

MODERNIZATION TECHNOLOGY ASSESSMENT

MTA Number	MTA-MA-025
Title	
Reduce Maintenance Costs and Time at Reduced Power by Extending the Maintenance and Test Intervals for Turbine Valves and the Turbine Overspeed Protection System (OPS) Using an Enhanced Turbine Missile Probability Model	
Description	
Turbine O&M costs can be reduced by extending the time between inspections and repairs of turbine steam inlet valves and performing less frequent testing of the valves while the plant is operating. Test intervals can also be extended for the control components in the turbine overspeed protection system (OPS). Using an enhanced turbine missile probability model, the impact of extending the maintenance intervals for turbine valves can be assessed against the available margin to the NRC acceptance limit. A failure modes and effects analysis (FMEA) of the valves is also performed in combination with a review of maintenance and inspection records to determine the condition of valves that are overhauled at the current maintenance interval. Combining the missile probability analysis, FMEA results, and assessment of valve condition, a technical basis can be formed for extending the turbine valve maintenance interval to reduce maintenance costs over the life of the plant. Testing intervals can also be extended to reduce the number of tests performed while the unit is operating, minimize the risk of an unplanned turbine trip due to system malfunction or operational transients, and minimize the time spent at reduced power for turbine valve stroke tests. A detailed reliability model of the OPS including the turbine steam inlet valves is used to evaluate the impact of test interval extensions on turbine missile probability.	
Benefits	
Benefits Estimate	Level 1 – Savings are less than \$1 million per year per unit for both maintenance savings and test interval savings. Significant cost savings could be realized over the lifetime of the facility and through crediting avoidance of turbine trips.
Benefits Description	Benefits of turbine valve maintenance interval extension include: • Increased cost savings from fewer maintenance inspections over the life of the plant. • Increased equipment reliability because likelihood of maintenance-induced failures is reduced. Benefits of turbine valve and OPS testing interval extensions include: • Reduced risk of turbine trips because fewer tests are being performed online thereby increasing plant safety. • Reduction in time at reduced power for tests that require downpowers.
Costs and Schedule	
Cost	Level 3 – Implementation cost is less than \$1 million per unit. Cost is less than \$300,000 per unit including analysis of maintenance and test intervals and resources for surveillance frequency change.
Schedule	Less than six months.
Scope Context	Per unit

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	Cost and schedule estimates include contracting out the necessary analyses, including FMEAs and turbine missile probability analyses, as well as the internal efforts to extend the intervals.
Risks	
A review of the current licensing basis for turbine valve and OPS test intervals is necessary to verify that no restrictions exist that preclude making test interval changes.	
Administrative Items	
Date	04/23/21
Functional Area Where Benefits Will Be Realized	Maintenance Operations Work Management
Reference Implementation Guidance	Contact Industry SMEs for guidance.
Industry SME	EPRI – Constantin Chitic-Foldi EPRI – Patrick O'Regan Contact: NuclearPlantMod@epri.com
Previous Implementation	This methodology has been implemented at several US nuclear plants. Please contact the EPRI SME for additional information.
Implementation Enablers	N/A
SWEEP Score	- Cost – Level 3 – Implementation cost is less than \$1 million per unit. Cost is less than \$300,000 per unit including analysis of maintenance and test intervals and resources for surveillance frequency change. - Savings – Level 1 – Savings are less than \$1 million per year per unit for both maintenance savings and test interval savings. Significant cost savings could be realized over the lifetime of the facility and through crediting avoidance of turbine trips. - Payback – Level 3 – Payback period is less than one year. Payback can be realized immediately should interval extension be implemented in a year where maintenance and testing is required. - Technical Readiness – Level 3 – The methodology to extend turbine valve maintenance and testing intervals has already been implemented at commercial nuclear sites. - Licensing Readiness – Level 3 – No regulatory changes are required for implementation. A 10 CFR 50.59 screening/evaluation is required along with a NEIL variance request. A UFSAR wording revision may be required if the intervals are specified. - Implementation Proficiency – Level 3 – This methodology can be implemented by all sites regardless of digital experience.
Applicability	All reactor types All geographic regions
Keywords	Turbine valve; overspeed protection system; OPS; interval extension; maintenance; testing interval

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Business Case Analysis Cross- Reference	Plant Modernization Business Case: Use of Risk-Informed Methods to Reduce Main Turbine Maintenance and Testing (3002020580)
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