WORDS: INDRAJIT SEN

# COMBATTING THE CORROSION CURSE

**As the financial impact of corrosion on the oil and gas industry – thought to be in billions of dollars in losses each year – is realised by operators, rusting management products and services providers are swooping in to cater to the needs of the upstream sector**

In the prevailing circumstances, caused by the downturn in the oil and gas industry, upstream operators across the globe are striving for operational excellence and are adopting measures that focus on optimising existing assets, as opposed to acquiring new ones. This naturally implies that oil and gas equipment, drilling platforms, tools and manufacturing units in use are being subjected to more wear and tear than ever. Rigs and machinery – particularly in the high corrosion sectors – are rusting rapidly, thereby burdening companies with increased expenditure on maintenance.

Subjected to the duress of the low oil price era, when energy players are striving to do 'more with less', corrosion control thus assumes paramount importance. Although a natural phenomenon, corrosion, if left unchecked, has the potential to not just render equipment useless but also potentially halt or damage entire operations.

Certain upstream segments within the oil and gas industry, are far more exposed to corrosion than the rest – the sour gas and offshore sectors for instance. ↓

"Corrosion today is a major threat to the integrity of production assets upstream. The most common areas for corrosion monitoring in upstream oil and gas production is the production flowline, water injection systems, and import and export lines," Kjell Wold, global business development manager, Roxar Flow Assurance, at Emerson Automation Solutions, says.

"The causes of internal corrosion vary from pipeline to pipeline, depending on the product being transported, but it's normally linked to the presence of water and the use of carbon steel. Since water is heavier than oil or gas, corrosion is often found at the bottom of pipes, where access is particularly challenging for most monitoring technologies. Changing process conditions, such as lower flow rates, also increase the probability of water holdup," Wold says.

Philip Horsford, the regional manager for Cortec Middle East says it is important to understand and gauge the detrimental impact of corrosion in the first place. "To put this into context, five metric tonnes of steel is degenerated every second worldwide. Accordingly 40% of all produced steel is used to replace corroded steel! That's a lot of corrosion and an important challenge to address," he states.

"Corrosion is simply nature's way of reversing an unnatural process back to a lower energy state, when a metal corrodes or deteriorates it cannot hold the same loads as it did before corrosion began. Preventing corrosion is vital in every step in the production of oil and gas," Horsford comments.

Over the years, several attempts have been

# $1.372BN

**THE GLOBAL ANNUAL COST OF CORROSION IN THE OIL AND GAS INDUSTRY IS ESTIMATED TO BE $1.372BN.**

↑ Oil and gas operators today are resorting to the sterling corrosion control portfolio of various service providers, to curb the menace.

↗ Kjell Wold, global business development manager, Roxar Flow Assurance, at Emerson Automation Solutions

↗ Philip Horsford, regional manager, Cortec Middle

made by industry bodies and stakeholders to estimate the financial blows of corrosion, specifically to the oil and gas industry. In 2016, NACE International published its 'NACE Impact' study, which indicates the global cost of corrosion to be $2.5tn, which is equivalent to 3.4% of the global GDP (of 2013). The global annual cost of corrosion in the oil and gas production industry is estimated to be $1.372bn, broken down into $589mn in surface pipeline and facility costs, $463mn annually in downhole tubing expenses, and another $320mn in capital expenditures related to corrosion.

In a corrosion management report, the UK's Energy Institute ranks corrosion as the second most frequent cause in initiating loss of hydrocarbon containment in offshore platforms, and highlights it as a major threat to asset integrity and plant efficiency. In the UAE alone, the annual cost of corrosion was estimated at $14.26bn in 2011, with most of the cost relating to the energy industry. Additionally, in the US, the corrosion-related costs are estimated at $7bn to monitor, replace, and maintain these assets, with the maintenance costs accounting for 80% of this cost.

The Saudi Aramco Journal of Technology also estimates that as much as 36% of all maintenance costs in refineries can be linked to corrosion remediation and repairs and, according to Honeywell, up to 50% of all pipeline leaks are down to corrosion. A Kuwait study specifically undertaken by NACE in 2016, indicated that the cost of corrosion to the country's industrial sector was 1.2% of GDP, which translates to an approximate loss due to corrosion for the Middle East's industrial sector of $34.2bn.

Helena Seelinger, chief regulatory and public affairs officer at NACE International Institute, mentions that NACE's 2016 International Measures of Prevention, Application, and Economics of Corrosion Technology (NACE IMPACT) study also suggested that by using available corrosion control practices, it is estimated that savings of between 15% and 35% of the cost of corrosion could be realised; i.e. between $375bn and $875bn annually on a global basis.

As such oil and gas operators today are resorting to the sterling corrosion control portfolio of various service providers on offer in the market, to curb the menace. LUX Assure's primary corrosion offering relates to improving corrosion inhibi-



From left to right: Helena Seelinger, chief regulatory and public affairs officer at NACE; Remko Knol, general manager of Frames Separation Technologies; Alex Lattimer, product line director at Flexitallic

tor management. For many systems, corrosion inhibitors are the front line in the defence against corrosion, forming a film on the metal surface that protects from corrosion processes.

"We have developed a product, called CoMic, for film forming corrosion inhibitors; example quaternary amines and imidazolines. We gather data on the presence of the corrosion inhibitor in field fluids and use this to recommend to the operator whether the management of the chemical is appropriate, and if it is being optimally dosed. The technology is patented and uniquely available from LUX Assure. It's been deployed across the world, with the GCC a key market," Emma Perfect, CEO of LUX Assure, tells *Oil & Gas Middle East*.

"LUX Assure has also developed an operator deployable product - to enable the operator to conduct the initial on-site testing regime. We provide the initial training on the system, which allows the operator to become proficient with the equipment. Using our CoMic system can also help the operator achieve its target to upskill and retain key technical staff," Perfect says.


Emma Perfect, CEO of LUX Assure.

"In 2013, Flexitallic started a collaboration to help a major oil and gas company to prevent flange face corrosion by replacing their standard graphite-filled spiral wound gaskets with Thermiculite," Alex Lattimer, product line director at Flexitallic, says. "The success of this project led to the development of Corriculite as an improved and cost-effective solution for corrosion-sensitive environments."

"Corriculite, the new industry standard, responds to the latest end user demand for gaskets, with strong anti-corrosion characteristics. It has been specifically formulated for use in upstream applications. Corriculite is fire safe complying with the industry recognised fire test standard API 6FB," Lattimer adds.

Certain upstream segments within the oil and gas industry, are far more exposed to corrosion than the rest – the sour gas and offshore sectors for instance. "Nowadays, more sour and high pressure/high temperature reservoirs are in production. Corrosion increases with higher temperatures, presence of H2S and CO2 (sour service), and salinity, but also increased presence of production water (PW) in current oil production; PW can be five times more saline (thus containing salt) than seawater," Remko Knol, general manager of Frames Separation Technologies, tells this magazine. "Typically, systems are designed for sour service and presence of H2S; like the Inconel cladded pressure vessels for Separators and Treaters like for Kandym. Many produced water treatment that we supply are in stainless steel and are commonly used as Duplex stainless steels."

With regards to the offshore segment, Perfect says: "There are indeed specific challenges to offshore corrosion management and these will

↑ Non-intrusive Field Signature Method corrosion monitoring of a pipeline powered by solar panels.

grow as offshore exploration moves into deeper and more hostile environments. Components which have enhanced resistance to the effects of corrosion are expected to become more prominent."

"From LUX's point of view," she adds, "the offshore challenge isn't just one of harsher conditions but also more difficult logistics in mobilising the assets to assist. It can be more difficult to secure helicopter and bed space, and access to on-site laboratories of sufficient size, when compared to working with onshore systems."

Industry players believe that corrosion management efforts in the Middle Eastern oil and gas industry is at par with the global standards, but more awareness among regional players would improve the corrosion containment capabilities. "We believe that the focus on corrosion and corrosion management in the GCC region is good. However, with some clients, we believe that more awareness of technology updates and the benefits of the range of technologies and solutions available, could only add value to their integrity management programmes," Wold says.

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> KJELL WOLD OF EMERSON AUTOMATION SOLUTIONS.

"Cortec runs awareness sessions with its clients to educate them on the available options from FEED design through to mothballing," Hosford says. "Proper consideration to corrosion management in design and manufacturing/construction phases can significantly decrease operation and maintenance cost over the life of the many assets."