

Corrosion Symposium

Presented By AMPP Portland Section

in Collaboration with

PNWS-AWWA Engineering Committee

August 11, 2022, 8:00 am – 3:15 pm

Tualatin Valley Water District 1850 SW 170th Ave, Beaverton, OR

Feeling a little rusty on your corrosion knowledge? Please join us for a one-day corrosion symposium discussing corrosion and its impacts on municipal infrastructure. People who might be interested in attending are owners, operators, and builders of municipal water and wastewater infrastructure, but the topics discussed are applicable to a wide range of professions.

Beverages, snacks, and lunch will be provided

5 PDH/0.5 CEUs pending

Cost is \$130

Presentations and Schedule

8:30 – 10:00 Fundamentals of Cathodic Protection

Presented by: Stu Greenberger, PE, and Alex Fussell, PE (RH2 Engineering, Inc.)

Fundamentals of cathodic protection are within your reach in this crash course. The presentation will address foundational concepts including the mining and refining of metals, the galvanic series, and the electrochemistry of the corrosion cell. Then we will address corrosive conditions; corrosion of materials; and galvanic and impressed current cathodic protection for waterworks pipes, structures, and facilities.

10:00 – 10:15 **Break**

10:15 – 10:45 Direct Buried Infrastructure Reliability – Corrosion Control Case Studies

Presented by: Roy Rogers, PE (Cathodic Protection Engineering, Inc.)

Municipal, utility, and industrial pipeline operators, now more than ever, expect long-term pipeline reliability and life expectancy. During this presentation we will examine several case studies where corrosion control best practices were used, how they were applied, and what they ultimately look like in the field. Following the presentation, we will allow time for an extended question and answer session with Roy and other symposium speakers.

10:45 – 11:45 Corrosion Control Strategies at the Portland Water Bureau

Presented by: Stephen Ngai, PE (Portland Water Bureau)

The Portland Water Bureau operates one of the largest cathodic protection systems in the State of Oregon with over 100 active impressed current facilities. The Bureau has kept pace with corrosion technologies, beginning in the 1970s with the retrofit of large diameter pipelines with impressed current cathodic protection, developing a suite of techniques to accommodate urban light rail in the 1980s, the adoption of computer-controlled rectifiers for tanks in the 1990s, utilizing remote GPS synchronization in the 2010s, and now pursuing remote monitoring and operation with integration into SCADA, GIS, and SQL databases. The presentation will be a guided tour of the corrosion control mitigations used at the Bureau for pipes, tanks, services, and other assets. We will explore detail drawings, specifications, and materials used. Extra time for audience questions and follow-up discussion will be provided.

11:45 – 1:00 Lunch (Provided)

1:00 – 2:00 Corrosion Protection of Oregon’s Historic Coastal Bridges

Presented by: Bernard S Covino, Jr., NACE/AMPP Fellow

Approximately 11 steel-reinforced concrete bridges were built along the Oregon Coast by Oregon State Highway Commission Bridge Engineer Conde B. McCullough from 1919 to 1936. This talk will explore these historic bridges, their corrosion issues, and possible corrosion mitigation strategies.

Steel embedded in concrete exists in a very stable passive environment if destabilizers such as carbon dioxide and salt are excluded. Of interest will be the effect of destabilizers on corrosion, corrosion initiation times, and the consequences of the failure to mitigate.

Several corrosion mitigation strategies, some of which are still being used in Oregon, will be discussed. While several strategies, including bridge replacement, were considered, what was adopted was thermal-sprayed zinc anode as a cathodic protection system. We will explore how this mitigation system is installed, how it works, and how and when it eventually fails. The final part of this talk will be a brief look at the use of stainless-steel rebar in reinforced concrete bridge construction.

2:00 - 2:15 Break

2:15 – 3:15 Protective Coatings Update: Third Party Inspection

Presented by: Ron Watts, MCI #0041 (Certified Coating Consultants Inc.)

In protecting our nation’s infrastructure, protective coatings are currently the most widely used method of corrosion control. Products and systems are designed for protecting our most complex (and costly) structures and projects (e.g., bridges, pipelines, dams, water/wastewater systems, etc.). When designed, specified, and manufactured correctly, coatings can protect against corrosion, enhance appearance and performance, and significantly extend asset life for a relatively low cost.

Unfortunately, coating systems can be complicated, and a myriad of factors involved during the installation process (from surface preparation to final cure) can pose challenges during a coating project. Economic pressures (low bid syndrome) and time constraints add another layer. Mistakes can happen:

critical specification details may be misinterpreted or missed, hurried work can lead to poor quality or non-conformance, unsuitable ambient conditions may affect cure. With the potential of catastrophic failures, structural collapses, danger to health and human life, and significant economic consequences from excessive down time or repair, the quality assurance (QA) provided by a qualified third-party inspector can be vital to a successful coatings project and subsequent long-term asset service life.

This presentation will dive into the role of the third-party inspector, the inspection process, and key quality checkpoints of a project. We will also look at some common coating failures and failure mechanisms that may have been averted by having this important QA role in place.

Backup Presentation (1 hr)

Mitigation of CO₂ Internal Corrosion in Natural Gas Transmission Pipelines

Research by Dr. Zineb Belarbi and Omer Dogan (Mr. Dogan is the available speaker), National Energy Technology Laboratory

CO₂ internal corrosion is a major challenge facing the oil and gas industry. To minimize CO₂ corrosion inside steel pipelines transporting natural gas, sacrificial coatings can be used. Many factors complicate designing an efficient CO₂ transmission pipeline and selecting materials. These factors include gas chemistry and impurities (O₂, H₂O, H₂S), pressure, and velocity.

The presentation summarizes a study which investigated the corrosion behavior of metallic coating as sacrificial coating candidates for protection of pipeline steel in CO₂-saturated aqueous electrolyte under natural gas conditions. In addition, the corrosion performance of steel pipelines was studied in CO₂ saturated water phase and dense-phase CO₂ utilizing an immersion autoclave. Electrochemical and weight loss methods were used to investigate the corrosion performance of the pipeline steels and the metallic coatings exposed to CO₂ environment.