OUR VALUES

Ø ZERO INCIDENTS ARE POSSIBLE.

握手 DO WHAT’S RIGHT.

灯泡 WE SOLVE PROBLEMS.

刷新 RESULTS MATTER.

星 BE BETTER.

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Todd Brabson provides an overview of our 2017 safety initiatives

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Dale Lindemuth discusses a proposed standard more than six years in the making
2017 AFFIRMS COMMITMENT TO SAFETY AND TECHNOLOGY DEVELOPMENT

Aegion’s 2017 safety results demonstrate our continued commitment to ZERO INCIDENTS ARE POSSIBLE. Our safety performance greatly improved with a 25 percent reduction in recordable incidents and a 58 percent reduction in lost time incidents year-over-year. Our leading indicator reporting, a key element to our success, includes behavior-based safety observations, near miss reporting, hazard identification and safety suggestions. We recorded just under 141,000 observations in 2017 – 42 percent greater than our target. Congratulations to the entire Aegion team as we continue to BE BETTER.

Aegion also invested significantly in the development of technical solutions for our customers. Main areas of emphasis were data and material science.

DATA

We greatly improved our accuracy and efficiency in processing pipeline survey results in 2017. Turnaround times for transmitting data and issuing reports were significantly reduced. Additional tools were developed for predicting external corrosion rates in soil environments. We also completed ChargeLine™ – a web-based software analysis tool for calculating the probability of alternating current (AC) interference along a pipeline. We continue to work on our model to assess external corrosion risk.

Data collection, communication and management systems were advanced for cathodic protection system monitoring, maintenance and control, pipeline liner performance and quality control for the Fusible PVC® pipe fusion process. We will continue to pursue next generation sensor technology, data transmission and storage in the cloud, including advanced analytics and risk assessment tools.

Another important innovation was developed to detect and record surface defects and quality of internal girth welds to prevent costly repairs of pipeline joints prior to internal coating in the field. This technology identifies errors in root bead welding as well as potential surface defects that affect coating quality.

MATERIAL SCIENCE

We also improved materials that are available for use in our products and protection systems. We delivered an advanced technology coating and thermal insulation system in 2017 for the Shell Appomattox deepwater project. We then continued formulating materials and delivery systems for the field joints and subsea equipment, specifically the PLETs (pipeline end terminations). Application equipment was designed, built and qualified for project execution.

BEND TESTING OF NEW MATERIAL FOR OFFSHORE FIELD JOINTS

Our composite material technology continued to evolve with the introduction of new resins and fabrics for use in our water and wastewater pipeline rehabilitation systems. We introduced new styrene-free resins with longer pot life and NSF approval for use in drinking water pipelines. Our fabric designs were enhanced with new glass and carbon fiber materials. Curing techniques and end terminations were improved.

2018 will bring continued work in many of these areas and the commencement of new projects as we continue to SOLVE PROBLEMS.

Sincerely,

David Kroon, P.E.
Chief Technical Officer
Aegion Corporation
Aegion’s safety culture took another step forward in 2017. Strong performances by all three platforms led to significant reductions in lagging indicators. Aegion’s focus on leading indicators continues to become ingrained in the culture as each platform surpassed set expectations. The Focus Four initiative within the organization grew stronger in 2017. Each platform emphasized driving these processes to improve business unit performance. With the value of ZERO INCIDENTS ARE POSSIBLE constantly in the forefront, Aegion had a very good year.

Aegion’s U.S. operations saw improved safety performance in 2017 compared to 2016, with a 25 percent reduction in recordable incidents and a 50 percent reduction in lost time incidents. However, Aegion’s international operations outside North America had a total of four recordable and one lost time incidents in 2017, compared to only one recordable incident in 2016. While an uptick in incidents is disappointing, we have made improvements in getting timely and accurate safety reporting from our European operations.

Our Infrastructure Solutions team deserves congratulations, achieving a total recordable incident rate below 1.0 for the first time in Aegion’s history. Additionally, the team reduced recordable incidents by 54 percent in 2017, with further progress expected in 2018. The Corrosion Protection platform also had an excellent year for safety performance in 2017 following a very strong 2016.
On World Trenchless Day in 2017, Trenchless Technology magazine announced its 2017 Project of the Year recipients. In an unprecedented occurrence, Aegion companies were recognized in each place for the Rehabilitation category.

PROJECT OF THE YEAR

In summer 2016, work began on one of the largest rehabilitation projects ever of its kind – a critical project to rehabilitate a PCCP force main carrying the entirety of the sewage flow for the City of West Palm Beach and Town of Palm Beach to the East Central Regional Water Reclamation Facility, which treats up to 70 million gallons of water per day for approximately 100,000 residents. A condition assessment concluded that a section of pipe segments with broken wire wraps – about 5 to 100 broken wires per 20-foot segment – had increased the risk of failure.

Working with Jacobs Engineering, the city designed the project to withstand the 25 psi pressure rating of the 48-inch-diameter line. Insituform was selected to rehabilitate the line using InsituMain® CIPP, its latest fiber-reinforced product. While open-cut or traditional sliplining is normally used for this type of project, open-cut was ruled out due to project costs and disruption to homeowners and a golf club. It was also determined that traditional sliplining would result in too great of a diameter reduction for the flow capacity of the line.
DESIGN, DELIVERY & EXECUTION

The liner was designed and manufactured by Insituform to address the specifications of the project. The liner was then impregnated with epoxy resin in Indianapolis and shipped to Florida for installation. An epoxy resin was determined to be the best choice to stand up to the structural and pressure requirements. The benefits of epoxy in comparison to polyurethane include higher strength and chemical resistance.

The first tube shipment presented a challenge for the installation crew. A premature exotherm occurred during shipment, and the liner had to be shipped back to Indiana for proper disposal and to determine the cause. A new liner was shipped back to the jobsite and installation was able to resume at a rate of about one segment per week using water inversion and hot water cure. The project was broken up into six separate installations, with the largest measuring over 1,100 linear feet.

In addition to being the first rehabilitation project to use fiber-reinforced CIPP at this pressure, diameter and length, a variety of challenges made the West Palm Beach project outstanding. Since the pipeline is critical to delivery of sewage to the treatment plant, it was unable to be diverted or shut down. To install the bypass piping, the force main was hot-tapped by Rangeline Tapping Services without taking the primary line out of service. Once the valves were attached, Sunbelt Pump & Power Services set up four 24-inch HDPE lines each running 5,700 feet. While three lines were sufficient, a fourth added redundancy and safety factor.

The bypass and installation footprint traveled directly through a private Jack Nicklaus-designed golf course, a condo parking lot and common grounds, about a dozen backyards, along a canal and by a middle school. In order to continuously provide communication with the very strict homeowner’s association and surrounding community, Insituform worked with a local PR firm to provide information on the work schedule, answer questions about community impact and address any other communications-related issues that came up during the project.

MATERIAL IMPROVEMENTS

Testing during the project also precipitated improvements to the fiber-reinforced CIPP system, including the use of long-oriented chopped fiberglass fabric and a thermoplastic polyurethane coating. Testing of these new products in the lab and the field showed better expansion capabilities and adhesion, longer installation lengths, increased diameter ranges, improved liner flexibility, reduced layer construction, decreased resin usage, higher pipe burst strength (up to 1,400 psi), greater composite strength and improved long-term corrosion resistance.

Post-installation, the force main was reconnected to the rest of the system and pressure testing commenced to verify that the line could withstand the normal 25 psi operating pressures and 35 psi surge pressures. With the improvements, this project was able to be pressure tested at 55 psi, which at 48 inches in diameter equals over 100,000 lbs of force. The line was put back into service in early October 2016.

Fiber-reinforced CIPP proved to be the best solution for this project to ensure minimal impact and stay on schedule. No modifications had to be made to the system and there was little to no impact on service for the surrounding community. Timing and coordination with the client helped mitigate any excess costs. Along with cost savings, the use of trenchless technology reduced the impact on operations for the municipality and golf course, while also maximizing flow capacity of the pipeline with minimal diameter loss, helping to make this a project worthy of Trenchless Technology 2017 Project of the Year.
RUNNER-UP

A cured-in-place-pipe (CIPP) lining project at McGuire Airforce Base was named runner-up for the category. Manufactured Technologies Corporation (MTC) was a supplier on the project, manufacturing more than 1,000 LF of 10-foot-diameter CIPP for contractor US Pipelining LLC. When length and diameter are taken into account, it is the largest CIPP ever installed. The project required roughly 240,000 lbs of resin and used an over-the-hole installation method.

“At 121 inches in diameter, the liners were among the largest our facilities have ever manufactured. Our design and manufacturing staff worked around the clock with the team at US Pipelining to ensure the liner materials and manufacturing specifications were met. This was a major accomplishment for all involved.”

Mark Wetzel, Senior Director
MTC

HONORABLE MENTION

An Honorable Mention was awarded to United Pipeline Systems for its work on the high-profile Valley Forge project. Also known as the Tredyffrin Township Water Pipeline Rehabilitation, the project rehabilitated more than 18,000 feet of PCCP force main running through the Valley Forge National Historical Park using the Tite Liner® system. The project was implemented to repair the pipe, which had experienced a series of failures in 2012 and 2014.

The Tite Liner® system was chosen because it could meet the pressure demands of the line, was cost-effective and could provide expanded system capacity for future use. United worked with the township, the Pennsylvania Department of Environmental Protection and CH2M to implement the project, which was successfully completed in less than a year. Upon completion, the system was upgraded from 20 MGD to 28 MGD.
The drive to **BE BETTER**, one of Aegion’s core values, is part of our culture. In 2017, two of the business units in the Corrosion Protection platform, Aegion Coating Services and Corrpro, achieved ISO 9001:2015 certification. The Infrastructure Solutions platform was also certified for the manufacture and installation of Insituform CIPP and the manufacture of Tyfo® composite products. ISO 9001 is a set of quality standards used worldwide for developing and maintaining a quality management system (QMS). In September 2015, the ISO 9001:2015 standard was published. Businesses certified to the ISO 9001:2008 standard have until September 2018 to upgrade to the latest revision or lose their certification. Industry changes and improvements are the catalyst to revisions of the ISO standard, which occur every six to eight years.

The purpose of a QMS is to deliver a structured approach to quality and customer focus. The new standard has an increased emphasis on risk and leadership involvement, with a broadened scope around products and services. The standard now requires risk to be considered before executing work. This risk-based thinking is used to help mitigate and prevent unforeseen issues. It is the responsibility of leadership to support the QMS and successfully meet customer expectations. This starts at order entry with customer input and continues through project closure, with the end goal of adding value to the customer and organization.

Effective use of the ISO 9001:2015 standard has strengthened the quality management systems at Aegion. Policies, procedures and other documented information have been updated through employee involvement to meet the requirements of the new standard. These changes have allowed us to better plan and execute work, resulting in improved customer satisfaction and operational efficiency. Customer feedback, audits and the non-conformance system are all part of the structure for continual improvement of our products and services. Additionally, support of the QMS by Aegion’s leadership team has been integral for executing work and continual improvement. Certification to the ISO 9001:2015 standard helps embody Aegion values through systems and processes we use every day.
There is growing concern about the occurrence and management of external corrosion induced by alternating current. While many corrosion engineers recognize the threat, they find it hard to know exactly where to start given the large number of miles of pipeline in operation. While software packages exist to analyze this threat, they typically require expertise not found in most organizations to use and administer. Also, the tools don’t work until they are populated with engineering data, which is not readily available. Outside expertise can help, but one still needs some notion of which pipelines to assess and where to dedicate attention and resources.

In 2017, Aegion developed a tool that could help simplify the discovery and threat categorization of AC interference on a pipeline. This web-based tool, ChargeLine™, is simple to use and requires no engineering experience to operate. The user simply uploads a spatial file containing a pipeline centerline and then the tool does the rest.

Once the data is uploaded, ChargeLine™ automatically compares the pipeline to our power line database and notes any crossings or power lines that may run in parallel with the pipeline. Using proprietary algorithms based on years of expertise and industry knowledge, the application can assess and mark areas that have some level of threat. These levels include **NONE**, **POTENTIAL**, **MEDIUM** and **SEVERE** and are shown in a map view through our online GIS – the Asset Integrity Portal. Foreign line crossings are also annotated on the map.

A single click generates a PDF report that contains additional information about the findings.
Our customers share a common concern: “Where are the potential problems with corrosion on my pipeline, and where should I spend my limited dollars on remediation and protection?”

Corrpro SOLVES PROBLEMS every day through the surveying work performed by our Pipeline Services group, which inspects over 25,000 miles of pipeline each year. The number of miles we survey, and the massive amounts of data these activities generate, is unmatched in the industry. With decades of experience, we know how to expertly conduct a pipeline survey and analyze the resulting data. But, we are driven to BE BETTER.

Even with such deep engineering expertise, we continue to invest heavily in technologies to improve the quality of our services and the data we collect on behalf of our customers. One such development is CISVIEW™, an advanced technology we created in-house in 2017. This state-of-the-art tool streamlines our close interval survey processing work flow, enabling us to more efficiently deliver data. Although our customers do not use this application, they will benefit directly through higher quality data with faster processing and delivery times.

CISVIEW™ works with our existing Asset Integrity Portal, which we launched in early 2017. This secure platform leverages technology from ESRI, Microsoft and Amazon Web Services to provide internal and external services around the data we collect and manage. A key part of this platform is the central data repository.

Before CISVIEW™, data was loaded into the Asset Integrity Management (AIM) platform only after it was completely processed. This was often cumbersome because individual data processors had different ways of storing the processed results.

With CISVIEW™, data collected in the field goes immediately into the repository in a standard format. Data processors then use a number of web-based tools to analyze and process the data directly in the database. The data stays in place as the data processors perform various tasks to check, format and transform the field survey into the reporting products needed by the customer. These products can be delivered directly to the customer through the Asset Integrity Portal, creating an indelible archive of customer data that is easy to retrieve.

Many of the tools developed in CISVIEW™ simplify the workflow through automated processing services. For example, the data is immediately transformed into geospatial mapping data as it is loaded and checked for gaps, sequencing and overlaps. Any duplicate or erroneous GPS locations are automatically detected.

We continue to develop additional analytics and reporting tools to provide other value-added services for our customers. This is just one of the many ways that Aegion is improving the way we deliver information to our customers.
Since direct assessment (DA) formally became recognized by the pipeline industry as a method for assessing pipeline integrity in 2002, Corrpro pipeline services personnel have completed 624 DA projects for nearly 50 pipeline operators. Of these projects, 401 have been for natural gas pipelines and 223 have been for hazardous liquid pipelines. In 2018, Corrpro is on track to perform more than 100 direct assessment projects.

The chart to the right shows the number of DA projects performed annually by Corrpro from 2002 through 2017. The increase in projects in 2011 and 2012 reflects the 2012 deadline for gas transmission pipeline operators to complete assessments of all high consequence area (HCA) pipeline segments on transmission pipelines. Gas pipeline operators have up to seven years (until 2019) to reassess all transmission HCA pipeline segments. Consequently, significant increases in the numbers of DA projects will occur in 2018 and 2019. Pending pipeline safety regulations for moderate consequence area (MCA) transmission pipeline segments and for gas distribution and gathering pipelines will also result in significant increases in the numbers of DA projects in future.

Direct assessment processes have been developed for external corrosion (ECDA), internal corrosion (ICDA) and stress corrosion cracking (SCCDA). Other pipeline integrity assessment methods include in-line tool inspection (smart pig) and pressure testing, typically with water.

DA is an alternative assessment method for pipelines that cannot reasonably be inspected by in-line tools or pressure testing. Additionally, DA offers the benefit of being a proactive assessment method whereas the other two assessment methods are reactive methods.
DIRECT ASSESSMENT IS A 4-STEP PROCESS THAT INCLUDES:

1. **PRE-ASSESSMENT**: collection and evaluation of pipeline information
2. **INDIRECT INSPECTION**: surveys and survey data evaluation to obtain information pertinent to the three specific types of corrosion
3. **DIRECT EXAMINATION**: pipe inspections at sites where evaluations indicate corrosion is most likely to have occurred
4. **POST-ASSESSMENT**: evaluation of the DA process and identification of remedial work requirements.

The primary purpose of DA is to identify sites on a pipeline where corrosion is likely to have occurred, is occurring or may occur in the future if remedial action is not taken. This is achieved by integrating all available pipeline data and indirect inspection survey data and then evaluating the integrated data. Corrpro achieves data integration through our CorrVision® analysis. The graphic above is an example of a CorrVision® graphic for external corrosion direct assessment (ECDA).

AN ECDA CorrVision® PLOT CAN PROVIDE THE FOLLOWING:

- Aerial photo of pipeline easement with pipeline centerline drawn on the photo
- Description of features on and along the pipeline
- Close interval pipe-to-soil potential cathodic protection survey data
- DC voltage gradient (DCVG) coating defect survey data
- AC current attenuation (ACCA) coating condition survey data
- Soil resistivity survey data
- Pipe depth-of-cover and ground surface elevation

By having all of this data integrated by CorrVision®, sites where corrosion is most likely to be occurring or has occurred can readily be identified, evaluated and tied to physical features along the pipeline right-of-way. With this information, pipeline operators are able to easily determine and plan remedial action requirements for corrosion control.
Corrpro engineers have been assisting a major natural gas pipeline company with their direct current (DC) transit stray current corrosion control program since June 2017. Initiated several years ago, the proactive program is a testament to those who set the founding principles. This includes a legally binding mutual cooperation agreement with the influencing DC powered light rail transit system covering roles, obligations, procedures, action thresholds and fiscal responsibility. The first phase of the more than 40-mile-long transit system went into service in the late 1990s.

The gas pipeline stray current control maintenance and monitoring program is set up as a multi-phase annual assessment. Each year, gas company corrosion control personnel evaluate approximately 400 established test points across the piping network in general proximity to the transit system. This includes data logging DC pipe-to-soil potentials for 15 minutes at each location. We analyze the various data from the initial phases and identify possibly troublesome areas requiring further investigation to quantify the corrosion control significance of the transit stray current interference. We then work in conjunction with gas company personnel to perform detailed field investigations and map out corrective/remedial action as appropriate.

Since inception of the stray current control program, particularly high levels of stray current influence have been detected on gas pipelines near one of the two maintenance and repair yard/shops operated by the transit agency. These significant effects have perplexed the gas company and transit agency alike for years. Upon review of the available historic data, our engineers visited both yards. Based on this assessment and our proven transit and pipeline corrosion control expertise, it was readily concluded the traction power positive (catenary) and negative (running rails) circuits for the yard in question were electrically common with the mainline.

As this mode of traction power operation has been known to cause widespread stray current corrosion problems, we partnered with the gas company and transit agency to develop and implement a field evaluation plan to determine the significance of the electrical interconnect.

The coordinated field evaluation concluded that peak stray current interchange on the order of 100 amperes was occurring between the yard rails and earth. Electrically separating the yard traction power system from the transit system mainline during the controlled testing reduced this stray current to less than a few amperes. There was also a corresponding 90 percent reduction in adverse stray current effects on the gas pipelines in the immediate area, and up to a 50 percent reduction at remote locations. Additionally, positive corrosion control effects of the yard isolation on the gas piping were measured over 11 transit track-miles away. As a result of the yard isolation tests, the transit operator is in the process of implementing changes to establish the much needed yard/mainline electrical separation under normal transit operations.

As the gas pipeline corrosion control program continues, we are advising on resolution of specific stray current control issues. This includes assisting with efforts to control the stray current leakage from the transit system, pipeline cathodic protection system adjustments, advanced monitoring techniques including the use of coupons and corrosion rate probes at pipeline test stations and revisiting the pipeline test point quantities and locations to optimize the monitoring. Our expertise is particularly beneficial as we often act as a highly effective bridge between the pipeline company and the generator of the stray current. As illustrated by this example, technically well-founded cooperation is typically the best course when assessing and resolving stray current interference matters.
Telecommunication towers around the world allow millions of wireless service users to communicate. These towers are an essential component in our daily lives – both personally and professionally. The structural integrity of these towers is regularly maintained for both operational and safety reasons. In Canada, the CSA Group (CSA) Standard S37, Antennas, Towers, and Antenna-Supporting Structures, typically applies to the design, manufacture, installation, inspection and maintenance of these types of towers. Also included in CSA Standard S37 are requirements for corrosion protection. Corrpro has been working with telecommunication companies for decades to help ensure integrity of their towers by protecting below-grade steel, primarily in anchor points, from corrosion.

Typical guy-wire-supported telecommunication towers are approximately 300 feet tall and require three to six anchor points to keep the tower upright. The integrity of these steel anchor points must be maintained, in part, through the application of effective corrosion control. On many tower sites, cathodic protection is included as part of an overall corrosion control program. In Alberta alone, Corrpro has installed cathodic protection systems at over 400 telecommunication tower sites.

**Typical Tower Site, Typical Tower Anchor Point**

In 2017, Corrpro was contracted to conduct cathodic protection maintenance investigations at a large number of tower sites throughout Alberta. Over 200 tower sites were investigated within a very short time period, with updates provided to the client daily. The investigations included soil analysis, interference investigation, “ON/OFF” potential surveys and full analysis reporting.

Along with the investigation, Corrpro was also tasked with remediation of cathodic protection systems at 41 tower sites. This remediation work included test station repairs, broken cable repairs and new groundbed installs. Of the 41 tower sites requiring remediation, 29 sites required new groundbeds and 12 required repairs.

In alignment with Aegion’s value, **RESULTS MATTER**, Corrpro provided timely expert services to keep our customer’s telecommunication towers working better, safer and longer.
DISTRIBUTED SACRIFICIAL ANODE SYSTEM FOR IN-SERVICE SUMP TANKS

By Jeff Delorme

Engineers unfamiliar with cathodic protection (CP) requirements often overlook the need for CP on buried sump tanks during the design and construction phase of new facilities. The owner may only discover the need for CP after mechanical completion and commissioning of the site are complete. This scenario recently occurred in Canada, where a buried sump tank was installed and commissioned without a cathodic protection system.

A client in Alberta, Canada retained Corrpro to provide design and installation services for the protection of an in-service sump tank. Design constraints included:

- Provide adequate CP to the sump
- No impressed current CP system
- No mechanical excavation
- No electrical isolation of sump
- No ground disturbance within 3 feet (1 m) of sump

Below-grade sump tanks are typically 3 to 6 feet (1 to 2 m) in diameter by 6 feet (2 m) in height. They are constructed with double-walled steel and a fusion-bonded epoxy (FBE) coating. Numerous flanged connections and the requirement for electrical grounding of the sump motor make electrical isolation of sumps challenging. In addition, isolation is generally not possible where buried piles support the sump.

In these cases, the standard approach for cathodic protection is a flood-style cathodic protection system that provides current to all facility structures. These flood style systems demand current capacities far above what is practical with sacrificial anodes in soil. The current requirement for the subject facilities was estimated to be 20 amperes, with the sump requiring less than 100 milliamperes.

In order to provide adequate cathodic protection to the coated sump while avoiding excessive current loss to nearby facilities, Corrpro designed and installed a distributed magnesium anode system (Figure 1). The system was installed using hydrovac excavation with anodes arranged in a polar array of five semi-deep vertical holes spaced roughly 5 feet (1.5 m) from the tank shell with multiple anodes per hole (Figure 2).

A cathodic protection coupon with integrated zinc reference electrode was installed equidistant to the anodes on the facilities side. The CP coupon represents a coating defect on the sump and helps to determine whether anode-sump spacing is adequate to overcome the current loss to the electrically continuous facilities (Figure 3).

The cathodic protection system was commissioned and allowed to polarize. Potential data obtained by Corrpro after the installation indicates that adequate CP was provided to the sump despite the current loss to the facilities.
FIGURE 1

FIGURE 2

FIGURE 3

Facilities (continuous, uncoated)

Sump Tank (coated)

Distributed Magnesium Anode Bed
5-6 holes radially symmetric
3-5 anodes per hole

Coupon

Support Piles (continuous, uncoated)
From 2016 to early 2018, Corrpro Canada, Aegion Coating Services (ACS) and United Pipeline Systems worked together to rehabilitate over 600 lattice towers for Sask Power near Saskatoon, Saskatchewan. Initially conceived as a three-year project, the schedule originally planned to complete the rehabilitation of two lattice towers per workday from July 2016 through the spring of 2019. The scope included excavation, hoarding, surface preparation, three-layer coating and installation of cathodic protection, backfill, liner and gravel.

In July 2016, the project began as planned. Multiple crews from ACS and Corrpro began their respective scopes of work, attempting to perform their specific process on each lattice tower as they went down the right-of-way (ROW). Corrpro was responsible for groundwork and cathodic protection, while ACS handled surface preparation and coating. United provided trucks and trailers for logistical support.

After a few weeks, it became clear that this sequential process was running into problems. Inclement weather led to ROWs becoming impassable. Excavated tower legs filled with rain water and could not be coated for days. Additionally, several of the towers were situated in fields that were being harvested, leading to excessive particulates contaminating the coating. The three-layer coating system compounded problems, since excavated pits had to be open for longer than usual. This caused production to slow to an unacceptable pace of less than one tower per workday.

DO WHAT’S RIGHT

The coating pace had picked up by the end of September and ACS was back on target to meet the three-year plan. Unfortunately, Corrpro was highly concerned that production issues would return, and did not want to expose the customer to any further risk.

Aegion brought in a third-party applicator that specialized in cold-weather coating for the winter towers scheduled to be rehabilitated in late 2016 and early 2017. However, the third-party applicator also ran into severe organizational issues regarding production and personnel, and ACS was brought back to SOLVE PROBLEMS and regain the customer’s trust.

BE BETTER

In 2017, the Aegion team met to determine a better way to proceed. The project execution plan had to be revamped. Operations decided to alter the order of operations, only excavating the tower legs that could be coated before any inclement weather occurred. By performing coating ahead of the cathodic protection installation, the ROW was less congested and work flowed more easily. In addition, Corrpro worked with the landowners to schedule around harvesting periods.
WE SOLVE PROBLEMS

It was determined that the three-layer coating system was compounding the inclement weather issues since the pits had to be left open longer. The customer was approached with a proposal for a more appropriate two-layer coating system. This system reduced the number of pinholes, eliminated much of the cure time and reduced the chance that weather would completely shut down production. Additionally, the amount of wasted material was reduced by over 30 percent.

RESULTS MATTER

Applying a two-layer coating system allowed Aegion to manage customer expectations regarding the apparent quality of the coating. Due to the high-contrast nature of the coating colors, several perceived visual quality issues were actually within specification. ACS decided to address the perception by applying slightly more topcoat while staying within the coating manufacturer’s recommendations.

The project management team took a big risk by moving all operations from a power line running along the eastern portion of the project to a power line on the western side. Medium-term weather trends indicated that the eastern power line would remain rainy and muddy for weeks. The cost associated with the additional mobilization was offset by the continued production on the western power line through what would have otherwise been non-working days.

From a logistics standpoint, ACS brought smaller, lighter vehicles to the ROW. Rather than full-sized pickup trucks, small side-by-sides fitted with miniature trailers had just enough room to fit the coating equipment. This increased the number of available working days by allowing access to muddy roads that larger vehicles would have been unable to negotiate.

Another major improvement was to rightsize the coating crew. Rather than having two large crews doing the same or similar tasks in parallel, ACS assigned one medium-sized crew to perform the bulk of the work and a two-man team to complete smaller tasks behind them. With this setup, the ACS team was able to stay right behind the Corrpro team and quality greatly improved.

By the end of 2017, production rates skyrocketed. ACS averaged seven towers per workday, and managed to complete all remaining summer work. In early 2018, only 14 winter towers remained to be completed. Sask Power’s original three-year execution plan was reduced to just over 18 months. Labor costs, material waste and ancillary expenses were all reduced by Aegion’s Corrosion Protection platform companies working together to **SOLVE PROBLEMS**.
Aegion Coating Services (ACS) executed an insulation solution in 2017 for 10 pipeline end terminations (PLETs) on the Shell Appomattox project. The skids, rated for temperatures over 400°F (200°C) and exposed to depths beyond 7200 feet (2200 m), required specialized insulation materials. Traditional insulation materials, such as silicone or polypropylene, would not meet the customer’s needs. Aegion selected a novel insulation system that included a proprietary new material developed by Materia, which was applied using special molds and equipment developed by ACS.

WE SOLVE PROBLEMS

ACS leveraged this new insulation product for use in field coatings for the project. Starting with the new formulation, ACS determined that it was too inviscid to be used in a field insulation environment. In order to minimize the risk for spills, ACS had Materia alter the formulation to increase viscosity, as well as speed up the reaction time.

Since this was the first time this insulation material was applied in a field environment, ACS designed, built and tested a specialized application skid. The thicker formulation required increasing the size of the metering pumps compared to available equipment. During the course of development, ACS also upgraded the control system to improve reliability and add safety interlocks. The final version of the metering skid could pour over 200 gallons (800 liters) at a time, keeping the mixing ratio within 3 percent of nominal.

Insulating PLETs involves completely encasing the volume around the pipes and valves with the insulation material. Aegion designed and modeled the intricate molding system to minimize installation time, despite the difficult geometry of the assembly. Additionally, the risk for leaks was reduced by minimizing the total length of sealed edges and connection points. ACS was also responsible for verifying electrical continuity among the mold segments to allow for cathodic protection from sacrificial aluminum anodes mounted on the skid.

RESULTS MATTER

Following a successful full-scale test in Conroe, Texas, the insulation process was approved. The metering and mixing equipment was shipped to New Iberia, Louisiana, where the PLETs and molds were fabricated. ACS personnel installed the molds and performed the pours in less than 20 days with a perfect safety and environmental record, proving that ZERO INCIDENTS ARE POSSIBLE.

The rapid turnaround time reduced the required mobilization costs, allowing the customer to come in under budget and ahead of schedule.
Pipe bursting helps save old growth trees

By Patrick Laidlaw

Pineview Water Systems comprises three water agencies in the Ogden, Utah area: the Ogden River Water Users’ Association, the South Ogden Conversation District and the Weber-Box Elder Conservation District. Collectively, these agencies have hundreds of miles of mostly small-diameter distribution and water transmission infrastructure.

Ogden is one of Utah’s oldest and most heavily populated cities. It is home to a wide variety of industries that has kept the economy strong and facilitated significant growth. Unlike other fast growing communities, Ogden’s infrastructure is older and more difficult to expand or replace. Many of the water lines are over 50 years old with some dating back to the beginning of the 20th century. Some of these pipelines are located in areas that cannot be easily dug up with conventional dig and replace methods.

Pineview has looked to trenchless technology to help better address the needs of this growing city while minimizing business and environmental impact. For example, over the past few years, Pineview has implemented pipe bursting as a means to replace corroded, leaking pipes without the use of large trench zones. The vast majority of aged watertlines are either cast or ductile iron and are being replaced with PVC pipe. Originally, a spline and groove restrained joint PVC pipe was used to burst the metal pipes. In 2017, Pineview turned to Fusible PVC® pipe for use with the pipe bursting installation methodology. Fusible PVC® pipe has a higher safe pull force and does not have a collar that requires the bursting hardware to be upsized due to its larger outside diameter. A larger outside diameter increases the risk of the pipe getting stuck or heaving the pavement at the surface.

The 2017 pipe bursting project replaced 10- and 12-inch ductile iron pipe with 10- and 12-inch Fusible PVC® pipe. The main section for replacement was under a sidewalk that separates Washington Boulevard, one of Ogden’s busiest roadways, and a row of majestic old growth trees that line the boundary of the Ogden Golf and Country Club. Minimizing the impact on Washington Boulevard and the trees was a key design parameter for both the utility and its design engineer.

The project bid in January 2017 and AAA Excavating was selected as the general contractor. They started construction in February and finished the project in March. Boyd Ricks, owner of AAA Excavating, said, “Both the Pineview Water System and Underground Solutions were easy to work with. I look forward to doing additional pipe bursting projects in the area.”

Pineview intends to continue to utilize pipe bursting and Fusible PVC® pipe to replace its aged metal pipes as it aggressively rehabilitates its water system. Pineview is progressive in its rehabilitation program. Annually, it identifies system sections that are most critical for continued sustainability instead of reacting to failures as they occur.
More than six years ago, the NACE International Task Group 430 was formed and tasked with developing a standard practice relating to AC-influenced corrosion. This industry guidance is currently in the draft and formal review process based on feedback from task group members and the larger NACE membership. The comprehensive document, Alternating Current Corrosion on Cathodically Protected Pipelines: Standard Practice for Risk Assessment, Mitigation, and Monitoring, provides guidance on detecting and controlling AC-influenced corrosion caused by high voltage alternating current overhead power lines. When published, it will be a companion document to the NACE Standard Practice SP0177 Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems. In addition to their expertise in AC interference detection and mitigation, Corrpro engineers are active on the NACE technical committees involved with these standards and have played a significant role in related industry-sponsored research through PRCI International.

One aspect of the draft NACE standard on AC-influenced corrosion control deals with criteria to determine when action is advised. Following guidance in NACE SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems, the primary criterion being proposed is documenting a corrosion rate of less than 0.025 millimeters per year (0.001 inch per year or 1 mil per year). This can be done through the effective use and analysis of electrical resistance type corrosion rate probes and in-line inspection tools. The draft standard acknowledges the influence of direct current (DC) effects on AC-influenced corrosion, including those caused by unnecessarily high levels of cathodic protection and/or cathodic interference.

In this regard, additional alternative action criteria are provided and are determined through electrical measurements using probes and/or coupons installed at a sufficient number of locations:

- Time-weighted average AC current density no greater than 30 amperes per square meter (A/m²) if the DC current density exceeds 1 A/m².
- Time-weighted average AC current density no greater than 100 A/m² if the DC current density can be maintained at less than 1 A/m².

The “time-weighted average” language is included in the above criterion to recognize that AC-influenced corrosion is related more to the net effects over time than the maximum effects. The analysis to determine compliance with these criteria must account for variations in power line loading that can affect the AC influence on the pipeline, as well as other possible variations in the AC and DC effects over time. Due diligence – including the use of remote surveillance as appropriate – is essential for an effective AC interference monitoring and mitigation program. While moderating the DC levels on a pipeline can be part of an AC interference control strategy, the proposed NACE standard notes that cathodic protection must also be effectively maintained according to the criteria in NACE SP0169.

Corrpro’s practical engineering expertise in the area of AC interference control includes many tools such as computer modeling, field engineering, problem solving and corrosion rate remote monitoring. The key to success in effectively managing the threat of AC-influenced corrosion on pipelines is to know which tool[s] to use. AC interference evaluation and analysis procedures set forth in the proposed NACE standard have been important to Corrpro’s day-to-day business for some time.