DBE TECHNOLOGY NEWS 4

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DBE TECHNOLOGY GMBH AT THE IAEA GENERAL CONFERENCE 2014

DEVELOPMENT OF A REFERENCE BACKFILL MATERIAL FOR THE DISPOSAL GALLERIES IN THE CURRENT BELGIAN REFERENCE CONCEPT

INVESTIGATIONS ON THE CHEMICAL BARRIER PERFORMANCE OF SODIUM SILICATE GROUTS

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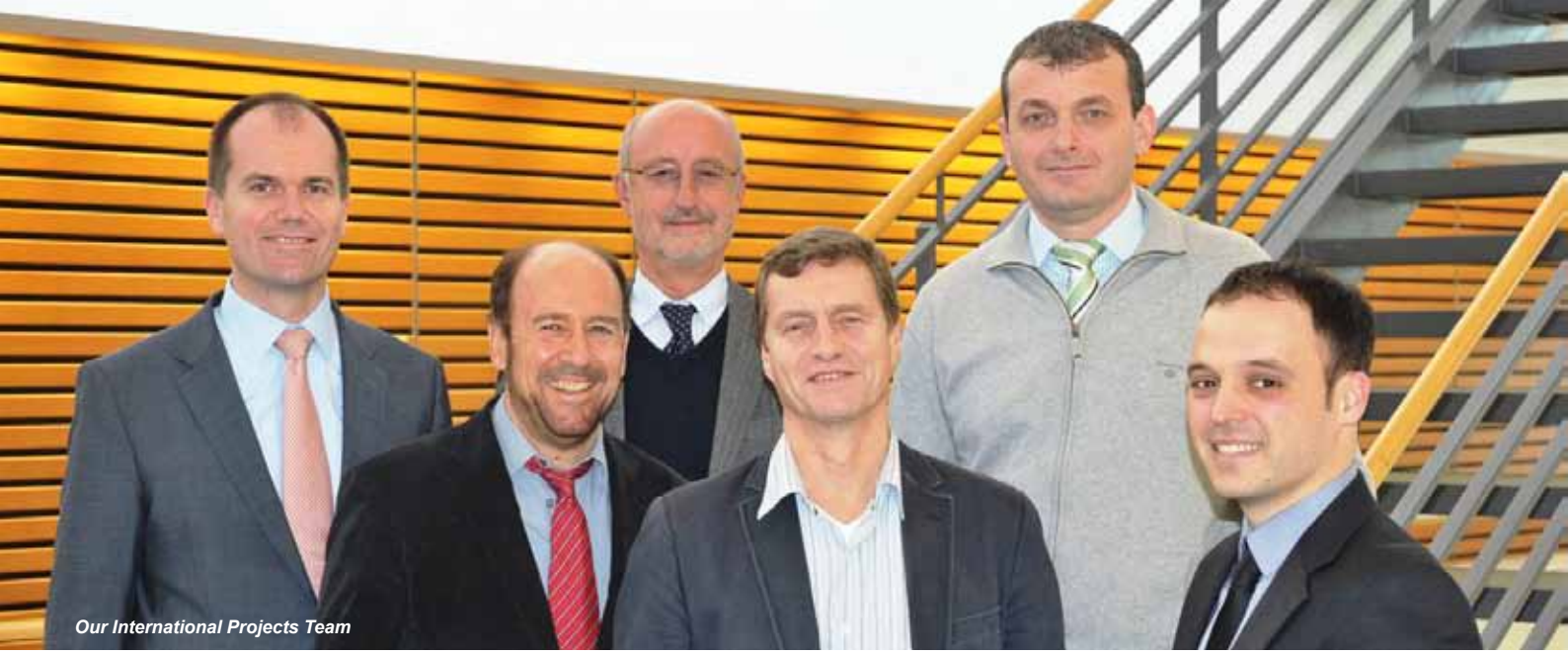
FIFTH US/GERMAN WORKSHOP ON SALT REPOSITORY RESEARCH, DESIGN, AND OPERATION

Verantwortung für Generationen
Responsibility for Generations

DBE TECHNOLOGY GmbH



Our International Projects Team

Dear Readers,

Despite public misperceptions, the disposal of radioactive wastes offers a fascinating field of activity. It brings together, like almost no other field of endeavour, representatives from numerous different faculties: from elemental geology to sophisticated physics, from detailed bio-chemistry to simple engineering, from neat nuclear energy technology to robust mining technology. And due to the fact, that there is no country in the world featuring the same waste streams, similar geologies or identical national contexts, there is also no such thing as a generic blueprint for a radioactive waste disposal programme. Thus, utilising proper experience is key to the success of each programme.

We are proud that we are able to provide such experience to projects at very different stages of radioactive waste programmes on a worldwide basis. The work and support we provide, although obviously founded on our experience in German projects, extends well beyond through the manyfold variety of international projects we have been and continue to be involved in. We are assisting various national governments in establishing and refining radioactive waste policies and strategies; as well as executing contracts in the performance of activities related to repository operation and closure. Our projects involve work in Deep Geologic Repositories in a variety of different host rock types as well as work in designing and developing Surface and Nearsurface Repositories.

As a company we maintain a continuous exchange with our partners around the world. Our involvement in international exchange activities is an essential aspect to responding to arising needs and challenges. We strongly believe that experience exchange is beneficial for all participating parties.

But please convince yourself: Current projects of DBE TECHNOLOGY GmbH impressively show our range of capabilities. In this edition of our newsletter we are emphasizing some of our selected international activities. We present specific results from our work in the Belgian High Level Waste Repository Project for Clay, describe a recent visit of delegates from the Japanese Diet to DBE TECHNOLOGY GmbH and present a summary of key points from the 5th US/German Workshop on Repositories in Salt recently held in the USA.

It goes without saying that successful work is only possible with an excellent team and the accompanying longlasting hard work associated with building up the needed expertise and teamwork spirit. I would like to take the opportunity to express my deepest thanks to the team and especially to my predecessor, whom many of you know, Dr. Enrique Biurrun. He did all the hard work to lead us to where we are today.

Now please lean back and enjoy a tour through our international activities.

Best Regards

Thilo von Berlepsch

Head of the Department of International Cooperations

DBE TECHNOLOGY GmbH

DBE TECHNOLOGY GmbH at the IAEA General Conference 2014

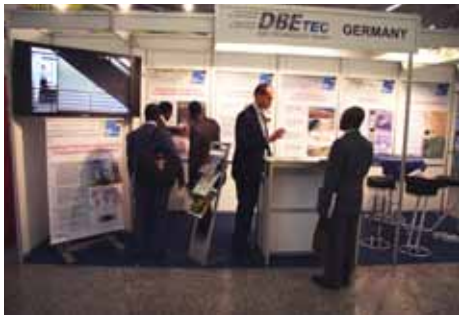
DBE TECHNOLOGY GmbH's exhibition, which was organised on invitation by the Federal Ministry of Economy and Energy (BMWi) as Germany's representation on this year's General Conference of the IAEA, was very well accepted by many participants of the General Conference. The areas of interest at the stand were manyfold: They went from basic request for information on radioactive waste disposal (e. g. as expressed by several school classes) over astonishment about Germany's energy and disposal policy (especially addressed by political and technical experts) to the interest in potentially getting support for the management of radioactive wastes by DBE TECHNOLOGY GmbH. In the discussions the respective expertise could be demonstrated by pointing to projects in the areas of supporting governments and authorities in developing and optimising radioactive waste management policies, strategies, organisations and processes as well as designing, licensing and operating of disposal facilities for radioactive wastes.

High-profile visit: T. Herdan, German Federal Ministry for Economic Affairs and Energy (BMWi, Head of Delegation), K. M. Scharinger, German Ambassador to the United Nations in Vienna and Dr. H.-C. Pape (BMWi) with MD Dr. J. Krone (r.) and Dr. T. von Berlepsch (l.), DBE TECHNOLOGY GmbH.

DBE TECHNOLOGY GmbH had been a member of the German delegation for IAEA's General Conference, and, on top of all, had been asked by the IAEA to present its experience on proofing the feasibility of technology for radioactive waste disposal at the Scientific Forum on the Challenges of Radio-

Precipitation of salts at the contact surface of a heavy metal and a sodium silicate solution

active Waste Management, which was taking place in parallel to the General Conference. The delegation consisted of, besides consulting experts, representatives of the BMWi, the Federal Ministry of Foreign Affairs (AA) and the Federal Ministry for the Environment,



International visitors at the stand

Nature Conversation, Building and Nuclear Safety (BMUB). All members of the delegation on working level as well as the heads of delegations of BMWi and AA were visiting the exhibition with the aim to inform themselves on the course of the conference; they had been very pleased with the success of the German representation at the General Conference's exhibition.

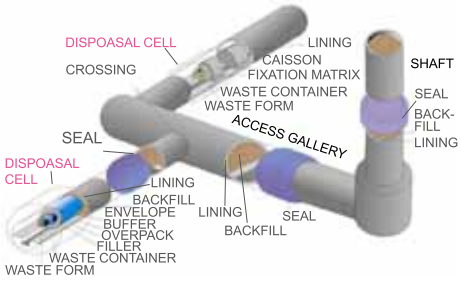
Reference Backfill Material for the Disposal Galleries in the current Belgian Reference Concept

The Belgian radioactive waste management agency ONDRAF-NIRAS plans to dispose of long-lived and high-level radioactive waste in galleries of an underground repository constructed in clay. For stabilization purposes the disposal concept provides a concrete backfilling of the disposal galleries. Plans call for mixing the concrete in above ground facilities and pumping it through the shaft and drifts into the galleries. Upon hardening the backfill will guarantee a corrosion-retarding environment and reduce the mobilization of radionuclide complexes. To

Mock-up test demonstrating the feasibility of a void free backfilling of the disposal drifts

avoid an impairment of the gallery walls swelling of concrete must be limited. In addition, the backfill should contribute to the dissipation of the decay heat of the radioactive waste and – according to appropriate legal requirements - its strength must be low enough to enable the retrieval of the waste packages.

DBE TECHNOLOGY GmbH was contracted to develop a suitable backfill



Schematic view of the Belgian reference concept for the underground disposal of long-lived and high-level waste (Category B and C) (source ONDRAF-NIRAS)

material and to demonstrate the feasibility of the backfill process. Laboratory tests were carried out including investigations on the pumpability and the flow or spreading behavior of the mixture. Examinations of pore solutions were performed to evaluate the chemical environment with regard to corrosion limitation. Thermal parameters of the backfill material were determined, which will be used as input parameters for future numerical thermal calculations.

Mock-up tests were performed to investigate the flow behavior of the grout in 2 m long Plexiglas tubes, which were designed to simulate a section of the disposal galleries. The pump pressure and the pressure in the pipeline were registered in order to develop the design of the backfill system.

Investigations on the chemical barrier performance of sodium silicate grouts

Long-term isolation of radioactive waste in deep geological repositories mainly relies on the retention properties of the host rock. Therefore, the impairment of the host rock must be minimized and existing pathways must be sealed. For sealing of rock fractures, sodium silicate solutions (water or liquid glass) are a commonly used grout. The applicability and efficiency of fracture sealing using water glass was investigated in the course of an R&D project. Field experiences have shown that the permeability of damaged rock salt can be reduced by water glass injection. The sealing effect is a result of the formation of insoluble amorphous silica and other long-term stable minerals due to the chemical reactions with the soluble salts of the host rock as well as salt solutions.

Fifth US/German workshop on Salt Repository Research, Design, and Operation

The precipitation of dissolved trace elements in water glass is relevant with regard to the migration of toxic or radioactive elements as trace constituents. This process was analyzed by laboratory tests using brine with barium (Ba), cobalt (Co), iron (Fe), nickel (Ni), and strontium (Sr). The visual observations are comparable to those obtained from well-known crystal or chemical garden experiments, where chemical gardens result from the precipitation reactions generated by adding crystals of a soluble heavy metal salt to aqueous solutions of sodium or potassium silicate. In particular, chemical analyses demonstrate a removal of small divalent ions (Co, Ni) as well as a significant decrease in the UO2 concentration. The precipitates can comprise insoluble salts, as well as hydroxides and silicate phases. Another well-known and in water treatment frequently used property of amorphous silicates is their high sorption capacity.

Visit of Members of the Japanese Diet

In Japan the search for a suitable site for a repository for high-level radioactive waste (HLW) is challenging not the least because of the country's geology. Similar to the process currently planned in Germany, regions with a potentially suitable geology shall be identified as a first step. Subsequently, once these regions have been identified communities will be requested to voluntarily support site characterisation work.

Japanese Delegation at Gorleben site

On the basis of our good and fruitful cooperative relations, DBE TECHNOLOGY GmbH was requested to organise a meeting for the purpose of an information exchange in the above mentioned context with a group of Japanese dignataries. Accordingly, members of the Japanese Diet, representatives of NUMO and the Japanese embassy in Germany met with DBE TECHNOLOGY GmbH on August 26th 2014. Over the course of the discussions the success and progress made so far in the German repository programme was demonstrated. Of special interest to the visiting group of dignitaries were the safety relevant issues associated with Gorleben as well as background information regarding the lack of political support for Gorleben despite the obvious and as yet not disproven suitability of the site. All technical queries were answered by DBE TECHNOLOGY GmbH to the satisfaction of the guests. On the basis of the successful meeting the Japanese delegation expressed their wish to continue the fruitful exchange of ideas and experiences.

Fifth US/German workshop on Salt Repository Research, Design, and Operation

Collaboration between American and German researchers with a mutual interest in radioactive waste disposal in deep geologic salt repositories has been a lively process under the umbrella of the US-German Workshop for several years. This year, the fifth workshop in the series, which was titled Salt Repository Research, Design, and Operation, was held in the Santa Fe (USA) from September 7 to September 11. DBE TECHNOLOGY GmbH, Sandia National Laboratories and Project Management Agency Karlsruhe, the three coordinating institutions of these workshops, had the pleasure to welcome more than 50 participants from American and German institutions as well as from the Netherlands (an invited speaker).

The purpose of this series of workshops is to assemble invited key researchers in salt repository science and engineering. For the workshops, agendas were agreed with the intent of maximizing individual resources for the mutual benefit of each program. At the fifth workshop "Repository design and operations" has been highlighted as an area of interest and reflected in presentations from US institutions on the WIPP site and of DBE TECHNOLOGY GmbH on experiences with operational safety in German repository mines. Furthermore, the aspect of retrievability has been addressed, which is a legal requirement for German HAW-repositories since 2010. Furthermore the thermomechanical behaviour of salt, plugs and seals, the safety case as well as special topics like hydro-mechanical coupled modelling of two-phase flow and results of a German study on partitioning and transmutation were discussed.
Next year, the sixth US/German workshop will be held in Germany.

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

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