



Pigging Industry News

the newsletter of the Pigging Products & Services Association

THE PRESIDENT'S LETTER

By Jessica Nichols, Inline Services, USA

I would like to take this opportunity to express my deep appreciation for the honor of being the first female PPSA President. 2019 was an exceptional year for the pigging industry and 2020 is off to a solid start. In addition, I would like to welcome the new PPSA members to the community and thank our existing members for their ongoing support.

It has been a busy several months for PPSA! The PPSA seminar took place in Aberdeen in November. It was a very informative event with 9 technical papers being presented and an exhibition. The papers and presentations are available at www.ppsa-online.com/papers. The day before the seminar, Petrofac and PPSA hosted a visit to the Montrose testloop (near Aberdeen) for YPP (Young Pipeline Professionals) members giving them an overview of pigging, as well as the opportunity for hands-on experience launching/receiving pigs.

Looking ahead, on Monday, February 17th the annual golf tournament takes place at the BlackHorse Golf Club in Houston. Thanks to both the sponsors and players for supporting this event. All proceeds go toward funding YPP projects. For details please go to www.ppsa-online.com/golf.

The golf tournament kicks-off the 32nd Annual PPIM Conference that takes place February 17 – 21st at the George R. Brown Convention Center in Houston, Texas. PPSA will be exhibiting at booth 716. Please stop by and introduce yourself if you are there. The PPSA Annual General Meeting will be held at 3pm in the Marriott Marquis Hotel. Your participation is welcomed and encouraged to help shape and inform the direction of the Association.

During my time as PPSA President, it has been exciting observing the next

NEW Members

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Pipeline Products & Project Services Ltd., Nigeria

Individual
Vinu Vidhyadharan, U.A.E.

generation of pigging and pipeline integrity professionals entering the industry redefine best practices in pigging design, manufacturing and quality control processes. Pigging manufacturers are learning to embrace a culture of continuous improvement in order to meet the ever-increasing demands of the customers they serve. I said it last year, and I will say it again; it is an exciting time to be in the pigging industry!

Thanks to everyone at the Association for your support this year! Although I will be “passing the torch” soon, I look forward to continually making contributions that will enhance all the great things PPSA is currently doing for the industry, as well as supporting the next PPSA President.

Thank to all the golf sponsors!



The push and pull of pigging: Rescuing a third party's stuck tool from an offshore pipeline

Pipeline pigging is almost always predictable and problem-free -- but sometimes a pig gets stuck, stalled or damaged inside the pipeline. Removing it requires a prompt and safe solution, but there's no one-size-fits-all response, and what looks like a viable option could actually make things worse.

That was the case when poor design —specifically, too much bypass combined with heavy polyurethane (PU) disc stack up— caused a third party's subsea, bi-directional (Bi-Di), 28-inch pig to stall in a gas export pipeline offshore Myanmar.

The pig was stuck halfway into the barred production tee located immediately after the pig isolation valves. Although it wasn't entirely obstructing product flow, the pig couldn't stay where it was indefinitely: eventually, pressure or flow bypass would move it farther into the pipeline. At that point, the pig would block the line completely, seriously affecting operations and costing millions of dollars in lost production. What's more, the pig had to be removed before T.D. Williamson (TDW) could perform a previously scheduled SmartPlug® in-line isolation on the same line to facilitate valve replacement.

The operator and TDW evaluated several possible rescue alternatives, including using another Bi-Di pig to push the stuck pig to the onshore receiver. TDW knew that solution was fraught with risk. If the pig got stuck farther in the pipeline while being nudged forward, especially if that happened subsea, it would make retrieval even more complex. Pulling the pig back to launcher would be a safer alternative, although that meant TDW had to develop a 100 percent engineered approach. It wouldn't be simple—in fact, it would require designing and manufacturing a unique recovery tool—but it would avoid a possible cascade of other problems.

Pre-engineering confirms recovery force to ensure appropriate tool design

During pigging, the outer edge of the parabolically shaped sealing discs fold backwards. To reverse the pig's direction, the discs must be flipped so they fold forward. Otherwise, the pig can't move, or at least not without extremely high force. In the pre-engineering phase, TDW determined how much force it would take to flip the sealing discs on the stalled Bi-Di pig so it could be pulled back to the launcher. That was accomplished in a replica test rig TDW built at its Global Solutions Center in Stavanger, Norway, where an identical pig was subjected to various differential pressures.

Once TDW identified the appropriate recovery force, they could configure the recovery tool. It included a spring-loaded mechanism that would click into place on the bypass holes of the stuck pig's body, gripping it as it was pulled out by a hydraulic pulling system that was attached to a strong hold anchor point behind the launcher.

Tool testing took place on the replica rig in Stavanger. Because the operator would have to shut down production during the rescue operation to ensure safe access, timing the pig recovery was part of the testing process.

Spring-loaded gripping tool recovers stuck pig without incident

Once the rescue operation was underway, the recovery tool worked as designed. Crews spent just seven hours successfully and safely rescuing the pig, completing the project well ahead of schedule.

It takes expertise, ingenuity and diligence to deal with a stubborn, stuck pig, and the best solution might not be the obvious choice at first. By considering multiple options, evaluating risk and conducting extensive testing, TDW and the operator could be confident they were making the right choice and the results proved the efforts paid off.

Enduro Exhibits Pipeline Prowess



Visit the interactive Enduro booth #727 while you're visiting PPIM 2020, February 17-21 in Houston, Texas. Our highly trained specialists will update you on Enduro's newest pigging products, multiple technology tools, PigProg II Presenter analysis software, and pipeline integrity services.

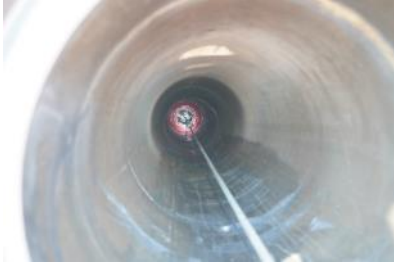


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Deployment for pig recovery tool



Gripping tool with wire attached to the pig body



Pulling the pig



Camera system



Wire attached to hydraulic cylinder and strong hold behind the launcher



Pig successfully recover to the launcher

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Verification of material properties and attributes augmented by in-line inspection

The natural gas onshore transmission pipeline market in the United States has new regulations continuing the pursuit of zero incidents. On July 1, 2020 the first set of new regulations will take effect regarding Safety of Gas Transmission Pipelines. This first installment of new regulations for onshore gas transmission pipelines comes with a focus on Maximum Allowable Operating Pressure (MAOP) Reconfirmation, Verification of Pipeline Material Properties, Expansion of Assessment Requirements, and API 1163's incorporation by reference. As part of MAOP Reconfirmation, which has aims to reconfirm a pipeline segment's MAOP, an operator must use the pipeline's material properties which are Verifiable, Traceable, and Complete to accurately represent the pipeline segment's physical characteristics.

The Verification of Pipeline Material Properties and Attributes for onshore steel transmission pipelines is defined by section 192.607. This new section of the regulation can be thought of as a tool to establish physical material properties for pipe to support fulfillment of the requirements in MAOP Reconfirmation, Analysis of Predicted Failure

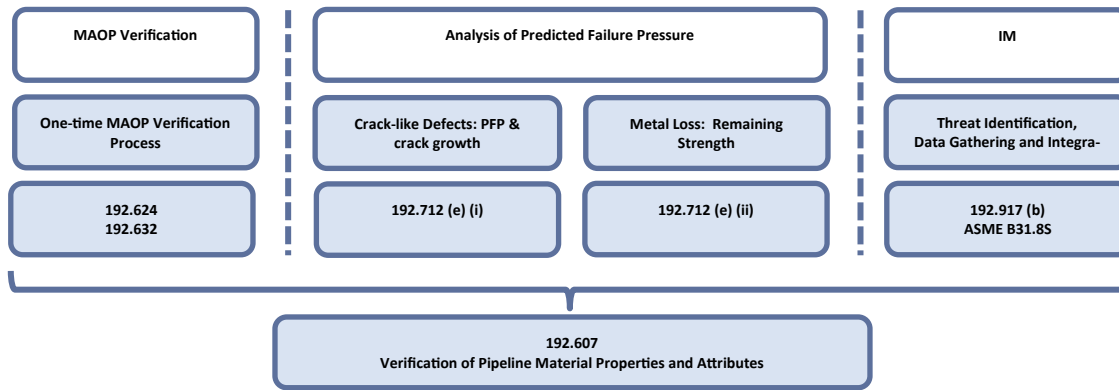


Illustration 1: 192.607 Verification of Pipeline Material Properties and Attributes is a tool to support MAOP Reconfirmation, Feature Assessment, and Integrity Management

Pressure, and Integrity Management related to Threat Identification, Data Gathering and Integration (**Illustration 1**). The efforts associated with 192.607 Verification of Pipeline Material Properties and Attributes (192.607) will be to establish a pipeline segment's:

- Diameter
- Wall thickness
- Seam type
- Yield strength and ultimate tensile strength
- Toughness



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Effectively pipeline operators must develop and implement procedures for establishing populations based on known information, conducting destructive and non-destructive testing, examinations, and assessments to verify the material properties. Secondly an operator would then implement an excavation program for examination of pipe and testing. This excavation program would continue until the lesser of 150 excavations or one excavation per mile of unknown required material data (i.e. wall thickness, yield strength, etc). The excavation program may be scheduled or leverage opportunistic pipeline exposures. If a pipe material is discovered at an excavation site which was not intended then the program must include a plan to extend the number of excavations for that population, and the newly discovered material, until a 95% confidence level is achieved.

ROSEN understands the value of data based decision making processes and the continuous value proposition of In-Line Inspection (ILI). Leveraging ILI an engineering approach to establish material properties can be implemented. Delivering a programmatic approach to identifying populations based on pipe physical characteristics and targeted *insitu*-field examinations. This approach also provides a superior mechanism in identifying outliers and understanding how to deploy resources to reduce risk. If sound joint by joint information is not used to establish populations then it is possible to not know where the outliers are located, and thus failing to achieve complete knowledge of existent material characteristics. **Illustration 2** demonstrates how deploying a program for in-field examinations without sufficient information and leveraging opportunistic exposures may miss a high risk outlier.

As part of Integrity Management, ILI has been mostly deployed since the early 2000's using conventional geometry and metal loss based technology in gas transmission pipelines. These datasets can be used to establish the foundation for establishing populations using physical characteristics such as wall thickness (WT), joint length (JL), and in some cases the manufacturing process used to form the

pipe (long seam welded or seamless pipe). This is a great starting point to integrate Traceable, Verifiable, and Complete (TVC) material records to these populations to enable the development of an excavation program and the number of examinations required. Additionally, in many cases ILI systems have been deployed to assess for long seam integrity threats using a combination of circumferential magnetic flux leakage (C-MFL) ILI and/or Electro-Magnetic Acoustic Transducer (EMAT) ILI. These two planar and crack-like feature detecting technologies can often provide sufficient information on the characteristics of the seam welding process to further establish populations. ILI can also enable pipeline mapping services, RoGEO XYZ, to provide the ability to execute highly accurate plausibility checks of the derived populations through a route analysis.

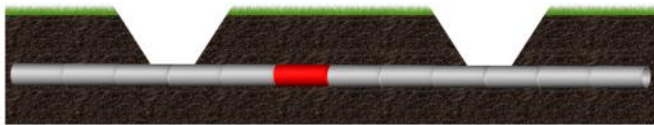


Illustration 2: Prescriptive compliance with 192.607 may not

ROSEN has developed an engineering assessment called *Pipeline DNA* which incorporates existing records, ILI data, *insitu*-field examinations, material testing, and industry expertise to establish populations, identify outliers, and ultimately the required material properties required by 192.607: Wall thickness, diameter, seam type, yield and ultimate tensile strength, and toughness. When ROSEN's RoMat PGS ILI system is deployed, which provides Yield Strength (YS) and Ultimate Tensile Strength (UTS) for each joint of pipe inspected greater than 3.3 [ft], the populations can be more clearly defined. **Illustration 3** demonstrates how leveraging joint by joint data for WT, JL, and YS can facilitate a sound process to deriving populations. Each population can have the RoMat PGS data (YS and UTS) plotted as a histogram to understand the frequency distribution of YS and UTS. Representing the YS data of a population as a histogram, as in **Illustration 4**, increases confidence in assigning the grade of pipe for the population and is representative of the pipe manufacturing process. These distinct populations can now be examined in-field for validation of records and the results from *Pipeline DNA*.

In conclusion, 192.607 *Verification of Pipeline Material Properties and Attributes* will be a process which can be used to establish pipe properties through defining populations and satisfying a specific number of excavations and pipe material testing. In some cases this prescribed process will be suitable. However, ROSEN's *Pipeline DNA* engineering assessment can be leveraged, along with ROSEN's RoMat PGS, to deploy a targeted excavation campaign to comply with 192.607, reduce risk by identifying outliers, improving material records and asset knowledge, and focusing expenditures.

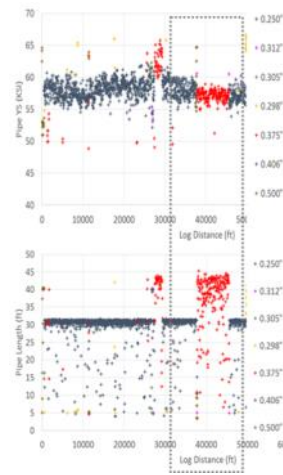


Illustration 3 Pipeline DNA leverages material characteristics to establish populations

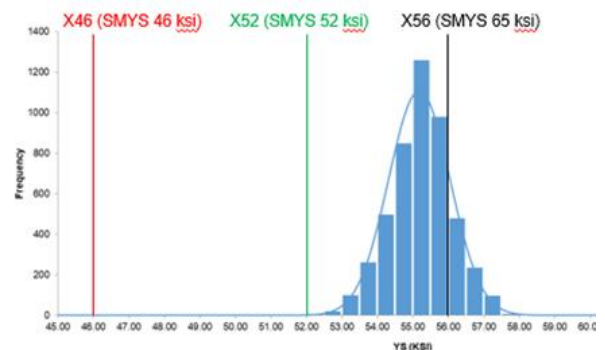




Illustration 4



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Malaysian isolation success for STATS Group

STATS Group (STATS) have completed an extensive pipeline isolation campaign offshore and onshore Malaysia.

The six month campaign covered 12 pipeline isolations on behalf of partner Handal Energy Berhad for a major operator in Malaysia, and represented the largest integrated campaign undertaken by STATS in the region.

All workscopes featured STATS' range of Remote Tecno Plug® (RTP) which provided inline pipeline isolation to allow the live repair and replacement of valves on onshore and offshore assets in West Malaysia and Sarawak.

STATS DNV GL type approved RTPs provides fail-safe double block and bleed isolation of pressurised pipelines while the system remains live and at operating pressure. Dual seals provide a zero-energy zone to enable maintenance work on pressurised systems to be carried out safely and efficiently.

The RTPs ranged in size from 12" to 32" and teams from STATS Beranang workshop in Kuala Lumpur, backed up by personnel from the UK and UAE,

worked jointly to complete the projects safely and on schedule.

Gareth Campbell, STATS Group's regional manager for Asia Pacific, said: "With the successful completion of two 28" RTP isolations on facilities in Sarawak, this brings to a close our six month long isolation campaign in Malaysia, during which a total of 12 safety critical projects have been completed for valve repair and maintenance.

"Using a combination of local expertise from our Kuala Lumpur base, supported by colleagues from Aberdeen and Abu Dhabi, we have reaffirmed our position as the primary provider of safety-critical pipeline isolation services in Malaysia, and look forward to maintaining this success with future projects already confirmed for 2020."



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IK-Group brought closer together following Online Electronics rebranding announcement

Online Electronics Limited (OEL) are pleased to announce exciting news regarding the branding and evolution of the company. From January 2020, OEL and its regional offices in Houston, Dubai and Singapore, will rebrand as "IK" whilst retaining the Online Electronics name which is recognized and esteemed within the pipeline industry.

OEL's Managing Director Andy Marwood says: "The rebranding brings our dynamic Group closer and better enables OEL and its sister companies to reach out to its customers. Additionally, the Group can now easily demonstrate the breadth of capability and solutions in pipeline construction, commissioning, maintenance and integrity that we hold as a long-standing innovative group of business."

The new brand message elevates all the Group businesses as they can now be seen more holistically with four operating locations, three additional sales offices and total staff approaching 200 rather than stand alone niche businesses.

Case study 42 inch and 20 inch Pig diverters

iNPIPE PRODUCTS™ was approached by a leading global supplier of storage solutions for a crude oil blending and storage project in South Africa.

The client required to install pig diverters on the 42” and 20” pipelines, which connect to the adjacent tank-farms pipeline to the VLCC offloading terminal on the jetty.

It was required that the pipelines be pigged on a regular basis and this requires being able to pig from the jetty to either of the tank farms. The first alternative considered by the client was to tie into the pipelines with a straight through connection to the existing tank-farm and to construct pig traps and bypass connections on the pipelines to the second tank-farm. However, this option had the following disadvantages:

- It is only possible to pig the 42” and 20” pipelines from the jetty to one of the tank farms
- The transfer station would require a stand-alone pigging station to facilitate the pigging of the pipelines to the second tank-farm
- This operation would require careful stock control depending on whose crude oil is in the pipeline from the jetty to the transfer station
- This operation is time consuming
- The operation has a potential pollution risk, which was considered unacceptable in the environmentally sensitive area where the transfer station had to be constructed

Solution and benefits to the client

Following a technical review of the client project requirements iNPIPE PRODUCTS™ proposed a bespoke solution, which consisted of the design, engineering and supply of 20 inch and 42 inch pig diverters. Site supervision was subsequently provided during commissioning stage.

The use of the pig diverters allows the client to pig directly from the jetty to either of the tank-farms and there is a minimal risk of pollution at the transfer station.



42 inch and 20 inch Pig diverters



Transfer station

Trans Asia Group announces new division in Aberdeen UK

Trans Asia Group, are pleased to announce the recent opening of their new division in Aberdeen UK. The new division, Trans Asia Energy Services (UK) Ltd, is part of the company’s plans to become a global provider of pipeline & process services, the UK division will be responsible for developing the companies growth into the UK, Europe, Mediterranean,, Africa & Caspian regions. Headed up by Regional Manager Robert Fraser, the new division will be offering all the services currently covered under the company’s portfolio, along with some new service lines that the company plan too introduce later in 2020.

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Vertical casing inspection

3P Services has provided in-line inspection for 28 years now. Usually, pipelines in the oil and gas industries, as well as in the chemical and petrochemical industries, are regularly inspected regarding their integrity. The main objective is to detect, locate and measure defect anomalies, such as metal loss, on the inner or outer surface.

In principle, these same inspection tools can be used equally well in vertical as in horizontal installations, although there are differences between these applications. 3P Services modified their inspection tools for vertical casing inspection and created a simplified set-up for job execution of recent projects, for example in an LPG storage facility. No drilling or work-over rig was required. This set-up has already been used in several projects.

Like in horizontal pipelines, the adapted ILI tools work autonomously in vertical casing applications since they are equipped with their own power supply, data processing and storage. The execution itself is effectively a wireline job for lowering and lifting the inspection tool without need for separate power supply or data transfer through a cable.

A truck-mounted crane holds the fixed-point of the cable-fairleader over the well. The measuring unit is run on a steel-cable, controlled by a hydraulic winch. Profile runs with gauging plates to ensure free passage or cleaning runs to eliminate inner deposits are also executed like this.

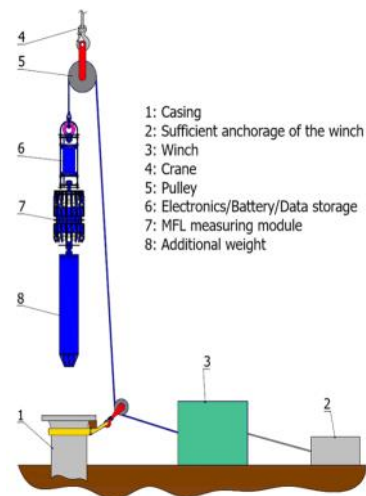
The measuring unit, equipped with different sensor types, is changeable to cover individual tasks. Ultra-sonic (UT) and Magnetic Flux Leakage (MFL) technologies are typical for wall thickness measurements. Further technologies are available for specific detection of inner corrosion, scaling and/or geometric deformations (GEO, GEO+, DMR).

The high resolution inspection delivers detailed data on the current condition of the casing: description of the physical structure (depth of circumferential welds or connectors, the centraliser visible from external, etc.) and defect anomalies on the inner or outer surface with indications of length, width and depth, accurate to a millimetre.

The level of detail of the loss of material is standardised corresponding to the POF guidelines (Pipeline Operators Forum, www.pipelineoperators.org). Depending on the diameter, wall thickness and technology used, individual performance specifications are available.



Lowering 20" UT tool



Simplified setup

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Inspection of subsea pipeline with large ID restrictions

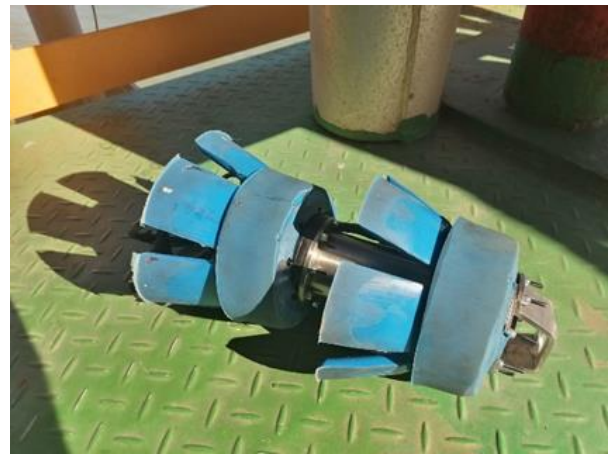
i2i Pipelines have successfully inspected an offshore pipeline with a 30% concentric ID restriction with a standard Pioneer pig. The Pioneer pig not only negotiated the ID restriction without any issues but collected good quality data for the length of the pipeline. Prior to the deployment of the i2i Pioneer pig the client had run a standard gauge pig tool to determine the minimum ID of the pipeline.

The gauge pig run came back with significant deformation showing an ID change from 154mm down to 114mm, equal to a 26% concentric ID restriction. The restriction prevented any conventional ILI being carried out on the pipeline and i2i were called in to do the inspection.



Gauge plate after the pig run

The 6 inch Pioneer tool safely negotiated the pipeline restriction and collected good quality data for the entire length of pipeline. There was no mechanical damage to the Pioneer tool and the run was considered a success. This project demonstrated that the Pioneer tool is a cost effective and low risk alternative to conventional ILI pigging with the ability to carry out internal inspections in difficult pipelines with large internal restrictions.



6 inch Pioneer pig after the inspection run

Taking a good look: Visual data for improved pipeline integrity management decisions

Author: Michael Bruns, Sales Manager Field Products & Services, ROSEN Europe

A visual inspection using an in-line inspection (ILI) tool equipped with a camera allows for an actual look inside a pipeline. The use of a visual ILI inspection is broad, and by adding this feature to regular pigging operations or an ILI tool creates an additional source of data for future integrity decisions, without the need for a tethered camera inspection.

This type of inspection can be used to:

- identify damages and the status of the inspected pipeline network
- visually check of pipeline repairs
- assess the general condition of a pipeline
- assess the condition of installations (i.e. status of valves, guide bars, branches)

In addition, this type of look into the pipe allows for the success of other integrity work, as it can quantify the success of a cleaning campaign and whether an internal pipeline coating is intact or whether there are any liquid accumulations such as water in the pipeline and at what location.

To make this kind of data collection possible, the **ROSEN Group** has developed a modular device

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that can be attached to tailored cleaning tools ranging from 12" to 56" or an intelligent inspection (ILI) tool (see Figure 1). Developments ensured the camera inspection device could meet the high demands on the quality of the recordings and at the same time withstand the rough conditions in a high-pressure gas pipeline. This article briefly focuses on recent case studies rather than technical specifications of the camera device to show how the reported visual data, gathered during regular pigging operations, benefits pipeline operators.

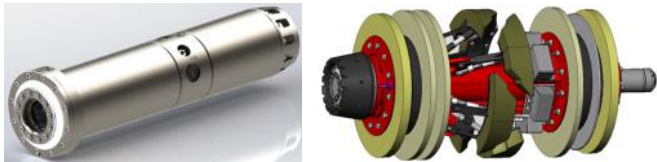


Figure 1: RoVisual modular service device is mounted to the front of a ROSEN Ultimate cleaning tool

Case Study 1:

One specific application of the visual inspection device was to prove a potential restriction/obstacle in an over 50-year-old pipeline, as the sensor arms of a high-resolution geometry tool had been heavily damaged during an in-line inspection, and the gauging discs showed an unexplainable deformation (see Figure 2).



Figure 2: Gauge plates with unexplainable deformation

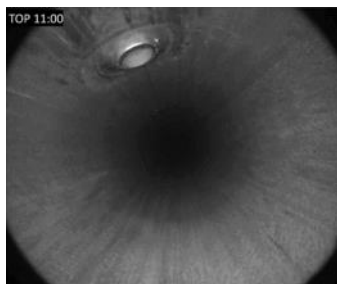


Figure 3: Protruding offtake in an over 50-year-old pipeline

The recorded RoVisual data gave a fast and clear answer - an unknown approximately 50 mm protruding offtake was the reason for these damages (see Figure 3). As a result, the operator removed these offtakes to ensure a safe and successful in-line inspection followed.

Case Study 2:

In a different case, recorded RoVisual data provided a pipeline operator with evidence and certainty on the question whether a present tee of an older asset was barred or unbarred (see Figure 4). Additionally, the data allowed assessing the condition of an older hot tap and related guide bars that actually were recessed (see Figure 5). Unbarred tees and recessed pig bars could potentially result in tool deviation into the offtake, or led to a stalled tool due to increased bypass. Therefore, the status of such installations is important to know in order to modify future cleaning and / or inspection tools for safe passage of such installations. It is however remarkable that all this data footage has been recorded at pig velocities of around 2 to 2.5 m/s.



Figure 4: Verification of an unbarred tee

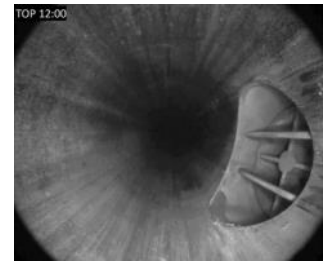


Figure 5: Hot tap with recessed pig bars

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How microbiologically influenced corrosion (MIC) can be eliminated from pipelines

Pipeline integrity is a crucial topic that goes hand in hand with the need to operate and maintain a pipeline to ensure continued, safe and efficient performance. This article deals with the internal cleaning management of a pipeline suffering from Microbiologically Influenced Corrosion (MIC).

Why is MIC present in pipelines? MIC results from accelerated deterioration initiated by different microbial activities present in oil and gas systems. Depending on Pipeline Integrity, MIC can cause enormous damage to the pipeline and in worst case lead to production shut down.

In 2018 **Reinhart Hydrocleaning SA (RHC SA)** was asked for a 10” pipeline cleaning job located in the North Sea. Inspection results showed that the 10” water injection pipeline suffered from MIC. The pigging program with ordinary brush pigs were not able to properly clean the pipeline and embank the MIC problem. In the third Quarter of 2018, RHC SA performed a progressive cleaning campaign with in total 6 hydromechanical cleaning tools (HMCT) adapted to the pipeline. After the cleaning program, the pipeline was inspected and the data was compared to the previous inspection result. Based on the positive outcome of the ILI, the client decided to run HMCT’s on a regular basis. A hybrid HMCT was designed by RHC SA



Ferromagnetic debris taken out by the HMCT

which contained multiple cleaning elements of the used HMCT on the initial cleaning campaign. Since 10/2018 these hybrid tools are frequently sent by the pipeline operator. Followed inspection results showed that the pipeline condition remained the same and that MIC was no longer increasing in the 10” pipeline.

The key to a successful inspection and maintaining pipeline integrity is the regular and continuous use of appropriate mechanical cleaning tools that will clean the line to the required level and maintain that level of cleanliness throughout its operational lifetime.

RHC SA is a family business based in Switzerland that has been providing a range of innovative, hydro-mechanical pipeline cleaning tools for over 65 years. Designed and manufactured in house, the unique technology for pipeline cleaning can be applied to a broad range of industries and includes pipelines manufactured from steel, cast iron, PVC, Flexibles, etc..

Maintaining pipeline condition by utilizing specialized mechanical cleaning tools on a regular basis as part of an operators ongoing production pigging and integrity management strategy keeps the pipeline in a clean condition throughout its operational life maximizing pipeline performance and corrosion management. The use of high-quality mechanical cleaning tools will reduce the frequency of regular production pig runs required to maintain a higher level of internal cleanliness when compared to running off the shelf utility pigs. RHC SA focus on achieving the highest standard of internal cleanliness by using the best technology for the application.

The provision of specialized high-quality RHC mechanical cleaning tools designed and manufactured to suit the pipelines operational conditions are used initially to clean the line to the required level and thereafter when used as part of the regular production pigging strategy, they will maintain operating performance of the pipeline.

RHC SA is not just a company for “special cleaning jobs” but a company that is able to support and maintain long-term pipeline cleaning and integrity management on a regular basis throughout its operational lifetime.



RHC SA Hydromechanical Cleaning Tool (HMCT)

More than 100 presentations in 30 technical sessions at 15th Pipeline Technology Conference in Berlin

Europe's leading pipeline event is now taking place for the 15th time, this time from 30 March to 2 April 2020 in Berlin's Estrel Congress Center.

A key factor in the success of **ptc** is the many operators from all over the world who will be present during the four-day event. For them, there is a series of high-ranking plenary sessions and panel discussions, all of which deal with topics of interest to operators worldwide. This includes comprehensive topics such as "Safety" and "Integrity" as well as current challenges in the areas of "Qualification & Recruitment", "Difficult to Inspect Pipelines", "Illegal Tapping" and "Digitalization". Important future topics such as hydrogen transport and Power-to-X are also included in the program.

Another unique selling point of the **ptc** is its internationality: "About two thirds of the participants come from abroad. Last year, we saw the greatest growth from Latin America and Eastern Europe, a large proportion of which were pipeline operators," says Dennis Fandrich, Chairman of the Pipeline Technology Conference. This makes **ptc** the most international event of its kind in the world. More than 900 participants from 50 different countries and delegations from 80 different pipeline operating companies are expected to attend **ptc 2020**.

The conference will be accompanied by a trade exhibition at which leading technology and service providers and pipeline operators will be able to present their innovative pipeline solutions. With more than 90 exhibitors, a new record is also expected in this area in 2020. The conference and the trade exhibition will be complemented by thematically oriented one-day seminars, workshops and operator round tables in which participants will be able to delve deeper into various topics. ●

3X Engineering performs high temperature repair in Oman

The objective of the repair, performed in August 2019 by **3X ENGINEERING (3X)** and its local distributor **SYNERGY**, was to reinforce 2 tees of 8" suffering from internal corrosion and through wall defect.

Calculations using 3X software were performed to define the minimum thickness and length necessary to give back the full integrity of the water pipe, (according to the design pressure <1 bar and operating temperature 60°C). Following client's request, it was decided to design the repair according to no standard, to reduce the number of layers. In these conditions,

3X advised to apply a minimum of 12 layers of REINFORCEKiT[®] 4D HT+ (specifically dedicated to high temperature) to reinforce the tee with through wall defect and 8 layers for the one suffering from internal corrosion.

Due to through wall defect, the client shutdown and flushed the line in order to apply the composite on the leak.

Before starting the tee reinforcement, surface preparation was completed with grit blasting to get a good surface roughness and ensure the bonding between the steel pipe and the composite. Surface profile evaluation was performed to confirm the roughness was superior to 60µm. The surface was then cleaned using acetone and hygrometric conditions were checked before wrapping procedure (steps described below).

- F3XS1 filler with metallic plate was applied on through wall defect to seal the leak (this step was not necessary for internal defect).
- Wrapping process covering the delimited areas was completed using Kevlar[®] tape impregnated with R3XHT+ resin (12 layers for hole defect and 8 layers for internal defect -> both of them with 600mm repair length).
- Reference plate was installed on each repair for traceability purpose.

For each repair, samples of filler and resin were taken during application for quality control. This job was a great challenge because of the several complicated data: tee geometry and hole defect and high temperature. Despite these difficulties the 2 lines were successfully repaired using our REINFORCEKiT[®] 4D HT+.



View of tee with through wall defect



Wrapping completed (12 layers) & ID plate installed ●