Improving integrity for the well life cycle

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Well integrity presents complex global challenges for the offshore oil and gas industry. With major operators and service companies often holding the shared expertise to deliver bespoke solutions, collaboration and knowledge exchange is integral to managing well integrity now, and in the future.

Recent estimates suggest that 34% of wells in the UK, and 18% in the Norwegian North Sea have integrity issues (*SPE and Norwegian Petroleum Safety Authority*). Globally, 760,000 wells are affected by well integrity problems – resulting in 19% of these being shut-in. (*OTM Consulting 2009)*.

For fields in long-term decline, operators are challenged with how to tackle a decrease in production and maximise the potential of reserves. However, extending field life only increases the scale of well integrity issues to be managed, particularly given the age of wells and ever-increasing regulatory requirements. Whilst mature brownfield assets are the traditional focus for such issues, the well integrity of new wells cannot be ignored - particularly in challenging environments such as HP/HT or deepwater.

The need for better collaboration between service companies and operators has been widely discussed and it is important we act upon this now, for the future security of the industry.

Historically, operators have worked closely with both equipment manufacturers and service companies, inciting an ethos of partnership whilst still looking inwards for a solution. However, to truly open dialogue and maximise opportunities across the sector, operators could also consider partnering with one-another to collectively share valuable information and expertise. In order to take the issue to the next level, it is vital that this dialogue opens up.

Well life cycle

Well integrity issues are caused by a number conditions; age and field maturity, incompatibility of well metallurgy with well fluid, casing condition, cement-related failures, tubing corrosion, active tectonic areas and poor maintenance.

A leading factor in well integrity is the environment in which the tubulars exist. This is subject to corrosive fluid and high pressures/temperatures, which can cause tensile or compressive loads. Engineers must assess whether the well has been designed for variations in reservoir properties, which can change over time, particularly as more water or gas is produced.

Other aspects include wellhead seal designs (and their compatibility with the environment), casing stability in the surrounding formation, and breaching of casing from subsurface movements.

If well integrity is breached, well intervention can be required to rectify the problems. However the frequency or type of well intervention can score tubing and in some cases, cause corrosion to be accelerated. Such breaches, whether these stem from eroded tubulars, leak paths in threaded components or failed well control equipment, undermine well integrity and performance throughout the lifecycle.

This is traditionally where service companies such as Expro provide technical support and assistance in terms of tools, solutions, services and future planning. This may involve well inspection using downhole video cameras, mechanical callipers, leak detection services and well barrier monitoring, allowing them to pinpoint leak paths and undertake remedial corrective action.

Unlocking revenue

The overarching drivers behind the push on ensuring well integrity are health, safety and environmental legislation. This includes providing a well integrity management system that identifies issues, recommends solutions, and creates a clear audit trail of documentation that meets company and regulatory requirements.

However, the direct impact well integrity can have on an organisation’s profitability cannot be ignored. Proactively planning or restoring a failure in well integrity can unlock key revenue. In purely economic terms, well integrity issues currently costs operators $1.1bn per day in lost production revenue *(BP Statistical review of world energy 2010; US EIA-28, 2009; OTM Consulting 2011).*

Even when CAPEX constraints are in place, operators will return to focus on optimising production from existing well bores through applying effective intervention techniques – or in some instances, revisiting temporarily abandoned wells.

Irrespective of the drivers, early involvement in planning from a service company perspective is absolutely crucial in order to provide bespoke design, delivery, implementation, management and support of well integrity requirements. This extends from onshore management, expertise and systems through to well site services, supervision and support.

In terms of well intervention technologies, and subsea in particular, the industry still needs to actively collaborate to ensure the highest value technology is delivered and implemented. Service companies traditionally develop technology to meet clients' needs as and when required, or depending on the demands of specific projects. But our industry has a poor record in terms of adopting of this new technology.

It is acknowledged that in the North Sea over the past 40 years, the region has been a driver of subsea, deepwater and ultra deepwater developments in technology. Certainly in the UK North Sea, this innovation has led to extended field life, increasing production and revenue far beyond initial expectations.

Despite a recent push on technology goals in countries such as Norway, where accelerated development has now moved to 8-10 years, the average time from concept to market penetration of new technology in the oil and gas industry worldwide has been estimated at 16 years - with certain areas including the UKCS taking significantly longer (Scottish Oil & Gas Industry Leadership Group, Strategy 2012-2020).

If real collaborative efforts were made, the significant risk to services companies - that R&D spend will not realise return on investment – would be reduced. For the operating community, this approach would also ensure optimal technology is delivered to successfully complete key projects.

The issue comes back to access to finance and the real need for significant capital investment and commitment to develop technology. It is essential that the industry works together and moves forward on a partnership basis to ensure alignment. Operators need assurances that solutions can be provided that will fill demand, and service companies need commitment that technology, once developed, will be deployed successfully.

Predictive methods and intervention for optimum value

In recent years, we have moved towards proactive diagnostic campaigns, with the level of reactive vs. proactive well integrity differing between geographical areas. Certain companies have legislation that requires a well management system, but the majority do not and as a result, often adopt a reactive approach.

In terms of corrosion modelling, the use of proactive mapping and data can play an important part. However, to achieve an accurate picture, this must be validated by real-time data attained through well interventions.

With a clear line between well integrity and revenue, commitment to this issue now forms a key part of strategic planning and budgets, with wells subjected to annual and independent audits that provide key performance indicators for future planning. Service companies have rightly identified this area as a growth market sector and have developed sophisticated solutions to address the issue.

Moving from purely data gathering, there is now a collective push to effectively use this ‘big data’ and feed it into intervention methods in order to bring operators closer to the reservoir. It is important that the industry works together in synergy to gather data, analyse the information and apply solutions in terms of tools, technology and people, in a streamlined process.

This trend is reflected in the recent re-launch of Expro Group’s Integrated Services (EGIS) which aims to provide a holistic well integrity management solution in terms of well integrity, well technology, reservoir and petroleum engineering capabilities.

Expro’s tailored software system, SafeWells™, was developed directly with clients, openly collaborating via a regular ‘User Forum’ to assess the needs, risks and gaps in solutions of both independent and multi-national operators. The highly flexible software allows the monitoring of maintenance and associated remedial actions, risk assessment needs, dispensations and changes in the well operating envelope.

Operators can therefore plan production and well intervention activities safe in the knowledge that they are compliant with policies, whilst being able to demonstrate production forecasts by tracking their wells’ status.

Integration across services companies, equipment providers and operators, not only ensures that specialist skills and technology is developed and retained by the industry, but that these areas link together in order to achieve a joint positive outcome.

This is an ethos echoed by Sir Ian Wood in the UKCS Maximising Recovery Review Final Report (Feb 2014) which highlighted that the sector must continue to be led by the operators who provide the significant investment of funds. The report also pinpointed the lack of co-operation as a key issue leading to increased costs and delays, calling for a regulator that would be the catalyst for 'facilitating, co-ordinating, mediating and promoting collaboration' to take the industry forward positively.

While legislative and HSE requirements remain at the forefront of the issue of well integrity, operators are ultimately responsible for maintaining their assets to optimise production. Despite this, the loss of well integrity should be considered an industry-wide issue with clear implications on the economic health of the sector.

Together, service companies and operators are collectively responsible for ensuring that the systems knowledge, competency and technology to achieve this is available and deployed to manage well integrity as professionally, safely and environmentally responsibly as possible.