Behind Pipe Evaluation Technique (BPET℠) Service

ADVANCEMENTS IN GAS DETECTION, BARITE IDENTIFICATION, AND ANNULAR CONTENTS EVALUATION THROUGH CASING STRINGS

OVERVIEW

The identification of any hazardous or problematic materials within the pipe annulus greatly reduces HSE risks during cut-and-pull operations. Halliburton's new Behind Pipe Evaluation Technique (BPET℠) service is ideal for assessing the composition of annular contents from acoustic and nuclear log responses. The input data are collected using a set of wireline tools that can be run in a single descent. They include the Spectral Density Log (SDL™) tool, the Dual-Spaced Neutron (DSN™) tool, the Circumferential Acoustic Scanning Tool (CAST℠) service, and the Cement Bond Log tools. The resulting answer product depicts the potential presence and distribution of cement, settled mud solids, light-to-heavy liquids, and gas.

Interpretation of the combined log data may also be used to determine maximum cut depth, which will allow the casing to be cut and pulled in a single work string descent.

VALUE

» More accurate answers when using all the BPET tools in combination to determine if gas is present

» Density-neutron measurements yield an increased depth of investigation over ultrasonic responses and provide the ability to distinguish more types of materials

» Advanced recognition of annular composition provides a better understanding of downhole environment, producing a safer and more efficient casing extraction

BENEFITS

» Reduces HSE risks during cut-and-pull activities

» Enables real-time data quality control throughout logging operation

» Provides a recommended cut depth prior to rigging down logging equipment

» Offers timely delivery of interpreted results including Rig-Pull Tension Profile
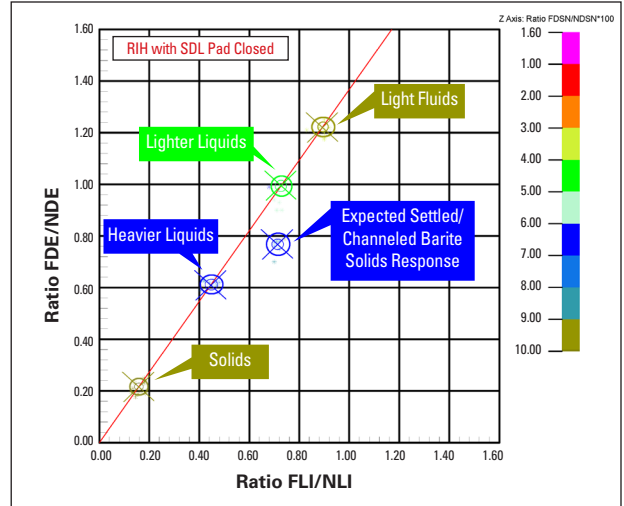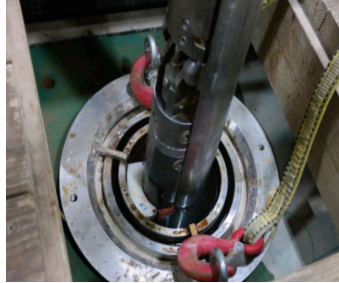
BPET Acoustic and Nuclear Composite
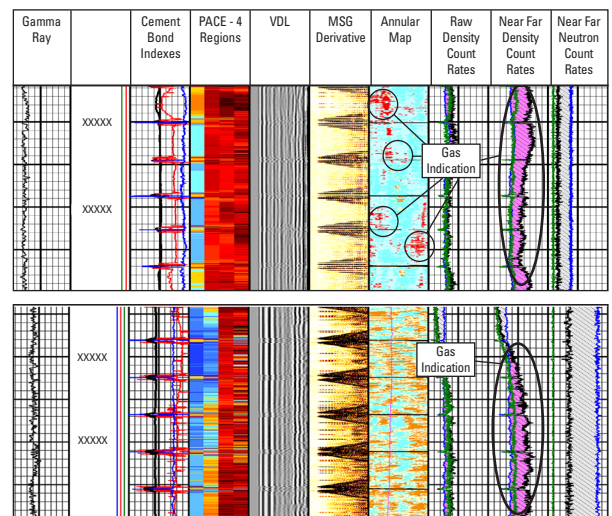
The upper display shows gas detection from the ultrasonic and nuclear sensors. The lower display demonstrates a case where the nuclear method detected gas and provided a solution where the ultrasonic method could not due to probable accumulations on the casing exterior.

The BPET service can reduce costs in deep water through precut analysis.

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BPET SOLUTION OVERVIEW

Measurements from the SDL and DSN tools play a key role in being able to identify any solid or liquid materials that are located within the pipe annulus. The density-neutron crossplot is from a historical review of over 30 subsea wells logged with Halliburton's older-generation tools in deepwater Gulf of Mexico starting in 2012 and based on best known instances of cut-and-pull operations. The Halliburton Tool Response and Characterization Laboratory (TRAC Lab) standardizations have been performed to correlate the LOGIQ® new-generation tools to the legacy tools. The use of calibrated count rates allows consistent comparison between individual tools and multiple generations of tools. The responses (pictured far upper right) span from solids and heavier liquid in the lower-left cluster of data to very light fluids in the upper-right cluster of data. Settled barite solids are expected to populate off from the reference line (black) due to spectral density log responses to the high-density materials.
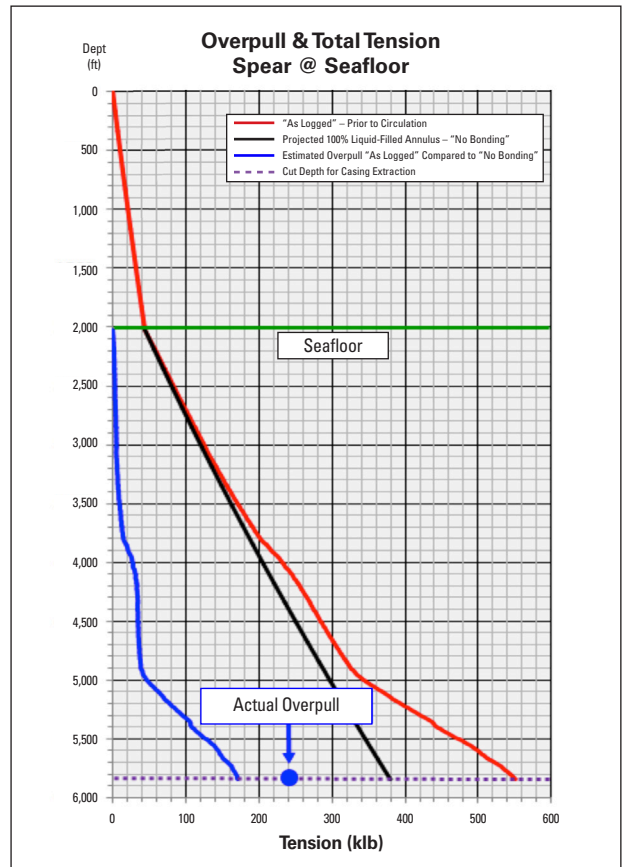
RIG-PULL TENSION PROFILE FOR CUT-AND-PULL OPERATIONS

After the BPET service has been utilized to identify materials located within the pipe annulus, the maximum cut depth of the casing is determined. In addition, a tension profile for pulling the casing is generated based on the frictional effects of the materials surrounding the pipe. The graph to the lower right displays estimations for rig-tension pull for a completely solids-free liquid-filled annulus displayed with the black trace—what is expected should the post-cut cleanup circulation be 100% effective in removing all solids in the annulus. The current as-logged annulus conditions are displayed with the red trace—projecting bonding and associated friction conditions as evaluated by the acquired log responses.

These represent the two extremes of predicted conditions after cutting that the rig will need to apply to retrieve the casing. The estimated overpull for as-logged conditions compared to 100% free pipe is shown in the blue trace, indicating friction drag effects due to bonding measured by the logging sensors.

For further information about the Halliburton BPET service, see paper SPE-174777-MS.

Density-neutron count rate responses for annular materials commonly found in abandonment well conditions.

Rig-pull predictions modeling of rig applied-tension profile to extract cut casing based on BPET log evaluation. Arrows show actual extraction overpull applied compared to predicted estimate on blue trace above.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

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