The Geological Storage of Spent Nuclear Fuel and Depleted Uranium beneath the Williston Basin

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Regulatory agencies in both Canada and the U.S.A. are recommending that spent nuclear fuel eventually be stored in suitable geological repositories, where highly-engineered barriers will prevent or retard the leakage of nuclear material into the surrounding rocks.

In Canada, a repository will likely be developed somewhere in the Precambrian Shield, where rooms are mined at depths in the range of 500-1000 m. In the U.S., a repository is under construction at Yucca Mountain, Nevada, in volcanic rocks from 200-500 m below the surface.

High-level nuclear material will remain hazardous for hundreds of thousands of years. Over that period of time, it is likely that engineered barriers will eventually fail due to degradation, and that geological barriers subject to seismic activity like earthquakes and faulting, may also fail. Eventually, rocks surrounding any repository will likely become contaminated with leaked nuclear material and since fractures in the rocks surrounding a repository provide potential conduits, contaminated groundwater moving in these fractures could eventually communicate with the biosphere.

If a repository were developed in the Precambrian beneath the Williston Basin, the geological character of the repository site and the significant thickness of the overburden (> 2.5 km) would likely provide suitable separation from the biosphere for a period far longer than the radioactive material is likely to be hazardous. As well, basal aquifers in deeper parts of the basin host resident brines which would provide a dense, brine "blanket" over a repository that would potentially prevent the vertical migration of any contaminating material.

Very deep (2-4 km) repositories could be developed using drilling equipment currently used in the petroleum industry. Numerous laterally-drilled holes could provide abundant storage space for the spent nuclear fuel in both the U.S. and in Canada, and for safe and secure disposal of depleted uranium in the U.S.

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Many large, single-point industrial emitters of greenhouse gases are currently considering the implementation of Carbon Capture and Storage technologies to reduce their emissions. Since 2002, Brian has been investigating areas in the deep subsurface of southern Saskatchewan where carbon dioxide and other greenhouse gases can be safely and permanently sequestered. Work in this area includes application of regional geological systems that can potentially provide for permanent storage and isolation of many greenhouse gases and other industrial by-products, including high-level nuclear material. Email: brianbrunskill@sasktel.net