SandVA

INSPECTION & ANALYSIS OF SAND CONTROL IN GAS STORAGE WELLS

EV's Optis Infinity M125 provides a complete 360˚ image of the well enabling a new quantum of data on sand screen condition & status.

THE NEED FOR EFFECTIVE SAND MANAGEMENT

Sand control or sand management is estimated to be required in more than 50% of wells globally during their productive lives. The need arises in both conventional and unconventional wells with high rate gas production from unconsolidated sandstones reservoirs and flowback from hydraulically fractured wells providing common examples. In certain regions the use of slotted liners or sand screens to control sand production is widespread. In these locations production from unconsolidated sands would not be economically possible without their use.

Sand screen condition and performance often become areas of concern as reduction over time can impact production and well life. Typical screen problems such as plugging, leading to reduced flow capacity, or erosional failure, leading to sand accumulation and/or erosion of wellbore or surface components, are potentially very costly. In most cases, remedial solutions are straightforward: breaches in sand control may be resolved with the installation of mechanical barriers such as plugs, patches or straddles, or through the application of chemical treatments to consolidate the sand formation in the near wellbore region; whilst inflow performance issues may be addressed with targeted washing, or jetting services. The challenge, however, is identifying the site(s) at which these solutions should be placed and assessing their performance in-situ.

360° COVERAGE OF THE WELL

As the operator wished to obtain a detailed, 360° assessment of screen condition the Optis Infinity M125 was selected to determine and understand well status. Previous technology relied on a single side view camera, rotated by an electric motor, requiring lengthy start and stop operations to capture all base holes within the sand screen. Optis Infinity, however, is equipped with 4 cameras in the same plane offset by 90 degrees, allowing for full 360° coverage of the well in a single continuous pass. The images in **fig.1** demonstrate the high-quality imaging acquired with the Optis Infinity M125, allowing for the analysis of screen integrity. The captured footage was transferred electronically to an EV data center where the condition of the screens were analyzed in detail.

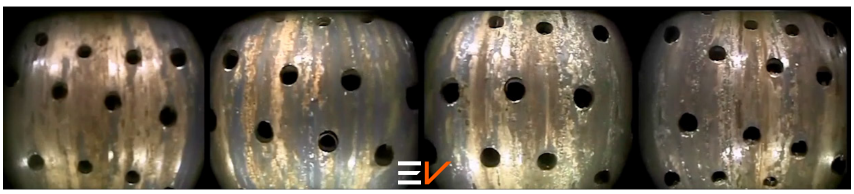

Figure 1: Optis Infinity Raw Images

THE CHALLENGE

A gas storage well operator in continental Europe required detailed assessment and visual confirmation of the condition of sand screens within the well. Sand control in this well is further complicated by frequently alternating periods of injection and production. Regulatory requirements entail periodically confirming the condition of sand screens and other downhole components.

THE SOLUTION

EV's Optis Infinity M125 tool was deployed on slickline with both downview and sideview video footage acquired over the entire well. Four screen sections with an average length of 6m (20 feet) were captured. The resulting images were subsequently visually inspected and measured to evaluate both erosion and plugging of the screens, to provide a quantitative evaluation of screen integrity and inflow performance.

THE RESULTS

Mosaic images for each screen interval were created to provide an optimal medium for visual inspection of more than 2,500 base holes present in each assembly. Zones of specific interest can be quickly identified from such images as changes in pattern, hue and light intensity are easily identified. **Fig.2** provides an example of a 20cm interval near the top of the screen. This shows a deposit of sand like material on the tubular wall, along with partially plugged base holes particularly around the 90˚ azimuth. There was no visual evidence of erosion, however a trend of increasing restricted flow area emerged from the top to bottom of the screen **(Fig.4)**.

SAND CONTROL EVALUATION

Following the visual assessment, individual base holes were then dimensioned at selected depths and azimuths **(fig.2)**. As the well was near vertical over the sand screens the azimuth of measured holes were assigned to 90˚ sectors based on visual indications of the low side of the wellbore such as debris movement and tool string decentralization. 54% of the base holes were partially restricted (plugged) with debris having a sand-like appearance. **Fig.4** reveals a trend that emerged of increasing restricted flow area from the top to the bottom of the screen.

This example illustrates that video image resolution allows very detailed inspections of small features such as base holes in sand control devices. It also enables sufficiently accurate measurements of erosion or plugging to provide meaningful quantified assessments of screen condition. Quantitative inspection allows patterns and trends to be identified and these can help diagnose the causes of problems, positively influence any required treatments and improve future performance of similar components.

MAXIMISING PRODUCTION FROM SAND-PRONE RESERVOIRS

Having demonstrated that the integrity of the screen was indeed intact, the operator satisfied the legislative requirements to continue operation of the well. The plugging of the base holes was noted, but the operator elected to take no further action at this time and would assess changes in the levels of plugging during subsequent inspections. From this time-lapse information a rate of change could be calculated to provide input for decision making on when to schedule wellbore and screen clean-up interventions.

This quantified information provided by SandVA allows patterns and trends to be identified, helping diagnose the causes of problems and understand their severity. This information helps operators implement effective sand management programs, enabling them to maximize the performance and productive life of their assets.

Figure 2: Dimensioned Base Holes Image

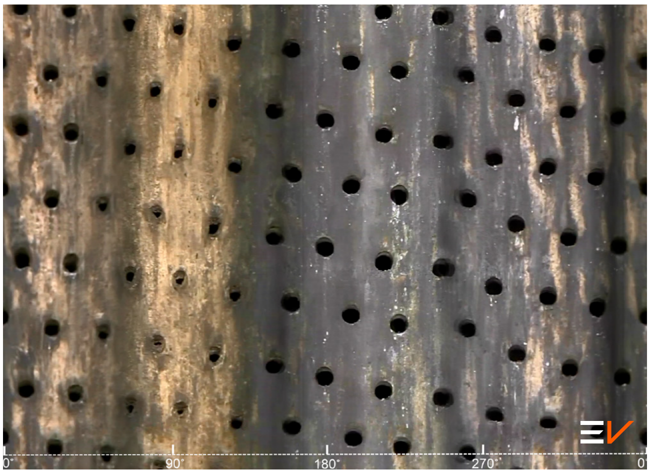

Figure 3: Processed 'Mosaic' Image

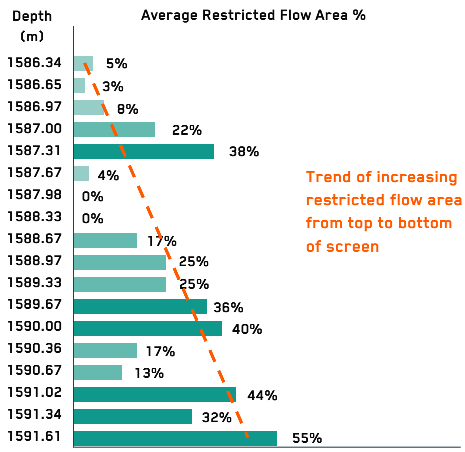

Figure 4: Average Restricted Flow Area Per Base Hole