



## Pigging Industry News

*the newsletter of the Pigging Products & Services Association*

### THE PRESIDENT'S LETTER

*By Chuck Harris, T.D. Williamson, USA*

I would first like to thank our past President Iain Shepherd for his service on the board and leadership. It is with great honor that I am able to introduce myself as President of the PPSA, and I look forward to serving you this year. Michael Rapp of Rosen will serve as Vice-President. I would also like to welcome our new Directors: Jessica Nichols of Inline Services, Mark Olson of Entegra, and Anthony Rose of Vitrozcell USA. The board and I also thank Eric Farque of CDI, past Director, for his support of the PPSA. Most importantly, I thank Diane Cordell for her passion, commitment, and dedication to the success of our great association.

The 12th annual PPSA golf tournament occurred on Monday, February 27<sup>th</sup> in conjunction with the Pipeline Pigging & Integrity Management Conference (PPIM). Twenty-six teams took advantage of the great weather and participated in the event. Three of the hole sponsors cooked at their sponsored holes and provided food throughout the tournament. A very special thank you to our many Sponsors, which were higher in number than in recent years. You can find tournament winners and photos of the event on the PPSA website under the "PPSA Golf Tournament Tab."

We held our Annual General Meeting (AGM) on Tuesday, February 28<sup>th</sup> at the Marriott Marquis in Houston, TX. The meeting was well attended by both officers and members, and covered a variety of topics including election of new Directors, updates on key

initiatives such as launcher/receiver simulator, and discussion on industry sponsorship opportunities for the PPSA. One such example is PPSA's sponsorship of the Pipeline Integrity course provided by Oklahoma State University Institute of Technology (OSUIT). Joe Bartlett, who leads this Pipeline Integrity School, displayed a PPSA banner and made PPSA publications available at their graduation luncheon. Additionally, the PPSA is exploring options to better engage young pipeline professionals and introduce them to pigging applications.

The PPSA continues to remain active within the industry in both hemispheres. The Association exhibited at PPIM in February, and attended the Pipeline Technology Conference in Berlin, Germany in May. PPSA's annual seminar will be taking place in Aberdeen on November 7-8, 2017. To submit abstracts and tutorial ideas for the seminar, email the Seminar Organizer Diane Cordell at [ppsa@ppsa-online.com](mailto:ppsa@ppsa-online.com).

There have been conversations for many years about our ageing workforce and the risks associated with the resulting knowledge gap. I recall during a panel discussion at a conference a few years ago, a major pipeline operator stated they were seeking to "revive the workforce". Among other things, their approach involved the recruitment of young engineers straight out of college to "train up in the business". The PPSA recognizes this continued struggle to pass knowledge and experiences on

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to the next generation. It is our mission to support the industry by promoting the knowledge of pigging and related products and services, which is done through our frequently asked questions, case studies, seminars, papers, availability for technical inquiries, and soon to be e-training tools. I encourage you to visit <http://ppsa-online.com/> to leverage these valuable resources.



*Iain Shepherd of Halliburton receiving the President's Plaque 2016*

# Industry news

## Inline Services has another successful Speed Control Pig run

**Inline Services** performed a Speed Controlled Pig (SCP) run on April 20, 2017 in a 73.8 mile section of 30 inch natural gas pipeline. The SCP tool successfully recorded data for the entire run. The data quality was excellent and accurate giving precise tool speeds throughout the entire run. Using Inline Services' powered by Comtel Systems tracking equipment, personnel tracked the pig at mainline valves and other locations along the pipeline. The pig left the launch site at 11:51, stopped briefly at approximately 18.4 miles into the run, continued moving shortly thereafter, and was received at 20:14, totalling 8 hours and 23 minutes. The average speed for the entire run was 8.803 mph. Inline had set the dead band for this run at 8-10 mph. The pig performed perfectly at maintaining the desired speed along the way. When the pig was trapped, it was noted that the urethane cups and discs, Prostran brush, magnets, and other mechanical parts of the pig were in excellent condition and appeared to have even wear throughout.



*Inline Services' Speed Control Pig*

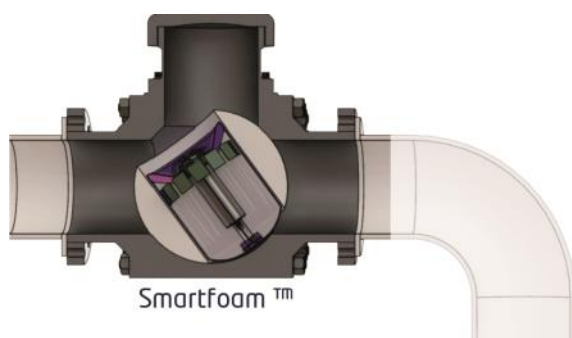
## Prospector™ - A smart pig for pigging valves

Building on the success of the Pioneer™ and Patrol™ Pigs, **i2i Pipelines** has continued to develop its service offering with the development of the new Prospector™ pig. The Prospector is designed to be launched and received through a pigging valve, enabling the inspection of gathering lines in the on-shore US fracking market, although its versatility has applications worldwide and it can be used in pigging valves in any configuration location or even gathering lines with conventional launcher and receivers.

Since 2014, i2i Pipelines has challenged the conventional approach to pipeline inspection by integrating smart sensor technology into simple utility pigs. This new generation of smart pigs have all the operational benefits and capabilities of utility tools while providing the additional benefit of gathering vital inspection data on the internal integrity of a pipeline. This integrity data is supplemented with additional flow assurance information including pressure, temperature and deposit mapping.

Historically pigging valves, due to their small capacity could only launch and recover cleaning or utility type pigs. The Prospector pigs use advanced electromagnetic inspection technology which can detect and size internal defects. Like all i2i smart pigs the Prospector uses rechargeable power packs and can negotiate changing ID and complex geometries, including 1.5D bends. The tools are designed for high frequency use enabling the monitoring and trending of anomalies over time.

A significant advantage of using the Prospector tool through pigging valves is that electromagnetic technology has the ability to inspect through liners up to 1" thick, including a cement lining, a common feature in many small bore gathering lines. The electromagnetic technology is also suitable for the inspection in gas pipelines without the need of a coupling fluid. Unlike other pigs available on the market, the Prospector is designed specifically to address the requirements for pigging valve operations. The Prospector pig will initially be available in sizes of 6" and upwards with a 2" and 4" available late 2017.

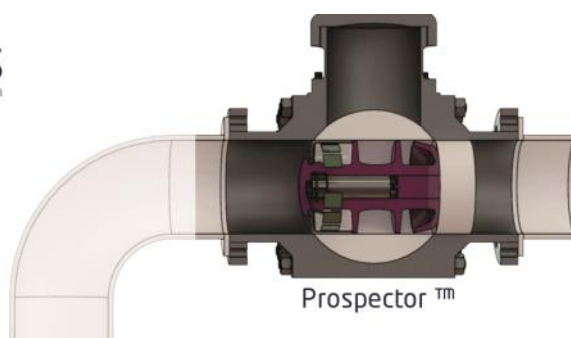


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## First of its kind pig set for delivery

One of the UK's leading pipeline pigging specialists – **iNPIPE PRODUCTS™** – has successfully completed an integrated sea water inlet cleaning system for a series of inlet pipelines in what is believed to be the largest pigging project in the world.

Commissioned by a South Korean conglomerate, the North Yorkshire based company has supplied a first of its kind integrated solution including cleaning tools, loading equipment, launching equipment together with an integrated tracking that will be used on some of the world's largest pipelines, measuring an impressive 90 inch in diameter.

The cleaning tool – commonly known as a pig or scraper – will be delivered for use at an Algerian power plant for five pipelines carrying cooling water. The pig will maintain the pipeline's integrity and prevent internal build of contaminants to facilitate optimum through-put capacity within the pipeline.

Speaking about the contract, Peter Fretwell, Director of Pigging Services at iNPIPE PRODUCTS™ said: "In my 40 years of experience in the industry, this is by far one of the largest and most technically complex projects that I have ever been involved in. We are delighted to have developed an integrated cleaning and loading/launching system that has never before been created on this scale."

"We believe we were awarded this contract based on having built our reputation as being the premier supplier of pigging products and services on a worldwide basis. Our experienced and flexible workforce, combined with our integrated state of the art design, manufacturing and testing facilities makes us the supplier of choice."

The unique full turnkey solution included the design, manufacture and vigorous testing using some of the principals from its internationally patented wet-buckle pipeline intervention system, which was designed for the world's largest oil and gas development, the Inpex Ichthys project based in Australia.

The scope of supply to the Algerian power plant, in addition to deploying the 90-inch cleaning tool or pig, included providing pig loading facilities and launching facilities right through to delivering flexible manifold delivery system to accommodate site installation delivery tolerances of +/- 500mm. Once the capital plant is delivered, iNPIPE PRODUCTS™ will further provide technical support and expertise for ongoing pipe cleaning purposes throughout the life of the project.

And in what has been a challenging time for companies operating in the oil and gas sector, iNPIPE PRODUCTS™ has bucked the trend with its sales growing in the Middle East and South East Asia. The company exports 84% of its turnover to six continents worldwide.

Simon Bell, Managing Director at iNPIPE PRODUCTS™ said: "We are extremely pleased with the company's performance over the last year. We have systematically improved delivery performance since relocation into to our larger, 60,000 ft state of art facility. We firmly believe that we have showcased our ability to adapt to changing market conditions and to deliver our world-renowned cost effective solutions to any part of the world."

"This project demonstrates that we are an innovative and progressive company that will continue to break new barriers in delivering first of its kind solutions across the globe".



*iNPIPE PRODUCTS™ 90" piglets enroute*



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## Uninterrupted production during critical isolation and repair of damaged subsea gas export pipeline in Thailand

**STATS Group** has completed its second subsea pipeline repair and isolation project which was the result of vessel anchor damage.

The pipeline technology specialist was commissioned by **CUEL Ltd** to repair an 8" gas condensate export pipeline which had been dragged eight metres out of position by a vessel anchor and required a permanent repair.

STATS utilised its range of subsea products to facilitate the repair, which included BISEP's, slab valves, hot tap fittings, completion plugs, end connectors and abandonment plugs – all engineered, manufactured, tested and deployed in-field - allowing a pipeline repair with no impact to production, the environment or risk to diver safety.

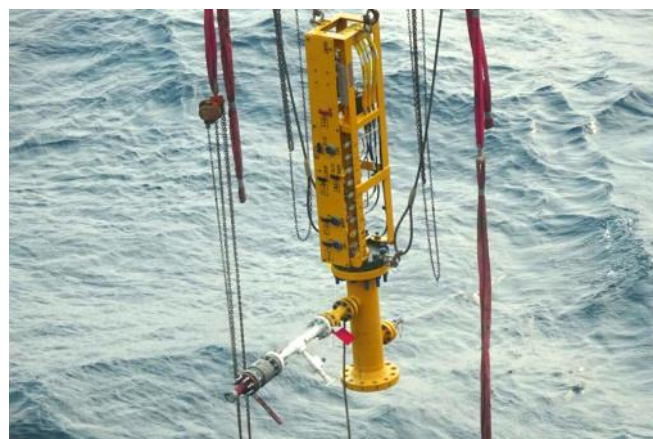
Working with CUEL and the pipeline owner, a repair methodology and solution was developed, whereby an 8" bypass was installed on the seabed as a permanent repair to re-route the pipeline medium away from the damaged pipeline section, which was situated at a water depth of approximately 60 metres and had an operating pressure ranging from between 7 and 21 bar.

Mark Gault, Subsea and EPRS Product Line Manager for STATS Group, said: "This complex subsea pipeline repair project presented many operational and technical challenges. The successful completion demonstrates STATS' ability to accommodate complex operations while maintaining high levels of safety at all times."

"STATS' range of subsea isolation and intervention equipment provides operators a turnkey service for pipeline repair scenarios and establishes STATS' capabilities within the subsea market. We will use the experience and our proven track record of first class delivery of these major projects to seek out other global opportunities for similar subsea contracts."

STATS' patented BISEP was selected to provide leak-tight isolation of the pressurised pipeline and was deployed through a full bore hot tap penetration at the isolation location through a mechanical hot tap fitting.

Mr Gault added: "The DNV GL type approved BISEP provides a fully proved, fail-safe, double block and bleed (DBB) isolation barrier from the pressurised pipeline. This level of isolation complies with industry guidance on isolation and intervention for diver access to subsea systems, ensuring diver and worksite safety."



8 inch subsea BISEP deployment

### PPSA pipeline pigging seminar Aberdeen, UK

**8th November 2017**— technical papers/exhibition  
**7th November 2017**— 1/2 day tutorials followed by evening reception/exhibition

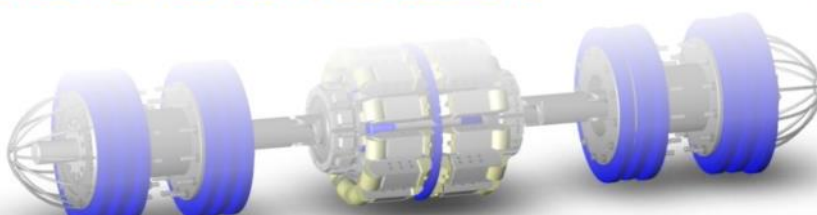
#### Call for papers and tutorials by 22nd June

For more details please visit  
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## ROSEN cleaning analytic service: run data that builds confidence

ROSEN's new Cleaning Analytic Service provides pipeline operators with the opportunity to gain information on their assets from standard cleaning runs. To this end, ROSEN captures information from multiple sources at the end of the run. The condition of the cups, the condition of the disks on the tool, and the amount and type of debris that is received tell much about a pipeline's current status. Additionally, ROSEN's Intelligent Gauge Plates and Pipeline Data Loggers (PDLs) can be integrated into the tool setup. While Intelligent Gauge Plates provide detailed information about the asset's geometry, PDLs measure and record temperature and pressure profiles, differential pressure, and rotation. The collective assessment of these parameters and monitoring of tool behaviour can be utilised effectively to detect and locate restrictions or deposits in the line, and provides cleaning progress effectiveness information while verifying operational pipeline conditions.

After all available information is gathered, it is entered into predefined templates on a tablet, directly in the field. The tablet then connects to a hosted system and the information is stored in a database. On that basis, ROSEN is able to provide valuable analytical services and generate reports, which are fed back to the customer. In this way, if applied in consecutive runs, the ROSEN Cleaning Analytic Service enables the building up of thorough knowledge about a pipeline's development over time. Additionally, status alerts can be provided, giving operators real-time feedback.

Included in the ROSEN Cleaning Analytic Service is access to a dashboard that visualizes all key metrics. Its clear design allows the evaluation of a specific run's efficiency, as well as the comparison of different runs. In addition to detailed results for each run, operators can also look at average values, such as average tool velocity or average volume of debris. This enhanced level of information increases confidence and supports operators in making informed decisions about cleaning and inspection frequency, tool configuration, and preparedness for inline inspection.

The ROSEN Cleaning Analytic Service consists of three main elements:

- The Smart Monitoring Package includes the collection of various kinds of data during cleaning runs.
- The Data Management Package includes the comparison of this data against existing pipeline system data.
- The Assessment Package includes the analysis of existing data and detailed reporting.

In this way, pipeline operators receive exactly the degree of information on their valuable assets that their individual situation requires.

## ROSEN confirms feasibility of high-level reverse lay procedure for Asia Pacific operator

An Asia Pacific operator proposed a repair solution to complete repairs to a PLEM (pipeline end manifold) attached to their decades old subsea pipeline, which was to recover it and associated attached pipeline, replace a flange connection and badly corroded sections of the PLEM/pipeline, and then return it to service. The proposed method for pipeline recovery was a reverse lay approach. To confirm the feasibility of this plan, ROSEN was approached to support with integrity services. The structural integrity of the pipeline needed to be established to confirm that the additional loads arising from the reverse lay procedure would not cause any damage to the pipeline.

In the first stage of the study, a series of DNV-OS-F101 code assessments was conducted to assess collapse due to external pressure, local buckling and propagation buckling under a maximum allowable set of loads specified by the operator for the reverse pipelay procedure. Levels of general wall loss were also assessed. Some of these scenarios were found to be unacceptable according to code, therefore further analysis had to be conducted.

In the second stage of the study, a series of finite



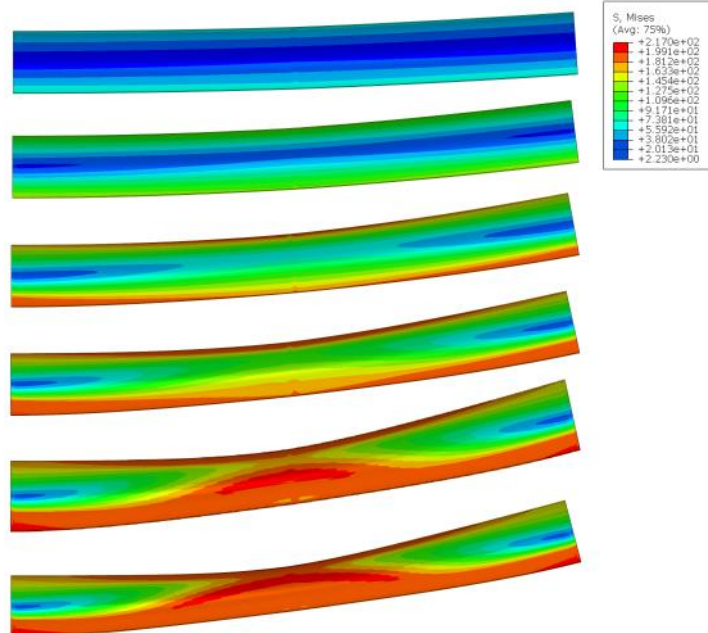
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element (FEA) analyses was conducted to generate failure assessment curves for the two worst corrosion features as well as the pipeline without corrosion (i.e. defect-free pipe). These curves show the loads at which local collapse and global collapse would be expected, under a range of different combinations of axial force and bending moment. These curves were generated so that the operator could assess the acceptability of the loads observed during the reverse. The results of the FEA analysis showed that neither global nor local collapse of the corrosion feature analyzed or the pipeline cross section would be expected under the maximum allowable loads specified by the proposed operation. This confirmed the feasibility of the reverse lay procedure assuming the worst-case corrosion features, based upon relatively old inspection data with conservative corrosion growth. The next phase of the project, when initiated, would involve further detailed engineering as the results of recent ILI and finalized repair technique/procedures are assessed to ensure the continued integrity of this crucial pipeline asset.



ROSEN's reverse lay analysis

## Golf tournament results:

The PPSA golf tournament took place at the Black-Horse Golf Club on Monday 27th February 2017. It was a lovely sunny day and twenty six teams took part. Many congratulations to the winning teams. The results are:

### First place:

Matt Chabala, Dusty Rhodes, Doug Hay, Cole Eason

### Second place:

Kelly Connally, Dana Croft, Clint Michael

### Third place:

Eric Montou, George Leiato, Brian Kidd, Jay Dinklage

**Closest to the Pin (sponsored by A.Hak):** James Hulse

**Longest Drive (sponsored by NOV):** Mike Padgett

Photographs from the event can be seen at <http://ppsa-online.com/golf.php>

## Save the date ....

The next golf tournament will take place on Monday 29th January 2018 in Houston

## Many thanks to all who took part especially our golf tournament sponsors:



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## 2017 delivers increase in pigging and plugging scopes at Jee Ltd

Jee Ltd's pigging and plugging division has had an excellent Q1 of 2017 with 11 new projects awarded by six different clients across Europe, Africa and South East Asia. The new projects, nine of which relate to pigging and two to plugging projects, are being delivered alongside eight contracts continuing from 2016.

Sitting within Jee's core engineering capabilities, the new 2017 scopes cover the full asset lifecycle from new projects to decommissioning pigging scopes and range from:

- Feasibility and concept studies for "unpiggable" or challenging pipelines and plugging operations
- Technical assurance of complex ILI campaigns including subsea launch/receipt, multi-diameter pipelines and bi-directional inspections
- Technical assurance of plugging operations for topside valve change-outs
- Site execution work overseeing pigging and inspection operations

Paul Otway, Jee's Head of Pigging, said: "2016 was a good year for Jee's pigging and plugging discipline, but this year has already started at pace. We are very excited to see where the rest of 2017 will take us, especially given the diversity of projects underway and on the horizon for existing and new clients."

Reflecting on the turbulence of the industry over the past two years, Mr Otway continues: "This time last year, inspection scopes were being deferred, increasing operational risk and the likelihood of a failure. It is encouraging to see a significant increase in the number of pigging and plugging scopes being considered and undertaken by operators, both in the North Sea and further afield, reflecting a more positive outlook across the industry."



*De-sanding pig and debris in receiver during operational cleaning*

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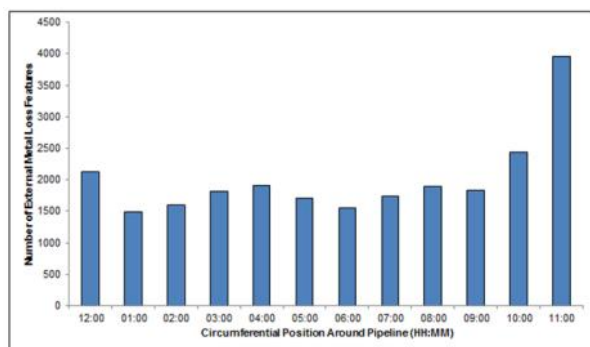
## High-speed integrity evaluations are here

There couldn't have been a more perfect time for **PII Pipeline Solutions**, a **GE Oil & Gas** and **Al Shaheen** joint venture to turn an internal R&D project into a vital repair prioritization tool for its customers.

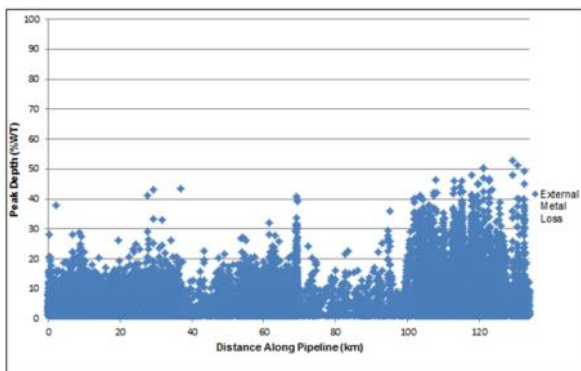
PII conducted a MagneScan in-line inspection (ILI) of a 134-km section of a 27-year-old, high-pressure, onshore gas pipeline. Their initial assessment of the MFL data indicated extensive corrosion, with over 24,000 features identified. In order to expedite a realistic and manageable repair plan, the customer had to find out which features actually needed immediate repair, versus those that could be dealt with over the next few years and beyond. They needed to know the exact whats, wheres and whens of the most critical defects — and they needed to know fast. A full integrity report typically takes anywhere from two weeks to a month to prepare, depending on various factors including run length (data volume), inspection specifications, additional inputs, and scope. But PII had a much speedier surprise in store.

Their data analysts and software engineers had already been working on precisely this issue and, by sheer stroke of luck, they had just finalized the solution. The operator was the first customer to take advantage of PII's new Excel-based integrity report — and they got it just 24 hours later.

It's that fast because it's automatically generated within their PipeImage software environment. An Integrity Engineer reviews it for accuracy, and that's it. The process is fastest on data from their own tools, but they can also input extra calculations and preparations to make it work with ILI data from other vendors. The report is provided as a 10-page Microsoft Excel workbook to facilitate ease of use, quick filtering of results, charting, and copy-pasting into other reporting tools and documents. It starts with a summary of key statistics, such as maximum defect size and distribution, so the results can be quickly digested at a glance. That's followed by a full description of the ILI findings with immediate and future integrity implications. In addition to a variety of top-level charts, full results are clearly provided in a pipeline feature listing that includes all vital information such as burst pressures and feature remaining life (time to exceeding acceptable limits and requiring repair). The report also gives GPS coordinates with Google Map hyperlinks to facilitate logistics planning for the repair program. Their new integrity report also uncovered deeper insights that could help the



*Distribution of external metal loss vs. orientation*

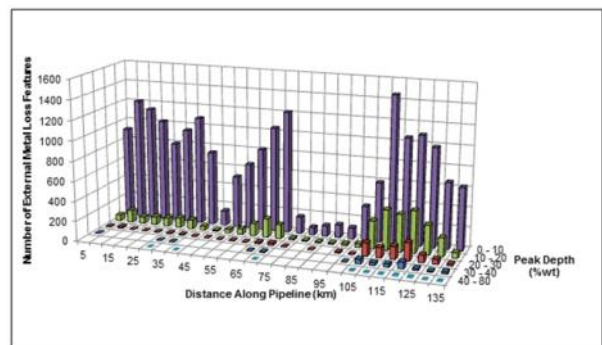


*External metal loss depth vs. distance (scatter plot)*

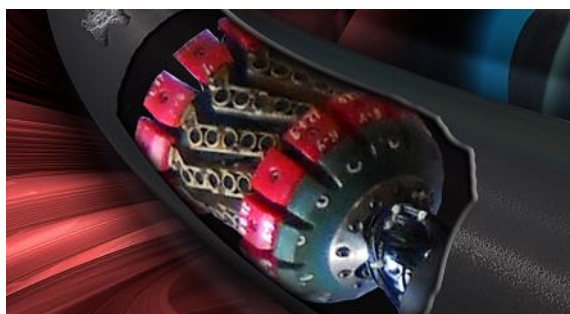
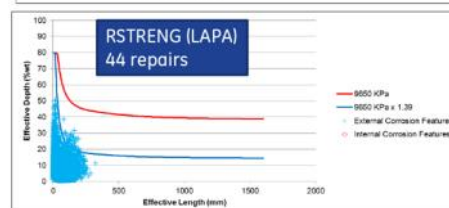
customer identify contributing mechanisms and work toward preventative measures:

- For instance, a high concentration of external metal loss was identified near field joints — this insight suggests a possible problem with the field wrap.
- There was also a slightly higher proportion of metal loss in the last quarter of the pipeline, with a higher frequency at the top of the pipe circumference, between the 10 and 2 o'clock positions, hinting at problematic soils or some other environmental influence in the area.

Of the 24,000+ external corrosion sites identified, 498 were considered unacceptable for continued operation according to ASME B31G, while 220 were unacceptable according to Mod.B31G. However, the report included an RSTRENG (LAPA) analysis which reduced the unacceptable count to 44 defects requiring immediate repair to enable continued operation. The results of the report enabled a more strategic response, and provided significant cost and safety benefits.



*Distribution of external metal loss according to depth and distance along pipeline*



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## Removing uncertainty in ultrasonic crack detection

**NDT Global** recently introduced the Enhanced Sizing capability to its ultrasonic (UT) crack inspection service. Before the introduction of Enhanced Sizing, there was an industry-wide uncertainty for crack depth sizing for depths anywhere above 4 mm (0.16 in), highlighted in the image below. Previously, for flaws above this threshold, a level of uncertainty existed. While the sizing of cracks with depths above 4.0 mm (0.16 in) was feasible, the uncertainty associated with it lead operators to adopt a conservative approach in their pipeline integrity management programs.

Anything above the 4.0 mm threshold was previously subject to speculation. There was no level of certainty when it came to sizing cracks in this range. With its new Enhanced Sizing capability, NDT Global removed this limitation. The innovation brings with it highly accurate depth sizing up to 100% wall thickness.

NDT Global's decision to develop and introduce this service to the industry underlines its commitment to seek continuous improvement in its offering to the market. Falling in line with the API standard of introduction of new developments in pipeline inspection, NDT Global planned and executed a strategy that took advantage of its leading-edge research and development from the most experienced UT crack inspection team in the industry. This process involved:

- Identifying a problem/solution
- Securing analyst feedback
- Conducting in-house research and expertise
- Simulation and modeling
- Testing – small and full scale
- Presenting the solution to market

With more accurate and in-depth information about their pipelines, operators now have the ability to conduct a more proactive, rather than reactive, integrity management program. The removal of the limitations of existing crack inspection processes provides operators with more accurate data for better-informed decision making about their pipelines. With this in mind, the introduction of more accurate information will ultimately result in safer pipelines. ●

## VKVC clamp installation to repair leak

Hydrocarbon leaks have a high probability to cause major accidents in the oil and gas industry. Leaks in hydrocarbon pipelines pose a major accident risk on land, especially if the line passes through a high population area as the danger could be life threatening.

A 14" pipeline located in Western India was reported to have developed a leak. It was a cross country transmission line and immediate repair was required. After thoroughly analyzing the situation, the **VKVC** team determined the location of the leak. They found that a 15mm crack had developed on the welding of the pipeline. A 14" VKVC clamp was selected for the repair of the pipeline. It took thirty minutes to remove the coating from the pipeline and another hour to install the clamp on the pipeline. The pipe was then pressurized and checked for 12 hours. No leaks were observed post repair and test.

Although the repair took place in extremely rough weather conditions with low visibility due to continuous desert winds carrying loose sand, the project was carried out safely without any incidents or detrimental effects on the environment. The entire procedure was meticulously planned and followed by the VKVC on-site personnel. Production and transportation was brought back without any delay thus making the client satisfied with the results. The entire process from point of contact to VKVC by the client to end result of resuming production was done within just 2 weeks. ●

## VKVC gel pigging

The oil and gas industry has been able to extend the productive lives of mature offshore pipelines using new technologies and expert management. Though successful in varying degrees, it is now known that many oil and gas platforms have reached or are approaching the end of their operational life. Here decommissioning comes into play. Decommissioning can be a particularly challenging task. Each pipeline design has its own set of complexities with respect to decommissioning. It has been observed that the probability for accidents is higher during shut down than during operational life. Owing to the hazardous nature of multiple materials handled and their impact on the

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environment and personnel, the procedures should be meticulously planned out to be efficient and safe.

Recently three 16" diameter crude oil lines were to be decommissioned as the distribution terminal located in urban South India was to be shifted. Safety was especially paramount as the lines ran through areas of high population. The lines were all of 16" NB size. All lines were filled with the product. One pipeline carried furnace black oil while the other two transported white petroleum products. The pipelines were all non-piggable thus making conventional pigging impossible.

The operator contacted **VKVC LLP** to provide and engineer a pigging solution. VKVC LLP used its high tech VKVC-Gel-2 pigging technology for the project. The pigs under this technology are water based organic, bio-degradable, non toxic and can be easily disposed of after use.

VKVC LLP mobilized the gel pigs and pigging equipment to the site. The gel pigs were formed at the location and launched using VKVC pig launchers. Once the gel pigging operation was completed the lines were cold cut at the lowest underground point. No oil or product was observed in any of the pipelines. The lines were indicated to be completely dry. The project was completed within 6 working days.

The VKVC-Gel-2 pigging system can also be launched ahead of conventional cleaning pigs to carry debris. ●

## Vitrocell Ltd and Vitrocell USA - ATEX battery certification for pipeline inspection cells

**EXIUM Technologies, Inc.** changed its name to **Vitrocell USA, Inc.** aligning **Vitrocell US** and the Canadian operations under the same brand and name recognition as their parent company, **Vitrocell Co., Ltd.** The official name change was accepted by the Texas Secretary of State on August 12, 2015. This alignment with their headquarters will allow for recognition of a single name, Vitrocell, as a supplier of high quality lithium primary cells.

Vitrocell Co, Ltd. continues to expand its sales into worldwide markets for Lithium Primary Batteries (Lithium Thionyl Chloride, Lithium Sulfuryl Chloride, Lithium Manganese Dioxide, Lithium Thionyl Chloride Reserve Thermal and Ampoule Batteries, among others). In addition to the rapid growth of its lithium primary battery line, Vitrocell Co, Ltd. has invested in developing innovative power solutions for Internet of Things (IoT), Energy Storage System and other portable devices, to name a few of the many products in production and development for the global market. Vitrocell Co., Ltd. is a recognized global supplier of portable power solutions to Smart Grid, Oil and Gas industry, Military Markets and the IoT sector.

### Features

- includes extreme shock and vibration resistance, to ensure trouble free operation under severe conditions in process
- available over temperatures -20C – 100C
- very high power and energy density
- high and stable operating voltage

The cells are suitable for temperature class T4 at ambient, atmosphere group IIB, operating zone 1 and 2 (level of protection B). The component is a lithium primary battery which can be integrated as power supply in an intrinsic safety certified equipment.

The line of products approved are:

Cell Type	Brand Name	Operating Temp	(V)
SB-A01	Tekcell	Li-SOCl2 -55°C à / to 85°C	3.6
SB-AA11	Tekcell	Li-SOCl2 -55°C à / to 85°C	3.6
SB-C02	Tekcell	Li-SOCl2 -55°C à / to 85°C	3.6
SB-D02	Tekcell	Li-SOCl2 -55°C à / to 85°C	3.6
SC-C01	Vitrocell	Li-SO2Cl2 -20°C à / to 100°C	3.91
SC-D01	Vitrocell	Li-SO2Cl2 -20°C à / to 100°C	3.91
SC-DD01	Vitrocell	Li-SO2Cl2 -20°C à / to 100°C	3.91
SW-D03	Tekcell	Li-SOCl2 -55°C à / to 85°C	3.6

### Conclusion

This new certification will benefit end users as well as pipeline inspection, magnetic flux leakage (MFL), smart utility pigging, ultrasonic (UT), radioactive techniques, pig locators, oceanographic devices, tsunami detectors, seismic devices, and others. Vitrocell is the leader of portable power solutions, for this and the next generation of tools. ●

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## Assessing the criticality of seam weld cracks

Jennifer O'Brian (Battelle, USA), Sean Moran (T.D. Williamson, USA), and Dr. Mike Kirkwood (T.D. Williamson, UAE). [1]

Today's advanced in-line inspection (ILI) tools are not only enhancing current capabilities but also adding new features that will arm operators with characterization data they have never had access to before. In particular, the **T.D. Williamson (TDW) Electromagnetic Acoustic Transducer (EMAT) ILI tool** (Figure 1) has the additional capability to create crack-shape profiles. The overall length and maximum depth of cracks are also provided in the standard EMAT reporting. Furthermore, ILI tools such as the **TDW Multiple Dataset (MDS) tool** (Figure 2) can be used to non-destructively characterize pipe material by noting the differences that may be tied to a change in pipe batch, manufacture, grade, seam type, and other material properties. In-the-ditch, non-destructive examination (NDE) techniques such as automated ball indentation (ABI) and optical emission spectroscopy (OES) are being used to report estimates of tensile strength, ultimate strength, and/or pipe grade. As these new NDE tools continue to be refined and validated, additional crack and material characterization data has the potential to drastically improve engineering critical assessments (ECA). This would be realized through improving the accuracy of failure predictions, optimizing dig and remediation prioritizations, and assisting operators to more efficiently navigate and meet U.S. Department of Transportation (DOT) compliance.



Figure 1 - 16-in Electromagnetic Acoustic Transducer tool. Two EMAT tool bodies are used for the assessment of crack and crack-like defects



Figure 2 - 16-in Multiple Dataset tool. The High Field Spiral/Helical MFL is the primary dataset used for the seam assessment on this inspection platform

To highlight the capabilities of the advanced ILI and NDE technologies mentioned above and how they could be used most effectively for an ECA, 34 crack-like seam defects reported by EMAT were assessed using Battelle's PipeAssess PI™ software. The pipeline used for this assessment was a 16-inch diameter, hazardous liquid, low-frequency electric resistance welded (LF-ERW) pipe. The potential impact of these 34 crack-like defects reported by EMAT was investigated by collecting the following information from both ILI and NDE technologies, then feeding it into PipeAssess PI and computing failure pressures:

- Effective ellipse crack profiles using EMAT [2].
- MDS material binning using pipe joint classification (PJC) [3].
- Crack type using NDE.
- ID/OD/midwall location using NDE.
- Pipe grade using PJC and NDE.
- Yield strength (YS) and ultimate tensile strength (UTS) using NDE.
- Measured wall thickness using NDE.
- Weld cap height using NDE.

Each defect was prioritized using an estimated repair factor (ERF) for an initial assessment of criticality and threat to the pipeline. The ERF metric selected was a standard "screening" approach dependent upon predicted failure pressure ( $P_{fail}$ ) with respect to maximum operating pressure (MOP). For this assessment the priorities were binned into three direct response plans as detailed in Table 1. This concept is a common ERF approach for one-dimensional screening and is often expanded upon in industry practice to account for complex features, increase binning resolution, incorporate additional criteria such as high consequence area (HCA) locations and other failure pressure metrics, and consider operational, financial, environmental, health, and public perception risks.

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Priority Level	Response Plan	ERF Criteria <sup>2</sup>
1	Repair/Replace Immediately	$0\% \leq P_{fail}/MOP \leq 110\%$
2	Remediate in 270 Days	$110\% < P_{fail}/MOP \leq 125\%$
3	Monitor	$125\% < P_{fail}/MOP$

Table 1: ERF Prioritization Criteria

The failure predictions are the product of utilizing the most accurate input available from NDE technologies commercially available today. The top five crack threats per the ERF are identified in Table 2. One Priority 1 crack required immediate repair/replace action, three Priority 2 cracks required remediation within 270 days, and the remaining 30 cracks were placed in the Priority 3 monitor program.

ERF Priority	Crack ID#	Failure Pressure (ksi)	P <sub>fail</sub> /MOP
1	6900143 5K	0.735	102%
2	6900142 4K	0.824	114%
2	6900108 3K	0.868	121%
2	6900114 8K	0.887	123%
3	6900102 7K	1.141	159%

Table 2: Top 5 Cracks identified for repair/replace action

By using advanced ILI tools that provided crack profile information (EMAT) and material binning (MDS), the number of cracks requiring immediate attention was reduced from 97% to 12%. This assessment is not only more accurate in identifying the top threats but is also more practical from a remediation perspective. Furthermore, the implication of not using these advanced assessment methods can be quite expensive as dig repairs typically range from \$25,000 to \$50,000 per dig depending on pipe diameter and location [5][6][7]. The results of this study suggest that advanced ILI and NDE

technologies combined with modelling and predictive analytics provided by *PipeAssess PI* can be used to eliminate unnecessary digs and optimize inspection intervals.

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## Enduro's 4-Step Solutions







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