

MTA Number	MTA-MA-027
Title	
Reduce Piping Inspection Costs and Worker Exposure through Risk-Informed In-Service Inspection Methodology	
Description	
In-service inspections (ISI) on piping generally focus on the welds between piping segments and are developed based on deterministic codes, such as ASME Boiler & Pressure Vessel Code Section XI. Inspection programs based on these codes incorporate deterministic approaches relying on safety classification, pipe materials, configuration, and design stress calculations focused on licensing basis events. However, such approaches do not account for available risk information, such as operating experience, the consequences of a pipe failure or the probability of that failure occurring. The use of the deterministic inputs may ultimately result in overly conservative inspection schedules and weld inspection locations, which can incur unnecessary contract labor costs, radiation exposure, outage complexity, and outage duration (e.g., if the inspections are in the critical path). The Risk-Informed In-Service Inspection (RI-ISI) methodology enables plants to reduce the examination scope of ISI programs, resulting in significantly reduced costs while maintaining nuclear plant safety standards. RI-ISI incorporates insights related to plant experience and potential failure modes (e.g., corrosion or fatigue), and targets inspections on areas of risk significant piping and increased failure potential determined through a plant-specific evaluation. EPRI has developed two RI-ISI methodologies for pipe inspections in nuclear power plants as an alternative to deterministic programs: the traditional RI-ISI (EPRI TR 112657REVB-A), and the streamlined RI-ISI (EPRI 3002003029). EPRI has also extended the RI-ISI methodology to include break exclusion regions (BERs) (EPRI 1006937). Each of these RI-ISI methods have been demonstrated to produce favorable returns on investments when implemented in plants with deterministic ISI programs. Plants may also benefit from transitioning to the streamlined RI-ISI from the traditional RI-ISI. This Modernization Technology Assessment assumes a one-unit plant incorporates the traditional RI-ISI methodology on Class I and II piping, starting from a deterministic ISI program without a plant probabilistic risk assessment (PRA) and without incorporating the EPRI RI-BER alternative.	
Benefits	
Benefits Estimate	Level 1 – Savings are expected to be less than \$1 million per year, per unit. Estimated savings are approximately \$200,000 a year. Savings include reductions in contract maintenance and NDE costs, along with increases in personnel safety and efficiency. Additional savings may be realized through dose savings and reduced outage duration and complexity from performing fewer inspections. Savings will vary on the RI-ISI methodology implemented and the scope of weld inspections included in the implementation.
Benefits Description	• Reduction in contract maintenance costs. Contract maintenance costs are due to scaffolding assembly/disassembly and insulation removal/replacement which may be eliminated due to reductions in weld locations. • Reduction in contract NDE costs. Each weld location eliminated with the risk-informed process reduces NDE contract labor costs. • Increased personnel efficiencies involved in outage planning and coordination and NDE labor oversight. RI-ISI results in reduced labor hours for plant personnel compared to ASME Section XI ISI programs or similar deterministic ISI programs. • Reduced dose, radwaste, and time commitment per outage from reductions in piping weld inspection locations.

Costs and Schedule	
Cost	Level 3 – Initial implementation cost is significantly less than \$1 million, which includes procedure revisions, RI-ISI analyses, and database updates. Ongoing costs include RI-ISI program maintenance (updates and revisions). Estimated implementation costs are between \$230,000 and \$360,000 depending on required RI-ISI weld evaluations, and estimated ongoing costs to maintain the RI-ISI program are \$20,000 per year per unit.
Schedule	Six months to one year, which includes planning and implementation.
Scope Context	Per unit. The associated business case (EPRI 3002020582) considers a one-unit plant implementing the traditional RI-ISI for Class I and II piping, with a remaining 25-year lifetime, without incorporating BERs.
Risks	
Standard project risks associated with utilizing a vendor service. For some countries, transitioning to an RI-ISI methodology, with the associated PRA, requires approval from the nuclear regulator, which may present increased schedule and cost risks. Following the reference implementation guidance should mitigate this risk. Risks are already mitigated for plants in the U.S. In the U.S.: • The streamlined RI-ISI approach does not require regulatory approval. • The traditional RI-ISI approach will not require regulatory approval in the near future, and • The RI-BER does not require regulatory approval unless BER requirements are included in a plant's Technical Specifications.	
Administrative Items	
Date	12/14/21
Functional Area Where Benefits Will Be Realized	Maintenance Engineering Work Management
Reference Implementation Guidance	Revised Risk-Informed Inservice Inspection Evaluation Procedure (EPRI TR-112657REVB-A) Nondestructive Evaluation: N-716 Revision 1 Pilot Study Results and Lessons Learned (EPRI 3002003029) Extension of the EPRI Risk-Informed Inservice Inspection (RI-ISI) Methodology to Break Exclusion Region (BER) Programs, Rev. 0-A (EPRI 1006937) Nondestructive Evaluation: Probabilistic Risk Assessment Technical Adequacy Guidance for Risk-Informed In-Service Inspection Programs (EPRI 1021467) U.S. Nuclear Regulatory Commission Regulatory Guide 1.178: An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping
Industry SME	EPRI – Patrick O'Regan Contact: nuclearplantmod@epri.com
Previous Implementation	Please contact EPRI for implementation examples and contacts.
Implementation Enablers	N/A

This MTA can be accessed from <http://www.epri.com\nuclearplantmod>. For more on MTA's please see EPRI product 3002020578

SWEEP Score	• Cost - Level 3 – Implementation cost is less than \$1 million. • Savings – Level 1 – Savings are less than \$1 million per year. • Payback – Level 2 –The payback period for implementation is between one and five years. Estimated payback period is 2-3 years for a one unit plant implementing the traditional RI-ISI. • Technical Readiness – Level 3 – This technology has already been implemented at nuclear power plants. • Licensing Readiness – Level 3 – This technology has already been implemented at nuclear power plants. • Implementation Proficiency – Level 3 – The technology can be implemented by all sites, regardless of digital experience.
Applicability	All reactor types All geographic regions
Keywords	Welds; risk-informed in-service inspection (RI-ISI); labor expense; deterministic methods
Business Case Analysis Cross-Reference	Use of a Risk-Informed Inspection Process to Reduce Labor and Contract Costs: Cost-Benefit Analysis of the EPRI Risk-Informed Processes for Inspections of Piping Welds (EPRI 3002020582)

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THE FOLLOWING ORGANIZATION(S), UNDER CONTRACT TO EPRI, PREPARED THIS DOCUMENT:

**MPR Associates, Inc.
320 King St.
Alexandria, VA 22314**

**Principal Investigator
A. Tran**

NOTE

For further information about EPRI, call the EPRI Customer Assistance Center at 800.313.3774 or e-mail askepri@epri.com.

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