

# DBE TECHNOLOGY NEWS

2016

Verantwortung  
für Generationen  
Responsibility  
for Generations

**DBE**TEC  
DBE TECHNOLOGY GmbH

**DIRECT DISPOSAL OF TRANSPORT AND  
STORAGE CASKS**

**STRATEGIES FOR FINAL DISPOSAL OF HIGH-  
LEVEL RADIOACTIVE WASTE IN GERMAN CLAY  
FORMATIONS**

**ASSESSMENT OF THE INFLUENCE OF SOUND  
CONSTRUCTION AND SAFE OPERATION OF A HLW  
REPOSITORY ON LONG-TERM SAFETY (BASEL)**

**UK NDA R&D FRAMEWORK CONTRACTS AWARDED**



Geotechnical measurements in salt formations, Morsleben repository (Germany)



Dear Readers,  
Radioactive waste has to be disposed of safely and securely for a long period. Therefore, a variety of safety protection objectives have been defined in the legal framework that have

to be complied with during the stages of repository planning, operation, closure, and during the post-operational period. Referring to long-term safety, closure systems are designed to ensure compliance with the safety protection objectives. These concepts are tailored to the specific geologic environment and have to address radiological safety as well as conventional protection issues, e.g. groundwater protection. The concepts anticipate the construction of seals and – if necessary – a backfilling of the cavities. Seals that are effective for a long time have to be designed and building materials selected or developed paying special attention to the mechanical, hydraulic, and chemical conditions at the repository site.

It is essential that the construction and the function of the closure system components have been tested under laboratory and in-situ-conditions. For an efficient development, it is useful to carry out small- and large-scale tests. Furthermore, standard procedures must be established for the construction as well as for quality assurance measures. Then, constructability can be demonstrated. Realistic data on construction material properties as well as methods to demonstrate the functionality are available.

Due to the experience gained in the operation of the German federal repositories

by our parent company DBE mbH, and our know-how accumulated in the course of many national and international projects, DBE TECHNOLOGY GmbH has comprehensive expertise in all fields of repository planning, construction, licensing, operation and closure. Thus, projects of surface, near-surface, and underground repositories in different geological / hydrological environments have been completed successfully and verify our experience and engineering know-how. Last but not least, cost analyses are one part of the portfolio of DBE TECHNOLOGY GmbH, and are carried out as a precondition for successful project implementation.

This flyer cannot give you an extensive overview of our company's activities; nevertheless, it is our pleasure to present several recent R&D projects and one international project. You can find further information about our projects in the fields of repository safety, research and development, and international cooperation on our website ([www.dbe-technology.de](http://www.dbe-technology.de)).

We would appreciate your feedback and wish you happy reading!

Dr. Hans-Joachim Engelhardt  
Deputy Head of  
Repository Safety Department

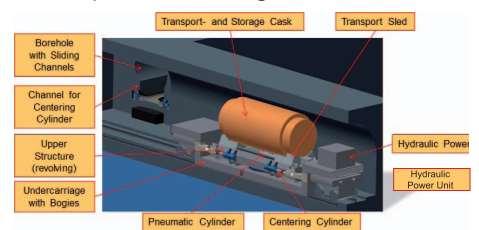
## Direct disposal of transport and storage casks

On behalf of GNS (Gesellschaft für Nuklear-Service mbH), DBE TECHNOLOGY GmbH developed an alternative to the existing concept for a final repository in a salt formation, which includes drift emplacement of POLLUX® casks and borehole emplacement of BSK3 canisters. In this context, the direct disposal concept of transport and storage casks (TSC) was developed

and assessed with regard to its technical feasibility.

This concept is expected to have the following advantages:

- Reduction of exposure rate of operating personnel in the conditioning plant because spent fuel elements are not dismantled into fuel rods and structural parts and canisters are not transferred from TSC into disposal casks
- Reduction of exposure rate of operating personnel in the repository by cutting the number of transport and emplacement actions in half
- Cost savings because redesign of POLLUX® casks and BSK3 canisters and scrapping of empty TSCs are not necessary
- Use of uniform transport and emplacement equipment for all large transport and storage casks



Device for drift transport and emplacement of transport and storage casks

For the implementation of the concept of direct disposal of TSC, the shaft hoisting equipment as well as the drift transport and emplacement equipment need to be adapted to the significantly higher payload of 160 t. For thermomechanical reasons (design temperature 200°C), the disposal of TSC in a final repository in salt can only be realized in short horizontal or vertical boreholes. In this context, the corrosion behaviour and criticality safety of the casks have to be taken into account. A long-term criticality safety can be achieved by

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Demonstration test of re-railing a derailed transport cart with a waste container

backfilling the void spaces in the TSC with magnetite fine-particle granulate. Analyses of the shaft hoisting equipment and of the transport and emplacement equipment showed that according to the current state of the art in science and technology, they are technically feasible in theory. The next step is to demonstrate that this alternative disposal concept meets the requirements for licensing by building the technical components and carrying out demonstration tests.

## Strategies for Final Disposal of High-Level Radioactive Waste in German Clay Formations

In Germany, it has been decided to analyse and compare different kinds of host rock to identify an option for the final disposal of high-level radioactive waste (HLW). To promote the development of know-how, the Project Management Agency Karlsruhe sponsored numerous R&D projects on behalf of the Federal Ministry for Economic Affairs and Energy. In the field of basic research for final disposal of radioactive waste in clay formations, the R&D project ANSICHT is the most recent project and started in 2011. The objective of the project is the development of the safety demonstration concept for a HLW repository in German clay formations. The project is a generic study. For the development of the models, various data from Germany and other countries had to be combined, because in Germany there is little mining in clay formations and, thus, corresponding geological, hydrogeological and hydrochemical data are limited and insuffi-

cient. The development of appropriate disposal concepts is a fundamental issue to ensure the implementation of the German safety concept for clay formations. The joint project is carried out by experts of BGR, DBE TECHNOLOGY GmbH, and GRS.



Construction work in Jurassic marls. Konrad repository (Germany).

Based on the German radioactive waste inventory, geological models for Northern and Southern Germany and a safety demonstration concept for a repository in clay formations, the conceptual design of two options for final disposal of HLW in clay formations have been developed on a generic level:

- borehole emplacement for Lower Cretaceous clay formations with a thickness of 540 m in the model for Northern Germany, and
- drift emplacement for the Opalinus-clay with a thickness of 110 m in the model for Southern Germany.

Both disposal concepts consider the safety requirements issued by BMU including requirements for waste retrieval. To comply with the safety concept, a suitable concept for backfilling and sealing has been developed as well. All project results confirm that HLW disposal in clay formations is generally possible in Germany.

However, an overall evaluation of the options would require a more detailed

design basis on a site-specific data set. Only then, a safety analysis and an evaluation of the suitability of the disposal concepts are possible.

## Assessment of the influence of sound construction and safe operation of a HLW repository on long-term safety (acronym: BASEL)

Nationally as well as internationally, there is extensive experience on how to demonstrate the safety of a repository for heat-generating radioactive waste and spent fuel, both for the operating phase as well as the post-closure phase. It is state of the art to compile all analyses and arguments in a so-called Safety Case. In the past, the discussion about the methodology used to develop a safety case was very much focused on long-term safety. Little attention was paid to the fact that the course of the operating phase ultimately determines the starting conditions for the analysis of long-term safety. Taking this into account, it is important to analyse the interfaces between operating phase and post-closure phase in a safety case and – based on the results – to develop tools and methods to minimize or even eliminate the interactions between operational safety and long-term safety. According to the German Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste as at 30 September 2010, the influences of the operating phase on the post-closure phase are to be documented in a safety case in a clear and transparent manner. However, methods to illustrate these influences and interactions are yet to be developed.



Consultancy meeting, Kiev (Ukraine)

On behalf of the Federal Ministry for Economic Affairs and Energy (BMWi), the Project Management Agency Karlsruhe (PTKA) has assigned the R&D project “Assessment of the influence of sound construction and safe operation of a HLW repository on long-term safety” (acronym: BASEL) to DBE TECHNOLOGY GmbH. The 2-year joint project started on April 1, 2016, under the direction of GRS. The aim is to define the requirements in the operating phase of a HLW repository and the requirements of long-term safety and to develop a clear and transparent methodology to assess the mutual impacts of both. These are fundamental steps necessary for an assessment of the technical feasibility of a repository and its safety analyses. One specific aim is to develop methods to illustrate the interactions between the operating phase and the post-closure phase.

In addition to establishing fundamental data, preparation of an outline of a safety concept for the operating phase, and the compilation of a FEP catalogue for the construction and operation of a repository, the work programme includes an assessment of the impacts of the safety requirements during the operating phase on long-term safety and vice versa. In the end, methods and approaches to assess the interactions between operating and post-closure phases are to be developed.

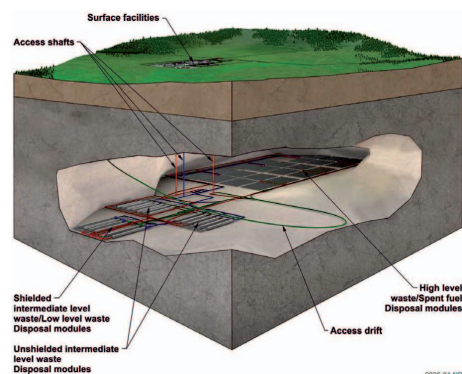
## UK NDA R&D framework contracts awarded

UK’s Nuclear Decommissioning Authority (NDA) is responsible for ensuring that the UK’s most complex decommissioning challenges are resolved. R&D plays a critical role in solving the wide range of complex, often unique challenges that have accumulated over the decades and now need to be addressed. With the aim to solve these problems more effectively, more efficiently and, where possible, for less cost, NDA channels R&D funds through two main routes: as a portion of the main budget allocated to its sites that seek support for specific projects; and directly, through work commissioned by NDA.

The Direct Research Portfolio (DRP) is the main mechanism through which the NDA directly funds R&D. The DRP is delivered through framework contracts that were awarded through a competitive process to various consortia. The contracts will be let for an initial period of 24 months with the option to extend by further increments of 12 months up to a maximum contract duration of 48 months. The estimated value is 6 000 000 GBP per annum over 3 lots. The framework contracts cover 3 lots, where Lot A supports the NDA’s University Research Strategy while Lot B and C support NDA’s strategic themes:

- Lot A – University Interactions
- Lot B – Integrated Waste Management and Site Decommissioning and Remediation
- Lot C – Spent Fuels and Nuclear Materials

As member of a Consortium led by Eden LE Ltd, DBE TECHNOLOGY GmbH was awarded a contract under Lot B. Thus, DBE TECHNOLOGY GmbH provides its comprehensive expertise on the planning, construction, and operation of geological repositories and the related R&D activities to the NDA programme. The other members of the Consortium are Cavendish Nuclear, Golder Associates Limited, Tradebe Inutec, and Project Time and Cost International Limited.



Generic repository design for hard rock formations (Source: NDA).

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

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