

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



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NRC / Industry Materials Technical Exchange Meeting
Rockville, MD
June 26, 2024

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^{-06} .
- 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*

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.

Status of Request for Alternative Inspections

(As of 6-26-2024)

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

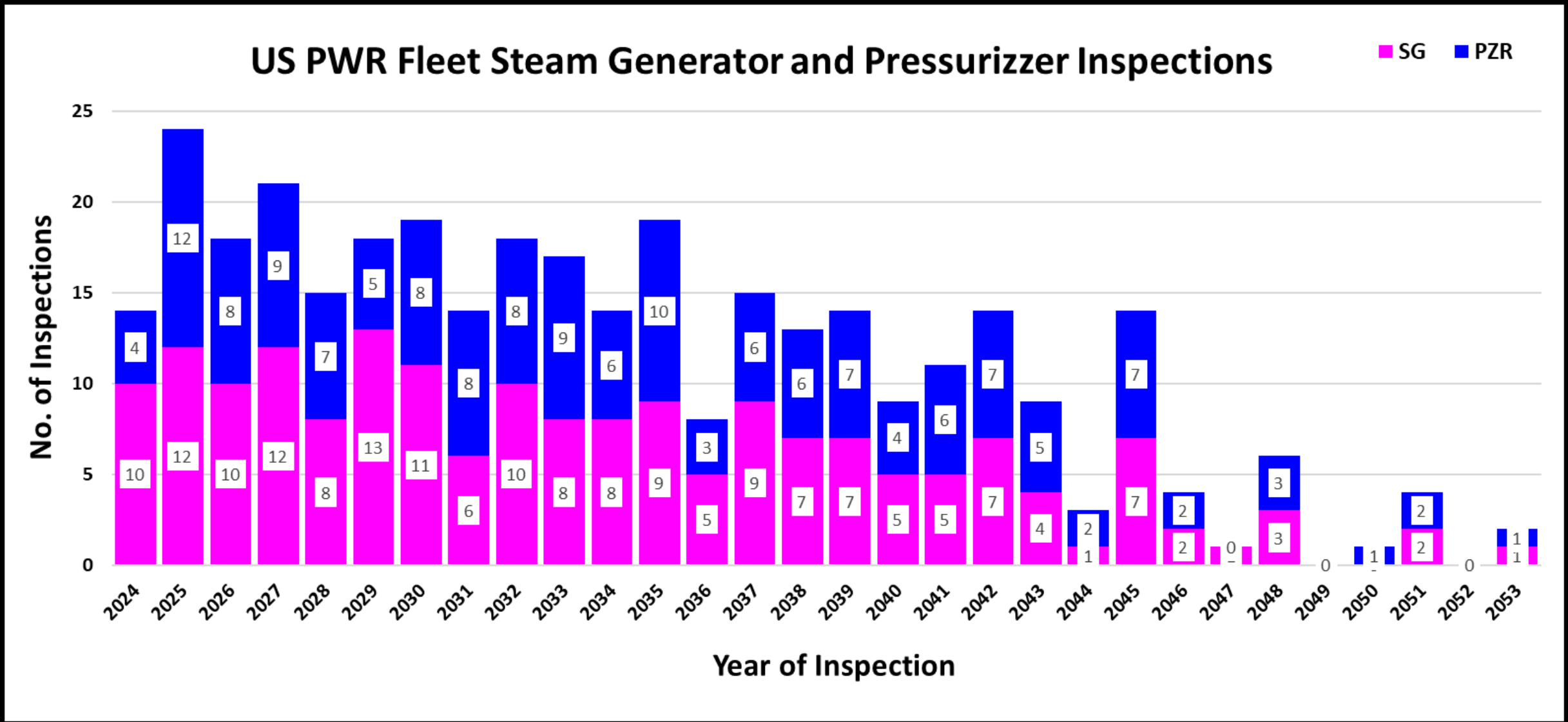
US PWR Fleet-wide Conformance to the NRC's Binomial Distribution Inspection Requirement

- 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



US PWR Fleet - SG & PZR Performance Monitoring for Current Operating License Period

Plant Name	End of Current License	Year																																		
		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055			
Diablo Canyon 1	2024																																			
Diablo Canyon 2	2025	X																																		
Ginna	2029																																			
Comanche Peak 1*	2030		XX																																	
Point Beach 1	2030		XX																																	
Robinson 2	2030																																			
Turkey Point 3	2032	X																																		
Turkey Point 4	2033	X																																		
Comanche Peak 2*	2033		XX																																	
Oconee 1	2033																																			
Oconee 2	2033																																			
Point Beach 2	2033		XX																																	
Prairie Island 1	2033		X																																	
Calvert Cliffs 1	2034																																			
Arkansas Nuclear 1	2034	XX																																		
D.C. Cook 1	2034																																			
Oconee 3	2034																																			
Prairie Island 2	2034		X																																	
Watts Bar 1	2035		X																																	
Millstone 2	2035																																			
Calvert Cliffs 2	2036																																			
Beaver Valley 1	2036	X																																		
Saint Lucie 1	2036	XX																																		
Salem 1	2036																																			
D.C. Cook 2	2037																																			
Davis-Besse	2037		XX																																	
Farley 1	2037																																			
Arkansas Nuclear 2	2038																																			
North Anna 1	2038		XX																																	
North Anna 2	2040	XX																																		
Salem 2	2040																																			
Sequoyah 1	2040		X																																	
Farley 2	2041																																			
McGuire 1	2041																																			
Sequoyah 2	2041		XX																																	
Summer	2042																																			
Catawba 1	2043																																			
Catawba 2	2043																																			
McGuire 2	2043																																			
Saint Lucie 2	2043	XX																																		
Byron 1	2044																																			
Callaway	2044	XX																																		
Waterford 3	2044																																			
Millstone 3	2045																																			
Palo Verde 1	2045																																			
Wolf Creek 1	2045	XX																																		
Byron 2	2046																																			
Palo Verde 2	2046																																			
Shearon Harris 1	2046																																			
Braidwood 1	2046																																			
Beaver Valley 2	2047	X																																		
Palo Verde 3	2047																																			
South Texas 1*	2047																																			
Braidwood 2	2047																																			
Vogtle 1	2047	X																																		
South Texas 2*	2048																																			
Vogtle 2	2049	X																																		
Seabrook 1	2050																																			
Surry 1	2052																																			
Surry 2	2053																																			
Watts Bar 2	2055	XX																																		

X = Steam Generator (SG) Examination
X = Pressurizer (PZR) Examination

- Not started RR yet. Performing ASME Section XI inspections
- Started RR but not submitted yet
- RR submitted but no SER yet
- Submitted RR and obtain SER
- End of Operating License Period

* Utility data not available. SG and PRZ inspections assumed to be distributed over 3 periods

NRC / Industry Discussion Points

- 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. (i.e., Option(s) to tie this commitment to regulation)
 - What is the appropriate periodicity for review – annually, every 3 years, etc. (EPRI Assist)?
 - Potential to shift all plants to a 30-year interval?
 - Per application for relief to ensure sampling rate and continuous data collection is being achieved (EPRI Assist)?
 - Should it, or would it, be part of all future applications as evidence the overall PM is not being compromised, if application is approved? (EPRI Assist)?
 - NEI 03-08 commitment?
 - Industry commitment letter (docketed)?
 - Technical Report documenting approach and submitted as a Topical, use of addendum letter to monitor and update fleetwide conformance to NRC two primary concerns (from slide #3) (EPRI Assist)?
- 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 (EPRI Assist)?



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