MODELING THE LONG-TERM FLUVIAL REDISTRIBUTION OF TEPHRA IN FORTYMILE WASH, YUCCA MOUNTAIN, NEVADA

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In the unlikely event of a volcanic eruption in the potential repository at Yucca Mountain, Nevada, radioactive waste may be transported in the volcanic plume. Contaminated basaltic tephra could be deposited on hillslopes around Yucca Mountain, which are part of the Fortymile Wash catchment basin, as an ephemeral stream system that is the primary drainage for Yucca Mountain. Potential deposition of radionuclides at or near a receptor (reasonably maximally exposed individual) location could occur either from direct sedimentation from the plume or from the remobilization of tephra by water and wind after initial deposition. Erosion and sediment transport rates in this arid region are difficult to measure directly. As an alternative, we have used a sediment budget approach to model the long-term fluvial redistribution of basaltic tephra at Yucca Mountain. Our model input addresses uncertainties in data and site-specific processes to demonstrate the quantitative (or mass flux) relationship between sediment budget components. These components include sediment yield, dilution by mixing with ambient sediment, balance of remaining tephra, associated changes in sediment storage, and discharge to the depositional basin as a function of time after the eruption. Using mean values for sediment yield and mass of erupted tephra, the model estimates that approximately 98 percent of the tephra deposit remains in the Fortymile Wash catchment basin 100 years after an eruption. An average of 4,100 years of erosion is estimated to deplete the deposit from the catchment basin. Using these same values, the ratio of eroded tephra to total sediment transported into the depositional basin is estimated to range between 0.4 and 0.5. These results suggest that potential basaltic tephra deposits within the Fortymile Wash drainage system may not be rapidly diluted within a few hundred years of deposition and that their erosion may not be explained by a simple decay relationship. The posteruption redistribution of tephra may, therefore, be an important consideration in the performance assessment of a potential Yucca Mountain repository.

This abstract was prepared to document work performed by the Center for Nuclear Waste Regulatory Analyses (CNWRA) and it contractors for the U.S. Nuclear Regulatory Commission (NRC) under Contract No. NRC–02–02–012. The activities reported here were performed on behalf of the NRC Office of Nuclear Material Safety and Safeguards, Division of High Level Waste Repository Safety. This paper is an independent product of the CNWRA and does not necessarily reflect the view or regulatory position of the NRC.