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## **Extreme Production Logging in Long Horizontal Wells with High Flow Rates using Downhole Tractors**

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### **Abstract**

Some of the most important aspects to consider during the design, construction and productive life of a well are the amount and nature of the risks associated with the conveyance of downhole instruments to acquire critical formation-evaluation data while the hole is open, and downhole toolstrings needed to monitor or service the well after installing the completion and production hardware.

Wells with horizontal sections in excess of 5,000 ft present significant challenges to the existing well intervention methods and technologies; in particular, production-logging programs under high-production rates using downhole tractor conveyance have proven to be particularly difficult to plan and execute in these wells.

This paper describes the extreme conditions offered by these long horizontal wells, the underlying physics that support modeling of mechanical and hydraulic lift forces, the hazards present when conducting logging operations under flowing conditions using wireline and downhole tractors, the relevant conveyance risk-reduction technologies and methods to successfully plan and execute these extreme operations.

To demonstrate the operational merits and practical aspects of the methods and solutions presented, a case study based on a real operation is included.

### **Introduction**

Over recent years, as oil companies found significant financial merits in the construction of long horizontal wells, drilling and completion companies successfully developed technologies and procedures that made them possible. Some of the wells being drilled today include horizontal drains in excess of 10,000 ft, as those listed in the IPTC paper 11567 (E. Pradié, 2007).

One of the most critical monitoring and diagnostics operations in these wells requires characterizing downhole production profiles with specialized production-logging tools that are designed to perform in horizontal wells with multiphase flow, as the one discussed in the SPE paper 63141 (D. Chace 2000). While performing these intensive data-gathering (logging) operations, the downhole instruments transmit large amounts of data, some of which the operator uses to optimize the instruments configuration and operational sequence, making electrical wirelines a necessity. Although proven wireline conveyance methods such as coiled tubing or downhole tractors already exist for high-angle and horizontal wells, these methods experience significant challenges in long wells since they were originally designed for use in much shorter horizontal sections, i.e. 2,000-3,000 ft.

The following hazards are the most prominent when using wireline assisted by downhole tractors:

1. Unable to reach the target depth due to loss of tractor traction, debris in the well and/or high flow rate
2. Wireline damage and cablehead failure caused by high torque, loss of tension, tension cycling, inadequate wireline-anchoring scheme and/or high flow rate
3. Toolstring pushed out of the well by excessive flow (toollift)
4. High wireline tensions while pulling out of the hole (POOH) that exceed the wireline safe-operating limit
5. Insufficient overpull capacity to free the toolstring if it becomes stuck
6. Downhole forces preclude the use of mechanical weak points to allow retrieval of only the wireline, if necessary