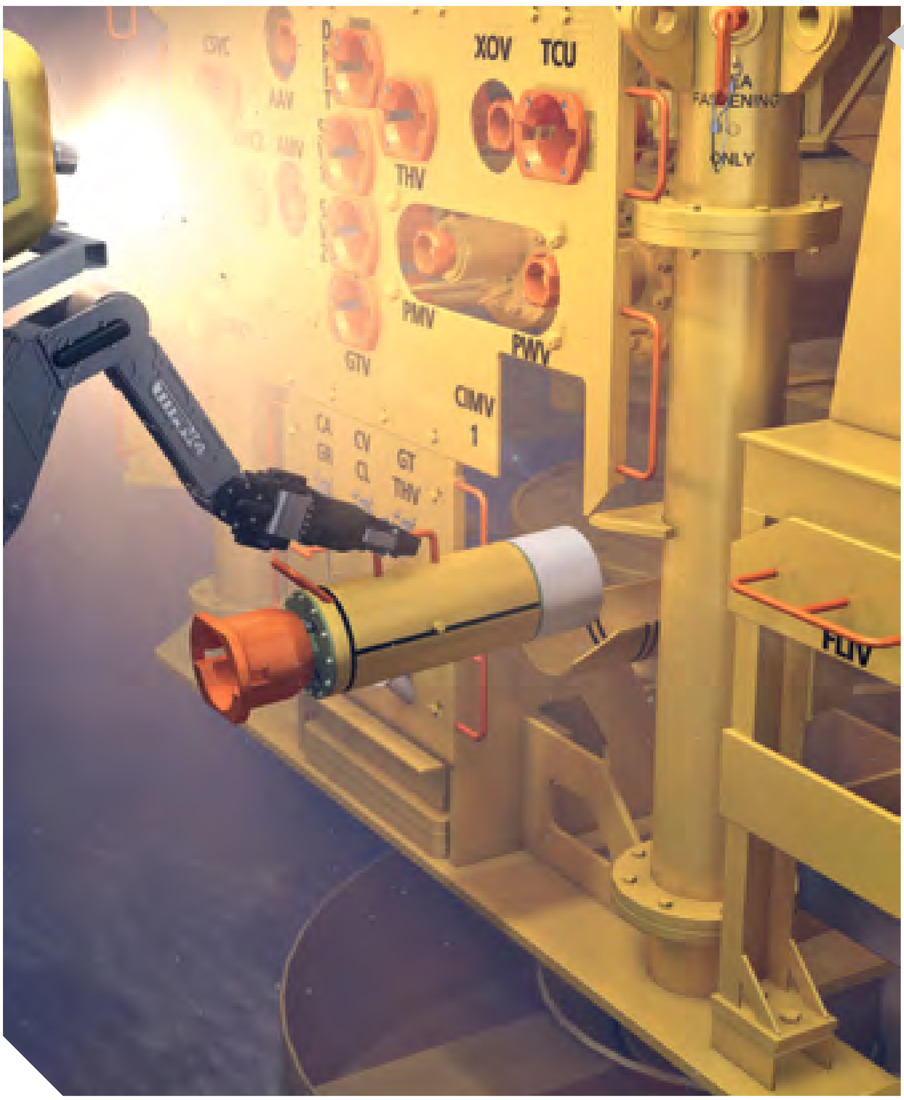
Point of no return – **injection accuracy**



In the subsea environment, accuracy of inhibitor dosage is paramount. The PULSE LF CIMV increases flowmeter accuracy and inhibitor dosage. Image from Schlumberger.

The dawn of ultrasonic flowmeter technology increases chemical dosage accuracy, says Cameron's David Simpson.

For low-dose inhibitor (LDI) injection on long step-out, deepwater tiebacks or satellite wells, the subsea chemical injection metering valve (CIMV) is the point of no return. Pinpoint accuracy of injection is not only critical to achieving full inhibition, it can save operators from pumping large volumes of excess chemical over the life of the field just to protect from chemical injection flowmeter inaccuracy. A typical field in which LDIs were injected at 2 L/h into 12 wells over a 20-year field life could become over injected by as much as 3-4 million liters of excess chemical based on the selection of CIMV technology.

In long step-out deepwater projects with complex system architectures, LDI injection and control can be problematic. Subsea distributed chemical injection is often best suited to address the flow assurance challenges of these wells, but requires greater control and accuracy over levels of LDIs being added, at multiple points, into the flow.

Effects of incorrect chemical dosage

Problematic and costly repercussions can occur should the inhibitor dosage be over or under the optimum application rate. Reasons for under- or overdosing are often tied to chemical injection flowmeter accuracy, which can be heavily influenced by the properties of the injected chemicals. Under injection of treatment chemicals can result in scale or paraffin buildup in well production strings or pipelines, lowering the production rate. If the scale or paraffin exist in the line for an extended time period, the well may have to be shut in to undergo a batch treatment, incurring deferred production and intervention costs. Where corrosion inhibitors are being injected, subsea umbilicals, risers, and flowline (SURF) facilities can, in severe cases, be taken offline until failed components are replaced.

In the case of overdosing, chemical excess costs can be significant and the additional chemical tanks take up valuable deck space on the platform. For instance, a company could spend more than US$1 million to overinject just one well over the life of the field. Furthermore, excess levels of LDIs in the export crude may affect its value at the refinery. Over the life of a field, accurate flow measurement and control of LDI injection could reduce operational expenditure by tens of millions.

The challenges of metering LDIs

With LDI injection, particulate blockage is a recognized cause of CIMV failure; this blockage is partly caused by the extremely low required injection rates, sometimes less than 0.5 L/h [3.17 gal/d] and the fact that particulate contamination can be introduced into the chemicals during transport, storage, and subsea distribution. These particulates can block moving parts inherent to many flowmeter and CIMV designs.

Traditional flow measurement technologies used in subsea chemical injection metering valves typically use Venturi-type flow measurement. Inaccuracies in flow measurement can stem from particulate contamination and blockage in the CIMV and from the fact that CIMVs are engineered years in advance of being put into service, often with limited knowledge of the chemicals to be injected. Such events render the CIMV as being not properly tailored for the chemicals being used, and ultimately, potential system under performance occurs.

A new dawn in CIMV flowmeter design

The latest low-flow CIMV flowmeter design delivers accuracy better than +/-2% of reading for LDI injection compared to the industry standard Venturi-type flowmeter that may only deliver accuracy of 5-10% full scale. Launched at OTC 2016, the new Cameron PULSE LF low-flow ultrasonic chemical injection metering valve features a microbore nonintrusive, line-of-sight ultrasonic flowmeter. Featuring no moving parts, the flowmeter delivers debris-tolerant flow measurement, is chemical independent with a very low native pressure drop, and does not require subsea filtration. Developed to address the complete LDI chemical injection portfolio from 0.25 L/h to 600 L/h [1.6 to 3800 gal/d], this flowmeter is combined in closed loop control with a throttling valve, providing a self-regulating device requiring only one user-defined input—low rate.

The PULSE LF CIMV's flowmeter addresses the key limitation of present LDI chemical injection technologies—sensitivity to blockage. The flowmeter is particulate tolerant, meaning that contaminated fluid can easily pass through the unrestricted flowmeter tube. It also provides consistent high accuracy of reading independent of changes in chemical properties such as viscosity, and reliably measures chemical inhibitor flow rate. Real-time feedback from the flowmeter enables autonomous control of the throttling valve, maintaining a user defined injection rate set point indefinitely regardless of up- or downstream system disturbances.

Packaged as an ROV-retrievable device with onboard diagnostics, the PULSE LF CIMV enables full inhibition without the risk of under- or overdosing. Operators now have the option to reliably deliver LDIs via cost efficient subsea distributed chemical injection systems with precision regardless of chemical properties or contamination, giving them the option to make chemical decisions independent of the installed hardware. OE

***David Simpson** is the subsea product manager for Surface Systems, Cameron, a Schlumberger company, a position he assumed in 2008. With 19 years' experience, he has worked offshore, in product design as principal subsea choke design engineer, as a technical account manager, and in product management. He launched the Cameron initial low-flow CIMV technology in 2007, and the third generation medium- and high-flow designs in 2010. Simpson is a chartered engineer with an honors degree in mechanical engineering from the Dublin Institute of Technology.*