

Industry Perspective on Application of Performance Monitoring in Optimizing Inservice Inspections

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Industry Perspective on Performance Monitoring

- Optimizing inspections has and can be justified using various analytical methods with significant margins and no adverse impact on performance.
- Performance Monitoring (PM), where applicable, can be implemented either on a station specific or industry wide bases.
- Industry wide approach is more efficient and likely more effective by covering more varied configurations and conditions.

Purpose of Performance Monitoring

- RG 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis”
 - Monitoring and trending performance characteristics to verify aspects of the underlying analyses, research, or bases for a requirement (e.g., measuring battery voltage and specific gravity, inservice inspection of piping)
- PM employs examination techniques that monitor for specific failure or degradation mechanisms

Existing Industrywide PM Programs

Several industrywide PM programs already employed that effectively support strong performance:

- Boric Acid Corrosion Control (BACC) Programs
- Routine Engineering and Operations Walkdowns
- Fatigue Monitoring Programs
- PWR RCS Leakage Monitoring Systems

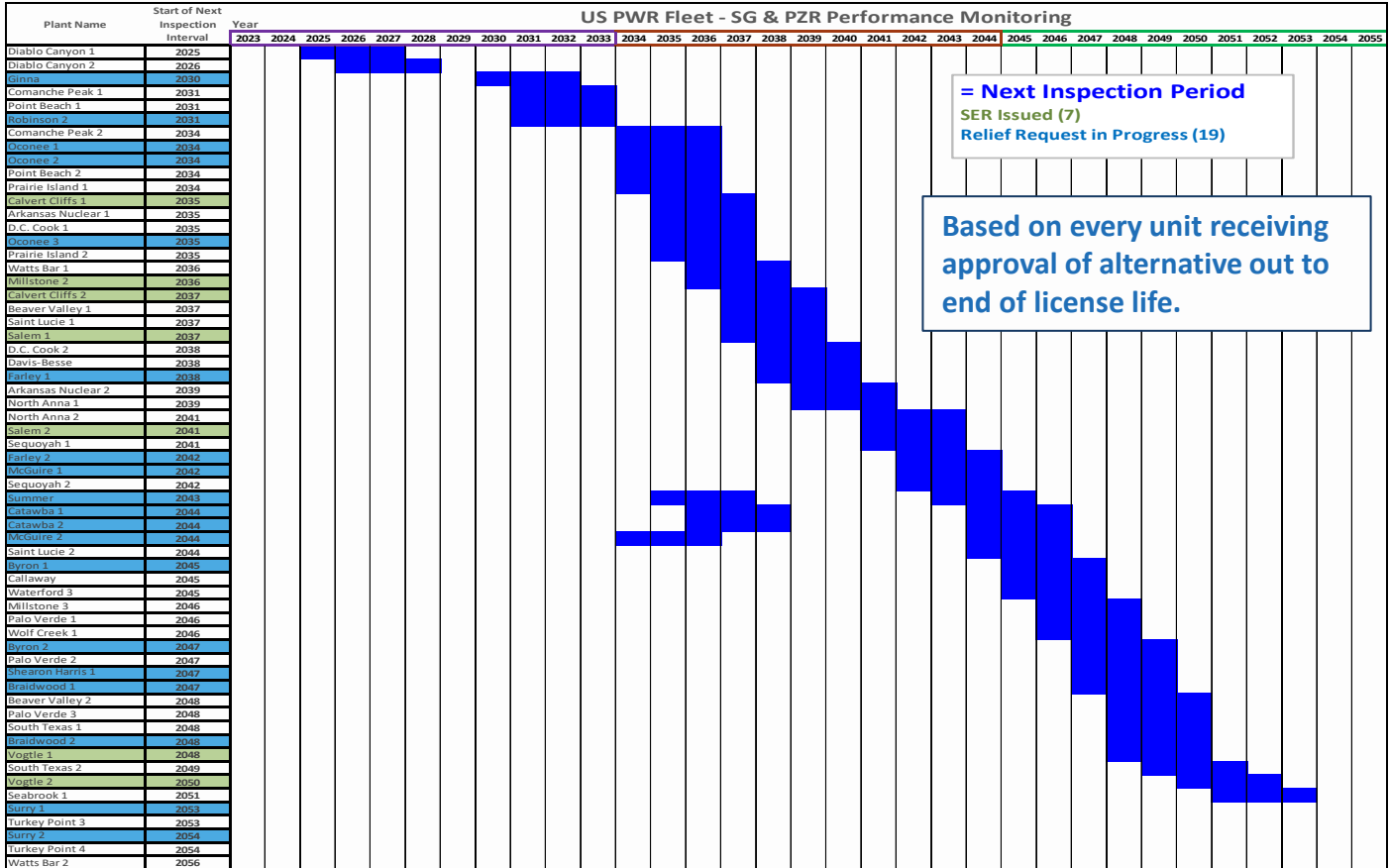
Most novel failure mechanisms have been found by these existing industrywide performance monitoring programs

Industrywide PM for Optimizing Inspections

Inherent Cadence of PM across the US PWR Fleet

- Matrix for postulated timing of alternative request applications and current operating license
 - Considers each component individually (SG, Pressurizer)
 - Combines components, considering all are low allow steel
- The included matrix illustrates the cadence and number of PM for future submittals
 - International units would provide additional data

US PWR Fleet Performance Monitoring



Required Pressurizer Inspections Based on Binomial Distribution

(From Slide No. 20 of NRC Presentation on April 27, 2023 – ML23114A034)

■ Analysis Inputs

- 61 PWRs in the US fleet –one pressurizer (PZR) per PWR
 - All units have previously inspected PZR
 - All welds under consideration have similar materials, similar stresses, similar environments (in part handled by analyzing an “inspection” as full set per PZR)
 - A 5% population incidence of novel degradation, with a 90% probability of detecting at least “one” occurrence in a PZR sampled
 - Three 10-year inspection intervals under consideration
 - ◆ Across US Fleet that is 183 required PZR inspections
- Using the binomial distribution, 45 inspections are required (41 inspections when Monte Carlo is used) –yielding about 25% of the ASME required inspections over the 30-year inspection interval or 15 inspection per 10-year inspection interval

Industrywide PM Approach

- In any 10-year window starting in 2030, from the proposed sequencing of periods for extended operation (new licensing period), there are more than the requisite 15 inspections. (Conservatively this is based on EVERY unit receiving relief until end of license life, which will not be the case.)
 - From 2030 to 2040 the US fleet will be conducting 28 inspections > 15 inspection per binomial applied to fleet
 - From 2035 to 2045 the US fleet will be conducting 32 inspections > 15 inspection per binomial applied to fleet
 - From 2040 to 2050 the US fleet will be conducting 30 inspections > 15 inspection per binomial applied to fleet
- Similarly, this industrywide PM approach can be extended to steam generators and yield the requisite 25% of ASME required inspections

Summary and Conclusion

- PM is effective for specific failure mechanisms
- Industrywide PM programs, including international operating experience, provide additional indications of potential issues
- Postulated timing of applications for extension of these specific component inspections results in inherent PM across the US PWR Fleet that satisfy the binomial distribution to yield more than 25% of the ASME required inspections over the 30-year inspection interval
- Industrywide PM approach is more effective and efficient than plant-specific approaches

QUESTIONS?
