Evaluation of Groundwater Pathways and Travel Times from the Nevada Test Site to the Potential Yucca Mountain Repository

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Yucca Mountain (YM), Nevada, has been recommended as a deep geological repository for the disposal of spent fuel and high-level radioactive waste. If YM is licensed as a repository by the Nuclear Regulatory Commission, it will be important to identify the potential for radionuclides to migrate from underground nuclear testing areas located on the Nevada Test Site (NTS) to the hydraulically downgradient repository area to ensure that monitoring does not incorrectly attribute repository failure to radionuclides originating from other sources. In this study, we use the Death Valley Regional Flow System (DVRFS) model developed by the U.S. Geological Survey to investigate potential groundwater migration pathways and associated travel times from the NTS to the proposed YM repository area. Using results from the calibrated DVRFS model and the particle tracking post-processing package MODPATH, we modeled three-dimensional groundwater advective pathways in the NTS and YM region. Our study focuses on evaluating the potential for groundwater pathways between the NTS and YM withdrawal area and whether travel times for advective flow along these pathways coincide with the prospective monitoring timeframe at the proposed repository. We include uncertainty in effective porosity, as this is a critical variable in the determination of time for radionuclides to travel from the NTS region to the YM withdrawal area. Uncertainty in porosity is quantified through evaluation of existing site data and expert judgment and is incorporated in the model through Monte Carlo simulation. Since porosity information is limited for this region, the uncertainty is quite large and this is reflected in the results as a large range in simulated groundwater travel times.