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CORROSION RISK MANAGEMENT CONFERENCE

June 11-13, 2018 | Houston, TX | Houston Marriott Westchase

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Conference Schedule

MONDAY, JUNE 11		
9 am - Noon	Exhibitor Set-Up	
9 am - 5 pm	Registration - Foyer	
1 - 5 pm	Exhibit Hall Open - Grand Ballroom D-E	
1 - 2 pm	Keynote - Deterministic Prediction of Pitting Damage in Oil and Gas Transmission Lines Grand Ballroom F-H *Presented by Digby Macdonald, UC Berkeley*	
2 - 2:30 pm	**Facilities Track - Grand Ballroom A-C**	**Pipelines Track - Grand Ballroom F-H**
	Corrosion Risk Management of Corrosion Resistant Alloys for Downhole Applications *Presented by Nausha Asrar, Schlumberger Products Center*	Determination of Internal Pitting Corrosion Rates Using Extreme Value Analysis *Presented by Carlos Melo Gonzales, University of Calgary*
2:30 - 3 pm	Surface Prep Tipping Point: From Desperate Measures to Quality Assurance *Presented by Robin Wright, Wirx Group, LLC*	Pipeline Metal Loss Evaluations per API 579 Fitness-For-Service Rules *Presented by Kraig Shipley, Equity Engineering*
3 - 3:30 pm	Afternoon Break - Grand Ballroom D-E	
3:30 - 4 pm	Critical Requirements of Training Programs for Engineered Composite Repair Systems *Presented by Matt Green, NRI Neptune Research Inc.*	Near-Neutral pH Stress Corrosion Cracking Assessment Using Bayesian Network Modeling: A Case Study *Presented by Shan Guan, DNV GL*
4 - 4:30 pm	Best Practices Using New Technologies for Advanced Corrosion Control *Presented by Douglas Foster, Intuitive Coatings*	Inspection of Coated and Uncoated Pipelines with Next Generation MEC Technique *Presented by Andreas Boenisch, Innospection Americas Inc.*
4:30 - 5 pm	Novel Surface Prep and Coatings to Gain Efficiency in Cavitation Corrosion Control *Presented by Douglas Foster, Intuitive Coatings*	
5 - 6 pm	Welcome Reception – Exhibit Hall, Grand Ballroom D-E	

TUESDAY, JUNE 12	
8 am - 5 pm	Registration – Foyer
9 am - 5 pm	Exhibit Hall Open - Grand Ballroom D-E
9 - 9:30 am	Keynote – Getting Involved in Technical Activities – Grand Ballroom F-H *Presented by Drew Hevle, Kinder Morgan*

9:30 - 10 am	**Facilities Track - Grand Ballroom A-C**	**Infrastructure Track - Grand Ballroom F-H**
	Underground Gas Storage – Past, Present, and Future *Presented by Valerie Wilson*	
10 - 10:30 am	**Non-Intrusive Inspection (NII) of Assets with Advanced MEC and PECT** *Presented by Andreas Boenisch, Innospection Americas Inc.*	**Risk Management of Metal Structures Using Adaptive Corrosion Protection System** *Presented by Yogiray Kachhela, Simon Fraser University*
10:30 - 11 am	**Morning Break - Grand Ballroom D-E**	
11 - 11:30 am	**Novel Approach, Better Outcome for Energy Infrastructure in Aggressive Environments** *Presented by Loren Hatle, Wirx Group, LLC*	**Concrete Field Corrosion Testing Utilizing Multiple Tools** *Presented by I-Wen Huang, BASF*
11:30 am - Noon	**Surface Decontamination Significantly Reduces Vulnerability to CUI** *Presented by Loren Hatle, Wirx Group, LLC*	**Microbiologically Influenced Corrosion of Submerged Steel Structures with Macrofouling** *Presented by Samanbar Permeh, Florida International University*
Noon to 2 pm	**Lunch – Exhibit Hall, Grand Ballroom D-E**	
2 - 2:30 pm	**Pipelines Track - Grand Ballroom A-C**	**Infrastructure Track - Grand Ballroom F-H**
	Enhanced Hot Tap Modeling Analysis & Validation *Presented by Steve Biagiotti, The Equity Engineering Group (E2G), Inc.*	**Pre-saturated CFRP Usage for Strengthening of Bridges** *Presented by Eri Vokshi, NRI Neptune Research Inc.*
2:30 - 3 pm	**Cathodic Protection of Subsea Systems: Lessons Learned** *Presented by Colin Reid, Clarus Subsea Integrity*	**Assessment of Long-term Durability of TDG and Zinc Metallized Steel in Atmospheric Environment** *Presented by Md Ashan Sabbir, Florida International University, Civil and Environmental Engineering*
3 - 3:30 pm	**Afternoon Break - Grand Ballroom D-E**	
3:30 - 4 pm	**Optimization and Scale-up Testing of Composite Repair Technologies** *Presented by Matt Green, NRI Neptune Research Inc.*	**Corrosion Susceptibility of Nanoparticle Enriched Zinc Coating after Adverse Exposure during Repair** *Presented by Saiada Faudi Fancy, Florida International University*
4 - 4:30 pm	**Preventative Measures to Protect HDD Pipeline Coatings** *Presented by Tammy Bomia, NRI Neptune Research Inc.*	

4:30 - 5 pm	**Internal Corrosion Asset Preservation of Pipelines** *Presented by Joseph Pikas, Technical Toolboxes*	

WEDNESDAY, JUNE 13	
7 - 9 am	**Breakfast - Grand Ballroom D-E**
8 am - noon	**Registration – Foyer**
	Exhibit Hall Open - Grand Ballroom D-E
8 - 9 am	**Keynote – Getting to Zero Incidents – Grand Ballroom F-H** *Presented by Chris Bloomer, CEPA*
	Pipelines Track - Grand Ballroom F-H
9 - 9:30 a.m.	**Urban Development Affecting Pipeline Integrity – Case Study** *Presented by Joseph Pikas, Technical Toolboxes*
9:30 - 10 am	**Gas Pipeline Corrosion Condition and Risk Assessment During Commissioning: A Case Study** *Presented by Maritza Lopez, IEnova*
10 - 10:30 am	**Morning Break – Grand Ballroom D-E**
10:30 - 11 am	**Manage Data, and You Manage Risks and Threats** *Presented by Randy Vaughn*
11 - 11:30 am	**HDD/Coating Assessment** *Presented by Joseph Pikas, Technical Toolboxes*

TECHNICAL SESSION DESCRIPTIONS

Monday, June 11

1 to 2 p.m.
Keynote – Deterministic Prediction of Pitting Damage in Oil and Gas Transmission Lines
Presented by Digby Macdonald, UC Berkeley

Over the past several years, we have carried out extensive research on the prediction of localized corrosion damage in industrial systems, including low pressure steam turbines, condensing heat exchangers, and oil transmission pipelines using three approaches: (1) The Statistical Penetration Model (SPM); (2) Deterministic Extreme Value Statistics (DEMS) and; (3) Deterministic Monte Carlo Simulation (DMCS).

This previous work essentially tailored Damage Function Analysis (DFA), which is a unique, deterministic, localized corrosion damage prediction technology that incorporates SPM, DEVS, and DMCS, to predicting localized corrosion damage in aluminum alloys and in oil transmission (pipeline) systems, with each method being selected according to the properties of the system. The work was motivated by aging aircraft issues and by oil leaks in gathering lines in Alaska, one of the most inhospitable oil producing regions of the world. This presentation describes the application of DFA (SPM, DEVS and DMCSM) in predicting localized corrosion damage in carbon steel oil and gas pipelines.

Facilities Track – Grand Ballroom A-C

2 to 2:30 p.m.
Corrosion Risk Management of Corrosion Resistant Alloys (CRAs) for Downhole Applications
Presented by Nausha Asrar, Schlumberger Products Center

Corrosion Resistant Alloys (CRAs) are essential for providing long-term resistance to corrosion for many components exposed to oil and gas production environments. Components include: downhole tubing and safety critical elements, wellhead and Xmas tree components and valves, pipelines, piping, valves, vessels, heat exchangers and many other pieces of equipment in facilities. However, processing, welding and downhole operation conditions sometimes significantly influence their corrosion resistance, and thus it is important that the final product form and manufacturing route are considered in the assessment of the suitability of the alloy for the intended operating environment. There is a variety of ways individuals and companies select CRAs for anticipated well and flowline conditions.

In this paper, the following information will be shared with an intent to provide corrosion risk management of CRAs:

- Different material selection procedures – pros and cons
- Corrosion and cracking of CRAs – case histories
- Lessons learned
- Specific selection criteria of CRAs for application in downhole conditions

2:30 to 3 p.m.
Surface Prep Tipping Point: From Desperate Measures to Quality Assurance
Presented by Robin Wright, Wirx Group, LLC

The common expectation of inevitable surface preparation difficulty and related coating failures in severe contamination environments reflects the tenacity of outdated technologies and assumptions within the industry to date. Regardless of the pervasive cognitive error, surface preparation technologies have continued to progress to a point where such failures are no longer inevitable, as proven through testing, pilot studies and actual field practice where new methods and products have proven to be a significant improvement across the board. Logic dictates that extremely beneficial new technologies should be readily adopted, but they are not.

The author argues the case for shifting organizational culture to actively receive, rather than avoid, new technologies by presenting cases referring to specific advancements, tracing the progressive adoption of similar technologies, and drawing on projections based on benefits observed and noted by organizations making the shift.

3:30 to 4 p.m.
Critical Requirements of Training Programs for Engineered Composite Repair Systems
Presented by Matt Green, NRI Neptune Research Inc.

For more than 20 years, Engineered Composite Repair (ECR) systems have been analyzed and used in the oil and gas industry, and much of this work has fallen on the material testing and design aspects of the materials, while the training and education of site installation is typically only a secondary thought. The ASME PCC-2-2015 and ISO 24817 are the two most commonly used documents for ECR systems as they are highly detailed in all aspects of the process, which includes installation training and education. The amount of responsibility that the technicians take on with installing these highly engineered materials is great and it should be given proper attention to insure it works as designed. Without this, there will be a higher potential of failure and greater risk associated with the use of ECR systems.

This paper will focus on the training and installation requirements as set forth within the ASME PCC-2-2015 Article 4.1 standard, and why they are critical to the successful implementation of an ECR system. In addition, a case study focusing on this aspect will be provided showing the need for complete and thorough training.

4 to 4:30 p.m.
Best Practices Using New Technologies for Advanced Corrosion Control
Presented by Douglas Foster, Intuitive Coatings

"Controlling variables leads to more predictable outcomes" is a truth applicable to virtually every industrial sector and scientific discipline. In the case of defense against corrosion of metal surfaces, the impact of variable control is multiplied since eliminating or reducing variables is the entire premise behind modern corrosion control.

By examining how new technologies for advanced corrosion control fit together in a whole "fabrication to in-service" system, organizations can equip themselves with the knowledge needed to craft strategies that significantly improved corrosion control outcomes in specific situations. Taking the time to review how, when and where to implement new technologies in a more holistic fashion allows organizations to better leverage the benefits of corrosion control advances while streamlining procedures and cutting costs.

This presentation examines interactions between technologies at the forefront of "new best practices" development, including wet abrasive vapor blast equipment, novel decontamination products and high-performance nanoceramic coatings formulated to meet specific environmental challenges and presents examples of "best practices" for planning a "cradle-to-grave" corrosion control system.

4:30 to 5 p.m.
Novel Surface Prep and Coatings to Gain Efficiency in Cavitation Corrosion Control
Presented by Douglas Foster, Intuitive Coatings

Cavitation and contamination cause severe damage to offshore impellers and pumps, resulting in their failure in a short time. Fouling leaves turbines and compressors vulnerable to corrosion and deposit buildup that incrementally causes a loss of power and efficiency. Exposure to high chloride, sulfide and microbial contaminants in the environment of LNG and alternative energy facilities causes coating failure and ensuing corrosion damage in many different types of offshore components. Especially vulnerable to corrosion attack: heat affected zones (HAZ) adjacent to the weld regions.

Comparing radical new decontamination and coating products used alone or in tandem to standard process illuminates the high potential of novel systems to decrease downtime and vulnerabilities while recovering operational and power efficiencies regularly lost through less effective, labor-intensive processes. Areas most likely to benefit from this strategy are: structural elements, waterline areas, pumps, pipes, valves, impellers and turbines, intakes, penstocks, isolation valves, scroll cases, wicket gates, turbine runners, draft tubes, spill ways, radial gates, compressors, and upriver dam nosings.

Pipelines Track – Grand Ballroom F-H

2 to 2:30 p.m.
Determination of Internal Pitting Corrosion Rates Using Extreme Value Analysis
Presented by Carlos Melo Gonzales, University of Calgary

Most of the existing corrosion growth models provide estimates for general corrosion rates, while pipeline failures usually occur at locations subjected to corrosion rates due to pitting. Analysis of internal corrosion rates should include the effect of microbiologically influenced corrosion (MIC), which contributes to approximately 20 – 30% of corrosion failures.

The aim of the paper is to develop a model using extreme value analysis to predict localized internal corrosion considering MIC. The first step is to estimate general corrosion rates using advanced mechanistic flow and corrosion models. Extreme value modelling is then used to transform the general corrosion rates into localized corrosion rates. This transformation accounts for operational, monitoring and mitigation factors that are related to internal corrosion. The monitoring factors for MIC include DNA analysis and the identification of species that contribute to MIC.

2:30 to 3 p.m.
Pipeline Metal Loss Evaluations per API 579 Fitness-For-Service Rules
Presented by Kraig Shipley, Equity Engineering

Analysis procedures from the current edition of API 579-1/ASME FFS-1, "Fitness-For-Service," applicable to piping system and pipeline components subjected to local and general metal loss are presented. This paper is meant as an overview so that inspectors, engineers and those maintaining aboveground and underground piping systems have a basic understanding of the available techniques in API 579-1/ASME FFS-1 for evaluation of thinning damage. The applicable sections of the API 579-1/ASME FFS-1 standard will be covered, including evaluation methodologies for local, general, and pitting metal loss (Part 4, Part 5, and Part 6, respectively).

This paper will provide practical and basic background information on the data (inspection, design, and operating) required for each type of FFS assessments, any limitations on the methodology, the actual FFS methodology and FFS acceptance criteria, any remediation and/or repair procedures that may be used to mitigate the particular damage, and any future monitoring that may be needed.

3:30 to 4 p.m.
Near-Neutral pH Stress Corrosion Cracking Assessment Using Bayesian Network Modeling: A Case Study
Presented by Shan Guan, DNV GL

Comprehensive modeling of the occurrence of stress corrosion cracking (SCC) at any given location on a pipeline has been elusive because the initiation of SCC depends on a myriad of interconnected factors. Unfortunately, a physics-based model encompassing tremendous number of factors affecting SCC is beyond the current state of modeling and computational capabilities, even if one has a qualitative understanding of all the sub-processes affecting SCC.

In this paper, we report on a model based on Bayesian network (BN) methodology for assessing the SCC risk of buried pipeline. BN based model can quantify the uncertainties and identify where the reduction of these uncertainties has the greatest benefit in terms of the overall failure. It also possesses the ability to supplement physical understanding of some aspects of the system with other corroborative observations.

The BN-based SCC model was tested using a 30-km gas pipeline segment located in Western China. Using this model, a 27-year SCC risk assessment was conducted combining available pipeline information from various sources.

4 to 4:30 p.m.
Inspection of Coated and Uncoated Pipelines with Next Generation MEC Technique
Presented by Andreas Boenisch, Innospection Americas Inc.

Corrosion is a constant challenge especially in aging and insulated pipelines.

This presentation focuses on the use of the next generation MEC (Magnetic Eddy Current) technique which is a further development of the fast corrosion screening SLOFEC technique for the inspection and integrity support of coated and uncoated pipelines and pressure vessels.

Internal and external defects such as individual pitting, microbiological and carbon dioxide corrosion and other defects are easily detected by the MEC technique. The differentiation between the different defect position and other occurrences like laminations or inclusions are also shown. Case studies and field experiences of the MEC technique for pipeline and pressure vessel inspection will be presented.

In addition, the next generation Pulsed Eddy Current Testing (PECT) technique for the detection of corrosion under insulation of the coated pipes will also be presented.

Tuesday, June 12

9 to 9:30 a.m.
Keynote – Getting Involved in Technical Activities
Presented by Drew Hevle, Kinder Morgan

Drew Hevle is manager of corrosion control for Kinder Morgan's natural gas pipeline group, based in Houston, Texas. Mr. Hevle has a Bachelor of Science in Mechanical Engineering, and is a NACE Corrosion Specialist and Certified Coating Inspector and NACE instructor, and serves as most recent past chairman of the NACE Technical Coordination Committee (TCC), which oversees all NACE technical activities. His hobbies are corrosion control and cathodic protection.

Facilities Track – Grand Ballroom A-C

9:30 to 10 a.m.
Underground Gas Storage – Past, Present, and Future
Presented by Valerie Wilson

Since the occurrence of Aliso Canyon, Underground Gas Storage has been at the forefront of operators and regulators minds and agendas.

PHMSA has now been given jurisdiction over Underground Gas Storage Facilities, which makes sense from the facility and pipeline point of view. But, what about the wells? Wells require a different skill set and understanding. Two new API documents, API 1170 and 1171 have been incorporated into the CFR's but is that enough? Are they understood? Do the current UGS operators have employees with the competencies to manage all the Well Integrity requirements or the assistance needed to implement and meet all these new requirements.

So many unanswered questions and such an interesting topic. This paper will explore the current status of UGS in the U.S. The new API requirements that are now part of the CFR's and how PHMSA is handling the implementation. It will also discuss Well Integrity and the current and past upstream industry progress and status in its development and popularity since other major upstream incidents.

10 to 10:30 a.m.
Non-Intrusive Inspection (NII) of Assets with Advanced MEC and PECT Technology
Presented by Andreas Boenisch, Innospection Americas Inc.

This presentation focuses on the use of the next generation MEC (Magnetic Eddy Current) and PECT (Pulsed Eddy Current Testing) techniques for the inspection and integrity support of upstream and downstream assets such as coated and non-coated pipelines, pressure vessels and storage tanks.

Field experiences from the use of the MEC technique for pipeline, pressure vessel and storage tank inspection will be presented. The PECT technique as well as field experiences in detecting corrosion in coated and insulated assets will also be presented.

11 to 11:30 a.m.
Novel Approach, Better Outcome for Energy Infrastructure in Aggressive Environments
Presented by Loren Hatle, Wirx Group, LLC

Offshore equipment, vessels and pipelines face multi-faceted attacks:

- Abrasion-Erosion: High-capacity pumps inject seawater and entrained sand particles at high pressure
- Cavitation Damage: Impellers, pumps and propellers cause cavitation that results in severe wear and rapid failure
- Fouling: Deposit buildup causes corrosion in turbines and compressors
- Contaminant Exposure: Atmospheric contaminants accelerate corrosion in LNG and alternative energy facilities
- Rapid Depressurization: Vapor from high CO2 levels used in tertiary recovery cause catastrophic failure to lining systems

High-profile efforts (such as ACORN) have spent considerable time, energy and capital developing novel high-performance coatings as solutions to the problem. In theory, the resulting products work well to protect against attacks. In practice however, the performance of any coating or lining relies on the level cleanliness, or hygiene, of the metal substrate to which it is applied.

A novel, systemic process achieves better outcomes. Focusing on simple but comprehensive surface preparation processes followed by highly resistant cavitation protective/fouling release coatings harnesses the high potential of new advancements in corrosion control, resulting in significantly fewer coating and asset failures, decreased downtime and recovery of operational and power efficiencies.

11:30 a.m. to noon
Surface Decontamination Significantly Reduces Vulnerability to CUI
Presented by Loren Hatle, Wirx Group, LLC

CUI (corrosion under insulation) is a pervasive, difficult and high-liability issue for petrochemical, power, shipping, and other industries. Situational variations (meteorological, geographical, seasonal, etc.) can confound conventionally-specified surface preparation attempts to achieve perfect or near-perfect metal hygiene, thus reducing expected coating life by 30-75%. Because conventional surface preparation processes have historically been unable to adequately relieve microcontamination of metal surfaces, organizations have settled for an uneasy balance between economic and physical feasibilities that exclude the possibility of achieving ideal surface preparation outcomes and rely more heavily upon barrier coatings to supply needed corrosion control.

However, coatings cannot fill the gap. To ensure maximum bonding of protective coating to metal, surface preparation must include metal decontamination processes to fully eradicate the full array of microcontaminants that impede coating adhesion to ensure maximum asset resilience against problems such as stress corrosion cracking (SCC) and other CUI vulnerabilities. Case studies prove that early adoption of novel surface decontamination technologies confer complete permanent microcontaminant removal for improved protective coating bond strength to reduce economic investment in maintenance and increase long-term coating reliability, thus reducing vulnerability to CUI.

Infrastructure Track – Grand Ballroom F-H

10 to 10:30 a.m.
Risk Management of Metal Structures using Adaptive Corrosion Protection System
Presented by Yogiray Kachhela, Simon Fraser University

NACE recommended practice SP0169-2013 (formerly RP0169) presents various methods to control external corrosion of underground and submerged metallic piping systems. Often it has been claimed that E log I criterion will provide a more accurate standard as this method is scientifically fundamental as well as on-site testing can be conducted that reflects specific environmental conditions. A simple current sourced adaptive corrosion protection system is proposed which extracts the protection current from the Tafel segment of the Britton curve and supply this current to target metal. This adaptive mechanism using a feedback loop will update the required protection current supplied to the target metal. This stand-alone, portable and modular system can offer reliability and cost-savings with short and long-term protection capabilities. These functionalities integrated into a system will effectively diagnose the corrosion status and update the protection parameters without any manual interaction.

The system can further be integrated with a smart-grid communication network that can effectively link control-room to remotely access and regulate the process. This proposed technique was validated in the laboratory using various metal samples in the different corrosive medium.

11 to 11:30 a.m.
Concrete Field Corrosion Testing Utilizing Multiple Tools
Presented by I-Wen Huang, BASF

To study the effectiveness of a surface applied corrosion inhibitor (SACI) applied parking garage, multiple field corrosion testing tools were utilized including half-cell, linear polarization, galvanostatic pulse, and connectionless electrical pulse response analysis (CEPRA). The SACI applied is a silane-based material with inhibitors to provide corrosion protection to concrete. The corrosion protection of the SACI was compared to a controlled surface treated area without SACI. Measurement was conducted for a year seasonally to obtain performance of the product as well as the tools under different weather. This presentation will also discuss the effectiveness of field corrosion testing tools and their limitations.

11:30 to noon
Microbiologically Influenced Corrosion of Submerged Steel Structures with Macrofouling
Presented by Samanbar Permeh, Florida International University

Microbiologically Influenced Corrosion (MIC) is an important degradation mechanism for materials in a wide variety of industries. Although MIC has not traditionally been a major durability concern for Florida coastal and inland bridges, a recent finding of severe corrosion of steel bridge piles associated with microbial activity has made identification of material degradation susceptibility of vital interest.

Although the role of the macrofoulers on the corrosion of the steel piles is not clear, the presence of the macrofoulers could affect the corrosion process by supporting biofilm development and creating localized corrosion. The objective of this research was to identify if macrofouling conditions can facilitate MIC on submerged steel structures. An experimental set up including laboratory testing with simulated physical characteristics of crevice environments caused by macrofoulers and field testing with exposed steel coupons was created to identify the possible MIC.

2 to 2:30 p.m.
Pre-saturated CFRP Usage for Strengthening of Bridges
Presented by Eri Vokshi, NRI Neptune Research Inc.

For many civil engineering repair applications, carbon fiber-reinforced polymers (CFRP) have proven to be very effective as externally-bonded reinforcement. It was shown through numerous experimental and analytical studies that externally-bonded FRP composites can be applied to improve and repair structural performance criteria such as stiffness, load-carrying capacity, ductility, and even durability of various structural members including columns, beams, slabs, and walls. Bridge strengthening projects have been carried out in almost every state in the U.S. As the technology is gaining ground, manufacturing companies are focusing on making the products cheaper, easier to use, and working with various organizations to make them more acceptable by building officials. A new externally-bonded-pre-saturated system in the market offers many advantages including shorter application time, less field resources, and high-quality assurance with controlled fabric to resin ratio.

A case study of the usage of these products for strengthening and protection of multiple bridge columns in New York City's RFK bridge is presented. In addition, research performed at University of Central Florida (UCF) compares the flexural and shear behavior of these systems to epoxy systems and highlights their advantages.

2:30 to 3 p.m.

Assessment of Long-term Durability of TDG and Zinc Metallized Steel in Atmospheric Environment

Presented by Md Ashan Sabbir, Florida International University, Civil and Environmental Engineering

Coating systems for corrosion mitigation of structural steel have been widely used. Thermal Diffusion Galvanizing (TDG) and zinc metallized steel have promising corrosion mitigation attributes but its durability in coastal environments can be of concern.

TDG and zinc metallized samples were tested in both marine and inland outdoor exposures conditions. Other test parameters included local coating defects exposing the steel substrate. Initial salt fog and outdoor testing of both coatings generally indicated corrosion mitigation of the steel but some limitations including possible surface staining, iron consumption, and coating degradation required further assessment. Long-term outdoor exposures (48 months) continued for the TDG and metallized samples. Testing included electrochemical techniques such as linear polarization resistance and electrochemical impedance spectroscopy. Electrochemical characteristics such as open circuit potential, polarization resistance, and electrochemical impedance was made after the extended exposure for samples from both marine and inland test sites to compare corrosion performance. Furthermore, results were compared to laboratory control samples with and without NaCl.

3:30 to 4 p.m.

Corrosion Susceptibility of Nanoparticle Enriched Zinc Coating after Adverse Exposure during Repair

Presented by Saiada Faudi Fancy, Florida International University

Zinc-rich-primer-based three-coat systems have been one of the most widely used coating systems for highway steel bridges since the 1980s. However, these coating systems have not been shown to provide maintenance-free durability for the service life of steel bridges in aggressive environments. Conventional repair materials and procedures also do not have long service life. Coating degradation can lead to exposure and enhanced corrosion of the steel substrate.

Nanoparticles are being considered in the development of durable coating systems due to their beneficial physical, chemical and mechanical properties. Earlier research showed that the nanoparticle enriched primer provided similar corrosion resistance in aggressive chloride environments as conventional three-coat systems indicating that there wasn't a negative consequence of supplementing the zinc pigments with nanoparticles. Indeed, enhanced mechanical strength was observed for the nano-particle enriched coating. As repair coating failures are often associated with adhesion loss, and from the results of earlier findings, it was thought that the presence of the nano-particles may provide enhanced performance. The purpose of this study was to evaluate the effect of surface preparation with varying surface contaminants on the corrosion performance of a nanoparticle enriched zinc rich epoxy primer.

Pipelines Track – Grand Ballroom A-C

2 to 2:30 p.m.

Enhanced Hot Tap Modeling Analysis & Validation

Presented by Steve Biagiotti, The Equity Engineering Group (E2G), Inc.

The two main concerns when performing a hot tap procedure are burn-through and weld/HAZ cracking caused by excessive cooling rates of the weld deposit and/or high carbon equivalent values. These risks can be reduced, but not necessarily eliminated, by careful control of the weld procedure heat input variables (i.e. weld amperage, voltage, and travel speed).

A new axisymmetric FEA-based transient thermal solver has been developed with a volumetric heat source to account for the weld heat input and convective boundary conditions at the inner surface (process flow) and outer (ambient) surfaces to account for cooling effects. The new approach improves upon the Battelle model including a new finite element solver with a finer mesh generation scheme. In addition, the heat transfer correlations were modified to appropriately model the heat transfer and account for the different boiling regimes at the steel/liquid product interface.

This paper will share the analytical enhancements associated with this modeling approach, compare the results of several simulated welding conditions for various hot tap conditions, and share field validation data conducted as compared to thermal transient predictions from the original Battelle thermal model, as well as the PRCI v4 Hot Tap model.

2:30 to 3 p.m.

Cathodic Protection of Subsea Systems: Lessons Learned

Presented by Colin Reid, Clarus Subsea Integrity

Coatings and cathodic protection (CP) are the principal measures for external corrosion control of subsea equipment and pipelines. Each subsea structure or component of an offshore development has its own independent cathodic protection design generally performed by the equipment supplier. Once all subsea equipment is installed and connected, the cathodic protection systems function as one integrated unit providing corrosion control throughout the entire subsea field.

This paper describes an approach to assuring compatibility between independent CP systems, and proper functioning of an integrated CP system over the subsea system service life, by presenting case studies of CP design, operation and inspection experiences. A key objective of this paper is to share experiences that will aid in optimizing cathodic protection designs and improving integrity management practices. The experiences presented in this paper include electrical discontinuity, anode sizing and layout, and unaddressed current drains. The paper also discusses the importance of baseline CP surveys, optimizing the value of CP surveys and visual inspections, and conducting comprehensive CP design audits/verifications during subsea system design.

3:30 to 4 p.m.
Optimization and Scale-up Testing of Composite Repair Technologies
Presented by Matt Green, NRI Neptune Research Inc.

For the past two decades, composite repair technology has significantly impacted the way operating companies maintain the integrity of their high-pressure gas and liquid pipeline systems. In the early 1990s, the pipeline industry adopted the use of composite materials for reinforcing corrosion features; however, today's composite reinforcing systems have been tested and many are used to reinforcement multiple anomaly types. Manufacturers of composite materials and pipeline operators have contributed greatly to the validation and adoption of this technology through funding of extensive and comprehensive full-scale testing research and development programs.

The contents of this paper will focus and provide details on the development of specialized composite technologies for reinforcing defect anomalies such as corrosion and dents subjected to aggressive operating conditions, and in taking the small-scale, coupon-level testing to characterize the effects of component change to take the next steps up to full-scale, burst testing and cyclic pressures. Information is included on the initial design process used by engineers to optimize reinforcements using constitutive properties and insights from previous testing and research programs to guide the advancements in understanding of the materials. Detailed test results will be included, including information on how both coupon-level and full-scale test results can be used to assist operators in maintaining their pipeline systems using advanced composite reinforcing technologies.

4 to 4:30 p.m.
Preventative Measures to Protect HDD Pipeline Coatings
Presented by Tammy Bomia, NRI Neptune Research Inc.

PHMSA proposes to add a requirement that each coating be assessed to ensure the integrity of the coating using DCVG or ACVG technology and damage be remediated if damage is discovered. In addition, for HCA segments PHMSA proposes enhanced preventative and mitigative measures and repair criteria for repair of coating with voltage drop classified as moderate or severe.

Trenchless technology is frequently used to install pipelines in HCA's when superstructure does not allow for a trench installation. With enhanced requirements to repair coating damage in HCAs choosing proper coating protection is the best preventative measure that can be taken in areas where repairs cannot be made. This presentation will discuss coating trends in the HDD industry and how we can proactively address coating damage caused by HDD and other trenchless technologies.

4:30 to 5 p.m.
Internal Corrosion Asset Preservation of Pipelines
Presented by Joseph Pikas, Technical Toolboxes

This presentation will provide the understanding for the preservation of assets from the effects of internal corrosion. A pre-screening for the mitigation of internal pipeline leaks at upstream and mid-stream pipeline facilities takes in consideration the internal safety aspects because of past leaks, elevation changes where liquids tend to collect in low spots or traps.

The primary goal in the screening process of large piping networks is to determine if corrosive environments exist while using a minimal amount of data to mitigate these leak risks to maintain production without reduction.

Wednesday, June 13

8 to 9 a.m.
Keynote – Getting to Zero Incidents
Presented by Chris Bloomer, CEPA, Canada

With more than 30 years of experience in the domestic and international energy business, Chris Bloomer leads the industry association that represents Canada's transmission pipeline companies, which operate 134,000 kilometres of pipeline in Canada and the United States.

Prior to being appointed President and CEO of CEPA in 2015, Chris spent three years as CEO and Director at Connacher Oil and Gas Ltd. Chris has also held other senior executive roles across a range of domestic and international energy businesses, including Shell Canada, Petrobank Energy and Resources, Castle Energy, Talon Resources and Korn/Ferry.

Chris has a degree in Geoscience and is a member of The Association of Professional Engineers and Geoscientists of Alberta (APEGA).

Pipelines Track – Grand Ballroom F-H

9 to 9:30 a.m.
Urban Development Affecting Pipeline Integrity – Case Study
Presented by Joseph Pikas, Technical Toolboxes

With more than 2.5 million miles of pipelines in the U.S. and an ever-growing population, the oil & gas pipeline infrastructure and urban development continue to collide in a battle to occupy the same land at the same time. Although there are many factors that can lead to pipeline failure, third party damage is still one of the leading causes of damage, or failure. This paper will discuss these issues but also propose practices of assessment and evaluation of these encroachments to meet regulatory and safety requirements.

While urban development is inevitable, it brings a myriad of different types of encroachments. Operators must be ready for encroachment and integrity evaluation, as the responsibility for maintaining the pipeline in compliance with regulatory standards and long-term integrity is the Operator's responsibility. The case studies will include the process of evaluating the integrity of the pipeline before and after the encroachment, evaluation of superimposed loads combined with operating stresses, and evaluating the compliance of industry regulations and recommended practice.

9:30 to 10 a.m.
Gas Pipeline Corrosion Condition and Risk Assessment during Commissioning: A Case Study
Presented by Maritza Lopez, IEnova

Pipelines continue to be the most cost effective and safest way for the gas transmission and distribution. Their integrity is, however, challenged daily, with damage due to corrosion, third party activities, material and construction defects, and geotechnical factors now recognized as the primary threats. An understanding of pipeline integrity threats and their inherent risks, thus represents a critical element in the development and implementation of effective mitigation plans, and pipelines safe operation.

This work presents a case study on a gas pipeline operator in Mexico's 48-inch onshore gas line and use it to showcase our approach to conducting corrosion diagnosis and risk assessment as part of the pipeline commissioning process. More specifically, the paper covers results from such a base line assessment of the pipeline internal and external condition, based on the data from historical hydro-test, ILI inspection, various soil analyses, and cathodic protection surveys, and (ii) discuss identified corrosion (damage) mechanisms, their risk, mitigation and control options. The implemented corrosion management strategy is then critically evaluated and updated accordingly.

10:30 to 11 a.m.
Manage Data, and You Manage Risks and Threats
Presented by Randy Vaughn

Because a pipeline is buried and out of sight, the only means of physically monitoring how well a pipeline is holding-up in its environment without digging it up, has always been data collected by the pipeline corrosion department. Over time data is compiled within a corrosion prevention database for a single pipeline system. Considering there may be more than one pipeline facility, the amount of data begins to build-up considerably.

The integrity management program (IMP) is a big user of all available data found within many databases like the one created by the corrosion department. Most data, if not all found within multiple databases will be essential information for use within all IMP internal processes (Risk Analysis, Assessment Method, Remediation, Prevention and Mitigation Measures, etc.). The IMP rule has been in place now for over almost 15 years, and many of the larger and more established pipeline operators have had similar programs in place for years prior to the rule. Because of all this data needed by an IMP, it has become an ongoing and cumbersome process that would be made more manageable and efficient by using a good database manager program.

11 to 11:30 a.m.
HDD/Coating Assessment
Presented by Joseph Pikas, Technical Toolboxes

Steel cased crossing have been used to avoid load considerations, unstable soil conditions, third party mechanical damage or when conditions dictated by regulatory or sound engineering practices. These practices have been used for many years at roads and railroad rights of way. However, due to a variety of factors such design, installation, construction practices, materials, coatings, etc. have caused problems with protecting the carrier pipe within the casing. Then Horizontal Directional Drilling (HDD) comes along and it becomes the installing pipelines quickly, economically and without impacting the environment. This drilling method with only one start and exit point, means several kilometers of pipelines can be laid beneath rivers, cities, mountains and the countryside. Now new problems emerge such as damaged coating and pipe, water holdup, aggressive fluids, causing a new dilemma in the industry.

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