DBE TECHNOLOGY NEWS 2

2016

SAFETY ASSESSMENTS FOR THE RADIOACTIVE WASTE FACILITIES IN GEORGIA

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Verantwortung für Generationen
Responsibility for Generations

DBE TECHNOLOGY GmbH

Team of DBE TECHNOLOGY GmbH

Dear Readers!

The services of DBE TECHNOLOGY GmbH include, among others, planning activities. It is well known that appropriate planning is essential to avoid problems during the execution phases of construction activities. Often, errors in planning are time-consuming to correct and are, thus, costly.

Practical examples of construction execution play a significant role. Such examples aid engineers in their assessment of constructability and operability. Furthermore, during technical implementation weaknesses in the construction can be identified, which can then be compensated with appropriate building materials and / or processes.

Specific to DBE TECHNOLOGY GmbH's work activities in Germany, construction activities at sites operated by DBE have been underway that are worth looking at in more detail.

One component of the closure concept of the LILW-repository ERA Morsleben are drift seals. In a full scale in-situ test, a 25-m-long seal segment consisting of approximately 600 m^3 of salt concrete was constructed and – after a convergence phase – was tested under brine pressure. Although potentials for injection optimization at the seal/rock interface were identified, the seal has a low permeability of 10^{-18} m^2 with a continuing decreasing trend. A further component of the closure concept are the shaft seals. In a subsurface operational demonstration test, the layerwise installation of a compacted gravel column and sealing with hot bitumen in a blind shaft with a cross section of 12 m^2 and a length of 6 m was carried out successfully. The residual porosity is very low. In the future LILW repository Konrad, the subsurface construction is also progressing. From a mining and rock mechanical perspective, the construction of the infrastructure support area, utilizing rock bolts and shotcrete as ground support, with an operational life requirement of 40 years, and, in part, to be completed with excavation cross-sectional areas larger than 100 m^2, constitutes an exciting and challenging construction measure. Some of the related mine openings will be excavated in a clayey-marly rock whose age, genesis, and mechanical properties are similar to the Callovo-Oxfordian argillite that France prefers for a HLW repository site.

Here, the knowledge gained in previous R&D projects, in close international cooperation with; e.g., ANDRA and NAGRA, can also be used to develop practical solutions to national challenges, whether associated with the disposal of LILW at Konrad or a future German HLW repository in claystone. In addition, the extensive knowledge gained in ongoing construction activities helps in selecting solid solutions for future planning activities both in national and international projects.

Happy Reading!

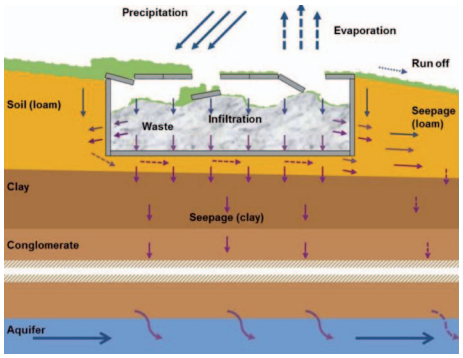
Mirko Polster
Deputy Head of
Repository Safety Department

DBE TECHNOLOGY GmbH

Safety Assessments for the Radioactive Waste Facilities in Georgia

Within the framework of the EC programme "Instrument of Nuclear Cooperation", a project in the field of radioactive waste management was undertaken for the Saakadze radioactive waste disposal site and the radioactive waste interim Centralised Storage Facility (CSF) in Georgia. A consortium of two companies, TÜV NORD EnSys Hannover GmbH & Co. KG and DBE TECHNOLOGY GmbH, was awarded the contract for the project, which was successfully completed with the recent provision of the final versions of the Safety Assessment Reports to the European Commission.

In the framework of the project, DBE TECHNOLOGY GmbH completed the Safety Assessment of the Saakadze disposal facility near Tbilisi in Georgia, a Radon-type surface facility designed to accommodate up to 600 m^3 of low and intermediate level radioactive waste. IAEA recommendations and guidelines were applied for the methodology used in the safety assessment. Taking into consideration the insufficient knowledge about a number of important parameters for the safety calculations, conservative values and model assumptions were selected and sensitivity analyses were performed.



Normal Evolution Scenario analysed for safety assessment of Saakadze (Georgia)

In general, the safety calculations demonstrated that the Saakadze site has very favourable environmental conditions for a surface disposal facility for radioactive waste. Results from the Normal Evolution Scenario and several Altered Evolution Scenarios show only limited dose rates, which are significantly smaller than the regulatory limits. In contrast to these results, the estimated dose rates for the human intrusion scenarios demonstrated values that are at least in part significantly above the limit value of 1 mSv/a. These high dose rates result from the fact that the vaults are currently not backfilled and a properly engineered cover over the vaults has not been constructed. Therefore, the Consortium recommended an appropriately engineered backfill to fill void spaces inside the disposal vaults and to design and construct

NPP Tschernobyl Ukraine

a suitable cover over the facility. With the implementation of these measures and in conjunction with an effective institutional control over a 300-year monitoring period, it should be possible to expand the disposal capacity at the site by another facility to account for sealed sources and other radioactive waste that are presently stored at the CSF.

In Memoriam of Dr Enrique Biurrun, Recipient of the Wendell D. Weart Lifetime Achievement Award

Shortly before the Easter weekend, our highly esteemed colleague, Dr Enrique Biurrun, passed away suddenly and unexpectedly at the age of 65.

Between 1988 and 2001, Enrique Biurrun, who was born in the Mendoza Province of Argentina, worked as a project engineer at DBE before becoming Head of the International Cooperation Department at DBE TECHNOLOGY GmbH in 2002. In his 30-year career, Dr Biurrun was involved with various international institutions working in radioactive waste disposal and was, thus, key in making our company well-respected within the community.

Only recently, Dr Biurrun was presented with the Wendell D. Weart Lifetime Achievement Award at the Waste Management Symposium (WMS) in Phoenix, AZ. For health reasons, he could not attend the Symposium in person but accepted the award via video message.

In his acceptance speech, Dr Biurrun pointed out that progress in radioactive waste storage and disposal in Germany may require a good deal of resilience, while in other European countries such as Finland, Sweden, or France, unaffected by political circumstances in Germany, licenses for the construction of final repositories have already been granted or are expected in the near future. He was proud of his personal involvement in a similar licensing process for Bulgaria. In addition, he emphasized the importance of international exchange and promoted the continuance of international collaboration. There is no better way to address the concerns and issues in this field.

In the field of radioactive waste management, the Symposium enjoys great renown around the world. It provides a platform supporting international discussions in the search for safe and sustainable solutions for the disposal of radioactive waste and the decommissioning of nuclear facilities. The award recognizes the long-term commitment of the recipient to solving major nuclear waste challenges.

With the passing of Dr Biurrun both we and the international waste management community have lost an outstanding expert and communicator, who has earned lasting respect and merit for his contributions towards the furtherance of international cooperation in the disposal of radioactive waste.

New Technical Support Contract for Future Belgian Geological Repository

ONDRAF/NIRAS, the Belgian Agency for Radioactive Waste and Enriched Fissile Materials, examines geological disposal in poorly indurated clay as the reference solution for the long-term management of its high-level and/or long-lived radioactive waste.

In 2009, ONDRAF-NIRAS launched an R&D feasibility program to support the development of their repository concept. This program was scheduled until the end of 2014 and consisted of several studies aiming at the confirmation that there are no fundamental flaws in the feasibility of building and operating the components and facilities for geological disposal according to the conceptual design. The studies were divided into three main lots:

- the fabrication of the disposal waste packages;
- the underground repository construction;
- the operation of the repository including its closure.

PRACLAY experiment, HADES URL (Belgium) (source: EURIDICE)

As an outcome of a Europe-wide tender, the part of this project concerning the operation and closure of the facility was assigned to DBE TECHNOLOGY GmbH. In the framework of this project, DBE TECHNOLOGY GmbH carried out a series of technical studies concerning e.g. the development of a shaft hoisting system, of an underground transport and waste emplacement system, and of a concrete mixture suitable for backfilling the emplacement galleries. At the end of this R&D feasibility program, ONDRAF/NIRAS initiated a follow-up program for further technical support studies from 2015 until the end of 2020.

DBE TECHNOLOGY GmbH succeeded again in winning the tender for the assignment of the operational part of this program, which is considered as strong confirmation of the quality of work carried out by DBE TECHNOLOGY GmbH in the course of the first R&D program.

The R&D studies to be carried out by DBE TECHNOLOGY GmbH in the new program will focus on the operational safety as well as on feasibility studies in regard to the backfilling and sealing

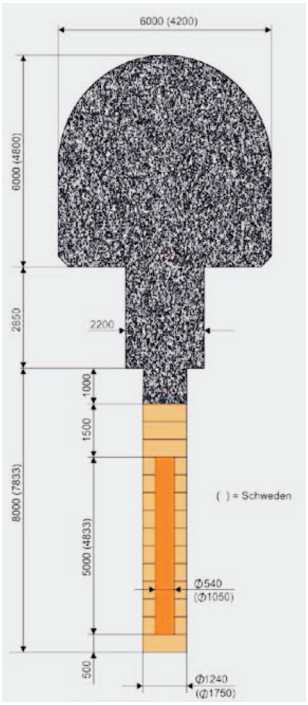
Exploration of crystalline rock, Onkalo URL, Finland

of galleries and shafts. Of highest priority are an optimization study on the underground layout and studies on the general operational safety, and the development of sealing systems for emplacement and access galleries.
The project was officially started with a kick-off meeting held on June 16, 2015, at the headquarters of ONDRAF/NIRAS in Brussels.

Areal Needs of a Repository for Heat-Generating High-Level Radioactive Waste

In Germany, it has been decided to analyse and compare different kinds of host rock to identify an option for the disposal of high-level radioactive waste. First, a new commission, the “Kommission Lagerung hoch radioaktiver Abfallstoffe” has been implemented in order to develop criteria for identifying suitable sites as hosts for a repository for high-level radioactive waste. In December 2015, the commission tasked DBE TECHNOLOGY GmbH with the preparation of an expert assessment and report specific to the “Areal Needs of a Repository for Heat-Generating High-Level Radioactive waste”. Based on the specific expertise DBE TECHNOLOGY GmbH possesses through numerous R&D projects conducted on the design of repositories in the three host rocks (salt, clay, and granite), mostly funded through BMWi, it was possible to complete the assessment within the two-month time frame specified.

Following the scope of work described, the repository areal requirements for three different host rock types in four variants were determined (salt: design temperatures 200°C and 100°C, clay: 100°C and granite: 100°C). The waste volume to be accounted for in the study was taken from the “National waste management program (NaPro)”.
Following the project specifications, single-level drift disposal was considered for salt and clay rock types while vertical borehole disposal (KBS3V concept) was considered for granite. Further specifications included the use of cylindrical, metallic disposal containers, uniform emplacement over a 30-year period and an adjustment of the container inventories to the respective design temperatures. To facilitate comparability, a uniform depth of 600 m for all repository variants was selected.

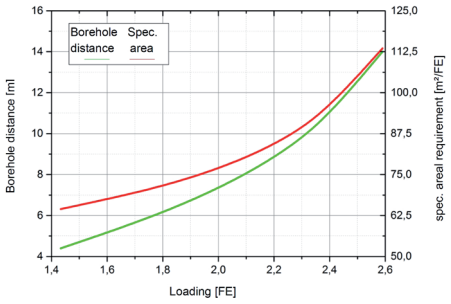


Emplacement concept for disposal canisters in vertical boreholes in crystalline rock

The assessment was conducted in a multi-step process, including planning and supplementation of the design basis; defining material parameters for the host rock, containers, and backfill as well as development of mathematical models, temperature calculations, design of repository layouts; and finally calculation of the areal extent of the repositories considering both subsurface disposal as well as operational support infrastructure needs.

The comparative assessment of the analytical results demonstrated that the smallest areal requirements were achieved for rock salt at a design temperature of 200°C. The total areal needs of the three variants with design temperatures of 100°C were primarily determined by the differing thermal conductivities of the selected host rock and backfill material. For a site selection process, the following calculated areal needs can be used as a planning basis:

- Repository variant rock salt at 200°C design temperature: 1.28 km²
- Repository variant rock salt at 100°C design temperature: 2.28 km²
- Repository variant clay at 100°C design temperature: 6.58 km²
- Repository variant granite at 100°C design temperature: 3.56 km²



Borehole distance and specific areal requirements depending on drift distance at a design temperature of 100°C

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

DBE TECHNOLOGY GmbH

Published by: DBE TECHNOLOGY GmbH
Eschenstraße 55 · D-31224 Peine
www.dbe-technology.de
April 2016
Edited by: Dr. André Lommerzheim
Design and Production: GLANDT WERBUNG PEINE