germany. In former times, the mine was used to excavate potash salt and halite. In 1965, the Mine became a federal facility and was used for the purpose of conducting research and development work for the disposal of radioactive waste in rock salt. In the period 1967 to 1978, almost 47.000 m<sup>3</sup> of LLW and ILW were disposed of in the mine. Since 2009, the Asse II mine has been run under the provisions of nuclear law, with a new operator, the Federal Office for Radiation Protection (BfS), which has to ensure the safe operation and closure of the facility, where priority is given to the retrieval of the emplaced waste.

Since 2002, DBE TECHNOLOGY GmbH has been involved in assisting in the process of closing the Asse II mine. Our assistance focuses on primary components of the closure process, which is considered as emergency precaution in case retrieval of the emplaced waste is not feasible. Our part is the conversion of theoretical model input requirements into practical procedures and constructions.

One of the main provisions of the closure process is the construction of drift sealing elements. DBE TECHNOLOGY GmbH has been contracted mainly for designing these sealing elements and for verifying their functionality. This work requires that effective permeabilities of less than  $5 \times 10^{-16} \text{ m}^2$  are demonstrated for

the integral permeability of the concrete construction, the contact zone, and the surrounding excavation-damaged zone. For this purpose, we developed a high-pressure injection process for rock salt formations. With this injection process it is possible to inject the sealing elements and to prove conformity with the hydraulic requirements at the same time. For construction purposes, we adapted special mixtures of Sorel concrete as building material for geotechnical constructions such as underground barriers and also as fluid injection material. Parallel to this work, we developed and upgraded the necessary quality control system for the concrete components, the mixture, and the final product. We are also involved in the development of the construction material mixing units with a production rate of up to 20 m<sup>3</sup>/h.

Planning and managing projects from construction supervision to final acceptance of work is another main part of our operations. This involves the preparation of tender documents in accordance with public procurement law, for example, in the fields of shaft hoisting, electric power supply, LHD technology, control center, underground ventilation engineering, and equipment for radiation protection.

Furthermore, our team provides management services for systems engineering projects by supplying our client with temporary, highly qualified in-house consultants. These colleagues work on operative project management support, mainly with the focus on planning, scheduling and controlling the implementation of the measures to decommission the Asse mine. Additionally, we provide the project coordinator for stabilizing the geochemical environment to ensure long-term safety. We assist our client, Asse-GmbH, in all matters concerning mining law licensing procedures and we provided the case coordinator for rock mechanics issues and the coordinators for shaft sealing. Together with our long-term experience, this has earned us the trust of our client as a reliable partner.

Happy Reading!

Hartmut Bothe

## Cigéo – Hoisting Systems for Material and Personnel Shafts

As reported before (TEC News 2014/2), DBE TECHNOLOGY GmbH has been hired by a consortium led by Tractebel Engineering S.A., which is contracted by ANDRA, to provide its experience for the French Geologic Repository Project Cigéo. Specifically, DBE TECHNOLOGY GmbH is tasked with planning and assessing the underground operation of the Cigéo facility and with carrying out design studies for the hoisting systems for the transport shafts of the facility, i.e. the material shaft for the transport of the excavated material and the material needed for building the underground supports and the two shafts for the hoisting of personnel.

The activities are progressing well despite the usual challenges of such a comprehensive project, as all geologic repository projects are. The simulation model for planning and assessing the operation of the facility now reflects the basic design of the repository and the main equipment to be used for the first phase of the Cigéo project. Hence, studies for a detailed assessment of the operation can soon be carried out subject to agreement with the client.

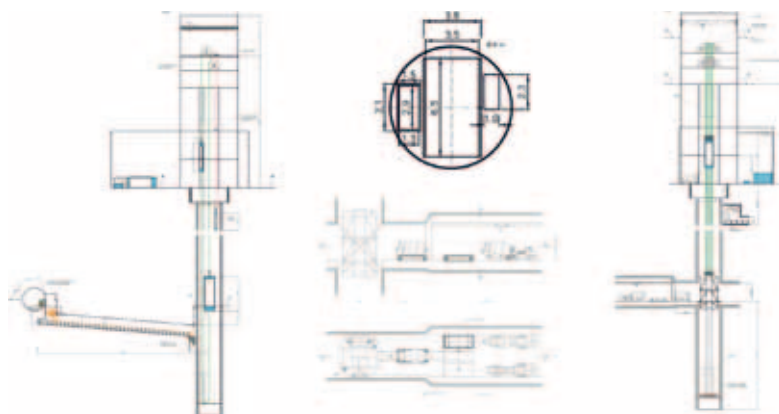
The design studies for the hoisting systems are developed further based on ongoing planning activities and, thus, varying requirements for the hoisting tasks for the shafts. Currently, it is assumed that the requirements are transport of up to 180 mixing drums for ready-mixed concrete and up to 1850 t of excavated clay for the material transport shaft per day, and 185 persons for the excavation and 70 persons for the operation of the repository per shift. For these purposes, current planning proposes that a heavy-

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Underground Laboratory in Clay, Bure, Belgium



Cigéo-Project: Design of hoisting system for a material transport shaft

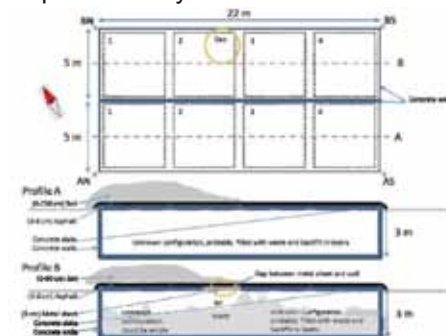
duty multiple rope Koepe system will be used for the material transport shaft and a simple hoisting system for the personnel shafts. Due to the lack of mining regulations and experience in France, DBE TECHNOLOGY GmbH also proposed solutions to define requirements where existing French regulations are not applicable.

In principle, the main activities of DBE TECHNOLOGY GmbH shall be concluded next year in order to finalize the planning for Cigéo and to be able to conclude the preparation of the licensing documents by 2017.

### Safety Assessments for the Radioactive Waste Facilities in Georgia

The Saakadze disposal facility near Tbilisi in Georgia was planned and constructed during Soviet times as a Radon-type surface facility to accommodate up to 600 m<sup>3</sup> of low and intermediate level radioactive waste. The safety assessment of the facility was carried out by DBE TECHNOLOGY GmbH in the framework of a project launched by the European Commission. The

project was assigned to a consortium of TÜV/Nord ENSYS GmbH and DBE TECHNOLOGY GmbH. The aim was to assess the safety of the Central Storage Facility (CSF) and the disposal facility at Saakadze.



Current conditions at the Saakadze Disposal Facility, Georgia (source ENCO)

In the safety assessment for Saakadze, large uncertainties had to be considered, especially with regard to the inventory. In addition, the current state of the repository does not comply with the state of the art in science and technology and with best practices. Nevertheless, results of the safety assessment indicate that by backfilling the remaining voids inside the concrete vaults and by constructing an engineered cover, radiological impacts close to or above

the limiting values caused by any normal or disturbed evolution scenario that might be applicable can reliably be prevented.

### Assessment of the Geotechnical and Geophysical Instrumentation for Salt Defence Disposal Investigations (SDDI)

In September 2014, the US Department of Energy (DoE) contracted DBE TECHNOLOGY GmbH to evaluate the current state of progress of instrumentation related to the proposed Salt Defence Disposal Investigations (SDDI) drift scale thermal test. The evaluation was to take into account the hands-on experience specific to instrumentation gained when conducting the thermal tests at the Asse mine and in the post-test assessment.

Based on the experience and know-how of DBE TECHNOLOGY GmbH with comparable testing environments from the former tests associated with the Asse project and direct experience with monitoring issues associated with scientific investigations in salt, an assessment of the proposed monitoring systems was carried out. In DBE TECHNOLOGY GmbH's opinion the scope of monitoring and its specific application appear suitable to the goals of the test as designed. The results of the assessment led to proposals and recommendations with respect to proposed instrumentation types, their placement, adjustment, protection, and data interpretation.

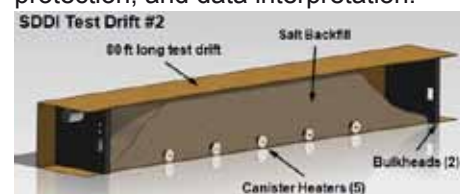


Illustration of Potential SDDI Test Set-up, WIPP site, New Mexico (USA) (Source: US-DOE)

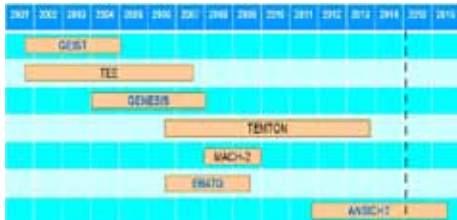




Waste emplacement at WIPP, USA

## Status of research and development concerning the disposal of radioactive waste in clay and crystalline rock formations in Germany

Research and development (R&D) concerning the disposal of heat-generating radioactive waste and spent nuclear fuel in rock salt formations has been successfully carried out in Germany for approx. 5 decades, and essential results have been achieved regarding technical feasibility and safety of disposal in salt formations.



R&D projects of DBE TECHNOLOGY GmbH concerning the disposal of heat-generating radioactive waste in clay (explanations are given in the text).

R&D work for a possible repository in clay and crystalline rock in Germany – funded by BMWi (Federal Ministry for Economic Affairs and Energy) – started only about 20 years ago. However, there has been cooperation between German institutions and partners in Europe who operate Underground Research Laboratories (URL) in clay and crystalline rock for more than two decades. The following diagram gives an overview of those R&D projects dealing with the disposal

of heat-generating radioactive waste that DBE TECHNOLOGY GmbH has contributed to since 2001. There are two types of projects. On the one hand, the impact of the heat generated by the waste on the thermo-hydro-mechanical (THM) behavior of the host rock has been investigated in the URLs Bure (France) and Mont Terri (Switzerland) (R&D projects TEE, TEMTON, and Mach-2). On the other hand, generic repository concepts have been developed for the geologic conditions of German clay formations (R&D projects GEIST, GENESIS, and ERATO). One important finding is that in clay formations – in contrast to salt formations – a technical support construction (lining) is required for the mine openings. In addition to this, the database for clay formations in Germany is significantly smaller than for salt formations and consequently still requires intensive investigations. In this context, DBE TECHNOLOGY GmbH together with BGR (Federal Institute for Geosciences and Natural Resources) and GRS (Gesellschaft für Anlagen- und Reaktorsicherheit mbH) is currently developing a safety concept and a safety verification methodology for such a repository in a German clay formation (R&D project ANSICHT).

R&D work concerning the disposal of heat-generating waste in crystalline rock formations is not as far advanced in Germany. However, research cooperation of German institutions with operators of URLs in Europe exists in this area as well (for example with SKB who operates the URL Äspö (Sweden)). In addition to this, DBE TECHNOLOGY GmbH is involved

in research activities connected with the German-Russian R&D cooperation in the field of final disposal in crystalline rock. In this context, the thermo-hydro-mechanical (THM) behavior of geotechnical and geological barriers in crystalline rock and the robustness of safety assessments of repository systems were investigated.



State of the art in constructing drift support systems in clay; the photo shows the roof bolt-shotcrete support system in the Konrad repository (Photo: BfS)

The results of the R&D projects regarding the disposal in clay and crystalline rock provide valuable input for the siting process according to the German siting act (Standortauswahlgesetz), which stipulates that the site that offers the highest level of safety be selected. This requires a comparison of repository systems, which can reliably be based on the results of our R&D projects, which take into account the radioactive inventory, the entire geologic environment as well as the safety concept and the safety demonstration.

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

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