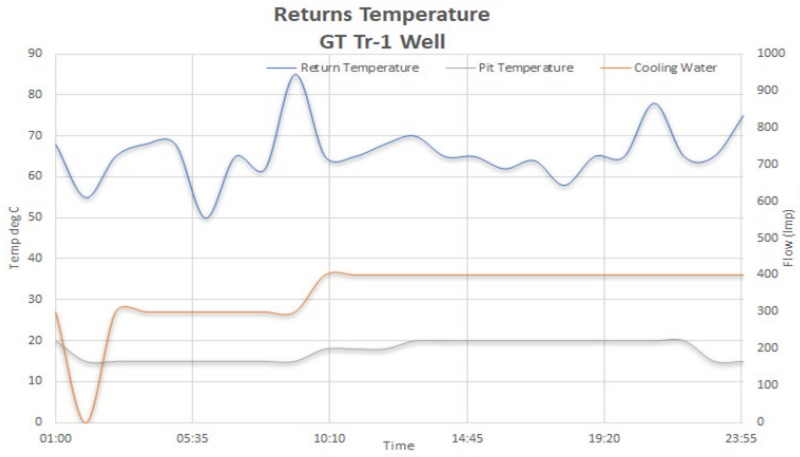
Underbalanced Workover Removed Scale from Environmentally Sensitive Geothermal Well, Enabled Submersible Pump to Recover Geothermal Water



Surface temperature management.

Objectives

- Remove scale buildup in a geothermal well from approximately 2,296 to 7,874 ft (700 to 2,400 m). Conventional workover such as acidization and inhibition was not possible due to environmental issues and freshwater contamination risks.
- Mitigate lost circulation and better cuttings/cleaning management in the hole through managed pressure drilling (MPD) technology.

Our Approach

- Weatherford experts collaborated with the customer's engineers to determine the equipment suitability and well engineering planning to select the optimal equipment.
- The teams performed a rig survey to determine the equipment interface and pipework requirement. With the compact location of the geothermal well adjacent to the processing plant, the highest priority was to determine the equipment spotting. In addition, a careful logistical and simultaneous operation (SIMOPS) plan was developed to ensure the optimum use of resources available. Based on the results, a rig-up procedure was prepared.

LOCATION
Germany

WELL TYPE
Vertical

HOLE SIZE AND ANGLE
13-3/8 in., vertical section

DOWNHOLE TEMPERATURE
230°F (110°C)

SURFACE TEMPERATURE
176 to 194°F (80 to 90°C)

DEPTH
7,874 ft (2,400 m)

PRODUCTS/SERVICES
- Land Series RCD 9000 rotating control device
- Surface handling system
- Well engineering
- Well services

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The critical component of any closed-loop drilling system–and the first line of defense for any wellbore–is the rotating control device (RCD). RCDs create a closed-loop environment to contain and divert fluids and to enable wellbore pressure management.

Our Approach (continued)

- After the initial data was collected and reviewed with the customer for accuracy, a robust engineering plan was prepared. Equivalent circulating density (ECD) calculations were performed to target the correct circulating pressure and ensure losses were mitigated. In addition, hole cleaning with selected drilling fluid (water) had poor cutting carrying capacity. Therefore, the engineers made velocity calculations to ensure adequate cleaning.
- Temperature and water production modelling was also performed to determine and manage the geothermal water. A well-specific drilling program and operational procedures were also prepared.
- Customer and rig training was performed onsite to familiarize the crew with the equipment to ensure the success and safety of all operations.

Value to Customer

- Weatherford expertise and underbalanced technology removed the scale from 2,296 to 4,921 ft (700 to 1,500 m).
- The process ensured and confirmed efficient hole cleaning, and, during the wiper trip, no obstruction was observed.
- The pre-job modelling of the temperature and water production helped in efficiently managing equipment and geothermal water at the surface.
- The Weatherford solution addressed all the environmental concerns, and the workover was successfully completed without the requirement of acidization or inhibition.
- Following the workover operation, the customer deployed a submersible pump to recover geothermal water, and the geothermal well was successfully brought online.

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