DOE/ET/44802--T15

DE87 008579

Rogers, A.M., Harmsen, S.C., and Carr, W.J., 1981, Southern Great Basin seismological data report for 1980 and preliminary data analysis: U.S. Geological Survey Open-File Report 81-1086, 148 p.

Sarna-Wojcicki, A.M., Bowman, H.W., Meyer, C.E., Russell, P.C., Asaro, F., Michael, H., Rowe, J.J., and Baedecker, P.A., 1980, Chemical analyses, correlations, and ages of late Cenozoic tephra units of east-central and southern California: U.S. Geological Survey Open-File Report 80-231.

Winograd, I.J., and Doty, G.C., 1980, Paleohydrology of the southern Great Basin, with special reference to water table fluctuations beneath Nevada Test Site during the late(?) Pleistocene: U.S. Geological Survey Open-File Report 80-569, 91 p.

Hydrology

By William E. Wilson, Lakewood, Colo.

Objective: To determine present and past hydrologic regimes of the Nevada Test Site and vicinity in order to predict the potential for ground-water transport of radioactive waste from a proposed repository in Yucca Mountain to the accessible environment.

Approach: Test drilling and hydraulic testing are being conducted in both the saturated and unsaturated zones to characterize in detail the hydrologic regimes of the Yucca Mountain area. Results will be used to interpret potential ground-water flow pathways and bulk hydrogeologic properties of unsaturated and saturated rocks, and to obtain information on the chemistry and age of the ground water.

Digital models simulating ground-water flow and solute transport are required to predict rates and directions of movement of radioactive species and their concentrations in ground water if they should be released from a repository on or near the NTS. The regional hydrology of southern Nevada has been defined, and ground-water flow and transport from the Yucca Mountain site to points of present and possible future discharge will be characterized in greater detail.

Worldwide changes in climate during the Pleistocene Epoch (glacial and interglacial stages) resulted in repeated changes in the ground-water regime. Future climatic changes are probable in the time period of significance to a repository for high-level and transuranic wastes. Paleohydrologic studies are being used to estimate recharge flux, water-table depths, hydraulic gradients, and flow paths to points of ground-water discharge during Pleistocene pluvial cycles in order to assess the differences between present hydrologic regimes and those that will prevail under wetter climates in the future.

DISCLAIMER

Progress: Piezometers were installed in test hole USW H-1 (fig. 5) to depths ranging from 640-1,806 m, under the direction of J.H. Robison. Measurements made while water levels in the piezometers were still equilibrating show that the three shallower piezometers have water levels within a meter of each other and near the original composite level. The deepest piezometer, which is open to the older ash-flow and bedded tuffs (table 1) has a water level about 50 m higher than the others. The vertical distribution of head in this hole indicates an upward hydraulic gradient near the bottom of the hole.

Hole USW H-3 was drilled to a depth of 1,220 m at the south end of Yucca Mountain. The Topopah Spring Member of the Paintbrush Tuff, and the Prow Pass and Bullfrog Members of the Crater Flat Tuff are all above the water table. An attempt to test pump the hole resulted in a sustained yield of about 0.3 L/s. On the basis of this test, the initial estimates of low permeability of the Tram unit of the Crater Flat Tuff and underlying tuff of Lithic Ridge, which were based on injection tests, have been revised downward.

Located in a wash east of the Yucca Mountain block boundary, hole USW H-4 was drilled to a depth of 1,220 m. The water table is in the Prow Pass Member of the Crater Flat Tuff, and the more permeable zones are broadly distributed in the Prow Pass and Bullfrog Members and upper part of the Tram unit, with a thin zone in the tuff of Lithic Ridge. The transmissivity of this section is about 40 m^2/day.

Hole USW H-5, located on the ridge of Yucca Mountain, due west of the proposed site of the exploratory shaft, was drilled to a depth of 1,220 m. The water table is near the top of the Bullfrog Member of the Crater Flat Tuff at an altitude of 775 m, about 45 m higher than the level in USW H-3. Permeability of the Bullfrog Member is relatively high compared with the underlying Tram unit and the tuff of Lithic Ridge. The hole was pumped initially at 9.5 L/s with 5.8 m of drawdown and, after making additional perforations in the casing, at 7.6 L/s with only 2.5 m of drawdown. The transmissivity is about 20 m^2/day.

Hole USW H-6, located west of a hingeline fault that cuts the Solitario Canyon block (fig. 3), was drilled to determine local permeability of the rock units and to establish the degree of hydraulic continuity with the Yucca Mountain block. Water levels west of the block may indicate the direction of ground-water movement toward and within the block. The water-level altitude in USW H-6 is 780 m above sea level, or similar to that in USW H-5. Water levels in and near the block suggest that ground-water flow within the block is to the southeast.

Under the direction of R.K. Waddell, test wells UE-29a-1 and UE-29a-2 were drilled in upper Fortymile Canyon, about 9 1/2 km (6 mi) northeast of test hole USW-G2, as part of the regional hydrology program. Only one hole was planned, but loss of the bit and drill collars at a depth of 65 m necessitated drilling UE-29a-2, which was drilled to a depth of 422 m and tested.

Testing of formations consisting primarily of rhyolite flows with a few bedded tuffs was performed in two stages: (1) in the open hole, from the bottom of the casing at a depth of 248 m to 354.5 m; and (2) through perforations in the casing extending from 87 to 213 m. During the second stage, a bridge plug was set in the casing beneath the lowermost perforation. Testing in both stages consisted of running pumping and recovery tests, tracejector surveys, and sampling for water chemistry.

The most significant result obtained from these holes is that the potentiometric level is much higher than expected, suggesting the presence of a barrier between these holes and well J-13. The rocks at the site have a relatively high transmissivity. Both potentiometric and carbon-14 data indicate that downward flow occurs at the site. Carbon-14 ages of 2,300 yr, 3,800 yr, and 4,100 yr were obtained from three samples taken progressively deeper at the site.

Water samples taken from different depths shortly after all pumping was completed, and kept in sealed containers, show that dissolved-oxygen content decreases from about 4 ppm at 200 m to about 2 ppm at 300 m.

A new map of potentiometric levels throughout a large area extending from Death Valley to Tonopah, about 160 km northwest of Beatty, and east to Pahranagat Valley, about 150 km northeast of Lathrop Wells, was compiled by R.K. Waddell. This map confirms and refines previous interpretations of the ground-water systems. Three ground-water basins (Oasis Valley, Alkali Flat-Furnace Creek Ranch, and Ash Meadows) have been defined. A map showing the availability of carbon-14 and hydrogen and oxygen isotopic data was also compiled.

Computer techniques for designing and analyzing tracer experiments were devised by J.R. Erickson. These experiments should provide estimates of natural ground-water velocities, and, in conjunction with other well-test data, a means for determining effective porosity. A series of these experiments is being planned for the Yucca Mountain area.

A two-dimensional, finite-element, flow and transport code was developed by R. K. Waddell that allows simulation of transport of members of sorbing decay chains. Inventory of the radionuclides in the repository is calculated with the Bateman equations (a simultaneous system of linear, homogeneous, first-order, ordinary differential equations with constant coefficients). Dissolution rate of the waste matrix may either be explicitly defined or calculated as a first-order kinetic dissolution process.

Lithologic logs from wells in the Amargosa Desert are being compiled for correlation with geophysical data and determination of most likely paths of ground-water flow in the Amargosa Desert.

The flood potential of Fortymile Wash and its tributaries draining Yucca Mountain was evaluated by R. R. Squires and R.L. Young. Considered in the analysis were floods that would be expected in 100-yr and 500-yr recurrence intervals, and the maximum potential floods. In Fortymile Wash, the maximum potential flood would stay confined within the wash "canyon" in the Yucca Mountain area; depths of these floodwaters are estimated to be about 5-8 m.

An investigation to map Pliocene and Pleistocene rocks and geomorphic surfaces of the Ash Meadows quadrangle and vicinity, Amargosa Desert, was initiated under the direction of Dr. R. L. Hay, University of California. Included in the study area are widespread spring deposits and lakebeds, indicative of hydrologic conditions different from those of modern times. Determining the spring discharge and lacustrine history of the Amargosa Desert will contribute significantly to our understanding of the regional paleohydrology.

A report entitled "Vegetation and Climates of the Last 45,000 Years in the vicinity of the Nevada Test Site," by W. G. Spaulding, was prepared in fulfillment of a University of Washington contract to the USGS and approved for release as Open-File Report 83-535. It states that during the glacial maximum (about 18,000 yr B.P.), the following conditions prevailed in the region as compared to modern conditions: Average winter and summer temperatures were both lower, resulting in an average annual temperature about 6-7°C lower; summer precipitation was about 40-50 percent less, winter precipitation was about 60-70 percent greater, and average annual precipitation was about 30-40 percent greater.

Reference

Waddell, R. K., 1982, Two-dimensional, steady-state model of ground-water flow, Nevada Test Site and vicinity, Nevada-California: U.S. Geological Survey Water-Resources Investigations Report 82-4085, 72 p.

Waste Isolation Pilot Plant, New Mexico

The DOE has been investigating an area about 45 km east of Carlsbad, New Mexico, to determine its suitability as a site for the Waste Isolation Pilot Plant (WIPP), a geologic repository for nuclear wastes generated by defense activities. The geology and hydrology of the area have been studied in cooperation with Sandia Laboratories to provide the DOE with information on which to base an assessment of the site, particularly with respect to geologic stability, long-term isolation of waste radionuclides, and the potential for the hydrologic system to provide a barrier to radionuclide transport. The potential host rock is bedded salt of the Salado Formation of late Permian age.