

Overview of the Deep Geothermal Production at the Peppermill Resort, Reno, Nevada

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The Peppermill Resort in Reno, Nevada is located on the Moana Geothermal Resource (MGR). Since the early 1980s, the Peppermill has used the MGR's low-temperature geothermal waters for space heating. Initially, two shallow wells on the Peppermill property produced 130 degree F water from Neogene sediments at the total rate of 143 gallons per minute (gpm) from depths of approximately 700 ft to 1,000 ft. Injection of the spent geothermal fluids into the producing formation was not required, allowing surface disposal. However, the Nevada Department of Environmental Protection terminated the Peppermill's permit for surface disposal in 1988, requiring the drilling of an injection well. The Peppermill #4 well was drilled from December 1988 to July 1989 to a total depth of 3,307 ft in andesites of the Tertiary Kate Peak Fm. It was then flow-tested using air-lift from approximately 180 ft. Results indicated the well was capable of producing 160 degree F water at the rate of 170 gpm under artesian conditions. It was subsequently completed as the disposal well, injecting spent geothermal fluids into permeable volcanic andesites below 2,620 ft.

In 2009, the Peppermill decided to expand the capacity of its geothermal space-heating system. The Peppermill #8 well was drilled by Ensign U.S. Drilling in August-September 2009, reaching total depth of 4,421 ft in andesites of the Kate Peak Fm. The well was tested flowing 1,185 gpm of 175 degree F water, exceeding the required fluid temperature and flow rate. This volume of new production, however, required drilling an additional well to supplement the Peppermill's injection capacity. Ensign U.S. Drilling drilled the Peppermill #9 in December 2009 to January 2010 to total depth of 3,900 ft in the Kate Peak andesites. The well was tested flowing 345 gpm of 153 degree F water. A maximum injection rate of 708 gpm at 246 psi was achieved during additional testing. Currently, the Peppermill's production and injection system is being expanded, with anticipated start-up with the new wells online by spring 2010.

The two recent wells encountered permeability in highly fractured altered andesite. Fracturing is associated with northtrending faulting that intersects a northeast-plunging nose off the Carson Range of Kate Peak volcanics, which outcrop approximately 2 miles southwest of the Peppermill.

Geothermometry using reported silica concentrations for water from the MGR and Fournier's 1977 equation suggests higher temperatures exist at depth, with an equilibrated resource temperature between 280 and 300 degrees F.