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IMPROVEMENTS TO MECHANICAL INTEGRITY TESTING EQUIPMENT AT THE U.S. STRATEGIC PETROLEUM RESERVE

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Abstract

Mechanical Integrity Tests (MITs) are conducted on oil cavern storage wells at the U.S. Strategic Petroleum Reserve (SPR), averaging one cavern MIT (1-3 wells) performed each month. These tests are among the highest risk tasks performed at the SPR. The MIT is conducted by a field test director who must manage subcontractors, collect detailed instrumetation data, and execute a comprehensive MIT procedure. Providing the test director with the best available tools and equipment to safely and accurately complete this complex task is critical to performing the test successfully.

Improved MIT practices include Class-1 battery-powered, wireless Bluetooth-enabled pressure instruments with line of sight range of 250 ft (76 meters), a nitrogen flow meter recording device, and a test monitor user interface personal computer or other smart device. While the testing method remains the same, the test is conducted using better tools. Previously, when the nitrogen-oil interface reached a scheduled depth, the wireline engineer used a horn or radio to call out the interface depth to the test director who was monitoring pressure gauges and the nitrogen flow meter outdoors on the well pad. The test director wrote down all available information at that point in time. The wireline engineer then moved the tools down to the next scheduled depth and the process repeated itself until the final test depth was reached. Now, the test director works inside the wireline logging unit where all test data are displayed and recorded on the computer. The test director can now also observe the position of the nitrogen-oil interface directly on the wireline engineer's display, instead of depending on the wireline logging engineer to convey this information to the test director verbally outside the wireline unit.

The enhanced system improves communication and coordination between the test director, nitrogen injection contractor and wireline logging engineer. This removes the test director from the proximity to the high-pressure nitrogen lines (potential hazards) and pressure transmitters/readouts at the wellhead. Moving the test director indoors also removes this person from heat, cold and rain, allowing nitrogen injection to continue, even when the site is under shelter-in-place site restrictions due to thunderstorms. Improved nitrogen injection temperature and flow rate monitoring helps provide better control of these parameters, which reduces temperature stabilization wait-time needed to conduct the test, resulting in cost savings. The MIT data (nitrogen injection rates, volumes, temperatures, pressures and logging interface depths) with respect to time are all located in one database. The test data are easily accessible for those involved with the test analysis reporting. The recorded test inputs are used to determine if the well passes the test.

Since implementing these improvements to the MIT program, 10-cavern MITs have been conducted using the new system. Of these, all 10-caverns or approximately 20-wellbores have had no problems with MIT data interpretation or safety concerns with the new setup.

Key Words: Mechanical Integrity Tests (MITs), Strategic Petroleum Reserve (SPR).

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