

US PWR Fleetwide Performance Monitoring for Optimization of Select NDE Examination Requirements



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Background

- EPRI has developed the technical bases that support deferral of steam generator (SG) and pressurizer (PZR) component exams well beyond the current ASME Section XI code requirements.
- The probabilistic and deterministic analyses performed considered an 80-year operating life and produced results that support exceeding the benchmark safety threshold of 1×10^{-6} .
- Considering a level of conservatism, the industry limited the deferral period to 30-years (or less in particular plant specific cases based on operating license expiration) in lieu of the current inspection requirement of the 10-year interval prescribed by ASME Code, Section XI
 - **EPRI 3002014590** - *Technical Bases for Inspection Requirements for PWR Steam Generator Feedwater and Main Steam Nozzle-to-Shell Welds and Nozzle Inside Radius Sections*
 - **EPRI 3002015906** - *Technical Bases for Inspection Requirements for PWR Steam Generator Class 1 Nozzle-to-Vessel Welds and Class 1 and Class 2 Vessel Head, Shell, Tubesheet-to-Head and Tubesheet-to-Shell Welds*
 - **EPRI 3002023713** - *Technical Bases for Inspection Requirements for PWR Steam Generator Auxiliary Feedwater Nozzle-to-Shell Welds*
 - **EPRI 3002015905** - *Technical Bases for Inspection Requirements for PWR Pressurizer Vessel Head, Shell – to-Head and Nozzle-to-Vessel Welds*

Background

- Pilot plants have used the technical bases documents to seek relief from the NRC
 - All pilot plants were granted deferral of 30 years or to the end of operating license (whichever comes first) without performance monitoring (PM) during the deferral period
- For follow-on plants (to date), the NRC approved the following PM during the deferral period:
 - Deferral Period \leq 20 years – No PM required
 - Deferral Period $>$ 20 years – PM required
- The NRC has determined, using a binomial distribution, for plants that require PM, ~25% of ASME Section XI required exams must be performed during the deferral period

Status of Request for Alternative Inspections

(As of 5-20-2024)

CATEGORY	UNITS
Submitted RR and obtain SER	12
RR submitted but no SER yet	7
Started RR but not submitted yet	8
Not started RR yet. Performing ASME Section XI inspections	34
Total	61

Industry's Understanding of NRC Concerns

- How does the fleet-wide performance monitoring plan conform to:
 1. The NRC's binomial distribution model defining a minimum number of inspections that need to occur across the fleet during the current operating licenses for all plants.
 2. Sufficient, continuous collection of inspection data points, over the range of time aligned with current operating licenses for all plants, to identify known and unknown degradation mechanisms in a timely manner.

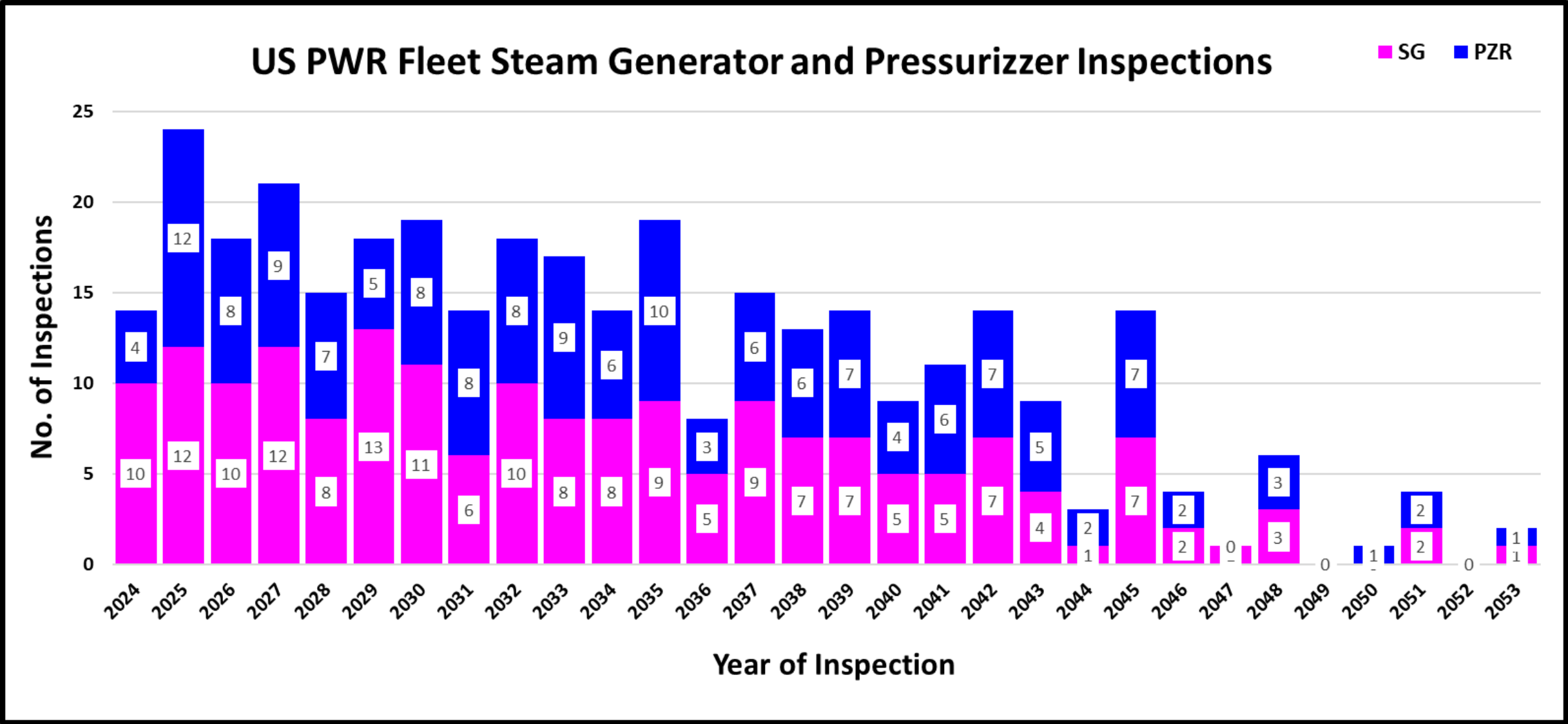
US PWR Fleet-wide Conformance to the NRC's Binomial Distribution Inspection Requirement

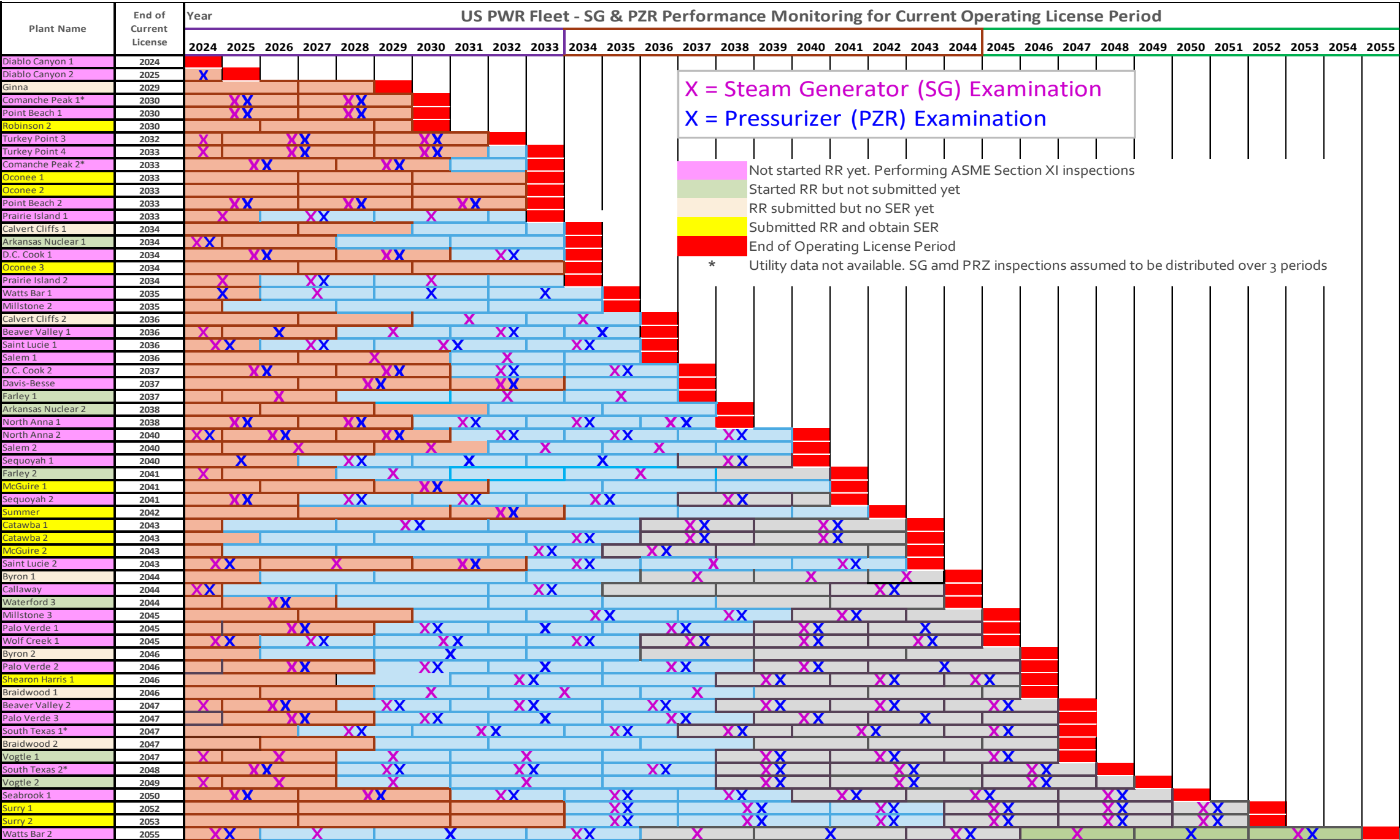
- Total of 61 units
 - Total No. of ISI Intervals until end of deferral (end of license) = 127
 - Total No. of SG or PRZ equivalent exams to be performed = **25% of 127 = 32**
- Calculation of SG and PRZ equivalent exams based on the methodology used in the Duke Energy SG and PRZ SER (ML23256A088 and ML23264A853)

CATEGORY	SG Equivalent Exams	PRZ Equivalent Exams
Submitted RR and obtain SER	9.8	9.3
RR submitted but no SER yet	3.8	0.7
Started RR but not submitted yet	4.8	4.2
Not started RR yet. Performing ASME Section XI inspections	64	68
<u>Totals</u>	82.4	82.2

- Based on the above table, currently the US PWR fleet collectively exceed the 25% binomial distribution inspection requirement by a wide margin

US PWR Fleet-wide Inspection Data Points Over Range of Current Operating Licenses





Let's Discuss (1/2)

- The dynamic nature of inspections for these components across the US fleet is more complex than what was done for the RPV inspection optimization.
- Due to the dynamic nature, it is recognized that there will be a periodicity, or potential triggers, for review of the overall plan.
 - What is the appropriate periodicity – annually, every 3 years, etc.?
 - Per application for relief to ensure sampling rate and continuous data collection is being achieved?
 - Should it, or would it, be part of all future applications as evidence the overall PM is not being compromised, if application is approved?
- All plants entering a new licensing period would be subject to original ASME examination requirements, these would then be part of the overall PM plan, as they become active (i.e. another trigger)

Let's Discuss (2/2)

- With this approach that has been discussed, does the NRC see any potential for use in conditioning current ASME Code Cases?
- Industry may consider rescinding the Code Cases.
- Option(s) to tie this commitment to regulation?
 - NEI 03-08 commitment?
 - Industry commitment letter (docketed)?
 - Technical Report documenting approach and submitted as a Topical?



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