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CELLAR CASING INSPECTION, REPAIR, AND ENCAPSULATION AT THE U.S. STRATEGIC PETROLEUM RESERVE

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Abstract

The objective of this paper is to explain in detail the process used in cleaning, inspection, repair, encapsulation, and lessons learned from the cellar casing inspection program at the Strategic Petroleum Reserve (SPR). The well casing exposed in the cellar between the cellar floor and the bradenhead flange can be overlooked by a well-maintenance program that focuses on subsurface casing inspection and wellhead integrity. Cellar casing inspection, repair, and encapsulation is the process of surveying, measuring the wall thickness, and the mechanical condition of the wellhead casings at each cavern at the U.S Strategic Petroleum Reserve. Each wellhead and cavern have a Maximum Allowable Operating Pressure (MAOP) that the casing needs to be able to withstand safely.

To ensure that the casings can contain the MAOP, they must be examined using non-destructive examination (NDE) methods to evaluate the mechanical integrity of the casings and to inspect for corrosion, loss of wall thickness, evidence of over-pressurization, or other mechanical damage. If any of these are present to such a degree that the integrity of a casing could be compromised, the MAOP must be recalculated, and the wellhead should be de-rated to meet the current condition of the pipe until repairs can be made and the wellhead restored to its original designed condition. Based on the nature and the severity of the findings, the inspection frequency may be increased for future inspections.

In the past three years, about 40 cellar wellhead casings have been surveyed at the West Hackberry (WH) and Bayou Choctaw (BC) oil storage sites. Maximum and minimum casing diameters were surveyed using calipers and ultrasonic thickness (UT) straight beam scans were used to map the longitudinal extent of reduced thickness areas. Depending on the severity of the casing wall thickness reduction, the cellar wellhead casing will receive either composite wrap reinforcement plus encapsulation or an encapsulation only.
Upon determining the appropriate solution for the wellhead integrity, removal of the previous wrapping of the wellhead casing was conducted, and the casing was pressure washed. Then the wellhead was blasted with garnet grit and cleaned. The casing wellhead cellar was visually inspected for any signs of cracking, damage, or leakage. After the visual inspection, UT measurements, and 3-D external laser scan mapping of the entire exposed cellar casing was performed, a report was provided for review. The report was analyzed to locate any anomalies that would require reinforcement of the wellhead cellar casing with composite wrap plus encapsulation or just an encapsulation only. Encapsulation was achieved by pumping epoxy-based grout into the fiberglass-reinforced polymer (FRP) jacket from the bottom up to seal the concrete deck tightly and prevent exposure of the casing to air or moisture to prevent future corrosion. The top of the grouted encapsulation was capped off with trowel-grade epoxy to form a watershed.

After the reinforcing repair, the cellar casing strength was restored to its original burst rating pressure. This process provides an important approach to maintain well integrity at the SPR and helps to eliminate any unplanned downtime associated with these aging and corroding SPR assets.

Key Words: *3-D, laser, scanner, NDT/NDE (Non-Destructive Test/Examination), MAOP (Maximum Operating Pressure), UT (Ultrasonic Thickness), Strategic Petroleum Reserve (SPR).*
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