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Deep Borehole Repository of HLW and SF - State of knowledge by SITEX.Network

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Many countries develop geological disposal projects for high-level radioactive waste (HLW) and/or spent fuel (SF) when considered as waste. The most widely selected option is the deep geological repository (DGR) concept, a mined repository with galleries located underground in geological layers into which packaged waste would be placed; the sites for such DGR have been selected in Finland, France and Sweden, and a site selection process is on-going in several other countries, such as in the United Kingdom, Germany and Switzerland.

As an alternative concept to the DGR, the deep borehole repository (DBR) concept, where waste packages are placed into single boreholes, relies on a similar safety strategy: confining and isolating the waste from the biosphere and surface natural phenomena in order to respectively rely on the geological environment to ensure long term passive safety and reduce the risk of human intrusion. The concept of DBR was first considered in the 1950s, but was rejected until the 2000s as it was far beyond existing drilling capabilities among others, given the constraints for HLW and SF management.

New technical developments in the drilling field relaunched the interest of a safe management of HLW and SF based on DBR concept in several countries. Therefore, the SITEX.Network association developed an overview of the existing studies that have been published on the DBR concept with information on the concept itself, on deployment strategies and methods, on issues associated with requirements related to waste packages and borehole equipment, hydro-geology, disposal operation, backfilling and sealing, and finally on safety analyses. The main aim is to provide bibliographical overview providing the state of knowledge about the DBR concept, the technical solutions for its implementation or major obstacles evidenced as a basis to identify safety issues important to deal with in a Safety Case. This could be considered to identify for the future R&D as well. This paper discusses also the controversial issue of DBR trying to provide information from different viewpoints, like the design options, R&D programs required, societal concerns and regulatory needs.