

Remote Monitoring

SCADA Zone Extended To Include Cathodic Protection

By **Brent McAdams, FreeWave Technologies, Inc.**

Aging infrastructure, new state and federal regulations, unfriendly neighbors, an aging workforce and heightened security restricting site access are burdening company operations with increasing costs and deteriorating operational excellence. Pipeline and utility operating managers look to extend their investment in high performance SCADA networks in the hope of gaining greater operational efficiencies and keeping costs in check.

Missions are getting bigger. Originally planned for integration to remote terminal units and programmable logic controllers, SCADA systems now are used for AMR/AMI applications, and operators are looking for even greater leverage of their existing systems.

A New Direction

A large municipal utility in Denver is experimenting with a new low-cost remote-monitoring solution specifically designed to monitor integrity management and corrosion prevention systems. Leveraging its existing SCADA infrastructure, it hopes to extend remote monitoring to critical cathodic protection (CP) systems as well.

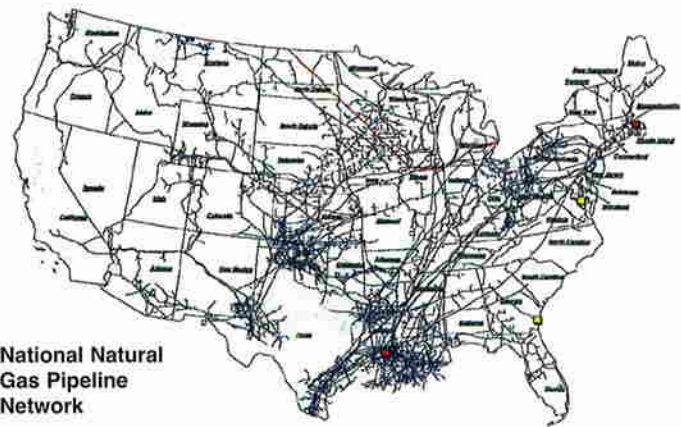
CP systems for storage tanks, pipes and other buried infrastructure are often located in remote locations making them difficult to maintain and operate, let alone operate at peak performance. In some cases, unauthorized third parties strip the critical rectifiers and wiring and sell them for scrap, leaving tanks and miles of expensive metal unprotected. Theft results in an increased risk of damage or even total failure of a system from corrosion. Compounding operational difficulties of remote systems are site access issues stemming from land use disputes, Homeland Security and urban sprawl.

The cost of implementing properly installed and well-maintained CP remote-monitoring equipment pales in comparison to the annual costs required to repair even a single leak. Reports estimate corrosion is responsible for costing U.S. industries more than \$270 billion per year, almost 3.1% of gross domestic product. The desire to rein in those costs has never been greater. Corrosion leading to leaks, lost revenue, groundwater contamination and other adverse scenarios affecting overall water quality, supply and/or public safety now can be prevented like never before through technological advances in the remote monitoring of critical tanks, pipes and casings.

As tank and pipeline operations grew throughout North America, so grew federal and state regulations governing the industry. Recent legislation passed by Congress further develops the legal implications of pipeline integrity management. At the heart of this growing legislative effort is the protection of public safety, the environment, irreplaceable national energy reserves and the U.S. economy.

Recent tragic events at the local, state, national and international levels place increasing focus on the protection and integrity of all U.S. pipeline operations.

Evidence of this increased national public awareness is demonstrated by the passage of the Pipeline Safety Improvement Act of December 2002, and the Pipeline Inspection, Protection, Enforcement and Safety Act of 2006. Both Acts serve not only to illustrate growing awareness, but also to educate the industry on pipeline operation best practices.



National Natural Gas Pipeline Network

The Pipeline Safety Improvement Act of December 2002 mandates significant changes and new requirements in the way the industry ensures the safety and integrity of its pipeline facilities, including:

- Each pipeline operator must prepare and implement an Integrity Management Program (IMP);
- Participate in planned-excavation one-call notification programs;
- Increase the penalties for violations of safety standards;
- Authorize state participation in interstate pipeline oversight;
- Offer a multi-agency program of research, development, demonstration and standardization to enhance the integrity of pipelines, and
- Develop an inter-agency task force to expedite environmental reviews when necessary to expedite pipeline repairs.

The Pipeline Inspection, Protection, Enforcement and Safety Act of December of 2006 requires certification procedures of annual and semi-annual pipeline integrity reports by a senior executive officer of each pipeline company to certify that the officer has read the report and, to the best of the officer's knowledge, that it is true and accurate.

To further illustrate the importance of corrosion prevention, in March 2007, Bill H.R. 1770 (The Corrosion Prevention Act of 2007) was introduced into the House of Representatives. If passed and signed into law it would provide a tax credit to companies that invest in corrosion control and mitigation technologies.

Recent tragic international events led many landowners, municipalities and government agencies to restrict access to sensitive areas making them onerous to enter for maintenance purposes. Many airports, office towers and mass transit sites are now "off limits" for routine CP maintenance checks. Restrictive site access procedures leave miles of buried infrastructure unmonitored and sometimes unprotected.

Rising energy prices, steel prices and labor costs add to operating budget shortfalls. The cost of repairing or replacing buried metal assets steadily rose more than 300% during the last 10 years and is projected to continue. One analyst speculates that pipeline integrity issues alone could drive energy prices higher by 27%.

The Colorado utility recently deployed a new advancement in spread spectrum wireless data communication technology which holds the promise of robust, cost-effective remote monitoring with no licensing fees, no recurring fees, no complex legal contracts and maximum network security behind the firewall.

Frequency Hopping Spread Spectrum

This technology, developed in the 1930s, is known as Frequency Hopping Spread Spectrum (FHSS). It is based on the concept

that most radio frequencies are underutilized. FHSS allows multiple users to simultaneously operate across a spectrum of radio frequencies. Provided all radios within the data communication network operate at the same frequency and then all hop to new frequencies at the same time and in the same hopping pattern; then effective, safe, trouble-free data communications exist.

An analogy of FHSS technology is illustrated by imagining a group of people wishing to carry on a conversation using citizen band radios. As long as all parties are on the same channel, they can communicate, and if they wish to keep others out of their conversation, they can carry on a private conversation by all agreeing to move from CB channel to CB channel on a random, yet, agreed upon, pattern of CB channel hopping.

As long as all parties hop from channel to channel on the same pattern at the same time, they can carry on an effective conversation. If they take roll call upon arrival at the new channel, they can further improve communication security. In some remote cases where a third party does hit the current CB channel at the right time, they only get part of the message, which means little to the third party.

CP Remote Monitoring

Advantages of this new FHSS technology as applied to remote monitoring of CP are no monthly recurring fees or costs, no initial or monthly licensing fees, no lengthy legal contracts, minimized network interferences, maximum network security, operates behind company firewall, own your own data, maximum system flexibility, infinite repeatability, maximum implementation into cabinetry and minimized field wiring.

The new FHSS wireless field-located CP RMUs remotely monitor rectifier and pipe-to-soil voltages, currents and potentials

CP RMU ID	CP RMU Description	Rectifier Current (Amps)	Rectifier Voltage (VDC)	Pipe-to-Soil Potential (VDC)	CP RMU Temp (°F)	CP RMU Battery Voltage (VDC)	Electric Output (kW)	Analog Input Value	CP RMU Fading Status	Custom New Data	Comments
1	Conduct 19 Owens Lease/Field Test Station	n/a	n/a	n/a	75.8	12.72	0	0.02			
2	Conduct 19 Pipe-to-Soil Backflow Prevention	n/a	n/a	n/a							
3	Conduct 19 Pipe-to-Soil Asset Protection	n/a	n/a	n/a							
4	Conduct 19 Pipe-to-Soil Backflow Connect	n/a	n/a	n/a							
5	Conduct 19 Pipe-to-Soil Element Conduct	n/a	n/a	n/a							
6	Conduct 19 Pipe-to-Soil SPS Valve Line	n/a	n/a	n/a							
7	Conduct 19 Pipe-to-Soil Redpipe Station	n/a	n/a	n/a							
8	Conduct 19 Pipe-to-Soil East Hufferford	n/a	n/a	n/a							
9	Conduct 19 Pipe-to-Soil Health South Feed	n/a	n/a	n/a							
10	Conduct 19 Pipe-to-Soil Kalking Mainline	n/a	n/a	n/a							
11	Conduct 19 Pipe-to-Soil Station Interference	n/a	n/a	n/a							
12	Conduct 19 Pipe-to-Soil Parker Road Feeder	n/a	n/a	n/a							
13	Conduct 19 Mainline Pipe-to-Soil Wyoming Trains	n/a	n/a	n/a							
14	Conduct 19 Mainline Pipe-to-Soil Kipling Gate Connect	n/a	n/a	n/a							
15	Conduct 19 Mainline Pipe-to-Soil Wellington LDC Plant	n/a	n/a	n/a							
16	Conduct 19 Mainline Pipe-to-Soil 15000 Light Trail Cross	n/a	n/a	n/a							
17	Conduct 19 Mainline Pipe-to-Soil Claymore Gutierrez	n/a	n/a	n/a							
18	Conduct 19 Mainline Pipe-to-Soil Fuel Outgoing CP Gate	n/a	n/a	n/a							
19	Conduct 19 Mainline Pipe-to-Soil Phoenix Plant Line	n/a	n/a	n/a							
20	Conduct 19 Mainline Pipe-to-Soil Catalytic Convert	n/a	n/a	n/a							
21	Conduct 19 Mainline Pipe-to-Soil Front Range East Loop	n/a	n/a	n/a							
22	Conduct 19 Mainline Pipe-to-Soil Golden Crest Tap	n/a	n/a	n/a							
23	Conduct 19 Mainline Pipe-to-Soil Lakeland Area Feed	n/a	n/a	n/a							
24	Conduct 19 Mainline Pipe-to-Soil CO Check Station	n/a	n/a	n/a							



and record them. Field data then is wirelessly collected from the field devices by a computer located in a central office or through a SCADA system for CP operator evaluation and monitoring.

Modern CP RMUs monitor ambient temperature and, if connected to a solar-power generation system, also will monitor the backup battery supply voltage.

CP systems are highly susceptible to transient lightning surge. In addition to being directly connected to the field piping structures, CP rectifiers are attached to overhead power lines, making them more likely to receive damage from near strike lightning. To protect sensitive wireless electronics, manufacturers use fully isolated relays and sampling capacitor technology for maximum protection.

For companies that do not have a SCADA network, they can deploy, low-cost CP data logging software readily available for less than the cost of a desktop computer.

Central data collection systems automatically inform CP professionals of immediate system operation requirements leading to optimization in keeping critical CP equipment online and operating within guidelines. As a result, remote sites no longer are difficult to monitor.

Demonstration System Available

One way to learn more about new CP remote-monitoring technology is through a test drive. Many manufacturers offer no-obligation demonstration systems. A test drive is implemented by first selecting a half dozen test points and a central office location and providing the manufacturer or vendor with site coordinates. For the purpose of the test drive, CP data either can be collected using the data logger software or by coordinating with the pipeline operator's CP RMU provider to design a plan to integrate the equipment into the existing SCADA architecture. Normal test drive intervals depend largely on the size and type of system deployment. However, 30/60/90 day test drives are not uncommon. *P&GJ*

ACKNOWLEDGMENT

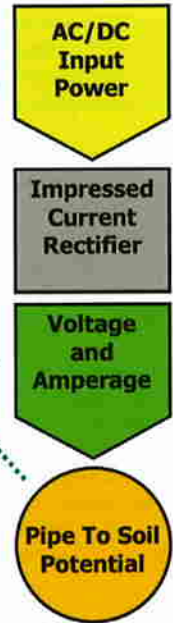
This article is based on a presentation at the 2008 NACE Central Area Conference in Independence, MO.

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SCADA

Many companies already own and operate a SCADA network and can easily integrate these new remote monitoring devices through existing RTUs, PLCs or radio networks.



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