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API Inspection Summit – *Upstream/Mid-Stream* Preliminary Program

Tuesday, January 8, 2013:

Challenging to Inspect Pipelines Track:

Unique Offering for Inspection & Assessment of Challenging to Inspect Pipelines, Real World Applications -Stefan Papenfuss, Quest Integrity Group
"Pipeline operators have always been aware of the need to manage and maintain the integrity of their pipeline systems. Advanced ultrasonic in-line inspection tools are capable of providing accurate, repeatable, 100% coverage data that can be used to manage pipeline reliability from cradle to grave. Recent advances and proven deployment of compact and highly accurate ultrasonic inspection tools for non-piggable pipelines are now allowing operators to examine pipelines and piping systems that were previously difficult, if not impossible, to completely inspect. Quest Integrity Group has developed a unique ultrasonic in-line inspection solution (InvistaTM) and fitness-for-service assessment of pipelines (LifeQuestTM) for pipelines that cannot be inspected using ordinary in-line inspection technologies. This paper examines some real-world case studies covering the application of this technology to inspect and assess traditionally non-piggable pipelines both in Australia and internationally.

Ultrasonic Pig for Difficult to Pig Lines - Hans Gruitroij, A Hak

Inspection of Lined Pipelines - Dave Russel, Russell NDE
The inspection of pipelines that have internal liners or coatings of epoxy, cement mortar, P.E. and HDPE has been a challenge for the incumbent MFL technology which is employed in most in-line inspection tools. While MFL is an excellent technology for the condition assessment of bare steel pipelines, it loses sensitivity as the distance of the sensors to the steel pipe increases. Remote Field Technology (RFT) is relatively insensitive to this "lift-off" of the sensors and can inspect through liners as thick as 1". The technology has now been in use in O&G pipelines for more than five years. The technique is described and three case studies are presented, along with new variations of the technology for detection of CUI from outside the pipe.

Innovative Pipeline Monitoring & Inspection Technology - Brian Morr, Subsea Integrity Group

Jan. 8 cont.

NDE Track:

Monitoring of Pipes Using Permanently Installed Guided Wave Sensors - Dr. Thomas Vogt, Guided Ultrasonics

Guided Wave Testing is now an established method used in the petro-chemical and related industries for screening pipe-work for defects. Each guided wave test requires amplitude calibration, which is currently based on the observation of the reflection amplitudes from girth welds as a reference. These amplitudes are assumed to be of a certain size and constant with frequency, but depending on the actual dimensions of the weld reinforcement this assumption can introduce large errors in the calibration. More advanced techniques therefore require direct measurement of the dimensions of the weld reinforcement, which allows for a more accurate estimation of the expected reflection amplitude. Nevertheless, this approach also breaks down, for example, when the weld reinforcement varies around the pipe circumference, there are no accessible welds that can be measured or the weld is defective in a way that it influences its reflection amplitude. All this has a direct impact on the reliability of the inspection since all defect reflections are sized with respect to this reference. For example, an over-estimation of the size of the weld reflection can lead to costly false calls. Until recently, existing calibration techniques were largely satisfactory for standard screening applications, but the demand for greater accuracy in the classification of defects makes a new approach necessary. The novel calibration technique presented here is a significant advancement in this direction and at the same time removes most of the limitations of current calibration techniques.

Structured White Light for Surface Damage Assessment - John O'Brien, Chevron and Matt Bellis

This paper will explore the development and application of a value for money, simple, highly accurate structure white light field unit for the profiling of surface damage, corrosion, mechanical damage. In the ditch validation of ILI indications and other surface features has progressed over the years from simple mechanical pit gauge tools to sophisticated laser scanners. These have had variable results and can be time consuming. Seikowave in conjunction with Chevron has developed Seikowaves structured light scanner into a filed portable device that can image surface damage in seconds, process and deliver fitness for service answers within minutes. We will explore images, comparisons with existing tools and outputs from the process.

Jan. 8 cont.

Radiographic Surveys for Locating & Evaluating Corrosion - Joseph Galbraith, Phillips 66 Pipeline Company

Over the last twenty-five years, advances in digital image capture along with the development of durable electronic computers, components and increasingly capable means of creating x- and gamma ray energy have led to more cost-effective, more capable applications of radiographic non-destructive testing in industry. Radiography can provide the most cost-effective non-destructive testing (NDT) technique for locating and evaluating anomalies that can adversely affect the integrity of an exposed, operating, in-service pipeline. The restrictions associated with the use of radioactive sources and the requirements for chemically developing the exposed film in a darkroom environment have historically decreased its use as an NDT method; however, recent advances in the sources and the image capturing devices have rendered the technique much faster, more powerful and more cost-effective as a field technique. The systems can be remotely deployed in areas difficult or dangerous to access, and can be used to generate information on an operating pipeline without the extensive, expensive preparation such as insulation and/or coating removal required when using other NDT techniques such as ultrasonics. Not only can digital images of hidden pipe features that can impact its ability to safely operate be directly created, processed, viewed and acted on in real-time in the field, but also the image enhancement software commonly available today can greatly assist the analyst in quickly determining the safe operating pressures of damaged pipelines. Techniques for locating and evaluating both internal and external corrosion on piping utilizing some of these advanced systems are discussed in this paper.

Subsea RT - James McNab, Oceaneering

Reliability / Integrity Management Track:

In the Ditch NDE Technique Performance - Mark Piazza, PRCI and John O'Brien, Chevron

This paper will present selected results from an on-going multi-year project within PRCI to evaluate and report the performance of NDE tools. Understanding the inherent tolerance and variability of NDE tools and the impact on measurement data related to procedures and personnel are critical components of assuring the quality of integrity decisions in support of process safety. To support the development of industry guidance on performance of NDE technologies, PRCI has established a state of the art repository in Houston, TX housing real world flawed pipeline samples across a range of defect types from Internal & External Corrosion through Stress Corrosion Cracking (SCC), Fatigue Weld Cracking, Dents, Gouges and a range of interacting threats. These samples are truly representative of real world flaws in sections up to 40’ in length. The repository is used for knowledge learning, training, and technique and technology development, as well as the core program of testing and determining NDE performance. We will demonstrate results from testing to date sharing what has been learnt about the performance of select NDE techniques for a range of flaws and features.

NDE and Validation of ILI - Sean Riccardelli, Riccardelli Consulting
Non-destructive examination (NDE), utilized as defect direct-assessment and validation of in-line inspection (ILI) smart tool data, is a critical function of pipeline integrity management. However, it is imperative that proper technology and techniques are deployed for validating anomalies identified by ILI smart tools. These defects must be properly characterized and the smart tool technology must be accurately graded by validation. Advanced ultrasonics, such as phased array, can provide more accurate crack sizing and corrosion mapping; or allow for more valuable defect characterization and post-inspection analysis. Furthermore, accuracy of ILI tool validation can be enhanced by the development of special calibration standards and ultrasonic probe holders, automated and semi-automated data acquisition scanners, and proprietary zonal-focusing transducers. Proper education and training is vital for the inspector technicians that are called upon to perform these duties. Qualification on real flawed specimens such as defect pipeline cutouts and mandatory practical exams can be a supremely beneficial implementation to validate an inspector's technical capability. Oil and gas operators, ILI smart tool developers, inspection companies, and pipeline integrity engineers are all encouraged to work together as a consortium to more effectively understand, develop, and implement best practices for the non-intrusive identification of pipeline defects, validation of anomalies identified by ILI smart pigs, and direct assessment of defect anomalies.

Integrity Management of AST Through Estimation of Corrosion rate of Bottom Floor Plate - Tariq, Al-Masoud, Kuwait Oil Company
Aboveground storage tanks are considered as vital assets in upstream sector of oil & gas industry. The large inventory of flammable product stored in these tanks poses a significant risk from HSE perspective. Over the years, Risk based inspection has been developed as alternative approach to assess the mechanical integrity of the tank and its components. Kuwait Oil Company (KOC) has large number of Aboveground storage tanks in Gathering centres and Export Tank farms, storing crude oil in different stages of production. Life assessment and integrity of these Aboveground storage tanks primarily depends on the tank bottom plate corrosion. Operational requirements occasionally constrain periodic intrusive inspection of these tanks. Longer operating cycle between successive intrusive inspections necessitates estimation of realistic corrosion rate, in order to adopt suitable integrity management program. In this paper, a study on the estimation of theoretical corrosion rate of bottom plate for Aboveground storage tanks

in Gathering Centres in Kuwait Oil Company has been made, using API-581 Risk Based Inspection recommended guidelines. Various extraneous factors like soil resistivity, water drainage and protective measures like cathodic protection etc.,

Advantages of Automated Ultrasonic Inspection of Pipeline Girth Welds as Compared to Radiography". - Andreanne Potvin, Olympus NDT

Panel: Buyer Beware - Validation of In Line Inspection Results – Panelists: Luc Huyse Chevron, S Riccardelli, M Piazza PRCI, B Brown ROSEN
'Caveat Emptor', Buyer Beware do you really understand what you will get when you buy ILI services or do you even understand what you need? This panel will discuss what you can and cannot see with ILI tools and invite challenges and discussion around this topic. Do buyers have unrealistic expectations? Do vendors deliver what they promise? Is the question more complex that people really comprehend?

Wednesday, January 9, 2013

Challenges to Inspect Pipelines Track:

Challenges & Technology Solutions in Integrity Management of Pipelines & Subsea Systems - Dave Wang, Shell
This presentation will provide an overview of major challenges and technology solutions for integrity management of onshore and subsea systems. The discussion will focus on three major challenges: 1) inspection of onshore and subsea pipelines that cannot be examined by conventional inspection pigs, 2) monitoring of pipelines for corrosion wall loss, third party intrusions, and geohazards, and 3) rapid response leak detection systems. Examples will be given on technologies that can help overcome the challenges. Such examples include free swimming pigs, electromagnetic acoustic transducer (EMAT) Lamb wave scanning, digital radiography, large standoff magnetometry, riser weld inspection pig, guided wave tomography, pressure wave and real-time transient modelling (RTTM), and fiber optics. The objective of the presentation is to encourage development and implementation of technologies that can close the major integrity management gaps currently existing in our industry.

Alternatives for Challenging to Inspect Pipelines - Bob Burns, Applus
Depending on the pipeline design, its operational characteristics, the extent of any damage (third party) to the line and economic factors that may or may not justify line changes, a pipeline may be designated as unpiggable. Unpiggable means these lines are not currently being inspected using In-Line-Inspection technologies. Unpiggable

pipelines are therefore a population of pipelines that have a broad range of characteristics and operators will often apply criteria to prioritize these, for integrity assessment. In this presentation we will provide an inventory of alternative inspection approaches commonly used to secure data for integrity assessment purposes. In addition, one novel approach that could be applied to short sections of pipe with limited access will be described. Long Range Ultrasonic System (LORUS) was developed and has been used primarily for the inspection of annular plates in a storage tanks for almost two decades. Applus RTD has been working to adapt the technology for use in pipelines by developing a unique comparative evaluation model.

Non-Intrusive Corrosion Monitoring - Geir Instanes, ClampOn AS
The paper discusses the latest technology development for Non-Intrusive Corrosion Erosion Monitoring for subsea installations.
Subsea production templates, flow jumpers, manifolds and flow lines can today only be inspected by pre-installation of corrosion/erosion sensors or by use of ROC-operated sensors. Current pre-installed sensor systems for monitoring pipeline integrity have proven to be of limited value to the operators and ROV-operated sensors only provide indicative and unreliable readings. A major challenge is that “hot-spots”, i.e. areas particularly susceptible to erosion/corrosion, are often detected after the template has been in operation for a while. Accordingly, the ability to retrofit a corrosion-erosion monitor (CEM) on identified hot spots subsea is crucial. Monitoring of pipe integrity is increasingly important as installations grow older.

Robotics for Challenging to Inspect Pipelines- Robert Pechacek GE Energy Management
This presentation overviews a new line of buried pipe inspection systems (Surveyor) recently introduced by the General Electric Company. These tools are targeted to address the needs of the Oil & Gas and other Industries to perform comprehensive inspections of their unpiggable buried piping systems to determine the integrity of the piping. Most unpiggable piping is not accessible from the OD and requires a comprehensive ID inspection solution. There have been few options for addressing these critical needs in the past. These devices use tethered, self-propelled robots to perform high resolution ultrasonic or electromagnetic inspections from the pipe ID to detect and map both ID and OD corrosion of the pipe wall. The Surveyor systems are capable of operating in liquid-filled, partially filled or empty piping systems. I will outline the capabilities, strengths and limitations of the Surveyor systems and the range of pipe diameters and conditions where it can be utilized. Additionally, I will overview recent 3rd party qualification testing of the technology and field deployment case study results. This presentation is targeted for all unpiggable piping asset owners and managers and will be delivered at a target intermediate level. Typical applications include storage

terminal pipe, transmission piping, road crossings, facility piping and all critical, low access piping systems.

Challenging to Inspect Pipeline Pipelines Solutions - Rolf Spoerkel and Steven Trevino, Oceaneering

In Line Inspection of Seam Welds – Adrian Belanger, TD Williamson
In the seam weld of a pipeline has long been susceptible to corrosion and anomalies due to the welding process, and because of its axial orientation, failures can be catastrophic. In the past it has been difficult to evaluate seam welds using traditional magnetic flux leakage (MFL) techniques, but with the development of new technologies, long seam assessment has become a staple of inline inspection. Each technology has its strengths and weaknesses, and this presentation will examine the use of magnetic flux leakage, ultrasonic inspection and electro-magnetic acoustic transmission (EMAT), describing their pros and cons so that pipeline operators can make informed decisions in choosing the best technology for their pipeline integrity programs. Line Inspection of Seam Welds.

Corrosion / Metallurgy Track:

Advanced subsea Inspection - Paul Cooper, Oceaneering
The rapidly growing number of subsea pipeline and riser systems has challenged the oil and gas industry to develop new automated inspection solutions for sophisticated materials and geometries. The new creative design solutions for deep water field development, combined with a growing requirement for subsea field life extension demands non-intrusive inspection techniques that provide detailed information for engineering evaluation. Operators are facing the commercial challenges to justify continued operation of existing subsea infrastructure where loss of hydro carbon containment is an ongoing risk that needs to be mitigated. With these operational and commercial challenges, comes an opportunity for innovation. Oceaneering is a market leader in developing and applying advanced subsea inspection technologies, and is in a unique position to combine in-house inspection technology, NDT expertise, and subsea engineering to provide the industry with NDT and condition monitoring solutions to meet the ever increasing subsea asset integrity requirements. Case studies will be presented, with focus on project specific challenges, solutions and results.

Upstream Digital RT - Case Studies - John Iman, GE

Inspection of Pipelines Using High Resolution MWM - Todd Dunford, JENTEK Sensors
This presentation focuses on upstream and midstream applications of MWM-Array eddy current sensors. MWM-Arrays offer a leap in capability for applications including pipe

wall thickness measurement through coatings, SCC mapping, and the characterization of pitting. Solutions for in-line inspection (ILI), underwater inspections (shallow water and deepsea) for pipe wall thickness, and permanently mounted sensors for continuous monitoring are also being developed. This presentation provides a status review on solutions for each of these applications. The specific advantages of the MWM-Array technology are: (1) the use of simple drive windings and sensor array constructs that can be accurately modeled using layered media models; (2) parallel architecture, high integrity impedance instruments; (3) multi-variate inverse methods that use Hyperlattices™ (pre-computed solution space databases) to convert wide bandwidth sensor data into real material properties (such as pipe wall thickness); and (4) GridStation decision support software that enables reliable inspections and data visualization. The progress over the last few years has been funded by the U.S. DOT with specific applications funded by PRCI and oil majors. Specific advancements include the development of an impedance instrument that can provide accurate measurements at very low frequencies (less than 5Hz) and high data rates at higher drive frequencies (10,000 samples/second for frequencies above 10kHz). This instrumentation allows the MWM-Arrays to perform inspections that are not typical for eddy current sensors, such as pipe wall thickness measurement and internal corrosion using in-line inspection (ILI). A series of case studies will be presented that demonstrate how eddy current sensors such as MWM-Arrays and very low frequency MR-MWM-Arrays can be applied to upstream and midstream applications. Permanently Installed Wireless Monitoring Sensors - Gene Silverman, Berkeley Springs Instruments

Permanently Installed Wireless Monitoring Sensors - Gene Silverman, Berkeley Springs Instruments

Acoustic Emission of Well Site Tanks - John Nyholt, BP America

Advanced Ultrasonic (caveman) Flaw sizing techniques - Mark Davis, Davis NDE

Reliability / Engineering Track:

Terminal Facility Piping Inspection Programs - Scott Lebsack, Mistras Group
In 2011, API Issued RP 2611 Terminal Piping Inspection—Inspection of In-Service Terminal Piping Systems. This document addressed the need to assure operational integrity without having to use API 570 as the basis for terminal integrity inspections. While API 570 can be applied to any process piping system, it is not a good fit for the different operating conditions found in a terminal versus those in a refinery. Terminal operators have recognized the need for periodic monitoring to ensure, public safety, operational integrity, and reduce environmental risk. Conditions in and around terminal

facilities dictate that a variety of assessment methods are needed to initiate an effective piping integrity program in terminals. This presentation examines the inspection challenges that are found in terminal operations as well as presenting the approach used in carrying out assessment programs following API RP 2611. Requests for diverse inspection programs to assess specific circumstances in terminals have increased over the last three years. Terminal operators are addressing an ever increasing public awareness of risks posed by these facilities along with an increasing regulatory and environmental awareness from local and national agencies. Case histories are used to illustrate how a comprehensive terminal inspection program is developed and how unique situations are addressed using a variety of inspection techniques to get the data needed to establish the condition of the pipe.

The Essential Elements of an Integrity Management System - Nick Marx, IRML
This is a presentation for an entire integrity management system not only an integrity assessment. Elements are: Elements. System scope; clearly define what is included and what is excluded. Organization & responsibility effective organizational structure: senior management, line management (QA/QC), integrity assessment, maintenance, operations, engineering, construction and purchasing. Concept, design, engineering must be clearly defined (DBM along with numerous HAZOP's) engineering contractor is suitable. Fabrication, construction, erection ensure companies have the jurisdictional approvals and sufficient competence Commissioning. Handover from projects to operations; Operating parameters and procedures need for the revision of existing procedures or the addition of new ones. Threats analysis, mitigation & monitoring; Operations ensure the equipment is operated within the parameters notices of any such excursion. Repairs & Alterations must include the steps necessary to effect both. Competency - some form matrix of tasks to identify the required certification, skills and knowledge. Inspection – integrity assessment Inspection at every stage of a program; competence of each inspector what and how criteria are to be established to determine inspections. Change management identify what items, processes and procedures need to be controlled. Purchasing, material control, contracting & approved vendors. Internal auditing. The IMS needs to be evergreen; must address changes to regulations, procedures and industry best practices. Corrective & preventive measures identify what types of issues root cause can be identified and eliminated or mitigated. A properly developed IMS will result in fewer incidents, unexpected outages, This better understanding of the resulting risk involved will also deliver a higher assurance of safety.

Real Time Application of Rarefaction Wave in Pipeline Leak Detection - Andy Hoffman, Atmos International

Acoustic (negative pressure) pipeline leak detection technology has been around for more than thirty years. However its application to operational pipelines has been limited, largely due to the large number of false alarms generated. This presentation addresses the development of a new rarefaction wave pipeline leak detection system, based on high performance pressure sensors, modern communication systems and advanced signal processing algorithms. Compared with the traditional acoustic systems, this new leak detection system has the following advantages: It works on all pipe materials: Lead, PVC, HDPE, MDPE, Cast Iron, Steel, Cement. It can cover any distance between 100 metres and 250 kilometres between two consecutive pressure sensors. It has a detection time of less than 3 minutes for leaks down to 1% of nominal flow. Leak location typically within ± 100 metres. Leak detection under all operating conditions including shut in and hydrostatic tests. A low false alarm rate once tuned to pipeline operations.After a description of the system, its application to a few operational pipelines will be discussed. The real life performance of the system will be presented with over 100 leak test results and the implementation details. The main challenges faced by the pipeline industry will be discussed together with realistic performance expectations.

Enhancement of Pipeline Integrity Management Plans with Advanced Leak Detection Technology - Maurino DeFebbo, Asel-Tech
Commercial use of internal leak detection monitoring technology on transportation pipelines has been common practice of pipeline operators for many years. The overwhelming majority of existing internal leak detection monitoring technology currently deployed is commonly referred to as “Mass Balance”. With ever increasing pressure from the public, the media, government regulatory agencies and pipeline operator management to mitigate pipeline failure risks and cost, there is a very keen demand for alternative and improved technology to be utilized across the integrity management board. The notion (and some techniques & vendors) of Acoustic leak detection have been around since the late 1970’s. Acoustics never really caught on because consistent performance was always an issue. Since that time, the quantum advances made in sensor/transducer technology and signal processing techniques and technologies (computers) has significantly enabled development of acoustic leak detection monitoring technology that works substantially better than its predecessors, and in most cases better than other CPM/Mass Balance type methods. Some advanced systems even allow for integration of the acoustic technology with mass balance type systems. The result being, a very versatile/broad spectrum system with built in redundancy.

Leak Detection by Distributed Acoustic Fiber Sensing - Collin Stegeman, BT

A solution for a solid Fiber Acoustic Sensing leak detection capability will be discussed. One of the most valuable applications is Leak Detection on pipelines, both for liquids and gas. Provided that the Fiber optic cable is close to or attached to the pipeline, a leak detection accuracy of 3 liters per minute is achievable in a low pressure liquid pipe. The entire described Fiber Sense system consists of only two parts: a standard fiber optic cable and a Helios interrogator on one end. The interrogator detects minute changes to the reflected light in the fiber caused by small vibrations anywhere along its length. Any noise or vibration disturbance to the fiber at any point can be detected at the end of the fiber. This means that anything – machinery, refineries, pipelines, even boreholes – can be closely monitored for changes that could signal trouble. The captured vibrations are analyzed and categorized against known parameters to determine if they can be ignored or passed on for further analysis. The solution can be fully integrated with existing CCTV, GPS and GIS technologies to pinpoint events. Intelligent location detection and tracking (LDAT) platforms manage alerts and minimize false positives.

Remote Sensing for Early Detection of Oil On water & Clean Up Support - Nina Soleng, Kongsberg Satellite Services
Use of Synthetic Aperture Radar (SAR) sensor from satellites has proven to be an excellent tool for detection of oil slicks, vessels and installations at sea. This advanced sensor can detect oil slicks due to the change in behavior of the sea surface (the slick´s dampening effect on the capillary waves). These radar satellites are able to observe features and objects on the surface independent of day light and works in cloudy and foggy conditions.

SAR has been used operationally for early detection of oil spills in Scandinavia since early 1990's for national authorities and the oil industry. This service concept was developed in Norway, and has been improved and refined through years of participation in national and multinational R&D projects. The analysis results from the experienced operators are overlaid with maps /positions of rigs, drilling ships, pipelines and subsea installations for detecting the most likely origin of the slick. Identification of vessels (AIS) is also integrated with the analysis. The oil spill detection service today has a tailored production chain for rapid alerts. So what started in Scandinavia 20 years ago today comprises of 26 European coastal states through European Maritime Safety Agency (EMSA) and is currently provided world-wide, assisting national authorities in detecting oil discharges, and alerting oil companies of any early indications of oil leaks. In Norway this monitoring by remote sensing is maintained by two entities; The National Coastal Administration is responsible for monitoring of the shipping lanes, monitoring for accidental and illegal discharges from vessels. NOFO (Norwegian Clean Seas Association for Operating Companies) is the responsible entity handling satellite monitoring of the offshore activity on behalf of their members (all operating oil companies on the continental shelf). Oil spill detection using local radar (OSD) is being used in addition to SAR from satellite, but at this time there is no operational use of this type of sensor -for early detection purposes- in Norway. There are however ongoing projects initiated by the industry and preliminary results from the Norwegian shelf can be presented. Norway is one of the few countries that have the privilege to benefit from full scale off-shore oil-on-water exercises NOFO organizes every year. The focus on integration of sensors to a comprehensible operating picture is of current interest (satellite, ship radar, AIS and infrared). Examples of use of remotely sensed data and integration of sensors from the national Oil on Water exercise summer 2012 will be presented.

Thursday, January 10, 2013

Pipeline Inspection Track:

Remote Measurement of Stress in Carbon Steel Pipelines - Paul Jarram, Speir Hunter
Monitoring the integrity of buried ageing ferromagnetic pipelines is a significant problem for infrastructure operators. Typically inspection relies on pig surveys, DCVG, CIPS and contact NDT methods that often require pipes to be uncovered and often at great expense. This presentation outlines recent developments in a novel remote sensing technique to detect corrosion, metal defects and the effects of ground movement by mapping variations in the earth's magnetic field around pipelines. Magnetostriction is the process by which internal domains inside the structure of ferroelectric materials, such as carbon steel alloys, create magnetic fields when subjected to mechanical stress. Corrosion, metallurgical defects and ground movements result in areas of increased stress in pressurised pipelines. Measurement of the remote magnetic field around a pipeline due to magnetostriction allows the measurement of stress and determines the location of defects in the pipe wall. The presentation first explores magnetostriction in ferromagnetic materials and then how measurements of remote magnetic field can be applied to define the location of defects in operational pipelines along with the benefits of using this technique which includes considerable cost savings since no modification to the line is required, no input of energy and no change to its operational parameters is needed. Examples of modeled predictions correlating both with actual scanned data collected from the field and ILI defined defects will be presented. This presentation will be of particular interest to all pipeline integrity and inspection management and engineers and specifically offers a solution for those involved with the inspection of unpiggable lines.

Magnetic Tomography Method a Remote NDE Technology for Buried & Subsea Pipelines - I Kolesnikov, Transkor Group

Magnetic Tomography Method (MTM) Technology is a non-contact approach for assessing safety and integrity of pressurized pipelines of any purpose made of ferromagnetic materials. Quality of assessment is not influenced by transported product (gas-, oil-, water- , or other). MTM is based on the inverse magnetostrictive effect (Villary effect) - the change of the magnetic susceptibility of a ferrous material when subjected to a mechanical stress. Method uses ""natural"" magnetization of the ferrous pipes by magnetic field of the Earth. MTM equipment remotely registers magnetic field from the pipe while moving along its axis. MTM does not measure the dimensions of geometric defects alone but instead it measures the stress caused by these defects and identifies their type, location and orientation in accordance with the location and orientation of the area of stress. MTM determines the comparative degree of danger of defects by a direct quantitative assessment of the stress-deformed state of the metal. This technology ensures probability of detection (POD) of anomalies of stress-deformed state greater than 80% at SMYS from 30% to 85%. POD is never less than 60% for any SMYS value. MTM inspection covers 100% length of pipeline and has following features: measurements could be performed remotely from within 15 diameters off the pipeline axis for both buried and sub-sea pipelines , without interference with the pipeline mode of operation Outcome of the application of MTM technology is the information on potentially faulty sections causing elevated concentration of mechanical stress. The latter includes: location (longitudinal, angular, GPS coordinates) evaluation of degree of danger (absolute value of local stress in the pipe material is computed, safe operation term is evaluated, maximum safe operating pressure of each pipeline anomaly section is calculated)As a part of adapting technology for the inspection of offshore pipelines, a series of tests was carried out during the last 2 years on the quantitative assessment of factors of pipeline serviceability with defects, provided the changes of hoop stresses. The outcome of comparing the results with the international codes ASME B31.G, API RP579, DNV RP F101-A & B demonstrate the convergence rate of more than 92%.

Rapid EMAT Lamb Wave Scanning of Onshore & Subsea Pipelines - Mark Adams, Spectrum

Inspecting pipelines using a couplant free ultrasonic guided wave system called EMATs (electromagnetic acoustic transducers) are simply a coil of wire in a magnetic field. By pulsing an electrical current through the coil, an eddy current is induced in the surface of the nearby conductive material; the magnetic field interacts with this eddy current to produce a mechanical force on the surface to excite ultrasonic vibrations. The same configuration of coil and magnet also detects mechanical motion of the surface because the motion of a conductor in a magnetic field produces currents that are detected and measured by the near-by coil. One of the most useful properties of EMAT technology as an inspection technique is its ability to generate the guided waves without having to worry about coupling, due to the non-contact and couplant-free nature of EMAT transducers. This ability enables EMAT technology to generate ultrasonic guided waves and scan the transducers over the inspection area at the same time. Our company has recently started to utilize our EMAT technology and developed a subsea pipeline inspection system called Magna Subsea Inspection System™. This EMAT technology is applied to the subsea pipelines for non-piggable pipelines, jumpers, risers and flow lines on the ocean floor. We have inspected two of the world's largest Pipelines using our EMAT technology.

Gamma Transmission Detection for Deposition Studies - Jim Bramlet, Tracero
This paper will describe the use of on-line diagnostic technologies for pipeline inspection that can be used to accurately measure the amount, location, and profile of any type of deposits within pipelines using gamma transmission. This technique uses a small sealed radioactive source and sensitive radiation detector positioned at adjacent sides of the pipe. The measured signal intensity can be directly related to the amount of deposit in the pipeline. Unsealed radioisotope tracing techniques are also used on a regular basis to measure fluid velocity, flow rate, phase distribution, and deposit inventory. By measuring the time interval between detector responses and knowledge of spacing the mean linear velocity can be calculated. If full bore turbulent flow can be assumed then the velocity can be converted to volumetric flow knowing the pipe internal diameter. For this paper the focus will be on sealed source gamma transmission technology. The application of gamma transmission for deposition studies can be summarized as follows: Identify, locate and quantify pipeline materials such as waxes, scales, sand, sludge, and hydrates, Assess total pipeline deposits as part of a cleaning program, Monitor pipeline wax build-up over long time periods. This paper will illustrate how employing these techniques in a remediation project will increase productivity, lower operational costs and allow the optimization of downtime.

"Ultrasound Data Processing for Detection of Laminar Imperfections in Welded Pipes" - Christophe Imbert, Olympus NDT

Oil & Gas well Drilling Tool Inspection - Mark Carte, Olympus NDT
This presentation includes the intricate details of inspection, dollar volume of this inspection business, safety concerns and the cost associated with Drilling Tool failures. The purpose of the presentation is to inform those who are concerned with the safety and efficiency of Oil & Gas Well Drilling. Also it is intended for those who are interest in expanding their inspection services in the Up Stream Petroleum Business Sector. It is the presenters intention to provide valuable information for a full spectrum of attendees

including Owner Operators of Drilling Rigs, Oil & Gas Companies and Inspection Service Providers. Included within the presentation is an all-encompassing information package detailing the Drilling Tool Inspection Business.

Mechanical Integrity & Damage

Use of Facility RBI versus Direct Assessment- Justin Monroe, Chevron
Both risk-based inspection and direct assessment have been used throughout the oil and gas industry for over a decade. Direct assessment was developed to identify areas on a pipeline where there is greatest potential for either external (potential damage to pipeline coating) or internal (probable areas where electrolyte can collect) corrosion by the following 4-step process: Preassessment; Direct Assessment region identification; Identification of locations for excavation and direct reexamination; Post assessment evaluation and monitoring. Risk-based inspection (API documents RP 580 and RP 581) is a process used predominately in upstream and downstream that evaluates both the probability of failure along with the consequence of failure in order to identify the following: Damage mechanisms; Inspection techniques; Corrosion monitoring location. Both of these methods provide risk mitigation/minimization strategies based upon decisions from non-destructive examination data at corrosion monitoring locations. However, an issue has emerged over which methodology would be more appropriate to identify areas to inspect at pipeline facilities. This presentation will identify similarities and differences between these two processes in order to provide guidance for the appropriate use of both processes for midstream operations.

MI Inspection During Capital Projects Promotes PSM Compliance, Corrosion rate Accuracy & Improved Budgeting - Travis Keener
Putting off the initial inspection (i.e. baseline) of piping and vessels in a new process unit is both common and problematic. The tendency is to rely on the nominal thickness because the actual original thickness was either not measured or not recorded. Consequently, significant errors in calculated corrosion rates may result from variations of thickness allowed by mill tolerance standards during fabrication. Not having the original thickness can mask potentially hazardous conditions, or cause concern where none is really warranted. Involvement of the inspection department in a capital project can significantly improve quality, reduce cost, and ensure compliance. The objectives of this paper are to provide: 1) justification for inspection during capital projects; 2) effective roles for inspection departments in capital projects; 3) justification for performing vendor surveillance in capital projects; and 4) the technical advantages from performing pre-service baseline inspections.

RBI for Decision Making & Infrastructure Assessment - Mike Manning, Kleinfelder

This abstract presents a risk based assessment program for infrastructure, and a quantitative method of prioritizing resources required to inspect, document, analyze, and plan asset repair. This topic is relevant because limited funds, workforce, and management, demand sound quantitative methods of efficient and consistent data collection, automated data analysis, automated risk prioritization, and automated RFP's to be used in forecasting, budgeting, and implementation. The objective of this abstract and presentation is to illustrate a method of efficient information gathering and automated decision making tools to: Assess Assets; Manage Risks; Reduce Costs, and Schedules; Prioritize Resources; Reduce Contractors and Staff; Provide Consistent Data Collection, Documented Quantifiable Decision Tools, Tools For Budgeting and Planning, Easy To Use At-A-Glance Reports 56. Facilities are outliving their intended life. We all face a difficult challenge of determining how to allocate funds and staff to manage risk. Facilities are under heightened scrutiny to maintain integrity for safety, productivity, and environment. Much of the infrastructure we rely on falls outside of mandatory inspection and reporting but is critical to safe productivity. Electronic data capture via tablets provides efficient and consistent data. Tablets programmed with well thought out inspection inquiries leads to precise quantitative data collection no matter the experience of the inspector. Predetermined risk parameters provide automated ranking of priorities based on owner's risk weighting. These automated rankings can be sorted by risk, material, cost to repair, method of attachment, condition category, or deficiency.(see attached samples for clarity) Easy to read rankings are highlighted in red, orange, yellow, and green representing high risk to low risk. These user friendly reports allow for quick and easy at-a-glance assessment and eliminate stalled forward progress. The sample report is posted separately on sharepoint.

Asset Integrity Within Chevron - Phillip Delpero, Chevron
Over the past five years, Chevron Upstream has been working to develop the asset integrity requirements and procedures that are part of the Surface Equipment Reliability and Integrity Process (SERIP). The initial effort was on developing the overall Asset Integrity Program and required management systems. Equipment specific requirements were then developed covering the range of equipment types encountered in Upstream. The last phase of the development effort is in progress and is focused on development of some standardized methods to assure more consistent performance across a diverse upstream workforce. Implementation of these requirements is now in progress across upstream. Initial implementation is focused on establishing an overall Asset Integrity Program and supporting management systems and implementation on the primary layers of protection of fixed equipment and structures. This talk will discuss the overall principles of the Chevron Upstream SERIP Asset Integrity requirements. The talk will first focus on the programmatic aspects of the SERIP Asset Integrity

requirements, will expand to cover SERIP asset integrity requirements at the equipment specific level, and then will wrap up some field learnings experience as Business Units implement their asset integrity programs.

Reliability / Engineering

Synergy Damage Behavior in Pipeline Steels - Prof. C Huai –Xiang

Coiled Tubing Assessment Tools for Manufacturing & In Service Inspection - Roderic Stanley, itRobotics

Advances in 3D Measurement In RVI - Edward Hubben, GE Measurement and Control

Facility Inspection beyond DOT Regulations - Justin Monroe, Chevron