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The Influence of Climate and Vegetation as Factors for Waste Cover Design

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The influence of climate and vegetation on the performance of waste covers at low-level radioactive waste management sites at the Nevada Test Site was evaluated using three numerical flow models. Modeling was conducted using UNSAT-H, HYDRUS and HELP to simulate the long-term water balance of 3 m thick bare-soil and vegetated waste covers using a 24-year climate record from two locations at the Nevada Test Site. Simulations were conducted for waste sites in Area 3 (1225 m elevation) and Area 5 (975 m elevation). The Area 3 site receives 38 percent more average rainfall, and is generally 2 C cooler than the Area 5 site. Results indicate that apparently small differences in climate and hydraulic properties between the two sites contributed to considerably different, although small amounts of drainage through the waste covers when no vegetation was present. The three models yielded surprisingly similar results. Total drainage after 24 years was 1.8 cm, or 0.6 percent of the total rainfall for that period at the Area 5 site, while total drainage was 45 cm, or 11 percent of the total rainfall at the Area 3 site. In addition, modeling was conducted for several waste cover thicknesses and results indicate that while additional cover thickness acted to delay drainage by increasing soil water storage, it had little effect on long-term total drainage. The presence of vegetation eliminated all drainage for every simulation. However, the presence of vegetation may allow plant uptake of radionuclides. These simulations are essential to understand waste cover performance and ultimately ensure long-term waste isolation.