TACKLING TUBULAR TRAUMA

Kris Earl and Juan Carlos Cunalata, Gyrodata, show how to maximise production through tubular integrity management.

Many operators in Latin America were forced to defer well maintenance during the recent industry downturn. Lost production and reduced budgets for workover programmes made it difficult to manage tubular integrity. These operators needed an easy, cost-effective way to identify tubular corrosion while maintaining production levels.

Tubular corrosion is caused by any number of forces, including pressure, temperature, wellbore fluids, and inhibitor choice (or lack thereof). Although the tubular design and manufacturing process has led to advances in casing and tubing strength, corrosion continues to be one of the leading causes of wellbore production decline. Single data set logs can identify the integrity of a single tubular string, but combining multiple data sets will provide a more accurate depiction of downhole conditions, improving tubular integrity diagnostics.

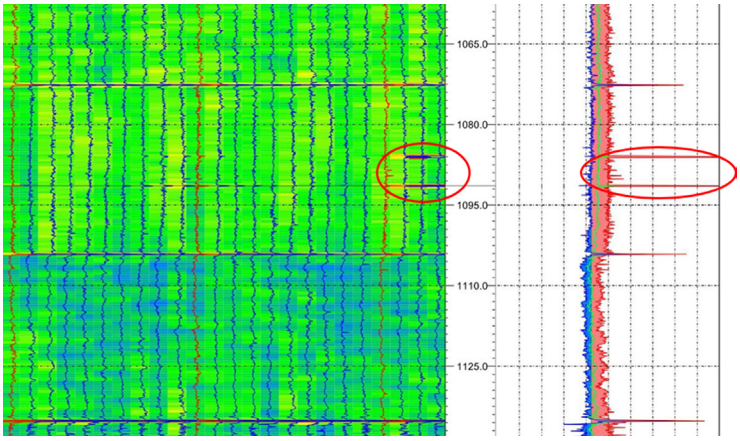

Figure 1. *Corrosion log indicated that tubular #36 has 96.5% and 100% penetration values.*

Figure 2. *Further analysis of the area with 100% wall penetration.*

Figure 3. *Tubular hole that correlates to depth identified in Figures 1 and 2.*

Table 1. Summary of corrosion log – tubing.

Tubular grade	Number of joints	Wall loss (%)
A	33	0 - 5
B	174	5 - 10
C	79	10 - 15
D	10	15 - 20
E	0	20 - 25
F	0	> 25

Traditional workovers are costly, requiring tubing to be pulled out of each well for scans on tubulars and casings, as well as for running casing integrity logs. Gyrodata offered a more cost-effective solution, enabling operators to accurately quantify corrosion on tubing and casing strings on electric wireline without removing tubing from the well.

For corrosion logging, the company runs multifinger caliper tools along with magnetic thickness detection logs. This solution proved to save operators time and cost. Identifying issues prior to bringing out the workover rig saved several days of downtime per well, giving operators ample time to order the appropriate tubular, patch, pumps and other production equipment ahead of time, as well as allowing the operator to view both tubular strings in one run to identify if the casing integrity was an additional issue across these areas.

Workover times for wells with corrosion logs run an average of three fewer days than wells that are just pulled for inspection. The logs also enable operators to identify high-grade tubing joints to repurpose across their most productive wells, maximising utility.

The multifinger caliper tool, with high-precision measurements of internal diameter, can detect any reduction or increase in the nominal ID of the tubulars as well as identify ovality issues. Reduction of the ID could be related to the material composition of the reservoir, such as paraffin wax, or pipe collapse due to external phenomena.

The magnetic thickness detection tool measures the thickness of the pipe based on the physical principle of electromagnetism. When an electrical pulse is fired into the transmitter, it creates a magnetic field around the pipe. This field allows the tool to detect the amount of ferrous material and therefore estimate the thickness of the tubular. This data is then processed to determine the loss of thickness, or in rare cases, increase in thickness, expressed in percentages.

The combined analysis and reporting from using both tools in the same run allows operators to draw solid conclusions on the integrity of the tubulars. Additionally, these logs can be run while the well is still in production, minimising the overall cost to the operator by having a very small impact on daily production totals.

Decreased production

An operator noticed a sudden production decrease in one of its most productive wells. Additional symptoms indicated a strong case for the damage in the tubing. The operator contacted Gyrodata to run a corrosion log to verify whether there was a hole in the tubing. The corrosion log identified general corrosion throughout the well and aggressive corrosion at several intervals in the production tubing, including 100% penetration – a hole in the tubular (Figures 1 and 2).

This corrosion log also identified several tubing connections with aggressive corrosion in the collar. The operator was advised to replace those joints to avoid separation of the tubular which would have required them to fish parts of the string from the well. The corrosion identified in the connection on the log was verified visually when the tubing was pulled several months later to address an ESP failure.

The operator chose to run a wireline-set tubing patch to eliminate the need to bring out a workover rig, saving an estimated three days of production time and US$25 000 of added expense. The ability to correctly identify whether the issue was a tubing or casing issue without having to bring out a workover rig to pull the well is estimated to have saved an additional three days of production time.

Tubular shortage

Due to deferred maintenance, there was a lack of high-quality tubulars in Latin America, forcing operators to start pulling high-grade tubulars from low-producing wells to keep the highest-performing wells online.

Originally, the operators were putting workover rigs on each of the wells and pulling all of the tubulars out to visually scan for usable joints – a costly and time-consuming task. Gyrodata ran corrosion logs in the lower-producing wellbores to help identify which joints of the tubing would be good candidates for use in other wells.

These corrosion logs were performed on 20 wells to identify the best candidates. Once the logging campaign was completed, only six of the wells logged were found to have enough high-grade tubulars left in them for use in other wells. At the average cost of US$25 000 per workover and scan using the previous system, it is estimated that using the corrosion logging service saved the operator US$250 000 in workover expenses. These savings allowed the operator to achieve their production goals without increasing or exceeding their approved budget. This process also proved to be far less intrusive and has a much smaller risk profile for HSE concerns than completing a full workover procedure.

Summary

As can be seen from the examples given in this article, Gyrodata's corrosion logging suite offers a cost-effective solution for operators by giving them the data necessary to make informed decisions. It also gives operators time to fully investigate their solutions while the well is still producing, minimising downtime.

Tubular corrosion is a well-known issue within the industry. Chemical inhibitors and advances in metallurgy have helped over the last several years, but challenges still remain. In the absence of well-specific solutions, identifying tubular and wellbore integrity will continue to be difficult for operators.

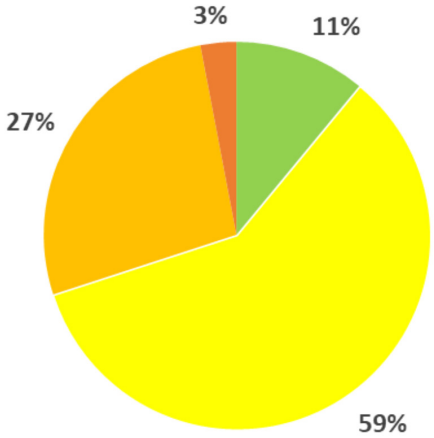

Figure 4. *The tubular grading overview with number of usable joints and percentage of well.*

Repetitive workovers on high-producing wells can lower the performance on a depth chart, marginalising overall well performance. These workovers also add a higher risk of HSE incidents and incurring associated costs. As prices for workover rigs rebound, the overall cost for these operations is continuing to rise. To maximise the profit from a producing well, operators must be able to make decisions about workover necessity and frequency based on real downhole data, not just intuition.

An average five day workover with a tubing scan now costs an operator around US$40 000. If additional logs need to be run at that point to identify the issues, additional spend will drive up that cost further. These figures do not even factor in the cost of lost production while the well is offline. Identifying tubular string corrosion quickly and accurately is paramount for cost-effective analysis.