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Geomorphic characterization of the Fortymile Wash alluvial fan, Nye County, Nevada, in support of the Yucca Mountain Project

Cline, DeLong, Pelletier, Harrington

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In the event of an unlikely volcanic eruption through the proposed high-level radioactive waste repository at Yucca Mountain, contaminated ash would be deposited in portions of the Fortymile Wash drainage basin and would subsequently be redistributed to the Fortymile Wash alluvial fan by fluvial processes. As part of an effort to quantify the transport of contaminated ash throughout the fluvial system, characterization of the Fortymile Wash alluvial fan is required, especially the spatial distribution of fluvial activity over time scales of repository operation, and the rates of radionuclide migration into different soils on the fan.

The Fortymile Wash alluvial fan consists of extremely low relief terraces as old as 70 ka. By conducting soils-geomorphic mapping and correlating relative surface ages with available geochronology from the Fortymile Wash fan and adjacent piedmonts, we identified 4 distinct surfaces on the fan. Surface ages are used to predict the relative stability of different areas of the fan to fluvial activity. Pleistocene-aged surfaces are assumed to be fluvially inactive over the 10 kyr time scale, for example. Our mapping and correlation provides a map of the depozone for contaminated ash that takes into account long-term channel migration the time scales of repository operation, and it provides a geomorphic framework for predicting radionuclide dispersion rates into different soils across the fan.

The standard model for vertical migration of radionuclides in soil is diffusion; therefore we used diffusion profiles derived from ^{137}Cs fallout to determine infiltration rates on the various geomorphic surfaces. The results show a strong inverse correlation of the geomorphic surface age and diffusivity values inferred from the ^{137}Cs profiles collected on the different surfaces of the fan.