ELECTRIC POWER RESEARCH INSTITUTE

MODERNIZATION TECHNOLOGY ASSESSMENT

MTA Number	MTA-EN-001
Title	
Reduce Maintenance Costs Using Wireless Gauge Readers	
Description	
Nuclear power plants typically have over 100 analog gauges used to monitor parameters such as pressure, temperature, humidity, and flow. These gauges are monitored manually, which can result in unnecessary dose and errors in readings. Additionally, data are only captured when an operator physically reads the gauge and documents the result. Wireless gauge readers are battery operated, noninvasive devices that attach to the installed gauges, automatically read the analog data, and transmit it wirelessly. The transmitted data can then be stored in a historian for tracking and trending to support the transition from time-based monitoring to condition-based monitoring of equipment. This technology enables cost savings through reduction in maintenance man-hours and personnel dose as well as increase in system monitoring capabilities with more frequent and accessible data collection.	
Benefits	
Benefits Estimate	Level 1 – Savings are less than $1 million per year per unit. Maximum savings can be achieved by updating procedures to reduce the need for in person data collection and by integrating the data into a historian for tracking and trending.
Benefits Description	• Reduction in man hours associated with in person data collection. • Increased equipment reliability because data can be collected more frequently and in real-time. • Reduction in maintenance costs by supporting the transition from time-based monitoring to condition-based monitoring. • Reduction in personnel dose, depending on gauge location. • Reduction in personnel hazards due to decrease in time spent near high temperature, high energized, and hard to reach equipment.
Costs and Schedule	
Cost	Cost – Level 3 – Implementation of wireless gauge readers, provided there is an Ethernet connection or a wireless connectivity framework already established, is less than $1 million. Costs typically range between $1,800-2,500 per sensor depending on quantity and type.
Schedule	Less than six months. Schedule estimate is based on a previous implementation of approximately 30 wireless gauge readers for one unit. The previous implementation was for non-seismic and non-safety related applications only.
Scope Context	Per component Cost and schedule estimates include purchase of the wireless gauge reader, development of the design change package, updating operational procedures and training, installation, and data management. The cost per sensor typically decreases as the quantity purchased increases. Cost estimates do not include ongoing maintenance.

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Risks
Cybersecurity: If the system is not properly segmented and implemented, potential cybersecurity deficiencies may result in an increase in vulnerability to cybersecurity threats. Following the cybersecurity guidance in the available reference implementation guidance will mitigate this risk. Electromagnetic Compatibility (EMC): If EMC implications are not considered, then the technology may adversely affect nearby equipment. Following the NRC EMC requirements and guidance for EMC testing in the available reference implementation guidance will mitigate this risk.

Administrative Items	
Date	12/15/2020
Functional Area Where Benefits Will Be Realized	Engineering Operations Maintenance
Reference Implementation Guidance	Configuration and Demonstration of 433-MHz Wireless Gauge Reader (EPRI 3002012915) Guidelines for Electromagnetic Compatibility Testing of Power Plant Equipment: Revision 5 to TR-102323 (EPRI 3002015757)
Industry SME	EPRI - Nick Camilli Contact: NuclearPlantMod@epri.com
Previous Implementation	Please contact EPRI for implementation examples and contacts.
Implementation Enablers	Ethernet connection or wireless network infrastructure (for example, see MTA-MA-003: Implement Wireless Network Infrastructure Using a Distributed Antenna System (DAS) and MTA-MA-004: Implement Wireless Network Infrastructure Using WiFi)
SWEEP Score	• Cost – Level 3 – Implementation of wireless gauge readers, provided there is an Ethernet connection or a wireless connectivity framework already established, is less than $1 million. Costs typically range between $1,800-2,500 per sensor depending on quantity and type. • Savings – Level 1 – Savings are less than $1 million per year per unit. Maximum savings can be achieved by updating procedures to reduce the need for in person data collection and by integrating the data into a historian for tracking and trending. • Payback – Level 2 – Payback period is greater than one year but less than five years (inclusive). This payback estimate is driven by the ability to integrate the data into a historian and update maintenance procedures. • Licensing Readiness – Level 3 – This technology has already been implemented at nuclear power plants and no changes to the site license would be required. The wireless gauge readers attach to the installed gauges and read and transmit the data. If the wireless gauge readers were to fail, they can be removed and data can be read from the installed gauge. • Technology Readiness – Level 3 – The technology is commercially available and is already in use at commercial nuclear sites. Commercially available wireless gauge readers operate at specified wireless bandwidths. Further research is required for custom wireless bandwidths.

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	• Implementation Proficiency – Level 2 – For full remote monitoring (wireless data transmission) of wireless gauge reader data, implementation proficiency is dependent on site-specific experience related to wireless data infrastructure, wireless data transmission for maintenance and monitoring, cyber-security protocols, etc.
Applicability	All reactor types All geographic regions
Keywords	Gauge readers; online monitoring; condition-based monitoring; reduced maintenance costs; reduced personnel dose; wireless; operator rounds
Business Case Analysis Cross-Reference	N/A

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