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Putting deep borehole disposal of nuclear waste into practice: the challenges for the international community

This paper explores the science, technology and engineering programs needed to facilitate the licensing of deep borehole disposal for Spent Nuclear Fuel and HLW.

The use of deep boreholes as a means of delivering geological disposal for these waste groups is a disposal option that is of increasing interest to policymakers around the world –because it offers high levels of safety, siting flexibility and reduced costs compared with the established model of nearer-surface geological disposal in a mined repository. Significant work has been done on the safety case for deep borehole disposal by a range of publicly-funded bodies, and in recent years this has been supplemented by private sector investment. Innovations pioneered by the oil and gas extraction industries have significantly expanded the range of potential locations in which it is possible to locate borehole repositories, by using directional drilling to place them in carefully-selected geologic formations in a greater range of safe depths and configurations. Large-scale demonstration projects are under active consideration; and a recent paper by an inter-disciplinary, cross-sectoral panel of borehole experts under the aegis of IFNEC estimated that the first disposal facility would be operational by around 2030 (https://www.ifnec.org/ifnec/jcms/g_13705/rnfswg-deep-borehole-webinar-qas) .

Yet the technology is clearly less mature than the mined repository model –a model which has already been successfully taken through to site selection and regulatory approval in a small number of countries. This paper explores the roadmap to delivering such approval for deep borehole disposal - and brings to bear new qualitative and quantitative evidence about the technical, operational, regulatory and societal challenges that remain to be addressed.

The paper's lead author is Deep Isolation, the leading private-sector company engaged in development and commercialization of deep borehole disposal for spent fuel and HLW. It presents a private-sector perspective on the challenges ahead, while at the same time presenting an evidence-based view from the policy-making and regulatory community. This view is based on preliminary results from a phased program of quantitative and qualitative research conducted with policy-makers working on nuclear waste disposal (in national governments and at international level), with national radioactive waste management organizations, and with nuclear regulators.

The paper sets out preliminary conclusions on further research and demonstration that is required, and on the roles that the IAEA, IAEA member governments, the research community and the private sector should play in bringing deep borehole disposal to fruition.

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