

DT #45003

QA: N/A

7/11/05

Natural Analog Studies at Peña Blanca, Mexico

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MOL.20050824.0147

The significance of the Peña Blanca uranium deposits in the State of Chihuahua, Mexico as potential natural analogs for a nuclear waste repository in unsaturated welded tuff was first recognized in the 1980s. In the 1970s, the Peña Blanca region was a major target of uranium exploration and exploitation by the Mexican government. Since then the Nopal I uranium deposit has been studied extensively by researchers in the U.S., Mexico, and Europe. The Nopal I deposit represents an environment similar to that of the proposed high-level radioactive waste repository at Yucca Mountain in many ways. Both are located in semi-arid regions. Both are located in Tertiary rhyolitic tuffs overlying carbonate rocks that have been subjected to basin and range-style tectonic deformation. Both are located in a chemically oxidizing, unsaturated zone 200 m or more above the water table. The alteration of uraninite to secondary minerals at Nopal I may be similar to the alteration of uranium fuel rods in this type of setting. Investigations at Nopal I and in the surrounding Sierra Peña Blanca have included detailed outcrop mapping, hydrologic and isotopic studies of flow and transport, studies of mineral alteration, modeling, and performance assessment.