Realizing flow assurance through clamp on production surveillance

Arran Davidson, Meters
Carolina Uribe Stopkoski, Meters

Operators are increasingly focused on implementing a proactive flow assurance strategy, to minimize any potential interruption to hydrocarbon production. Failure to implement an adequate strategy can not only lead to unplanned production outages, it can lead to further compounding issues including formation blockages, which will require costly intervention and/or remediation activity.

In the production phase of the lifecycle, having a stronger understanding of flow behaviors can lead to proactive decision making, resulting in improved overall flow assurance. This approach includes a range of portable metering technology, which can be deployed quickly and cost effectively, to a range of brown field, mature infrastructure and new build facilities.

Delivering improved flow assurance

Monitoring of individual well production and flow performance through the associated piping network, provides critical data to validate flow assurance models and implement associated improvements. Where infrastructure is already in place, the use of traditional, in-line flow measurement technologies is challenged by a number of factors; obsolescence, turn down, change in fluid properties and operability. The repair and/or replacement of existing inline flow metering can be cost prohibitive.

In an effort to provide operators and asset managers with a means to manage flow assurance, Expro developed a range of non-intrusive clamp on SONAR flow meters: ActiveSONAR™ & PassiveSONAR™. The company successfully deploys these meters globally for the surveillance of naturally and artificially lifted production wells, water and gas injection wells, and monitoring of midstream process applications (2).The clamp on design and measurement principle offers flexibility in meter placement and application suitability, as they can be installed on existing pipework, on a temporary or permanent basis, with no process shut down (chart 1). The technology's flexibility means that the flow meter can be applied in a variety of monitoring applications, including both single and multiphase flows, which allows the technology to be applied to both upstream and midstream applications – from wellhead to separator.

Providing multiphase measurement

Sonar meters measure the velocity of the mixture flowing through the pipe. Production optimization of the well typically requires the knowledge of individual phase rates - produced gas, oil/condensate and water. Expro has developed the Total Production Surveillance (TPS) system, incorporating PassiveSONARTM and/

or ActiveSONARTM meters, for multiphase reporting of black oil (naturally flowing, electrical submersible pump (ESP), gas lifted) and gas condensate production wells (3). The TPS system leverages a combination of PVT models and multiphase flow correlations for production surveillance, where flow assurance is critical.

Individual well production surveillance

Identifying and understanding the performance of each production well and how hydrocarbons flow through the surface piping and process plant, is critical in assessing and managing potential flow assurance issues. Production trends and flow rate management has become a leading focus in the flow assurance cycle, where identification of underperforming wells enables operators to address potential decreases in production early on.

The clamp-on sonar flow meter was successfully deployed for field-wide surveillance on Centrica Energy's North and South Morecambe fields, which are among the largest in the UK Continental Shelf in terms of original reserves (4). They consist of a central production facility, alongside several Normally Unmanned Installations (NUIs), with no individual well surveillance or export metering. The operator was experiencing measurement issues, leading to errors in back allocation calculations. Retrofitting Expro's ActiveSONARTM meters onto the existing pipe network provided a cost effective solution that facilitated the delivery of real time flow assurance data, at the central production platform and onshore.

The wells were liquid loaded, compounded by halite buildup across the perforations, which if left untreated would often kill the well. Remedial action involved calling out a coil tubing unit and nitrogen lift, to unload excessive liquid from the well bore.
The ability to monitor production rates in real time, allowed the operator to proactively manage the well unloading and, where possible, avoid the requirement for costly well intervention activity. The real time production data also allowed the operator to optimize the duty cycle between flowing and shut in, a technique used to promote liquid unloading from the wells, which resulted in a net gain of doubling peak production from those individual wells (chart 2).

Forty four ActiveSONAR meters have now been installed in Centrica Energy's platforms in the UKCS to date, and in operation since 2010.

Optimizing gas lift

Operators must balance the benefits of maximizing liquid production from a gas lifted field, versus recycling the lift gas and constraining the pipeline network capacity. Expro's meters have recently been utilized in a brown field, onshore field in North Africa, where the operator was trying to maximize liquid hydrocarbon recovery from individual wells.

Comprising a large, comprehensive and distributed pipeline network, the field has been in production for over thirty years and the wells are now flowing below bubble point. A temporary, sonar meter is being used to monitor gas lift injection rates during production testing operations, to establish a set point (chart 3) for gas lift and achieve maximum hydrocarbon liquid production rates (chart 4).

This gas lift optimization can in some instances result in a net increase of +/-10% of liquids on a well by well basis, which could equal around $500,000 per well per year. A further benefit also includes a reduction in lift gas, which increases capacity within the production piping for additional produced liquids and associated gas. The meters are also being used in this field to optimize gas injection distribution and for water injection for pressure support.

Flexible approach

In a lower for longer price environment, non-intrusive metering technology will have a growing and essential role to play in providing flow assurance surveillance solutions, which captures critical data and enable companies to make the most informed production optimization decisions.

In brown field applications, where production rates and fluid properties have changed, it allows operators to collect real time measurements, update their flow assurance models and validate new strategies.

Sonar meters operate in both single and multiphase flow regimes, offering a single technology platform in which to implement field wide surveillance in support of flow assurance. Simultaneous measurements from wellhead, flow lines and process equipment allow for a visualization of the interdependency of various “nodes” within the well and production network. Any consequence of change can be observed simultaneously at a system level rather than just a discrete point within the network. A change to a production choke at the wellhead may take hours or days to ripple through the network and validate that change.

The clamp on nature of the meter offers either a permanent retrofit to an existing or new build facility, for long term monitoring of flow assurance strategies, or as a temporary portable tool to provide real time diagnostics where flow assurance issues are suspected.

Offering this flexible approach to metering is increasingly important, as operators continue to develop and refine their plans for a cost effective flow assurance strategy.

First published in Harts E&P, August 2016