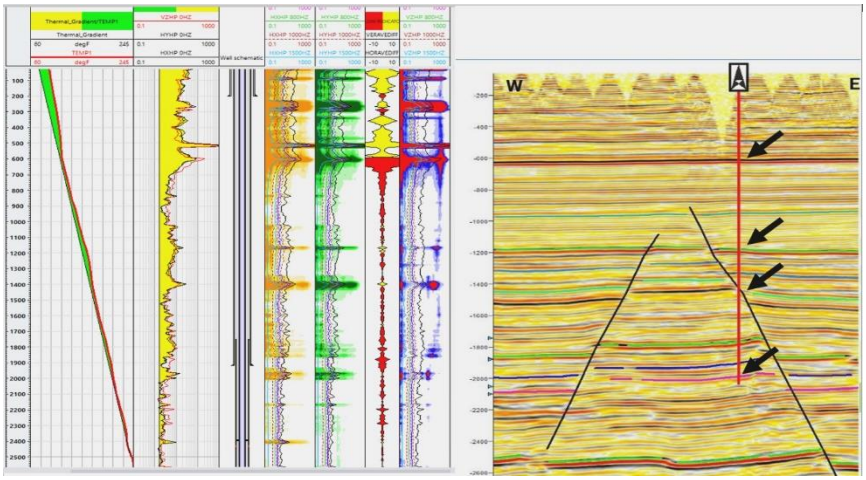
GAPS® Tool, MFC-MTD Logging in Tubing Successfully Identify Noise Behind Casing, Gas Migration Paths, Optimize Well Interventions



GAPS and the temperature data's composite with surface seismic interpretation identifies the sources of leakage that are clearly opposite to the porous formations and behind the casing, with the maximum noise at ~1,968 ft (600 m).

Objectives

- Identify gas oozing source on the surface and deliver a migration path analysis.
- Confirm the flow path from fluid entries into the wellbore up to the wellhead and highlight the casing integrity issues.

Our Approach

- A pre-job meeting with the operator revealed that the main issue was gas oozing in the field, first reported in May 2019. The gas leakage was initially observed in an abandoned tube well and later in cultivated land. The primary challenge for the operator was identifying the source of the gas oozing.
- Weatherford proposed and deployed a GAPS geophone array production survey tool along with a multi-finger caliper (MFC), a magnetic thickness detector (MTD), and temperature logs. Initially, two wells were selected based on the information provided. The GAPS tool was used to detect low-rate leaks (less than 1 m^3/day) and to differentiate between flow inside and outside the casing, as well as between liquid and gas flow.
- MFC and MTD multi-barrier processing confirmed that there was no significant metal loss or tubing damage.
- Interpretation of the GAPS station data was conducted using a proprietary software with a careful examination of the individual frequency bin responses.

LOCATION
Pakistan

WELL TYPE
Development

HOLE SIZE
8-1/2 in.

CASING SIZE
9-5/8 and 13-3/8 in. casing, 7 in. liner

LINER SIZE AND TYPE
2-3/8 in. tubing (4.7 ppf)

MEASURED DEPTH
8,431 ft (2,570 m)

OTHER
Logging interval is 88 to 8,431 ft (27 to 2,570 m) and the log was run through tubing with two shuttles at 9.8 ft (3 m) spacing with sampling rate is 1 ms.

PRODUCTS/SERVICES
- Wireline
- GAPS geophone array production survey tool
- Multi-finger caliper
- Magnetic thickness detector

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Our Approach (continued)

- The interpretation of composite data clearly identified the fluid behind the casing and its upward flow path.
- Based on the data interpretation, remedial intervals were suggested and discussed with the operator.

Value to Customer

- MFC and MTD multi-barrier processing confirmed no significant metal loss or tubing damage, ensuring the well completion's integrity and reliability for the operator. The GAPS survey enabled the operator to detect noise behind the casing, and temperature data further validated the GAPS results.
- Weatherford identified the potential gas migration path along the wellbore, providing the operator with critical insights into subsurface conditions.
- Based on the GAPS results, Weatherford delivered comprehensive insights into subsurface dynamics, including gas migration patterns, empowering the operator to make informed, strategic decisions and optimize well interventions.
- The operator acted on this data by perforating the section of the well at approximately 1,968 ft (600 m), where the noise behind the casing had been identified. Initially, the gas pressure was comparable to a production well, but it has since gradually decreased.

The Weatherford GAPS geophone array production survey tool is deployed in a cased borehole to profile the background noise levels throughout the length of the well. The background noise profile is analyzed to pinpoint areas with significant gas or water movement occurring behind the casing.

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