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Impacts of Nuclear Fuel Cycle Choices on Permanent Disposal of High-Activity Radioactive Wastes

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All options for generating power from nuclear energy generate radioactive waste products that will require permanent isolation from the biosphere. Choices made regarding nuclear fuel cycle options, including decisions for recovery and re-use of fissile material from irradiated fuel, have the potential to affect the waste stream characteristics such as mass, volume, radioactivity, and thermal power, but no options eliminate the need for robust isolation of wastes. Decades of experience has produced an international consensus that deep geological disposal is the preferred method for achieving permanent disposal. The paper reviews published results of safety assessments for deep geologic disposal concepts that have been proposed in the United States, Sweden, France, Switzerland, and other nations to provide insight into the waste form aspects that most affect the long-term performance of repository systems. Disposal concepts considered include geologic repositories in multiple rock types in both saturated and unsaturated environments. Additionally this work evaluates how repository performance may be affected by hypothetical waste form modifications from changes in fuel cycle choices.

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Country or International Organization

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