ATTACHMENT 7

**Non-Proprietary LaSalle County Station, Unit 1,
Responses to Grand Gulf RAI**

(NON-PROPRIETARY)

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Unit 1

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This is a non-proprietary version of the Grand Gulf Responses applied to LaSalle County Station, Unit 1, provided in Attachment 6, which has the GEH proprietary information and EPRI proprietary information removed. Proprietary portions of the RAI responses that have been removed are indicated by open and closed brackets as shown here [[ ]].

The Grand Gulf Request for Additional Information was associated with their EPU, and was divided into two areas: Irradiation-Assisted Stress Corrosion Cracking (IASCC) and Pressure Temperature (P/T) limits. Only those questions associated with the P/T limits are discussed in this submittal.

GGNS RAI #3

Confirm that the proposed PTLR will take effect prior to or concurrent with the proposed EPU, replacing the P/T limits currently in the GGNS Technical Specifications (TS).

Response

This RAI is not applicable to LSCS Unit 1 as it addresses a plant-specific GGNS implementation plan.

GGNS RAI #4

Do the P/T limit curves include a hydrostatic pressure adjustment for the column of water in a full RPV? If so, provide the pressure head used in the P/T limit curve analysis.

Response

Yes, the pressure head for LSCS Unit 1 is 23 psig. This is determined using the height of the vessel and the elevation of the bottom of active fuel. Similarly, the full vessel pressure head is 31 psig. The equation can be found in GEH Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves, NEDC-33178P-A, Revision 1, Section 4.3.2.2.2 and the LaSalle specific value can be found in section 4.3.2.2.2 of Reference 6.4.

GGNS RAI #5

Address inconsistencies between the statement that "the P/T curves are beltline (A1224-1 plate) limited above 1330 psig for Curve A for 35 EFPY..." and the NRC staff determination that the P/T curves are beltline (A1224-1 plate) limited ~1360 psig from data in Table 1 of GNRO-2010-00056.

Response

This RAI is not applicable to LSCS Unit 1 as it addresses a plant-specific GGNS statement.

GGNS RAI #6

Provide the surveillance data and the analysis of the surveillance data used to determine ART from BWRVIP-135, "BWR Vessel and Internals project Integrated Surveillance Program (ISP) Data Source Book and Plant Evaluations", as required by NEDC-33178P-A.

Response

BWRVIP-135, Revision 2 (Reference 6.10) defines the representative Materials for LSCS Unit 1.

Excerpt from BWRVIP-135, Revision 2 (used by permission)

[[

{E}]]

The results from the testing of the LaSalle Unit 1 120° Surveillance capsule have not yet been incorporated into BWRVIP-135. BWRVIP Letter 2012-026 (Reference 6.9) provides the LaSalle Unit 1 surveillance data considered in determining the chemistry and any adjusted Chemistry Factors (CF) for the beltline materials.

Plate
For LaSalle Unit 1, the Integrated Surveillance Program (ISP) representative plate, heat [[{E}]], is not the target plate, but is a heat in the LaSalle Unit 1 beltline region, and therefore the data reported in Reference 6.9 was considered in the evaluation of that vessel plate. The Best Estimate Chemistry for plate [[{E}]] is [[{E}]] Cu and [[{E}]] Ni; the CF from Regulatory Guide 1.99 Revision 2 for this chemistry is [[{E}]]. A fitted CF of [[{E}]] was determined based on the testing documented in Reference 6.9. The maximum scatter in the fitted data is within the 1-sigma value of 17°F for plates given in Regulatory Guide 1.99 Revision 2.

Because there are two irradiated data sets for this plate that fall within the 1-sigma scatter band, the ISP surveillance data was used to revise the projected ART value for vessel plate heat [[{E}]], with a reduced margin term (Regulatory Guide 1.99 Revision 2 Position 2.1). Although this material was considered in determining the limiting ART for the P/T curves; this is not the limiting material.

[[

{E}]]

Weld
For LaSalle Unit 1, the ISP representative weld, [[{E}]], is identical to the target weld and therefore the data reported in Reference 6.9 was considered in the evaluation of the vessel weld. The weld heat in the LaSalle Unit 1 vessel for weld [[{E}]] is [[{E}]] Cu and [[{E}]] Ni; the CF from Regulatory Guide 1.99 Revision 2 for this chemistry is [[{E}]]. The Best Estimate Chemistry for weld [[{E}]] is [[{E}]] Cu and [[{E}]] Ni; the CF from Regulatory Guide 1.99 Revision 2 for this chemistry is [[{E}]]. A fitted CF of [[{E}]] was determined based on the testing documented in Reference 6.9. The maximum scatter in the fitted data is within the 1-sigma value of 28°F for welds given in Regulatory Guide 1.99 Revision 2.

Because the representative weld material is the same heat number as the target weld in the LaSalle Unit 1 reactor, and because there are two irradiated data sets for this weld, the ISP surveillance data was used to determine an Adjusted Surveillance CF.

$$\text{Adjusted Surv. CF} = \left(\frac{\text{Table CF}_{\text{Vessel Chem.}}}{\text{Table CF}_{\text{Surv. Chem.}}} \right) * \text{CF}_{\text{Fitted Data}}$$

Therefore, the adjusted surveillance CF [[{E}]], which is used for the ISP weld material evaluation with a reduced margin term (Regulatory Guide 1.99 Revision 2 Position 2.1). The weld material [[{E}]] is the limiting material for LaSalle Unit 1.

[[

{E}]]

GGNS RAI #7

Provide additional detail for the non-beltline analysis conducted in the following areas in order for the NRC staff to compete independent verification of the proposed P/T limits:

a. Identify limiting materials for the Reference Temperature for Nil Ductility Transition (RT_{NDT}) values used to shift the generic Bottom Head and Upper Vessel P/T curves when applying NEDC-33178P-A.
b. The NRC staff identified a limiting RT_{NDT} of 10°F for the Bottom Head Torus Plates, while GGNS assumed a RT_{NDT} of 24.6°F for the Bottom Head Curve B. Support all RT_{NDT} values reported by providing details of any plant-specific analysis conducted.
c. Explain minor differences in assumed RT_{NDT} values for the Bottom Head. Specifically Curves A and C assume a limiting RT_{NDT} of 19°F, while Curve B assumes a limiting RT_{NDT} of 24.6°F.
d. Which region of the RPV is limiting for Curve C < 312 psig.

Response

In order to determine how much to shift the Pressure-Temperature (P/T) curves, an evaluation is performed using Tables 4-4a and 4-5a from NEDC-33178P-A. These tables define the required Temperature minus Reference Temperature of Nil Ductility Transition ($T\text{-}RT_{NDT}$) that is used to adjust the non-shifted curves. Each component listed in these tables is evaluated using the plant-specific initial RT_{NDT} for each component. The required temperature is then determined by adding the $T\text{-}RT_{NDT}$ to the plant-specific RT_{NDT}, thereby resulting in the required T for the curve. As the upper vessel curve is initially based on the non-shifted feedwater (FW) nozzle $T\text{-}RT_{NDT}$, all resulting T values are compared to the FW nozzle T. The difference between the maximum T and the FW nozzle $T\text{-}RT_{NDT}$ is used to shift the upper vessel curve. The same method is applied for the control Rod Drive (CRD) curve. In this manner, it is assured that each curve bounds the maximum discontinuity that is represented.

For the LSCS Unit 1 upper vessel curve, the maximum T value from the method described above is [[{3}]]. The initial required $T\text{-}RT_{NDT}$ for the [[{3}]], this is then adjusted by the LSCS Unit 1-specific maximum [[{3}]], resulting in [[{3}]]. However, at the same pressure the $T\text{-}RT_{NDT}$ for [[{3}]], and the limiting plant-specific initial RT_{NDT} for the [[{3}]]. The resulting hydrotest temperature is [[{3}]]. As can be seen, the hydrotest temperature for the [[{3}]] does not bound the [[{3}]], so the initial RT_{NDT} for the [[{3}]] is artificially increased to [[{3}]] so that the hydrotest temperature of [[{3}]] is bounded. This calculation was performed for each component shown in Table 4-4a; only the limiting case is presented here.

For LSCS Unit 1, the limiting value for the CRD / bottom head is the [[{3}]]. The required T-RT_{NDT} is [[{3}]], which is added to the [[{3}]]. It is seen that the resulting T required for the [[{3}]]. As [[{3}]] is limiting, the LSCS Unit 1 CRD / bottom head curve bounds the [[{3}]]. As noted above this calculation was performed for each component shown in Table 4-5a; only the limiting cases are presented here.

Appendix H of NEDC-33178P-A contains the details of an analysis performed to determine the baseline requirement (non-shifted) for the [[{3}]]. It can be seen in Section H.5 of Appendix H that the stresses developed in this finite element analysis demonstrated that the [[{3}]], resulting in a baseline non-shifted required T-RT_{NDT} of [[{3}]]. Therefore, considering the determination of the required shift from the paragraph above for [[{3}]], calculations for all components listed in Table 4-5a were compared to the CRD T, which is [[{3}]] (where [[{3}]] materials). Therefore, the shift for the bottom head [[{3}]].

For Curve C, the upper vessel and beltline regions are bounding at pressures up to 40 psig. For pressures between 40 psig and 312.5 psig, the upper vessel is bounding.

GGNS RAI #8

Attachment 7 identifies nozzle N12 as a beltline water level instrument nozzle and notes that an evaluation was conducted using the limiting material properties for the adjoining shell ring, which appears to be appropriate as nozzle N12 is identified as austenitic. Provide details of this evaluation which demonstrates that the drill hole for the beltline water level instrument nozzle is not limiting.

Response

The LSCS Unit 1 nozzle is fabricated from non-ferritic materials (Alloy 600), and the plant-specific material properties for the shell plates where the penetrations occur were used to determine the Adjusted Reference Temperature (ART) values for the nozzles. The water level instrumentation nozzles were not the limiting ART values.

Additionally, Appendix J of NEDC-33178P-A provides detailed results of an analysis performed for the water level instrumentation nozzle that provides the required stresses for the drill hole in the shell plate. These stresses were used to generate a specific curve applicable for the water level instrumentation nozzle to assure that this location is bounded in the P/T curves. For LSCS Unit 1, the water level instrumentation nozzles are [[
{3}]] for 32 EFPY.

GGNS RAI #9

Provide details on any plant-specific feedwater nozzle evaluation conducted in support of the proposed P/T limits or explain why plant-specific evaluation was not required.

Response

An evaluation was performed for the feedwater nozzle as described in Section 4.3.2.1.3 of NEDC-33178P-A. This evaluation confirmed that the feedwater discontinuity bounds the other discontinuities defined in Table 4-4a of NEDC-33178P-A. The first part of the evaluation is as described in the response to RAI #7, where it is assured that the limiting component that is represented by the upper vessel nozzle curve is bounded. A second evaluation was performed using the LSCS-specific feedwater nozzle dimensions; this evaluation is shown below to demonstrate that the [[{3}]] curve is applicable to LSCS Unit 1:

Vessel radius to base metal, R_v	[[
Vessel thickness, t_v	
Vessel pressure, P_v	
Pressure stress = PR/t = [[{3}]]	
Dead Weight + Thermal Restricted Free End Stress	
Total Stress = [[{3}]]	{3}]]

The factor F (a/r_n) from Figure A5-1 of "PVRC Recommendations on Toughness Requirements for Ferritic Materials", Welding Research Council Bulletin 175, August 1972 (WRC-175) is determined where:

$a = 1/4\ (t_n^2 + t_v^2)^{½}$	[[
t_n = thickness of nozzle	
t_v = thickness of vessel	
r_n = apparent radius of nozzle = $r_i + 0.29*r_c$	
r_i = actual inner radius of nozzle	
r_c = nozzle radius (nozzle corner radius)	{3}]]

Therefore, a/r_n = [[{3}]]. The value F (a/r_n), taken from Figure A5-1 of WRC-175 for an [[{3}]]. Including the safety factor of 1.5, the stress intensity factor, K_I, is $1.5\sigma\ (\pi*a)^{1/2} * F(a/r_n)$:

Nominal K_I = 1.5* [[{3}]]

A detailed upper vessel example calculation for core not critical conditions is provided in Section 4.3.2.1.4 of NEDC-33178P-A. Section 4.3.2.1.3 of NEDC-33178P-A presents the [[{3}]] FW nozzle evaluation upon which the baseline non-shifted upper vessel P/T curve is based. It can be seen that the nominal K_I from the NEDC-33178P-A evaluation is [[{3}]].

Therefore, it has been shown that the nominal K_I for the LSCS Unit 1-specific FW nozzle is less than the [[[3]]] K_I, demonstrating applicability of the FW nozzle curve for LSCS Unit 1.