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Real-time 'kick' monitoring can help prevent blowouts

BY GARY BEERS • FOR ENERGY PIPELINE

Gushers are signs of failures — not successes.

We vicariously enjoy movie scenes when a well gushes oil and showers characters such as those portrayed by James Dean in "Giant" and Daniel Day-Lewis in "There will be Blood." Under authentic settings, gushers often were viewed from a distance (Figure 1). However, to oilmen, a gusher is a dramatic sign of failure with an accompanying loss of valuable oil, expensive equipment, and — in many instances — a loss of roustabouts.

Many formations contain gases, oil, and water under high pressure and these start flowing, or blow out, when or after a well has been drilled through the formation. Blowouts of water are artesian wells and blowouts of oil are gushers.

NEED TO CONTROL WELLBORE PRESSURE

When drilling oil or gas wells, rig operators maintain wellbore pressure above adjacent formation pressure to avoid blowouts. In cases where wellbore pressure drops below formation pressure, a kick occurs. This is an early sign of a potential blow-out and the operator needs to take steps to "kill" the kick before it

evolves into a dangerous blowout.

Operators rely upon management of the drilling mud flows to identify and mitigate kicks. During drilling, heavier mud is used to increase wellbore pressure and, in some instances, blowout preventers are installed to shut the well until the pressure stabilizes. During tripping, or periods when drillstring is out of the hole, the operator adds supplemental mud to compensate for the void caused by this removal.

A basic introduction to causes of kicks, detection methods, and corrective actions is available in an article by Schlumberger engineers ("Improvements for Kick Detection," Oilfield Review, Volume 2, Issue 1, pages 43-51, 1990).

This traditional approach relies upon surface measurements on the rig floor to identify a kick that has occurred several thousand feet below.

This time delay is critical and limits the operator's ability to promptly mitigate the potential impacts of a kick.

REAL-TIME MONITORING OF KICKS AT DRILL BIT

Engineers at the National Energy Technology Laboratory (NETL) and at University of Southern California have developed a conceptual method for early, low-cost kick detection by using geophysical measurements from while-drilling instrumentation located near the bit (Kick Detection



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Figure 1. Gushers such as this maybe combined with the term "Eureka!" in the movies, but they really are signs of failure, not success.

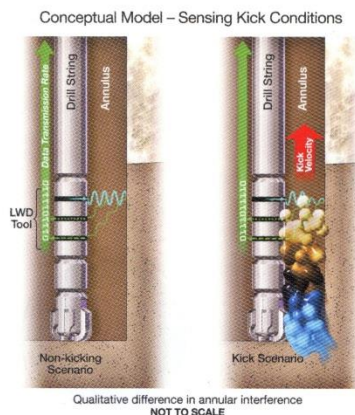


Figure 2. This depiction shows a simulated scenario developed for a gas kick occurring in a well.

equipment and these results synthesized into a scenario that was considered typical for oil and gas exploration wells. The graphic depiction of this model scenario is provided as Figure 2.

NETL reports that no modifications or additions to the drillstring are necessary to implement this technique.

at the Bit: Early Detection via Low Cost Monitoring, NETL-TRS-2-2016, EPA Technical Reporting Series, U.S. Department of Energy, June 2016).

According to this report, the viability of this approach was tested with a simulated scenario developed for a gas kick occurring in a well. Literature was reviewed on local properties of annular fluids and data telemetry

The prime advantage of this real-time approach is the time required to inform operators of a kick. The NETL report states: "Initially kick travel time is faster than kick detection time because of the data transmission limitations inherent in mud-pulse telemetry. For the given set of parameters, the break-even depth is approximately 800 feet. Beyond this depth, the kick detection time is faster than kick travel time. For the depth of typical exploration wells, which is approximately 6,000 to 7,000 feet, the time advantage presented by the kick detection method is significant.

For the given parameters the Estimated Method Detection Time is approximately 75 seconds, and the Estimated Kick Travel Time is approximately 1,000 seconds. The difference between these two values represents a significant time advantage for the well operator to take steps to avert any further loss of well control."

In other words, the well operator would receive a warning in 1.25 minutes and there would be a predicted 15.4 minutes before the kick reached the surface – ample time to implement a mitigation measure.

NEXT PHASE OF COMMERCIALIZATION

In the Available for Licensing announcement, NETL states:

"The technology is available for licensing and/or further collaborative research. Currently, NETL is looking for a partner to provide additional datasets from unfiltered LWD, MWD, and/or SWD datasets to use in further algorithm development and validation. Collaboration on development of those algorithms, as many operator software systems are proprietary, would be welcome as well. NETL is also looking for a partner to test and demonstrate this technology in the field during drilling operations in a configuration that would allow for secondary validation of kick events."

When asked for a status comment, the Public Affairs contact for NETL replied:

"NETL has had interest from stakeholders. The kicks phenomenon our technology monitors and detects happens in almost all wells. So the broader the coverage we can get on the technology, the more likely we can translate it into licensing of the technology and a partner that will help accelerate its movement into daily use."

Any Interest from operators in the Wattenburg Field?

Given the Niobrara and other gas-bearing zones are moderately over-pressurized, with many instances of blowouts in the Fort Hayes Limestone member, one or more operators should assist further development of this valuable monitoring technique and supply datasets from their wells. ♦

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