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ABSTRACT

TOPIC

Advanced Remote Monitoring Solutions: Merging High-Frequency Data Logging with Edge Computing for Enhanced Cathodic Protection Analysis

Ivano Magnifico, Automa / B&A Technologies

Recent technological advancements in cathodic protection monitoring have led to the development of next-generation remote monitoring devices that combine the capabilities of traditional Remote Terminal Units with high-frequency data logging features. These innovative devices address the growing challenges in modern infrastructure protection, particularly in environments affected by stray currents and telluric interference. By implementing continuous second-based sampling of critical parameters such as structure potential, coupon polarization, and current density measurements, these systems enable comprehensive analysis of time-variant effects on protected structures. The integration of edge computing technology represents a significant breakthrough, allowing these devices to process vast amounts of collected data locally and generate condensed daily reports containing essential statistical information, including averages, extremes, and threshold violations. This approach dramatically reduces data transmission requirements while maintaining analytical depth and consent daily data transmission even operating on batteries.

Real field cases will be shown, demonstrating that this combination of high-frequency sampling and daily reporting capabilities significantly simplifies cathodic protection effectiveness assessment, providing unprecedented insight into protection system dynamics. Real-world applications reveal how this technology enables technicians to identify and analyze complex interference patterns and protection issues that were previously difficult to detect, marking a transformative advancement in infrastructure asset protection monitoring.

Cathodic protection

AI exponential growth forecast-what effects will this have on AC Interference in our ROW's

Charles Poore, MESA

AI-Artificial Intelligence, the new technological buzz of this decade is poised for exponential growth over the next decade. Power requirements are projected to need up to a 500% increase in output to be able to handle this technological boom according to many industry sources. As our utility power providers look at ways to increase their output-what is the projected effect on our existing AC Mitigation systems and potential for new AC Interference issues in our crowded ROW's? This presentation will look at some of the issues and responses being utilized by power companies as they look for ways to increase the output to meet these future energy requirements and possible solutions/strategies for dealing with these increased power loads by pipeline operators, owners and contractors.

AC power grid expansion concerns

Challenges in laboratory qualification of corrosion inhibitors for oilfield applications.

Milan Bartos, Intertek

Laboratory qualification of corrosion inhibitors for oilfield applications is a multistage process consisting of a suite of performance and compatibility tests mimicking the field conditions as closely as possible. The final and often decisive step in this sequence is typically a longer term test focusing on the performance of corrosion inhibitor candidates against localized corrosion. Despite its fundamental importance in the decision making process, there is currently no consensus in the industry about the definition of localized corrosion and the pass/fail criteria for tested inhibitors. This

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paper provides a brief summary of the different views and opinions about this subject currently adopted by various producers, chemical vendors and independent third party labs with an emphasis on the potential relationship between surface characteristics of corrosion samples and initiation and propagation of localized corrosion.

Data-Driven Integrity for Unpiggable Pipelines: Leveraging Large Standoff Magnetometry and Virtual ILI

Arash Ilbagi, Rosen

The Permian Basin's pipeline network includes thousands of miles of unpiggable or difficult-to-inspect pipelines that remain critical to facility operations and regulatory compliance. Traditional inspection methods fall short when dealing with complex layouts, buried assets, or non-piggable segments. This presentation introduces a new methodology known as Non-Intrusive Pipeline Assessment (NIPA), which integrates multiple assessment layers — including Large Standoff Magnetometry (LSM), Close Interval Potential Surveys (CIPS), Direct Current Voltage Gradient (DCVG), and machine learning-based Virtual In-Line Inspection (V-ILI).

Through case studies across natural gas distribution and tank manifold systems, we demonstrate how LSM detects stress concentration zones and magnetic signatures indicative of corrosion or deformation — without interrupting operations. By correlating LSM signals with data from historical surveys, coating condition, and environmental parameters, we achieve over 90% probability of detection (POD) when compared to ILI results. The process enhances decision-making, prioritizes excavations, and supports license renewal for legacy pipelines — including those installed before the advent of modern records or pigging infrastructure.

This approach not only supports asset integrity in the face of aging infrastructure and increasing environmental scrutiny but also addresses challenges unique to the Central U.S. and Permian region. Attendees will gain insight into how data layering, machine learning, and non-contact technologies can help operators meet compliance expectations and reduce uncertainty in pipeline integrity decisions.

**Pipeline and asset
integrity**

Determining Pipeline Corrosion Criticality and Remaining Life More Definitively Using Expert Guided AI

Rabindra Chakraborty, Senslytics

Corrosion in hydrocarbon pipelines is complex and can arise from a variety of mechanisms, e.g., microbial activity, under-deposit corrosion, and flow-induced degradation etc., each influenced by distinct operational and environmental conditions. Conventional asset-wide risk modeling often overlooks this variability, leading to generalized forecasts that fail to capture the specific degradation risks of individual pipeline segments.

Senslytics' causal AI represents a new genre of artificial intelligence that iterates experts' hypotheses, forming guardrails that respond to situational changes. It is particularly suited for modeling time-delayed, adaptable systems. Causation-based AI can operate with limited meaningful data and construct scientific frameworks to predict unexpected corrosion issues that may otherwise be undetected or underestimated. Relying on a multi-view approach of causation, the AI better understands when it has a reliable estimate and when it does not. This allows corrosion engineers to focus their efforts on the most challenging situations the AI does not interpret.

This research presents the application of Senslytics causal AI to deliver segment-specific forecasts of corrosion rate and remaining life. By integrating inline inspection (ILI) data, material properties, and real-time operational parameters—such as flow regimes and contaminant levels, the system identifies dominant corrosion mechanisms and learns their growth behavior in context. This enables dynamic, mechanism-aware projections tailored to the evolving conditions of each segment. Validated through field data and applied case studies funded by DOT and OCAST grants, the AI demonstrates strong potential for improved dig and repair site selection, optimized chemical usage, ILI tool selection, and reduced leaks. This approach marks a shift toward precision pipeline monitoring, anchored in localized insight, mechanism-level modeling, and adaptive learning.

Artificial Intelligence

Dual Data Captured via Close Interval Potential Survey

Hongbo Ding, Fluor Corp

In a recent paper, we propose that the features observed in the Close Interval Potential Survey (CIPS) represent the earth's potential gradients, analogous to how the Scanning Reference Electrode Technique (SRET) represents the electrolyte potential. This idea was developed through a comparative analysis between CIPS and SRET. In this paper, we will further explore this concept using a more fundamental approach, beginning with a thought process. It will be demonstrated that CIPS captures both earth potential gradients and pipe-to-soil potentials. It is concluded in the paper that, 1) the CIPS measurement captures changes in soil potential; 2) the CIPS potential, both On and Instant Off, specifically represents the coating defect for pipelines with barrier-type coatings; 3) potential variations in a CIPS profile represent the electrical potential gradients in the soil caused by electrochemical reactions at the coating defect. Remote from the coating defect, the CIPS represents the pipe (defect)-to-remote earth potential of the defect, which includes maximum IR components.

Cathodic protection

Effective and Economical Chemical Management of SWD Facilities

Jodi Wrangham, SME

Produced water management and disposal activities are processes with inherent challenges which can be difficult to remedy in a quick, effective, and economic way. Removing residual hydrocarbon ensures that all resources are effectively recovered and the maximum profit is realized. Solids such as scales and biofilm fill tanks and decrease injectivity/increase pressure of wells. The use of unique specialty chemicals tailored to these obstacles is presented in several Permian Basin area case studies illustrating novel capabilities for best in class SWD system management.

Internal Corrosion Control

Electric and Facility Safety

Cal Chapman,

Internal Pipe Lining - Extending the Life of Pipelines Using Compression-Fit High-Density Polyethylene (HDPE)

Miles Venzara & Cordell Brown, United Pipeline

Objectives and Scope:

This paper presents the use of compression-fit high-density polyethylene (HDPE) liners—specifically the Tite Liner® system—as a proven solution to mitigate internal corrosion across a range of challenging pipeline environments. Originally developed for wet CO₂ service in naturally occurring dome fields, this technology has been successfully adapted for modern CCUS gathering systems, sweet and sour hydrocarbon service, and produced water infrastructure. The study highlights how internal lining provides long-term asset integrity while reducing reliance on expensive corrosion-resistant alloys, chemical treatment programs, or dehydration infrastructure.

Methods, Procedures, Process:

The paper compares corrosion challenges across multiple pipeline environments, including sweet gas, sour gas, produced water, and impure CO₂. It outlines the engineering principles behind compression-fit lining, reviews field installation techniques, and shares data from projects in the

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Permian Basin and other high-corrosion-risk regions. Case studies detail performance in both new and aging steel pipelines, as well as retrofits in sensitive or remote areas.

Results, Observations, Conclusions:

Field-proven results show that Tite Liner® significantly reduces or eliminates internal corrosion, scaling, and pitting—especially in areas where MIC, H₂S, chlorides, and solids contribute to asset degradation. Operators have extended pipeline service life, reduced O&M costs, and prevented premature failures. Unlike coatings or chemical inhibitors, HDPE lining provides a continuous corrosion barrier throughout the pipeline interior, including bends, tees, and elevation changes.

Significance / Novelty:

With the increasing demand for corrosion control in CO₂, produced water, and sour service lines—especially in large-scale infrastructure like CCUS and Permian gathering networks—HDPE lining offers a scalable, safe, and cost-effective alternative. This technology supports long-term pipeline integrity and environmental compliance, reduces leak potential, and enhances the reliability of aging and new assets alike.

Is it Yours or Mine? Mastering Influence & Interference Studies

Cole Finney, American Innovations

Influence and interference studies are pivotal in discerning the ownership and source of unintended interactions between electrical systems and structures. This presentation delves into the fundamental objectives of Influence & Interference (I&I) studies, elucidating their significance in identifying and mitigating the effects of external and internal electrical currents on infrastructure.

We'll explore a variety of tools and methodologies that technicians can adopt to perform I&I studies with precision and reliability. From advanced diagnostic techniques to analytical methods, attendees will gain insights into the practical implementation of I&I studies.

The presentation is enriched with case study data from partnering technicians, providing attendees with a concrete example of how I&I studies influence decision-making and strategy formation in real-world scenarios. By the end of this session, attendees will be equipped with the knowledge and skills necessary to approach influence and interference challenges, ensuring the integrity and performance of their systems stay intact in the face of external influences.

Cathodic Protection and Interference

Linear Anodes – When to use them on Poorly Coated Pipelines

Dean Lioliou, Anodeflex

We have a very old and aging pipeline infrastructure with over 3 million miles of pipelines in the US and 1/3 in serious risk of coating degradation and corrosion. How do you know what solution is best for addressing this issue with your assets? Linear Anodes? Re-Coating? It depends.

Typically, it is viewed to use:

- Re-coating for high-risk or accessible segments
- Linear anodes for long stretches, inaccessible areas, and more cost-effective solutions

This presentation evaluates the different methods of corrosion control on aging, poorly coated pipelines using linear anodes vs. recoating. An analysis and comparison of the different types of coatings – epoxies, viscoelastics, PE/PP coatings – vs linear anodes – ICCP, shallow/distributed beds, linear beds, MMO, HSCI, graphite anodes – and which system is more effective on addressing poorly coated pipeline and coating degradation issues. The presentation has a direct focus on linear anodes, when to choose linear anodes, picking the right linear anode materials, and understanding the key performance indicators of linear anodes to address coating degradation on aging pipelines.

Cathodic Protection and Interference

Mitigating AC/DC Interference: Advanced Corrosion Detection and Protection Strategies for Pipelines

Gabe Gonzales & Christian Cartwright, GPT Industries

As high-voltage AC (HVAC) and high-voltage DC (HVDC) transmission networks expand, underground pipelines face increasing risks from electromagnetic interference. AC-induced corrosion and stray DC currents pose significant threats to pipeline integrity, accelerating metal degradation and disrupting cathodic protection (CP) systems.

This paper explores advanced techniques for detecting and mitigating AC/DC interference, with a focus on remote monitoring technologies and predictive analytics. Key mechanisms of electromagnetic coupling—inductive, conductive, and capacitive—are analyzed to understand their impact on buried assets. Additionally, the challenges of step and touch potentials are discussed, emphasizing safety concerns for operators.

Innovative diagnostic tools, such as Remote Monitoring Units (RMUs), provide real-time data to identify interference sources and assess corrosion risks. Case studies demonstrate how these solutions improve asset resilience by enabling targeted mitigation strategies, including optimized CP adjustments, grounding systems, and decouplers.

Beyond technical solutions, this paper highlights the broader implications of interference on infrastructure management, regulatory compliance, and environmental sustainability. As underground networks grow more complex, proactive interference mitigation will be essential for ensuring pipeline longevity and operational safety.

Attendees will gain insights into the latest advancements in AC/DC interference detection and practical strategies for safeguarding buried infrastructure in an increasingly electrified world.

AC interference testing and mitigation

Monitoring Cathodic Protection System Measurements Using SCADA Communications

Jamey Hilleary, Elecsyscorp

Remote monitoring systems are widely used in oil and gas pipeline systems for cathodic protection compliance monitoring. The equipment used for these applications has evolved over the years resulting in monitoring systems designed for the harsh operating environments on pipeline systems. The monitors today are able to withstand lightning strikes, power surges, extreme temperature ranges, and widely disparate climates. In addition, they are designed for the specific purpose of monitoring cathodic protection systems. New regulations are requiring production and gathering systems to consider cathodic protection monitoring as a means to acquire and provide system compliance data. Production fields are often very remote and data communication is often accomplished using Supervisory, Control, and Data Acquisition (SCADA) systems. The equipment used for field measurements in SCADA environments are typically designed for general voltage monitoring and not necessarily hardened for reliability in the harsh, remote environments. This presentation is a case study, initiated by an oil and gas exploration and production company, focusing on adapting standard remote monitoring systems for use as the measurement component in a SCADA based cathodic protection data acquisition system. This case study follows the development of this adaptation for monitoring the cathodic protection on downhole well casings. This study serves as a blueprint for oil and gas production operations seeking robust and reliable measurement devices for use in their SCADA networks.

Cathodic protection

Non Shielding Below Grade Insulative Coating System

Arin Shahmoradian, SPI coatings

This abstract presents an innovative insulative coating system designed to address the critical issue of cathodic shielding in underground pipes while simultaneously providing superior thermal insulation. The significance of this problem is underscored by Dr. Zee Zamanzadeh's statement: "Up to 85% of all the external corrosion of pipelines is under dis-bonded CP shielding coatings. Non-shielding coatings are those which do not prevent distribution of CP current to the steel substrate through the dis-bonded coating. It is highly recommended that non-shielding coatings be used in cathodic protection applications."

To tackle this challenge, a novel below-grade insulation coating system was developed and subjected to multiple in-field trials. This dual-purpose coating not only prevents cathodic shielding but also serves as an effective insulator for underground FBE coated pipes carrying various fluids such as fuel gas, glycol water, and biodiesel. The study introduces a new application method where this insulative

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coating is applied in a controlled shop environment, allowing pre-coated pipes, tanks, and vessels to be delivered to the site ready for installation.

This innovative approach aims to enhance corrosion protection and thermal insulation of below-ground infrastructure while improving the efficiency of the application process. It offers a significant advancement over conventional insulation materials typically used in these applications. The pre-application method reduces on-site labor requirements and ensures consistent coating quality across all treated surfaces. This results in long-term cost savings, improved pipeline integrity, and enhanced overall performance of underground piping systems.

The presentation will detail the coating system's composition, application process, and performance results from field trials. It will also discuss the potential impact of this technology on the industry's approach to protecting and insulating underground assets.

Reducing Risk & Avoiding Failures CUI from bench to real world learning

Toby Stein, International Paint (an AkzoNobel Brand)

Corrosion Under Insulation (CUI) is pervasive in the oil and gas industry, posing significant risks to infrastructure integrity and operational reliability. This presentation aims to provide a thorough review of coatings solutions that have been effectively utilized to mitigate CUI over the past two decades. Drawing from extensive practical experience, long-term performance data, rigorous testing, and detailed case histories, this session will offer valuable insights into proven strategies for CUI prevention.

Starting with an overview of the challenges associated with CUI, the presentation will look into the specific coatings technologies that have demonstrated success in real-world applications. Attendees will gain an understanding of the selection criteria for these coatings, the application processes, and the maintenance practices that ensure their longevity and effectiveness.

The session will also highlight the importance of comprehensive testing and validation, showcasing results from both laboratory and field studies. We will explore various test methods and dig into real case histories, showing which technologies are still performing after 20 years in service. Additionally, we will address key issues that coating companies focus on to help avoid real-world failures that may not be planned for initially.

Furthermore, the presentation will address the latest advancements in coatings technology, including innovations that enhance performance and reduce application complexity. Attendees will learn about new products and techniques that are shaping the future of CUI mitigation.

By the end of the session, participants will be equipped with practical knowledge and actionable strategies to reduce the risk of CUI and avoid failures in their operations. This presentation is designed to provide peace of mind through a deep understanding of the coatings solutions that have stood the test of time and continue to evolve to meet industry needs.

Coating and other material selection

Rehabilitation of UV Degraded FBE Coating

Nickey Zafiris, ELZLY

In an ever changing natural gas market, pipeline projects are commonly delayed or cancelled. What happens to the FBE coating on the pipe procured for these projects as it is exposed to UV radiation during storage? This presentation covers the rehabilitation program implemented by one owner operator to address years of UV degradation on FBE to bring the coating back into compliance with project specifications, ultimately leading to the successful completion of the project.

Pipeline and asset integrity

Reinforced Concrete Corrosion: Effect of a Carbon Nanotube Additive

Farzaneh Farivar, Medlar Technologies

Concrete, as the most widely used artificial material globally, plays a crucial role in modern infrastructure. However, improving its durability is essential to meet the increasing demands for enhanced performance, efficiency, and longevity of concrete structures. In marine environments, the elevated concentration of chloride ions, coupled with factors such as humidity, dynamic wave forces, and air exposure, gives rise to profound corrosion within marine reinforced concrete structures. This corrosion gives way to detrimental consequences, including substantial deterioration in the mass of reinforcement bars, the emergence of cracks in the concrete's protective layer, and a decline in the adhesive potency between the concrete and reinforcement elements. This research investigates the potential of a carbon nanotube (CNT)-based additive to improve the durability of concrete. CNTs offer promising advantages, including their ability to fill internal pores, reduce microstructural defects, and

Other

strengthen the matrix, thereby enhancing the material's resistance to environmental degradation. By incorporating CNTs into concrete, this study aims to provide a deeper understanding of how these advanced nanomaterials can contribute to extending the lifespan and resilience of concrete structures. Through meticulous preparation and testing of standard concrete specimens, the project will assess various durability parameters, including corrosion, strength, and resistance to ion penetration. By focusing on the sustainability and effectiveness of CNT-based additives, the research aligns with the global need for innovative, environmentally friendly solutions to enhance infrastructure resilience and reduce carbon emissions, contributing to a more sustainable future.

Smart Pipes, Smarter Workers: Troubleshooting CP Systems with RMUs

Mill Jawed, Mobiltex

This presentation explores the transformative impact of Remote Monitoring Units (RMUs) on the modern cathodic protection (CP) industry. While much of the prevailing discourse around automation emphasizes concerns about job displacement, this discussion shifts the focus — highlighting how RMUs empower rather than replace.

We examine a real-world pipeline system where all CP measurements are remotely monitored, showcasing how RMUs serve as catalysts for field enablement and data-driven decision-making, leading to measurable improvements in system integrity and operational efficiency.

The presentation begins by outlining traditional CP systems and progresses into the advancements offered by remote monitoring technologies. Drawing from case studies and empirical evidence, it demonstrates how RMUs relieve personnel from repetitive field tasks, allowing corrosion professionals to redirect their expertise toward analytical, complex, and high-value activities.

We also explore the rise of new testing methodologies made possible by this shift — where human insight and machine precision converge to produce smarter maintenance strategies and deeper corrosion analysis.

In conclusion, RMUs are positioned not just as tools for monitoring, but as gateways to untapped potential in the CP industry. By enabling innovation, encouraging strategic thinking, and elevating the nature of fieldwork, RMUs are reshaping the profession — turning routine maintenance into mission-critical intelligence.

RMUs make pipelines smarter, but their full potential is unlocked by well-trained, curious, and tech-savvy field personnel. This presentation will cover remote troubleshooting techniques and build remote monitoring deployment strategies for beyond just monitoring your CP systems.

Cathodic protection

Surface Preparations, The Starting Point

John Glass, MontiPower

Surface Preparations, The Starting Point- Advancements in Power Tool cleaning have greatly improved from the basics of angle grinders and needle guns. One can now achieve most surface profiles with a power tool, this allows for better coating performance where blasting is not possible, permitted or cost effective. In the presentation we will discuss basic industry standards on surface preparation. Plus cover advance power tools, how they work, when to use and the new developments that increase production and profile options.

Surface preparation

The Threat of Hard Spots - An Evolving Understanding

Jonathan Chu, Rosen

A hard spot is an area on a pipe that has a higher hardness to the surrounding base metal. Hard spots are formed as a result of nonuniform thermal cycle during the manufacturing or construction process, leading to microstructures characterized by low toughness and ductility. Although non-injurious on their own, in the presence of coinciding threats or atomic hydrogen from the cathodic protection system or corrosion processes, hard spots can have significant impact on integrity assessment and subsequent response.

Operators are expected to manage the threat through a combination of assessment, using ILI and in-ditch validation followed by an appropriate response. A history of hard spot failures in the past 70 years has been the driver for research, establishment of guidelines, and improvements in assessment capabilities. Recent studies have provided insight to conducting susceptibility analysis and explore integrity management programs.

Pipeline and asset integrity

This presentation focuses on providing a holistic overview of the threat of hard spots, history of hard spot failures, learnings from the industry, and latest ILI tool advancements used to characterize and size hard spots.

VCI Economics in Oil & Gas Applications & Regulatory Update

Kelly Baker, Zerust Integrity Solutions

With over 20 years of experience using Vapor Corrosion Inhibitors for Oil & Gas asset protection, the results and economics are very clear. Whether talking about tank bottoms, pipe casing, pipeline protection while out of service or hydrotesting, VCI's are seen as a "Tool in the Kit" of corrosion mitigation strategies. What have the results shown in protection, reduced downtime and economics? This presentation will cover these topics and then review where VCI is currently in regulations.

Corrosion inhibitors

What Does Typical Laboratory Testing Reveal About a Lining's Suitability for Immersion Service?

Darryl Corbin, Sherwin

Do typical laboratory testing provides critical insights into a lining's performance and durability under various conditions. Do they these tests help determine whether a lining is suitable for immersion service by evaluating its mechanical properties and resistance to environmental factors.

This presentation explores typically tests used to determine a lining's suitability for immersion service. It provides an overview of each test and explains what it reveals and does not reveal about the lining. The two primary categories of testing covered are:

Mechanical/Physical Testing and Immersion/Environmental Resistance Testing.

Typical Mechanical Testing includes:

- Flexibility Testing: Assesses the ability of the lining to withstand bending and deformation without cracking.
- Taber Abrasion Testing: Measures the wear resistance of the lining surface when subjected to abrasive forces.
- Pull-Off Adhesion Testing: Evaluates the adhesive strength of the lining to the substrate by measuring the force required to pull it off.
- Adhesion by Knife Testing: Determines the adhesion quality by making incisions and observing the resistance to peeling.

Immersion or Environmental Resistance Testing includes:

- Cathodic Disbondment Testing: Examines the lining's resistance to disbondment under cathodic protection conditions.
- Standard Atlas Cell Testing: Tests the lining's chemical resistance to thermal gradients in a controlled environment.
- Pressurized Atlas Cell Testing: Similar to the Standard Atlas Cell but conducted under elevated pressure and temperature conditions.
- Autoclave Testing: Assesses the lining's performance under high temperature and pressure to simulate harsh service conditions.
- Salt Spray Testing: Evaluates the corrosion resistance of the lining when exposed to a saline environment.

Is there 1 test that can tell you a linings suitability, or does it require a multitude of laboratory tests to determine suitability? Do laboratory tests really determine a coatings suitability for service?

Asset integrity

Will Incandescent Bulbs Light Up Under HVAC Power Lines? Understanding Induced AC Corrosion, Key Measurements and Coupon Sizing

Alex McCarthy, American Innovations

Alternating current (AC) interference poses significant risks to infrastructure integrity. This presentation aims to demystify AC induced corrosion by addressing its definition and common locations for occurrence. Then it will cover key measurements and the importance of coupon sizing.

Asset integrity

We will discuss metal loss limits and their relation to measurement readings, as well as the rationale behind the differing sizes of AC and DC coupons used in monitoring. Additionally, we will present real-world examples of AC alerts.

