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# 比利时高放废物处置库设计及与基岩和工程屏障体系的热 - 水 - 力性状的相关研究

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**摘要** 在比利时, 泥岩中地质处置是高放废物最终处置的首选。处置库在高放废物与生物圈之间的多重屏障基础上设计的, 而Boom泥岩作为基岩的研究已有20多年历史。1980年比利时做出重大决定, 建立名为HADES的地下研究机构, 以研究Boom泥岩在地下223 m处的力学性质, 并调查和论证处置的可行性, 为处置库屏障(天然和人工)提供可靠数据。在HADES的众多现场试验中, 很多试验用来对基岩和工程屏障体系(包括封口和回填的可行性)的热 - 水 - 力性状进行研究, 包括CACTUS, ATLAS, BACCHUS和 RESEAL等项目。自1995年以来, 研究开发计划向大型和示范性试验方向发展。最主要成果是运用工业技术建立地下研究设施(竖井和井巷)可行性得到了验证, 且这种工业技术给研究提供一个较好机会, 便于进一步认识基岩泥岩(CLIPEX方案)的水 - 力性状及了解隧道开挖工程(SELFRAC课题)对挖掘破坏区的影响。另一个重大成果是成功地实现对一种称为“OPHELE”的预制膨润土(人工屏障材料)加热和水化地面大型试验。下一步工作内容包括实现大尺寸现场加热器试验(PRACLAY试验), 此试验预计于2006年开始, 并可持续10 a之久。据此, 首先简要描述比利时高放废物处置库设计, 然后回顾Boom泥岩和工程屏障体系的热 - 水 - 力性状相关试验, 最后介绍下一步大规模PRACLAY试验。

**关键词** [高放废物贮存设计](#) [地下研究设施](#) [工程屏障体系](#) [热 - 水 - 力耦合性态](#) [开挖破坏区](#) [模型试验](#) [大尺寸现场试验](#)

分类号

## THE BELGIAN HLW REPOSITORY DESIGN AND ASSOCIATED R&D ON THE THM BEHAVIOUR OF THE HOST ROCK AND EBS

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### Abstract

In Belgium, geological disposal in clay is the primary option for the final disposal of high-level radioactive waste(HLW). Repositories are designed on the basis of a multiple barrier system between the HLW and the biosphere. The Boom clay has been investigated for more than 20 years as the reference host rock. The most important decision was taken in 1980 to build an called high activity disposal experimental facility(HADES) in Boom clay formation at a depth of about 223 m at Mol site to investigate and demonstrate the feasibility of the disposal concepts and to provide reliable data on the performance of repository barriers(natural and engineering). Among numerous in-situ experiments carried out in HADES, several tests were designed to study the thermo-hydro-mechanical(THM) behaviour of the host rock as well as the engineered barrier system(EBS) including sealing and backfilling feasibility, such as CACTUS, ATLAS, BACCHUS, and RESEAL, etc.. Since 1995, the R&D(research and design) program has been oriented towards the large-scale feasibility and demonstration tests. Main achievements are the demonstration of the construction of the underground research facility(URF, shaft and gallery) using the industrial technique which gave an opportunity to extend the knowledge on the hydro-mechanical(HM) behaviour of host rock clay(CLIPEX project), more specifically on the excavation damaged zone(EDZ) due to tunnelling works(SELFRAC project), the realization of a large-scale heating and hydration mock-up test of a prefabricated bentonite called“OPHELIE”. Future work consists in realizing a large-scale in-situ heater test (PRACLAY experiments) that will start in 2006 for a period about 10 years. This paper will firstly give a brief description on the Belgian repository design for HLW, then a review on the performed tests regarding to the THM behaviour of the Boom clay and some EBS(in-situ and on surface mock-up), finally a general presentation on the future large-scale in-situ heater test(PRACLAY experiments).

**Key words** [high-level radioactive waste\(HLW\) repository design](#) [underground research facility\(URF\)](#) [engineering barrier system\(EBS\)](#) [thermo-hydro-mechanical\(THM\) coupling behaviour](#) [excavation damaged zone\(EDZ\)](#) [mock-up](#) [large-scale in-situ test](#)

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