Q&A PIGGING

World Pipelines asks four ROSEN experts about pipeline pigging.

ABCO ENTERS, Sales Manager, Netherlands

After studying at the University of Technology in Delft, Netherlands (Physics) Abco Enters has been in technical sales since 1990 for service companies in Non Destructive Testing, both for technologies and solutions. Contributing to prevent pollution to the (sea) environment from storage tanks, pipelines, wells and other physical assets. He has held varying roles over the years in different organisations in R&D, operations, sales, business development, general management and board of director level. Since 2021, he has been a Sales Manager for ROSEN Europe BV in the Challenging Pipeline Division.

ULRICH SCHNEIDER, Business Development Manager, Germany

After studying at the University of Hannover, Germany, Ulrich Schneider has spent over 40 years in operation and inspection of oil, gas and pipelines. At ROSEN, his focus is on business development and marketing for the dedicated Challenging Pipeline Division, specifically tethered inspection solutions. He has presented many papers at conferences worldwide in the last 30 years.

CHRIS HOLLIDAY, Integrity Engineering Lead, Canada

Chris Holliday holds the position of Technical Lead for Integrity Services at ROSEN Canada. Chris is a registered Professional Engineer in both Alberta and Saskatchewan. He moved to Calgary from the UK, where he is a Chartered Engineer with the Institute of Mechanical Engineers. Chris graduated with 1st class honors in Mechanical Engineering from Northumbria University followed by a Post Graduate Certificate in Pipeline Engineering from Newcastle University. Chris has spent the start of his career working for ROSEN as a pipeline integrity engineer in Newcastle, conducting engineering assessments, corrosion growth, dent strain & fatigue and crack assessments. During that time, Chris has presented a number of technical papers with an emphasis on the assessment of pipeline deformations reported by ILI and pipeline structural analysis in landslide areas. Chris is a sessional instructor at the University of Calgary on the Pipeline Engineer Graduate Certificate Program and he volunteers on the Young Pipeliners Association of Canada Central Executive Committee.

COREY RICHARDS, Business Development Manager, Canada

Corey Richards holds the role of Business Line Manager for ROSEN's Field Project and Services and Challenging Pipeline Diagnostics Divisions for the Canadian region. Since 2014, his area of focus has been creating solutions for unpiggable pipelines in the Canadian, Oceania and Asia Pacific regions. He is located in Calgary after having spent five years in Lingen, Germany where he was based at ROSEN's Technology and Research Centre. In his 13+ years with ROSEN, Corey has expanded his knowledge through various roles including: time in field operations and technical sales, before transitioning into his current position.

NEIL GALLON, Principal Materials and Welding Engineer, UK

Neil Gallon is a Principal Materials and Welding Engineer working for the ROSEN Integrity Services division in Newcastle upon Tyne, UK. He holds a Masters degree from the University of Cambridge and is a Chartered Engineer, a professional member of the Institute of Materials, Minerals and Mining and an International/European Welding Engineer. He has over 20 years of experience in manufacturing and consultancy, including working for companies such as Tata Steel and GE. His current interests include the impact of gaseous hydrogen on materials and welds.

Q Discuss a recently carried out pipeline pigging/inspection project.

A ABCO ENTERS, Sales Manager
A ULRICH SCHNEIDER, Business Development Manager

As we all know, not every pipeline is meant to be 'pigged'; pipelines are frequently classified as 'unpiggable' due to their operating conditions, geometry, accessibility or a combination of these. For 'unpiggable' pipelines, ROSEN has often created tailored solutions to allow for inline inspection, as was the case for the inspection of a 10 in. offshore oil riser recently inspected by ROSEN Norway. For this project, the inspection unit – launched and received from a single point – had to navigate a total accumulated bend angle of 1188° (17 bends) while successfully inspecting the pipeline for wall thickness and cracks. ROSEN chose a tethered self-propelled bidirectional ultrasonic tool able to perform geometry, wall thickness and crack inspections in a single run. The tool was to be launched and received from a trap installed on the platform. After extensive testing and development, the necessary equipment (including a winch with a 1.2 km tether, with a breaking load of 2000 kg and a normal pulling force of 1000 kg) was brought to the site. Two electrical crawlers were run in a tandem configuration to ensure the tool could negotiate difficult installations, such as slippery valves, Ts, etc. An ultrasonic sensor carrier with 160 UT probes was used alongside two odometers measuring the distance travelled and the tool velocity.

Figure 1. Extensive testing is required for any custom ILI solution. ROSEN conducted testing for this solution at the Bergen Norway location.

The second tool was a purpose-made scanner equipped with TOFD probes. Straight-beam pulse echo (PE) probes were installed to position the scanner correctly against girth welds to be assessed. When deploying TOFD sensors at corroded features in parent material, the tethered ultrasonic measurement tool position is used to determine the correct positioning of the TOFD tool. After presenting a site report, the equipment and the team were demobilised, and the detailed analysis was started from home. The data evaluation team now had four data sets for wall thickness (two forward and two return runs) and two data sets from the TOFD crack analysis. The full length and circumference of the targeted pipe section was successfully inspected, and the collected data was of very good quality, meeting the required specifications.

Q How do you predict, or assess, pipeline failure? How do your tools help manage risk?

A CHRIS HOLLIDAY, Integrity Engineering Lead

A variety of methods as well as technologies are available to predict, or assess, pipeline failure. Prior to inline inspection, risk assessments of entire pipeline networks are possible; these can be used to segment individual pipelines into low, medium or high risk. Various factors are considered when making this categorisation, including the variety of threat and the inspection history. Although this is a higher-level assessment, it can often lead to smarter decision-making for future integrity management efforts.

Oftentimes that next step includes data collection. ROSEN's inline inspection (ILI) tools are equipped with a variety of sensor technologies, each able to gather high-resolution data regarding the condition of the pipeline. Of course, once an ILI has been completed, the valuable data gained is translated into a variety of assessments, which cover risk management services, risk-based inspection planning, process safety management, safety and reliability services, and additional asset integrity services.

A more recent approach to predicting pipeline failure includes ROSEN's Integrity Analytics Initiative. This method uses a large repository of historical ILI results (feature listings) along with corresponding pipeline information called the Integrity Data Warehouse (IDW). As of now, the IDW holds information about more than 12 000 pipelines worldwide, and it is growing rapidly. This data – paired with relevant geo-enriched, socioeconomic or operational metadata – provides a clear foundation for scalable AI solutions. The approach becomes particularly relevant for uninspected pipelines. By learning from the condition of similar

PIGGING Q&A

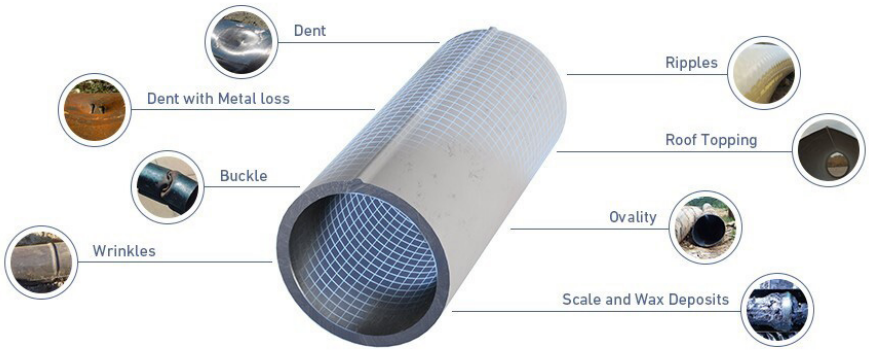

Figure 2. Geohazards can change the shape of a pipeline and may create local features, such as dents, buckles, ovalities and bending, all with potentially detrimental effects on the pipeline's integrity.

pipelines that have been inspected in the past, we can begin to understand the different variables that predict pipeline threats and develop models to predict the condition of uninspected pipelines. We can observe trends in inspected pipelines and apply what we have learned to uninspected pipelines. ROSEN has been advancing this initiative, and partnering with operators, to explore many applications of the IDW, such as corrosion prediction, external interference hit rate, crack prediction, condition metrics benchmarking and ranking, and corrosion growth rate prediction for uninspected pipelines. Future areas of interest include offshore asset condition, pipeline movement, bending strain and enhanced ILI anomaly classification.

Q Which types of pigging services are in increasing demand?

A COREY RICHARDS, Business Development Manager

Depending on the market, many operators are now in second or third-round inspection intervals, meaning they have established integrity programmes to address their most critical threats. They therefore are able to focus on more than the standard assessments and address more exotic features, such as selective seam weld corrosion, coincident anomalies (such as dents with gouge/metal loss), material properties and girth weld assessments.

Additionally – and, driven by the PHMSA gas rule, particularly in the US – material verification assessments are becoming more prevalent. Pigging services around geohazards are in increasing demand due to awareness of associated failures. Our expertise when it comes to slope stability issues and the assessment of related data is getting more and more accurate, allowing for better risk mitigation strategies.

Q Can you talk about pigging other types of pipelines, such as hydrogen or mixed-product lines?

A NEIL GALLON, Principal Materials and Welding Engineer

Pipelines transporting hydrogen are still pipelines, so all the threats operators face with natural gas lines are still relevant. However, there are certain characteristics of hydrogen that may increase the risk of some threats more than others. In general terms, hydrogen has little effect on increasing the risk of metal loss, a large effect on cracking, a very large effect on fatigue, and an unknown effect on dents and gauges. In terms of cracking and fatigue, three factors to watch for are 1) a decrease in material toughness; 2) a decrease in ductility; and, therefore, the inevitable 3) increase in the fatigue crack growth rate.

ROSEN has successfully inspected in hydrogen and has a comprehensive approach to both the integrity management and the inspection of hydrogen and blended pipelines.

Additionally, ROSEN has developed a phased framework for safely converting existing infrastructure to hydrogen pipelines. The framework is based on a structured approach, which makes the process digestible and creates a step-by-step guide. Figure 3 shows what these phases include.

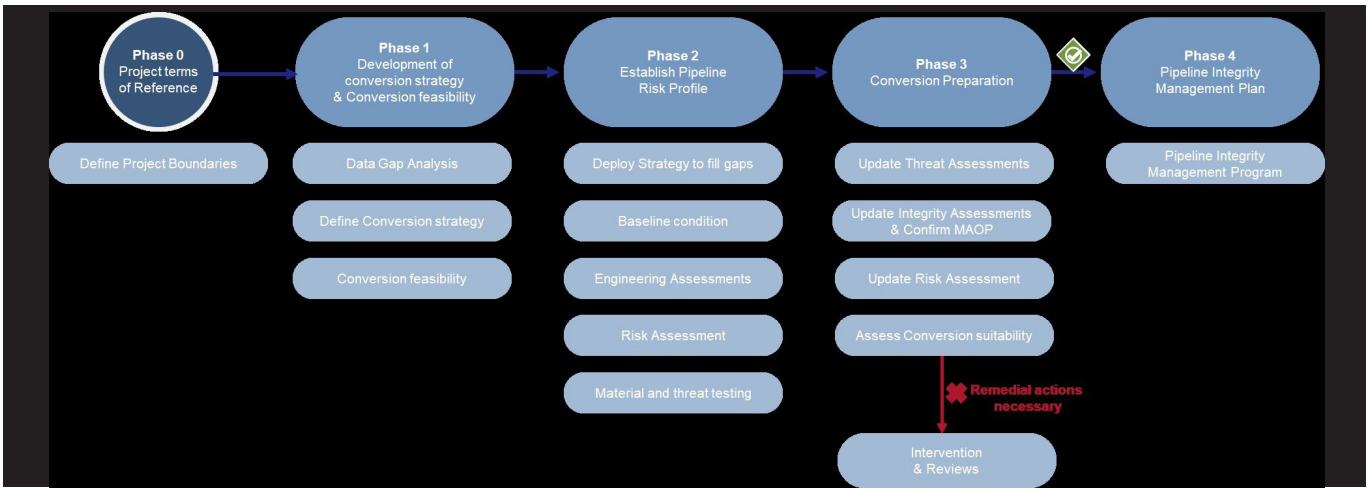

Figure 3. A phased approach allows for a feasible hydrogen conversion strategy.