Challenge
Corrosion of surface casing in onshore wells is a common problem throughout the Arabian Peninsula, so operators must periodically excavate around wellheads to inspect external casing. Though costly and time-consuming, this was until recently the only way to establish the competence of the surface casing, paramount for safe operations.

Solution
TGT has developed the ‘Multi Tube Integrity’ product as a cost-effective and efficient way to measure metal loss across multiple well barriers.

Until recently, diagnostic tools run through tubing have been able to evaluate the production casing but not the surface casing. Evaluating surface casing in this way required a workover. The operator of an onshore well wanted to assess the effectiveness of a new diagnostic system to evaluate the integrity of tubing, production casing and surface casing in a single survey, without the disruption of conventional methods.

The Multi Tube Integrity product is delivered by TGT’s ‘True Integrity’ diagnostic system that chiefly uses the Pulse technology platform to evaluate the wall thickness of multiple barriers.

Pulse combines advanced electromagnetic sensing and measurement technology with powerful modeling and analysis capabilities. Pulse features multiple coil sensors, each...
optimised by length and geometry to engage with a particular tube size. This enables it to assess the electromagnetic signature of each tube and so establish wall thickness variations. The minimum metal thickness loss levels that the Pulse platform can identify are a 3.5% reduction in production tubing, 6% in production casing and 12% in surface casing.

**Result**

Pulse analysis identified two zones of severe corrosion in the test well’s surface casing (Figure 1). Metal loss was estimated at 44% in the upper zone and 38% in the lower zone.

Subsequent excavation revealed severe corrosion equivalent to a 50% metal loss that confirmed the Pulse result. Following normal procedure, the excavation would have stopped at 12 ft depth and the inspection team would not have observed the second zone of corrosion.

Validation of the Multi Tube Integrity method for three-barrier corrosion assessment has had a positive impact on the operator’s well integrity processes and identified a gap in existing procedures for surface casing inspection.

The success of this trial provides further options for proactive well integrity management and has the potential to reduce total costs and deliver improvements in the health, safety and environment domain. In the future, Pulse will be incorporated into the operator’s routine inspection strategy. This is expected to deliver substantial technical and business benefits.

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**Figure 1. True Integrity diagnostics using the Pulse platform identified severe corrosion damage in the 13¾-in. casing (44% metal loss) in an area 5–8 ft from the tubing hanger and another area of significant corrosion at 20 ft. The lower section with 38% metal loss was missed by the conventional excavation procedure. The 18¾-in. conductor was not quantified in this case, but the discovery of severe corrosion in the 13¾-in. casing suggested there would be external corrosion on the conductor that was in contact with the water-bearing formation.**

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<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>WELL SKETCH</th>
<th>3 1/2” TDB</th>
<th>9 5/8” CSG</th>
<th>13 3/8” CSG</th>
<th>TOTAL GROSS DELTA</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>THICKNESS 1</td>
<td>THICKNESS 2</td>
<td>THICKNESS 3</td>
<td>METAL LOSS</td>
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<tr>
<td></td>
<td></td>
<td>0.0</td>
<td>0.4</td>
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<td>10  %</td>
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<td>6.5 Time (ms)</td>
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</tbody>
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