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Technical Activities Supporting the U.S. Nuclear Regulatory Commission’s Geologic Disposal Program

by

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The U.S. Nuclear Regulatory Commission (NRC) is preparing for changes to the nation’s policies for managing and disposing of spent nuclear fuel (SNF) and high-level radioactive waste. The NRC staff and the Center for Nuclear Waste Regulatory Analyses (CNWRA®) examine potentially risk-significant, generic technical issues regarding geologic disposal. Topics include near-field coupled processes, salt rock thermomechanical behavior, radionuclide transport, corrosion relevant to waste form and waste package performance, generic performance assessments, and system-level modeling of the back end of the nuclear fuel cycle. This presentation will summarize these activities, with emphasis on earth science. NRC and CNWRA are developing numerical modeling capabilities to represent coupled Thermal-Hydrological-Mechanical-Chemical (THMC) processes. Efforts focus on coupling thermal and mechanical modeling tools for the DECOVALEX project with the aim of understanding coupled processes and validating models against experiments. Models include THM processes in a heated bentonite buffer and argillaceous host rock, HM processes in bentonite seal plugs, and THMC processes observed in a single fracture in the laboratory. CNWRA also is developing models of the thermomechanical behavior of salt rock in a repository setting, including intact salt creep deformation, underground room closure, and crushed salt consolidation. For radionuclide transport modeling, CNWRA developed an approach for examining the implications of contrasting decay-chain radionuclide behavior and computational tools for improved understanding of uncertainty and variability. CNWRA also is conducting laboratory studies on the corrosion of simulated SNF, and copper and steel materials for engineered barrier systems of geologic disposal facilities; these studies focus on gaps in information that have potentially broad implications for disposal safety. Underlying these process- or component-specific analyses are performance assessment calculations that help establish a basis for focusing the work.

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