Short communication

SPECTRAL NOISE LOGGING FOR WELL INTEGRITY ANALYSIS IN THE MINERAL WATER WELL IN ASSELIAN AQUIFER

R.R. Kantyukov[1], A.A. Arbuzov[2], S.V. Soroka[2], L.A. Spirina[2]*
[1]*LLC Gazprom transgaz Kazan, Kazan, Russia*
[2]*LLC TGT Servis, Kazan, Russia*

Abstract. This paper describes a mineral water well with decreasing salinity level according to lab tests. A well integrity package including Spectral Noise Logging (SNL), High-Precision Temperature (HPT) logging and electromagnetic defectoscopy (EmPulse) was performed in the well which allowed finding casing leaks and fresh water source. In the paper all logging data were thoroughly analyzed and recommendation for workover was mentioned. The SNL-HPT-EmPulse survey allowed avoiding well abandonment.

Keywords: Mineral water, Salinity, Spectral Noise Logging (SNL), Casing Leaks, High-Precision Temperature logging, electromagnetic defectoscopy

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Introduction

This paper describes the results of a mineral water well integrity analysis using Spectral Noise Logging (SNL), High-Precision Temperature Logging (HPT), and Pulsed Electromagnetic Defectoscopy (EmPulse) techniques. HPT-SNL-HD-EmPulse logging suite was aimed at identification of casing leaks in a well with multiple casing strings. The well integrity analysis using modern logging technologies has successfully identified casing leaks and determined the source of low-salinity water inflow.

A detailed description of Spectral Noise Logging, High-Precision Temperature Logging, and Pulsed Electromagnetic Defectoscopy (EmPulse) techniques were earlier given in (Aslanyan, Volkov et al., 2016; Ansari et al., 2015; Maslennikova et al., 2012, Aslanyan, Aslanyan, Maslennikova et al., 2016; Neprimerov et al., 2016).

Brief well history

The surveyed well supplies potable mineral water. In the last year the total water salinity has started decreasing. A task was assigned to locate the water freshening source.

HPT-SNL-HD-EmPulse logging results

According to the integrated logging survey, the desalination sources are 219 mm casing leaks in the intervals 51.3-53.6 m and 64.8-67.2 m. These intervals are located within the boundaries of the Upper Kazan terrigenous-carbonate sequence which is the source of low-salinity water inflow. Leaking collars in 159 mm casing were also found in the intervals: 82.0-90.0 m, 97.6-98.6 m, 101.4-103.0 m, and 112.0-115.6 m (Fig. 1).

A combined HPT and SNL data analysis led to a conclusion that the leaks in 219 mm casing in the intervals 53.6 m and 64.8-67.2 m were the potential source of low-salinity water inflow. The SNL data showed a noise amplitude change during water injection in the interval 51.3-53.6 m. Based on the Production Logging Tool (PLT) and Heat Exchange Sensor (HEX) data, it was determined that the flow velocity changed in the intervals 51.3-53.6 m and 64.8-67.2 m, which is an additional indicator that casing leaks occurred in these intervals.

Additional noise zones in the intervals 82.0-90.0 m, 97.6-98.6 m, 101.4-103.0 m, 112.0-115.6 m and correlation with EmPulse data indicating metal loss in these zones made it possible to assume that casing leaks occurred in these intervals. The level of acoustic noise generated by the leaks was sufficient to be detected by SNL-HD tool due to the unique character of this tool and technique (Suarez et al., 2013; Aslanyan, Aslanyan, Karantharath et al., 2015; Ayesha Rahman Al Marzouqi, 2012; Aslanyan, Aslanyan, Minakhmetova et al., 2015; Ahmed S. Eldaoushy et al., 2015).

Conclusion

The HPT-SNL-HD-EmPulse hardware and software system has proved to be effective and allowed:

Identification of casing leaks;

Location of low-salinity water inflow source.

[*]*Corresponding author: Stanislav V. Soroka*
E-mail: stanislav.soroka@tgtoil.com

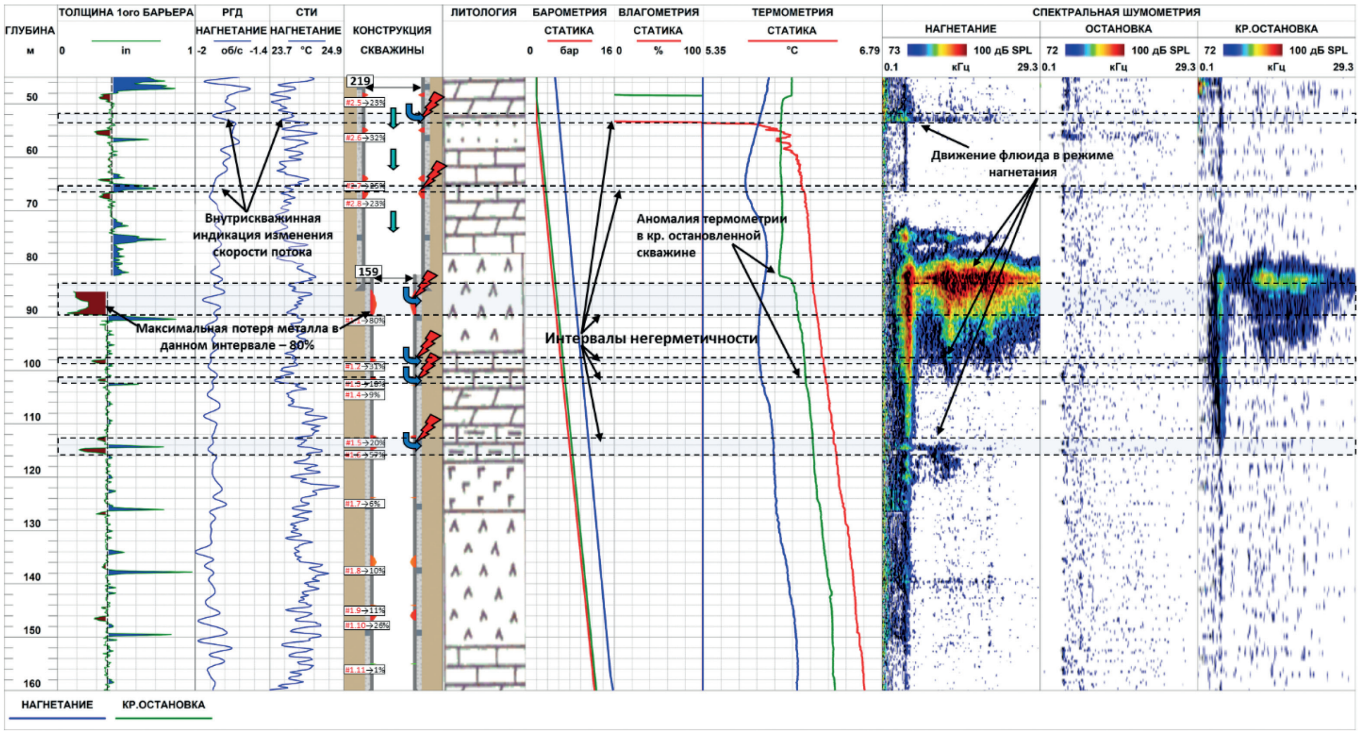

Fig. 1. Casing leaks identified by the downhole logging suite: 1) Based on the temperature gradient changes, flow velocity variations from PLT and HEX data, and presence of noise signals in the intervals51.3-53.6 m and 64.8-67.2 m, it has been concluded that there is a leak in 219 mm casing collar. 2) The SNL has captured some noise signals in the intervals 82.0-90.0 m, 97.6-98.6 m, 101.4-103.0 m, and 112.0-115.6 m, which is in correlation with the EmPulse data. This leads to the suggestion that there are leaks in the specified intervals of 159 mm casing.

Determining the location and nature of the leaks has made it possible to avoid well abandonment and work out a proper remedial cementing programme.

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About the Authors

Rafael R. Kantyukov – PhD in Engineering Science, Deputy Chief Engineer for Operation of Main Gas Pipelines, LLC Gazprom Transgaz Kazan

Russia, 420073, Kazan, Adela Kutuya St., 41

Andrey A. Arbuzov – PhD (Phys. and Math.), Deputy Managing Director, LLC TGT Servis

Russia, 420108, Kazan, Magistral'naya St., 59/1

Stanislav V. Soroka – Head of Tool Factory
LLC TGT Servis
Russia, 420108, Kazan, Magistral'naya St., 59/1
Phone: +7 843 210-17-74
E-mail: stanislav.soroka@tgtoil.com

Liliya A. Spirina – Engineer, Division of Spectral Noise Logging, LLC TGT Servis
Russia, 420108, Kazan, Magistral'naya St., 59/1

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