

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

Robert Grizzi, Program Manager EPRI - Plant Support / NDE

NRC Public Meeting Rockville, MD May 20, 2024

 in
 X
 f

 www.epri.com
 © 2024 Electric Power Research Institute, Inc. All rights reserved.

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 1X10^{E-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

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:
 - 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.

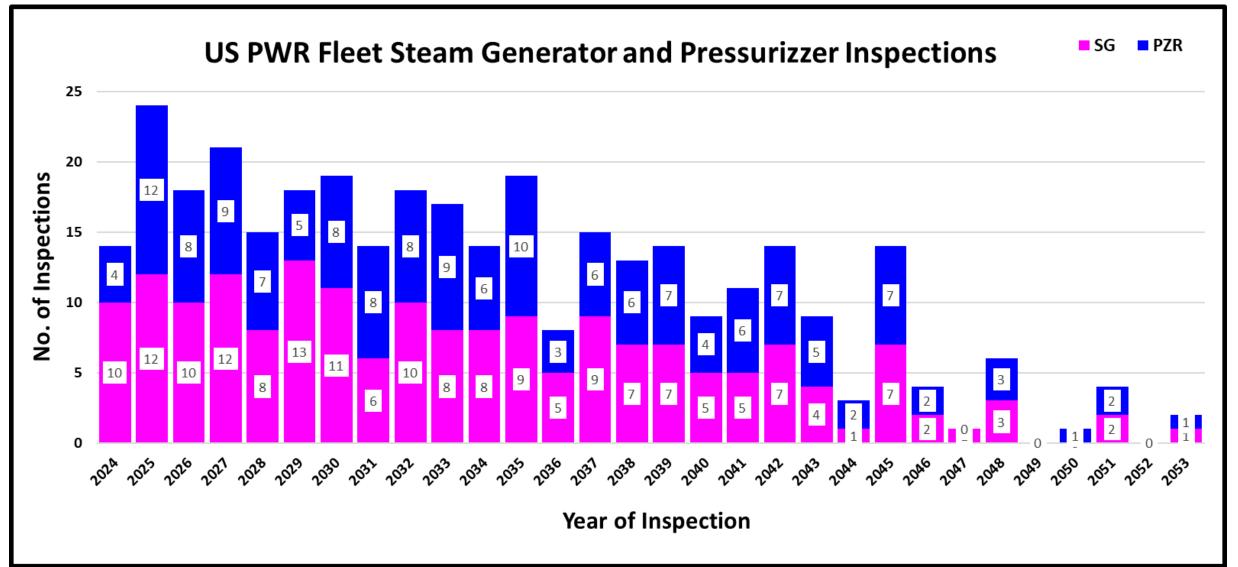
US PWR Fleet-wide Conformance to the NRC's Binomial Distribution Inspection Requirement

- 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



Plant Name	End of Current	of the contract of a contract of a contract of the contract of																											
Flant Name		2024	4 202	5 2026	5 202	7 2028	2029	2030 2	031	2032	2033	2034	2035	2036	2037	2038 2039	2040 20	041 2042	2043 20	044 2049	5 2046 2047	2048	2049	2050	2051	2052	2053	2054	2055
Diablo Canyon 1	2024						1							1															
Diablo Canyon 2	2025	X														•						•	1						
Ginna	2029			_										1	X =	Steam	Gen	erato	r (SG)	Fxar	ninatio	n	1						
Comanche Peak 1*	2030		XX			XX									^ -	Juli	Gen		· (30)	LAU	milatio								
Point Beach 1	2030		XX			XX										Drocci	rizor			ninat	ion								
Robinson 2	2030														^ =	Pressu	Inzer	(PZR)) EXai	mat									
Turkey Point 3	2032	X		<u> </u>	X			XX								1 1			1 1		1 1	-	1						
Turkey Point 4	2033	-Ŷ			X			ŶŶ																					
Comanche Peak 2*	2033			XX			XX									Nist st						• • • • • : • • • •		•					
Oconee 1	2033																				ction XI insp	ections	5						
Oconee 2	2033															Starte	d RR but	not subn	nitted yet										
Point Beach 2	2033		XX			XX			X																				
Prairie Island 1	2033		X			(X									omitted b												
Calvert Cliffs 1	2034				T											Submi	tted RR a	and obtai	n SER										
Arkansas Nuclear 1	2034	XX															Operatir												
D.C. Cook 1	2034			XX			XX			XX			1	1															
Oconee 3	2034												1	1	*	Utility	data not	available	. SG amd	PRZ ins	pections ass	umed 1	to be d	distribu	uted o	ver 3 p	periods		
Prairie Island 2	2034		X					X													-					- •			
Watts Bar 1	2035		X		X			X			X												1						
Millstone 2	2035														1							1	1						
Calvert Cliffs 2	2036								X			X										1	1						
Beaver Valley 1	2036	X		X			X			XX												1	1						
Saint Lucie 1	2036		XX		\mathbf{X}			XX				XX																	
Salem 1	2036						X			X																			
D.C. Cook 2	2037			XX			XX			XX			XX																
Davis-Besse	2037						X			XX																			
Farley 1	2037			X						X			X									1	1						
Arkansas Nuclear 2	2038																					1	1						
North Anna 1	2038								(X			XX		X	X							1	1						
North Anna 2	2040	XX								XX			XX			XX													
Salem 2	2040				X			X			X			X								1	1						
Sequoyah 1	2040		<u> </u>			<u> </u>			<u>X</u>				K _			XX													
Farley 2	2041	X					<u>, X</u>							Х															
McGuire 1	2041				_			<u> </u>	~~																				
Sequoyah 2	2041		<u> </u>		-				X	MM		X	X			XX													
Summer	2042		-			_				XX																			
Catawba 1	2043			_			X	X							- & 														
Catawba 2	2043 2043		-								XX	XX	_																
McGuire 2 Saint Lucie 2	2043		XX						X		~~	VV		XX															
Byrop 1	2043				_		1					XX			/		V X	X											
Byron 1 Callaway	2044 2044	VV				-					XX				_							1	1						
Waterford 3	2044	XX		XX						_	~~		_									1	1						
Millstone 3	2044	_			1							V	X			XX		X				1	1						
Palo Verde 1	2045				1V			XX			Y	~	^	Y	X		XX		X			1	1						
Wolf Creek 1	2045	· · · · ·	x'x		$\mathbf{\hat{x}}$	<u> </u>		<u>́хх</u>	_		~	XX	_		ŶX		- ŶŶ		Ŷ										
Byron 2	2045				~/							~~										1	1						
Palo Verde 2	2046				X	_		XX			Y			Y	X		XX		X			1	1						
Shearon Harris 1	2046		-							X	x			^						XX									
Braidwood 1	2046							X				(X							1	1						
Beaver Valley 2	2047	X		XY	-		XX			X	x	•		XX	~					XX			1						
Palo Verde 3	2047			- ^	X			XX			ÂX -			Ŷ	X		XX		X				1						
South Texas 1*	2047					XX			X	X			XX		r	XX		XX											
Braidwood 2	2047								-														1						
Vogtle 1	2047	X		X			X			2	(
South Texas 2*	2048			XX			- XX			Ź	X			XX		│ ŶŶ			X										
Vogtle 2	2049	X		X			X)	(│ ŶŶ			Ŷ		XX								
Seabrook 1	2050)	X			XX			XX			XX	X	X		XX									
Surry 1	2052												XX			XX		XX		XX		- XX		1 X	X				
Surry 2	2053												XX			XX		XX		XX		- XX		Ι Ŷ	X				
Watts Bar 2	2055		XX		X			X				XX			X		X			X	X			X			XX		

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?



TOGETHER...SHAPING THE FUTURE OF ENERGY®

in X f www.epri.com

© 2024 Electric Power Research Institute, Inc. All rights reserved