St. Lucie SLRA: Breakout Questions

SLRA Section 4.3.3, “Environmentally-Assisted Fatigue”

TRP: 143.3

Note: Breakout Questions are provided to the applicant and will be incorporated into the publicly-available audit report.

Technical Reviewer	Seung Min	12/7/2021
Technical Branch Chief	Matt Mitchell	12/21/2021
Breakout Session	*Date/Time*	*To be filled in by PM*

Applicant Staff	NRC staff
To be filled out by PM during breakout	

Question Number	SLRA Section	SLRA Page	Background / Issue (As applicable/needed)	Discussion Question / Request	Outcome of Discussion
1	4.3.3	4.3-21	SLRA Section 4.3.3 addresses the environmentally-assisted fatigue (EAF) analysis for the reactor coolant system. As part of the EAF analysis, Tables 3-1 and 3-2 of Westinghouse LTR-SDA-II-20-31-NP, Revision 2 report provide the leading EAF locations (also called sentinel locations) for the equipment components and piping components, respectively. In comparison, NUREG/CR-6260 identifies the charging system nozzle location as one of the EAF leading locations for Combustion-Engineering-designed plants. However, Tables 3-1	1. Provide justification for not identifying the charging system nozzle in the sentinel location list of LTR-SDA-II-20-31-NP, Revision 2 even though the component is identified as a leading EAF location for Combustion Engineering designed plants in NUREG-6260. If the charging system nozzle is bounded by another location in terms of environmental cumulative usage factor (CUF_{en}),	

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			and 3-2 of Westinghouse LTR-SDA-II-20-31-NP, Revision 2 does not clearly discuss the EAF analysis results for the charging system nozzle.	identify the bounding location and provide the environmental fatigue correction factor (F_{en}) and CUF_{en} values of the bounding location and charging system nozzle location to demonstrate the bounding nature of the other leading location.	
2	4.3.3	4.3-21	SLRA Section 4.3.3 addresses the environmentally-assisted fatigue (EAF) analysis for the reactor coolant system. In addition, Westinghouse LTR-SDA-II-20-31-NP, Revision 2 describes the applicant's approach for determining the EAF leading locations. The SLRA does not clearly address how the determination of the leading EAF locations evaluates the piping systems or zones that are exposed to different thermal and pressure transients.	1. Clarify how the applicant's determination of the leading EAF locations evaluates the piping systems or zones that are exposed to different thermal and pressure transients. As part of the response, clarify whether the leading EAF locations are determined based on the environmental cumulative usage factors in each piping system or zone that is exposed to essentially the same thermal and pressure transients.	

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3	4.3.3	4.3-21	The following BWXT report discusses the environmentally-assisted fatigue (EAF) analysis for St. Lucie Unit 1 replacement steam generators (Reference: BWXT Report MSLEF-SR-01-NP, Revision 0, St. Lucie Unit 1 Replacement Steam Generator Environmentally Assisted Fatigue Report). Table 2 of the BWXT report lists the design transients analyzed in the EAF analysis. SLRA Section 4.3.1 and Table 4.3.1-2 indicate that some of the transients, which are used for the CUF_{en} calculations in the BWXT report, will not be monitored in the Fatigue Monitoring Program for subsequent period of extended operation. The transients, which the applicant proposed not to monitor, are the following: (1) “plant loading/unloading” transient; (2) “10 percent step load increase/decrease” transient; and (3) “normal plant vibration” transient. The analyzed cycles of the “plant loading/unloading,” “10 percent step load increase/decrease,” and “normal plant vibration” transients in the EAF analysis of the BWXT report are 2077, 2000 and 1000000 cycles, respectively. The staff found a need to confirm the adequacy of excluding these transients from fatigue monitoring.	1. Provide justification for excluding the “plant loading/unloading,” “10 percent step load increase/decrease,” and “normal plant vibration” transients from fatigue monitoring even though these transients and associated cycles are used in the EAF analysis for Unit 2 steam generators. As part of the response, explain how the applicant can ensure that the actual cycles of these transients do not exceed the cycles analyzed in the CUF_{en} calculations of the BWXT report.	

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4	4.3.3	4.3-21	The following BWXT report discusses the environmentally-assisted fatigue (EAF) analysis for the St. Lucie Unit 1 replacement steam generators (Reference: BWXT Report MSLEF-SR-01-NP, Revision 0, St. Lucie Unit 1 Replacement Steam Generator Environmentally Assisted Fatigue Report). Table 5 of the BWXT report summarizes the EAF analysis results for steam generator tubesheet solid rim near the tubesheet dome. The tubesheet solid rim is fabricated of low alloy steel. Table 5 of the BWXT report also indicates that the environmental fatigue correction factor (F_{en}) for transient pair number 4 is greater than the F_{en} values for the other transient pairs by a factor of 6.7 approximately. The staff found a need to clarify why transient pair number 4 involves a significantly greater F_{en} value compared to the other transient pairs. In addition, Table 5 of the BWXT report lists both the design transient cycles and the 80-year allowable cycles. The staff needs to clarify the following items: (1) which cycles are used in the environmental cumulative usage factor (F_{en}) calculations between the design cycles and the allowable cycles for the transient pairs; and (2) whether the allowable cycles are based on the	1. Explain why transient pair number 4 involves a significantly greater F_{en} value compared to the other transient pairs. As part of the response, compare the temperature, strain rate, coolant's dissolve oxygen and steel sulfur content values used in the F_{en} calculations between transient pair 4 and the other transient pairs. 2. Clarify the following items: (1) which cycles are used in the F_{en} calculations between the design cycles and 80-year allowable cycles listed in Table 5 of the BWXT report; and (2) whether the allowable cycles for the transient pairs in Table 5 of the BWXT report are based on the acceptable 80-year projected cycles of the transients described in Table 2 of the BWXT report.	

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			acceptable 80-year projected cycles of the transients described in Table 2 of the BWXT report.		
5	4.3.3	4.3-21	The Framatome 86-9329644-001 report summarizes the environmentally-assisted fatigue (EAF) analysis for St. Lucie Unit 2 replacement steam generators, Unit 1 and 2 replacement reactor vessel closure heads, Unit 2 pressurizer repairs, Unit 2 weld overlays and Unit 2 auxiliary spray line reducer (Reference: Framatome Document Number 86-9329644-001, St. Lucie SLR CUF_{en} Evaluations Summary, July 15, 2021). Table 5-2 of the Framatome report specifies the reduced cycles of the transients that are used in the environmental cumulative usage factor (CUF_{en}) calculations, as reduced from the design cycles. Some of these transients, which involve limited (reduced) cycles compared to design cycles, will not be monitored in the Fatigue Monitoring program, as indicated in SLRA Section 4.3.1. The transients, which are used for the CUF_{en} calculations in the Framatome report and will not be monitored in the Fatigue Monitoring program, are the following: (1) “plant loading/unloading” transient; (2) “10 percent step load increase/decrease” transient; and (3)	1. Provide justification for excluding the “plant loading/unloading,” “10 percent step load increase/decrease,” and cold feedwater following hot standby” transients from fatigue monitoring even though these transients and associated reduced cycles are used in the EAF analysis of the Framatome report. 2. Clarify whether the “primary coolant pump starting/stopping” transient of St. Lucie Unit 2 will be monitored in the Fatigue Monitoring program. If not, provide justification for excluding the transient from fatigue monitoring. 3. Clarify whether the “spray nozzle,” “main spray initiation,” “auxiliary spray at power 1,” “auxiliary	

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			"cold feedwater following hot standby" transient. Given that these transients and their reduced cycles are used for the CUF_{en} calculations in the Framatome report, the staff found a need to confirm the adequacy of excluding these transients form fatigue monitoring. The staff also noted that the "primary coolant pump starting/stopping" transient (also designated as the DP transient) is used in the EAF analysis for the Unit 2 steam generator tube-to-tubesheet weld. However, SLRA Section 4.3.1 and Framatome report do not clearly address whether the pump transient for St. Lucie Unit 2 will be monitored in the Fatigue Monitoring program. In addition, SLRA Section 4.3.1 and Framatome report Tables 5-2 and 5-3 (addressing pressurizer spray nozzle transients) do not clearly address whether the following transients related to Unit 2 pressurizers, which involve reduced cycles in the CUF_{en} calculations, will be monitored in the Fatigue Monitoring program: (1) "spray nozzle" transient (also called the spray nozzle transient 17A/B/C); (2) "main spray initiation" transient; (3) "auxiliary spray at power 1" and "auxiliary spray at power 2" transients; and (4) "main spray term in cooldown" transient.	spray at power 2," and "main spray term in cooldown" transients will be monitored in the Fatigue Monitoring program to ensure that the actual transient cycles do not exceed the cycles projected and analyzed in the EAF analysis of the Framatome report. If not, provide justification for excluding these transients from fatigue monitoring.	

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