

Deep Borehole Disposal for Countries with Small Nuclear Power Programs

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Abstract

Nuclear power is used to generate electricity in 30 countries, providing ~11% of the world's electricity in 2012 [1]. Ten of those countries generate the majority of the electricity, ranging from 798 billion kWh/yr in the U.S. to 54.8 billion kWh/yr in Spain. Twenty countries in the world have “small” nuclear power programs. For this study, Spain, with seven operating nuclear power plants (NPPs), is considered the boundary and countries with fewer than seven NPPs are considered to have small nuclear power programs. Countries with small nuclear power programs are in the majority.

Options for management of used nuclear fuel (UNF) from these countries have been: (1) return UNF to the supplier, (2) off-shore reprocessing, with return and in-country disposal of the resulting high-level radioactive waste (HLW) (3) disposal in a deep, mined geologic repository and (4) development of a multi-national mined geologic repository.

Disposal of UNF or HLW is especially difficult for countries with small nuclear power programs – because of the economics of scale. However, recent work on deep borehole disposal (DBD) demonstrates that DBD may be especially suited for countries with small nuclear power programs, because it is: safe, less expensive per unit of waste and scalable [3].

A U.S. reference design for DBD is based on disposal of waste packages ~ 0.27 m in diameter at depths greater than 3 km [4]. The feasibility of disposal of packages with diameters of 0.56 m to 0.74 m has also been studied [5] and may be better suited for disposal of UNF assemblies or canisters of HLW.

A conceptual framework is offered for selecting amongst the options based on: volume of UNF or HLW, safety, cost and public acceptance. Other considerations include safeguards, geologic setting and access to technology.

References:

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