Remote Interference Monitoring of Offset Producers during Stimulation Operations

The drilling of horizontal wells is increasing rapidly throughout the oil and gas industry due to enhanced reservoir contact and thereby enhanced well productivity, especially in unconventional, ultra low permeability areas. It has become evident these low perm reservoirs will require multiple horizontal wellbores to be drilled on much tighter spacing than in traditional plays. In the last several years hydraulic fracturing has advanced, and using horizontal, multi-stage fracturing has become a common process. This has caused concerns with many operators as an adjacent producer to a well stimulation may be “knocked offline” or otherwise be affected by varying degrees of frac interference. Operators ultimately want to understand the severity of this communication / interference with nearby wellbores and how it correlates with well placement and frac design.

An interference/communication test can be used during the stimulation job to determine its affect on nearby offset producer(s). This is done by monitoring the wellhead pressures (shut-in or flowing), of the offset producer, during each frac stage. These studies allow operators to better understand the magnitude of interference in a given plane and develop a pressure versus distance calculation based on the resultant transient. With this data a more efficient fracture schedule can be put in place for the field. It can also be valuable information to have especially when fracing close to lease lines as interference problems could result in legal claims upon an operator.

Recently many customers have inquired about the SPIDR® gauge’s ability for remote communication. Operators want the capability to simultaneously watch pressures from offset wells during hydraulic fracturing. This would allow them to make rapid on-site decisions if needed, whether that be for production optimization purposes or for early warning of a need for remedial action. Halliburton has recently developed a way to supply remote communication for operators. We can now provide a radio communication system in conjunction with the SPIDR® gauge that simultaneously monitors up to two offset wells. This radio communication system facilitates the delivery of pressure responses from the monitored wells to the frac van for real time observation.

The remote radio communication system requires the following:
1. SPIDR® gauge(s)
2. Base station radio with antenna
3. Radio with antenna for each offset well
4. Laptop computer for USB connection to base station

The SPIDR® gauges are rigged up to the offset well following the normal installation procedure. The SPIDR® gauge is then connected to the radio through the SPIDR® gauge communication port. The base radio station is setup inside the frac van on location and is connected to a laptop supplied by Halliburton via a USB cable. The base radio station communicates through radio transmissions to each offset well. A Halliburton representative is sent to the location to ensure proper installation and confirm the system is working properly after which the system operates unattended by Halliburton personnel. Figure 1 displays the schematic for the remote radio communication system. The maximum reliable "line of sight" distance tested from base station to each offset well is one mile. If there is not a clear line of sight between radios, communication may be disrupted, although the use of extended antennas will aid in these situations. The communication system is battery operated and can operate up to 60 days.
Halliburton recently conducted a field trial for an operator in the Eagle Ford shale. The operator requested to have real time pressure readings from two producing wells during the frac job using our radio communication system. The SPIDR® gauge was connected to both wells during the stimulation of the nearby well. One of the offset wells was 1000 feet away while the other was 3000 feet from the active well. The readings from the two offset wells were sent to the base station where the pressure could be monitored from inside their frac van. The SPIDR® gauges were preprogrammed to send a reading every 3 seconds, however the SPIDR® gauge is able to record a data sample per second if necessary. There was a strong signal from one of the offset wells, but a weak signal from the well that was further away. This was due to the positioning of the antenna on the frac location, which was causing the signal to be blocked by the frac tanks. Halliburton has fixed this issue for future jobs and will now provide a portable mast that allows us to extend the antennas on the observation wells and the frac van. Overall, the customer was pleased and the remote communication system was considered a success.

Horizontal, multi-stage fracturing is now a common practice and as a result of this, we will continue to detect interference/communication on nearby wells. Therefore understanding the severity of the communication will be essential. If well placement isn't carefully considered during well planning, production could be affected. The SPIDR® gauge system with remote radio communication allows operators to monitor adjacent producers and send real time pressure readings to the frac van during stimulation operations to monitor interference. This system offers a low cost, no risk approach to providing operators with the ability to closely observe specific pressure responses during each frac stage. The SPIDR® gauge allows detection of the smallest pressure change possible without wireline trucks or well intervention. Please contact Halliburton for rental availability of the remote communication radio system.