PPIM

Pipeline Pigging and Integrity Management

22nd YEAR

FINAL CONFERENCE PROGRAM

WEDNESDAY, FEBRUARY 17

8.00

Opening remarks

8.10

Pipeline regulatory update

by David E Bull, ARM Manager, ViaData LP, Sugar Land, TX, USA

The US pipeline regulations are amended several times a year. This presentation discusses proposed amendments and recent rulings affecting pipeline operators. Included will be information on recent Transportation Security Administration proposals for collection of information on pipeline security programs.

8.45

Performance management of assessments and remediation

by Jerry Rau, Southern Union Gas, Houston, TX, USA
and Gary White, PI Confluence, Houston, TX, USA

Considering today's resource and financial burdens, performance measurement is becoming a valued metric. Operators have traditionally been very good at collecting data. This data, which is typically managed in a data system, is the result of an effort or a process and may be categorized as "lagging" key performance indicators. What operators have not been very good at is the measurement of efforts, which may be categorized as "leading" key performance indicators. This presentation will explore exactly what processes are and how they support performance measurement. Process management allows us to schedule, track, document and report efforts, specifically in the areas of assessments and remediation. Although assessment scheduling and dig tracking are the heart of integrity management, the processes that manage these efforts are just as important to: keep the assessment schedule current; facilitate the data analysis workflow; ensure the excavations are scheduled and completed; and to manage analysis of the results, all in a consistent and timely manner. Effective process management provides visibility into performance and creates program stability that ensures against workforce attrition by virtue of improved knowledge continuity.

9.20

Unpiggable pipelines – what makes them 'unpiggable' and available alternatives for inspection a survey

Taylor M. Shie and Dr. Gerhardus H. Koch, DNV Columbus, Inc., Dublin, OH, USA
Albert van Roodselaar, Chevron Energy Technology Company, Richmond, CA, USA

The United States has the oldest pipeline system in the world, and also one of the safest. A major reason the system is safe is that a significant portion of the onshore pipelines can be inspected using in-line inspection (ILI) tools. On the other hand, most of the offshore pipelines, located in the Gulf of Mexico, are considered unpiggable. Piggability is a major issue confronting both the on- and offshore pipeline industry, however, and if pipelines are deemed unpiggable, what can be done to inspect them and assess their integrity?

As part of a project for Pipeline Research Council International (PRCI), DNV Columbus performed an industry-wide literature search and conducted interviews with both pipeline operators and ILI service providers to determine exactly what make a pipeline "unpiggable" and what effective alternate methods exist to inspect and assess unpiggable segments and systems. This paper contains the results of this project.

9.55

Coffee, exhibition

10.30

Distribution integrity management plan: Chilean implementation experience

by Enrique Acuña, Dandilion Ingeniería Ltda, Santiago, Chile

A distribution pipeline integrity-management plan (DIMP) is currently being implemented in Chile. In February 2007 a serious accident in Valparaiso led the Chilean regulatory authorities to move forward with requirements for local distribution companies (LCDs) to establish underground pipeline integrity evaluation plans. A serious commitment from both the Regulator and LDCs is facilitating the development of a comprehensive management system, focusing on communications, quality control related to the preparation and re-engineering of procedures, and re-education of personnel.

11.05

How well do you know your pipeline?

by Paul Birkinshaw, Penspen Integrity, Newcastle upon Tyne, UK

Operators often under-estimate the importance of looking after pipeline design, construction and as-laid records. Having access to a comprehensive set of pipeline technical data can be invaluable to those responsible for preparing for pigging programs and managing pipeline integrity for pipelines with little or no pigging history. Good records permit more reliable and often less-conservative judgments over issues such as piggability or the response to reported features. Greater certainty results in reduced costs, less disruption to operations, and improved safety. This paper provides an insight into – and some examples of – how design, construction and as-built records can help manage the risks associated with pigging and integrity management, how poor records create difficulties and uncertainties, and how ILI can tell you more about pipeline construction.

11.40

Fundamentals of pigging systems and the importance of pig trap assessment

by Chris Cloyde, TD Williamson, Tulsa, OK, USA

12.15

Lunch, exhibition

1.30

Is your pipeline clean enough for inline inspection?

Intelligent inspection plays a key role in the ongoing monitoring of pipeline integrity. It is widely recognized that one of the main causes of the failure of such surveys is the unexpected presence of unacceptable quantities of debris in the line being surveyed, leading to a degradation of data quality. As a result, the design of a suitable pre-cleaning program, and the reliable assessment of its results, plays an important role in the overall success of the inspection process.

However, since techniques for assessing pipeline cleanliness have remained relatively primitive, it is generally required to design these pre-inspection cleaning programs in a conservative way, for example by aiming to clean until satisfied with the volume of debris produced with a pigging tool. This extends the times required for the operation and yet often fails to prevent compromise of the survey data by large quantities of debris.

Recent advances in intelligent callipering technology have resulted in improvements in the tools used to carry out these assessments, allowing for far greater accuracy when measuring the depth of debris present on the pipe wall. This paper looks at the techniques currently adopted for assessing the cleanliness of pipelines and in particular describes the use of Hall Effect-based sensor technology, configured to detect proximity to the pipe wall. The paper considers how this has been utilized in a tool with a suitable arrangement of pig mounted sensors which has the capability to measure the circumferential profile of debris to an accuracy of ±0.5mm.

2.05

Multi-diameter bi-directional pigging for pipeline precommissioning

by Magne Andreas Vik and Alf Age Kristiansen, StatoilHydro, Simon Sykes, FTL Seals Technology, Steve Hutcheson, Pipeline Pigging Technology, and Dr Aidan O'Donaghue, Pipeline Research (to be presented by Warwick Lockwood, FTL)

Abstract to come.

2.40

Capabilities of MFL inspection in duplex steel pipelines

by Age E Pedersen and Samuel Moe, Total, Stavanger, Norway and Hendrik Aue and Werner Thale, Rosen, Lingen, Germany

Duplex stainless steel is commonly used for offshore risers and combines the advantages of different stainless steel grades achieving corrosion- and SCC-resistance, as well as high strength, toughness and ductility. These properties enable riser sections to resist forces like wave loads and bending. Being relatively expensive, duplex usually is used for the risers only, while the rest of the pipeline consists of conventional carbon steel. This mixture of pipeline materials and the special magnetic properties of duplex are challenging for inline inspection with MFL technology.

Rosen inspected a Total pipeline with a duplex riser in 2008. Following the inspection, Total and Rosen partnered in 2009 to investigate the capabilities of MFL inspection in duplex steel pipelines. The ferromagnetic behavior of different duplex varieties had been characterized. Also a general inspection strategy for this type of pipeline was derived. The paper discusses in detail the results of pull tests in a 12-in' duplex test pipe with artificial metal loss features.

3.15

Coffee, exhibition

3.50

Panel Session: PIPELINE CLEANING PIGGING - THE ISSUES

5.00

End of day, Reception in exhibition

THURSDAY, FEBRUARY 18

8.15

Validation of the latest generation of MFL ILI technology leads to improved detection and sizing specification for pinholes, pitting, axial grooving, and axial slotting

by Eric Quick, Martin Bluck, Justin Pearce, and Jeff Sutherland, GE Oil & Gas, PII Pipeline Solutions, Houston, TX, USA and operator (tba)

In 1996, the Pipeline Operators Forum (POF) published its first version of an ILI specification to standardize how an operator and vendor would undertake a pipeline inspection. Within the POF document, anomalies have been classified into categories as a function of their length and width in order to allow vendors to state their probability of detection and sizing tolerances for each classification. Previously, when utilizing axial MFL tools, ILI vendors were not capable of supplying probability of detection and sizing specifications for several categories such as pinholes and axial slotting. Recent advancements with MFL technologies has allowed for improvements to be stated for both probability of detection and sizing tolerances for pinholes, pitting, axial grooving and axial slotting.

This paper will summarize experience gained from both pull-through and field results of the latest generation MFL technology leveraging data from a high density array of axial, radial, and transverse sensors. The data will show there is a distinguishable improvement in the probability of detection and sizing tolerances for many of the POF categories which will allow pipeline operators make more informed pipeline integrity decisions.

8.50

Detection of active corrosion from repeated ILI runs

by Guy Desjardins, Desjardins Integrity, Calgary, AB, Canada

Repeated in-line inspections (ILI) of transmission pipelines have been used for many years to estimate corrosion rates. However, the calculation of a corrosion rate from a direct comparison of ILI anomalies is often dominated by measurement error. An alternative to assessing a corrosion rate may be to use repeated ILIs to detect the presence of active corrosion by examining various statistical properties of the data. These statistics do not estimate corrosion rate, but they can indicate the presence of active corrosion. Once the active corrosion has been identified, the operator is then able to address each location.

9.25

A decade of bi-directional MFL inspection applications ILI experience in non-piggable pipelines around the globe

by Basil Hostage and Dr. Rainer Schmidt, 3P Services, Lingen, Germany

The paper offers a critical review of various pipeline inspection projects using 3P Services' bi-directional MFL inspection technology. Case histories are on tanker loading/unloading pipelines and North Sea applications. The focus of the paper will be to evaluate the different technical challenges encountered on each project. Advantages and disadvantages are discussed compared to inspection alternatives.

10.00

Coffee, exhibition

10.45

Inertial ILI results as basis for immediate repair prioritization, future risk-based mitigation strategies

by Markus Brors, Rosen Integrity Solutions, Houston, TX, USA

Environmental variables play a significant role in many of the key processes of pipeline integrity management, from determining design factors for construction to guidance on repair prioritizations and input on consequence assessment in a risk-based mitigation program.

This presentation is about the software-aided process for automated geographical pipeline centerline creation as the basis for a high consequence area (HCA) analysis, and how the process is ultimately used in defect criticality prioritization and a risk-based mitigation strategy.

11.20

Advanced assessment of pipeline integrity using ILI data

by Dr Ted L Anderson, Quest Integrity Group, Boulder, CO, USA

Improvements in in-line inspection (ILI) and computing technology, coupled with the emergence of fitness-for-service standards, have created an opportunity to advance the state-of-the-art in pipeline integrity assessment. This paper describes novel approaches for assessing cracks, wall loss, and dents in pipelines using data from ILI tools. Case histories will be presented for each of these anomaly types.

Crack-detection ILI tools that rely on shear wave UT have improved significantly in both detection probability and sizing accuracy. The Quest Integrity Group (QIG) employs realistic fracture mechanics models that utilize 3D elastic-plastic finite-element analysis. These analyses yield accurate predictions of failure pressure in pipelines that contain cracks. The combination of advanced modeling and reliable ILI provides a superior alternative to hydrostatic testing for ensuring pipeline integrity.

ILI tools that measure wall loss with compression wave UT provide superior results compared to MFL tools. The former outputs a digital map of individual thickness readings while the latter provides only estimates of flaw dimensions. Digital wall loss data obtained from UT-based ILI tools is ideally suited to effective area assessment methods such as RSTRENG and the API 579 Level 2 Remaining Strength Factor (RSF) calculation. QIG has developed software that can rapidly process large quantities of ILI wall loss data and evaluate the maximum allowable operation

pressure (MAOP) at discrete locations. The ranking of these MAOP values serves as a rational and rapid means for prioritizing the severity of corrosion throughout the line.

Dents that are introduced during fabrication, installation, or by a third party are the most common source of failure in pipelines. Traditional assessments are based on a simplistic characterization of the dent (such as the ratio of the dent depth to the pipe diameter), combined with a simple empirical equation. QIG has developed an advanced dent assessment that combines a detailed mapping of the dent from ILI data (either UT or a caliper pig) with 3D elastic-plastic finite element analysis. A dimensionally-accurate 3D model of the dented pipe is subjected to cyclic loading, and remaining life is computed through a proprietary low-cycle fatigue damage model. This advanced methodology can be applied to interacting anomalies such as dent/gouge and dent/crack combinations.

11.55

Lunch, exhibition

1.15

Augmenting ILI tools to assess external coatings

by J Bruce Nestleroth, Battelle, Columbus, OH, USA

This paper reports the results of a project in which a new sensor was developed to assess external coating that could work with currently available in-line inspection tools for minimal additional cost to perform the inspection. This development started with modeling and experiments to establish an optimal configuration for coating assessment. A multiple feature approach was used.

External coatings are routinely used to protect transmission pipelines from corrosion; however, coatings may degrade or disbond over time, enabling corrosion to occur. Transmission pipeline operators often use magnetic-flux leakage (MFL) ILI tools to detect metal loss corrosion defects. Rather than finding the cause of a problem, failure of the coating within a corrosive environment, MFL corrosion surveys only find the result of the problem, corrosion defects that may permanently alter the pressure carrying capacity of the pipeline. Stress-corrosion cracking (SCC) can be detected using ILI technology, but the availability of tools is limited and the cost of inspection is high compared to MFL inspection. SCC almost always occurs at coating faults; direct coating assessment could indicate future problems that could degrade the serviceability of the pipeline.

In this project, a new sensor was developed to assess external coating that could work with currently available in-line inspection tools for minimal additional cost to perform the inspection. This development started with modeling and experiments to establish a more optimal configuration for coating assessment. A multiple feature approach was used.

A commonly used feature, signal amplitude, provided good sensitivity to coating condition but was influenced by inspection variables. One unique feature identified in this development is arrival time of the ultrasonic wave. For the wave type and frequency selected, the wave velocity was different for bare and coated pipe. Therefore, disbonded or missing coating can be detected by monitoring arrival time of the ultrasonic wave, a feature that is amplitude independent. Another feature for assessing coating, absorption of selective frequencies, was also demonstrated.

Coating assessment capability was experimentally demonstrated using a prototype EMAT ILI tool. All three detection features were shown to perform well in an ILI environment as demonstrated at Battelle's Pipeline Simulation Facility and BJ Inspection Services pull rigs. Improvement to the prototype occurred between each test; the most significant improvement was the design and construction of a novel set of thick-trace transmitting and receiving PCB EMAT coils. Implementation variables such as moisture and soil loading were shown to have a minimal influence on results.

1.50

Case Study: Crack-sizing performance of the GE Ultrasonic Phased Array inspection tool on the Centennial pipeline

by T Hrncir and S Turner, Marathon Pipe Line LLC, Houston, TX, USA
S J Polasik and P Vieth DNV Columbus, Columbus, OH, USA
D Allen, I Lachtchouk, P Senf, and G Foreman. Presented by Mark Slaughter.
GE Oil & Gas, PII Pipeline Solutions, Houston, TX, USA

This paper documents the exercise undertaken by GE for Marathon Ashland Pipeline Co to change the sizing tolerances of the crack-detection ILI tool to an actual predicted depth with a more practical depth tolerance of +/- 1mm, from the traditional wide banding tolerance for this type of inspection. DNV (CCT) supervised and validated the field results and then used this enhanced sizing to provide a more cost-effective and practical crack-management plan for the Centennial Pipeline.

GE performed an ultrasonic phase-array (UltraScan DUO) ILI survey of a 24-in and 26-in products pipeline. The primary purpose of this ILI survey was to detect and characterize stress-corrosion cracking (SCC). A dig verification was subsequently performed through 2008 in order to establish a higher level of confidence in the detection and depth-sizing capabilities of this technology. The paper presents an overview of the USCD technology and experience, the method used for validating the ILI survey results, enhancements to the ILI data analysis, and the impact on managing the integrity of the subject line section. This enhanced sizing tolerance is now being made available to anyone needing more specific crack-sizing surveys.

2.25

Thresholds, accuracies, resolution: advantages of quantitative measurements for metal loss inspection

by A. Barbian, M. Beller, A. Hugger, C. Jäger, A. Pfanger, NDT Systems & Services, Stutensee, Germany
corresponding author: Beller

Different physical principles apply to various methods of non-destructive testing of pipelines, and each method has its own set of advantages and disadvantages. Choosing the most suitable NDT technology – and therefore in line inspection tool – for a given inspection task requires an understanding of these different techniques and their system-specific measurement thresholds, accuracies and resolutions. All of the latter are critical parameters relating to the suitability of inspection data as input for assessment codes such as ASME B31G, RSTRENG or DNV RP-F101. This paper will discuss major issues regarding the quality of data with respect to their use for integrity assessment and fitness-for-purpose applications. Case examples will be used to explain and show differences between qualitative and quantitative measurements. The influence of accuracy, resolution and confidence levels and their effect on integrity assessment results will be discussed.

3.00

Integrity management cycfles: practical examples from around the world applied to pipelines and beyond

by Bill Rees
PIMS of London Ltd, London, UK

Pipeline integrity managers have long considered the application of a dynamic process –serving to ensure improved security, safety and risk-control within oil and gas pipelines – a best-practice technique. In some cases, regulators attempt to implant such a dynamic process into the day-to-day rhythm of pipeline operators by calling for deliverables and reports that can best be produced as a by-product of such an integrity-management cycle.

In this paper, we examine how an integrity-management cycle is defined and applied by various operators around the world – including some who face regulation and others that do not. This exercise will illustrate those aspects common to all best-practice operators, regardless of the regulatory environment within which they operate. Provided that they align with the principles of continuous improvement, there is sound business logic to justify operations along the lines of an integrity-management cycle. In developing this paper we highlight the traits that are necessary to ensure that great businesses benefit from such process cycles.

The consideration that the integrity-management cycle is a business process is further underlined by a case study detailed within this paper. This illustrates how a consistent business process was extended beyond pipelines and shaped to apply to pipeline operators' facilities – ensuring that the entire transport system was covered by such a best-practice business operating technique.

3.35

Pipeline risk-based inspection – understanding and managing risk

by Dr Stephen Ciaraldi,
Technical Integrity Solutions,
BP Integrity Management Technical Authority (ret.),
Midlothian, VA, USA

4.00

End