R111

C-CSS-099.20-054, Rev. 000 (Owner has not been accepted yet!)

RAI-1 In Section 8.0, "Conclusion," it stated that the maximum concrete crack width is also examined and compared with the allowable crack width used in the original SB design. Note that the maximum crack width evaluation only applies to the structural concrete (i.e., the 30" thick reinforced concrete SB shell). Please, confirm that this is the only crack was found at the new construction opening and credited for this Calculation.

RAI-2 FSAR Section 3.8.2.2.5, "Analytical Techniques" stated that for thermal load, the cracking effect of reinforced concrete is considered as suggest by ACI 307-69. Has the root-cause-analysis for the recently cracks that were found have been determined? If not, Please explain why the thermal crack was used in the Calc.C-CSS-099.20-054?

RAI-3 In Section 1.0, "Purpose of calculation," The licensee stated that once the new construction opening is restored, the primary function of SB (i.e., biological shielding, controlled release of the annulus atmosphere under accidental condition, and environmental protection of the containment vessel) must be maintained. As of today, there were four cracks were indentified in the structure areas. These cracks were located at a various depth (> 3") and unknown of the cracked length. Please, discuss how you are going to achieve your above statement for the staff to review.

RAI-4 On the Mode Hold Resolution for CR-2011-03346, dated 11/02/2011, it stated that the Calculation C-CSS-099.20-054 evaluated the Shield Building in its current configuration with the construction opening. This is a very conservative modeling technique since all of the main shield building rebar is expected to remain effective. Even with the conservative model, this analysis concluded that the Shield Building is structurally adequate for this controlling load case. The licensee also stated that Condition Report 2011-03346 is investigating the cause of the cracking, there are no restrictions associated with the release of this Mode Hold. Please explain the above statement in detail while RAI-2 and RAI-3 are unknown.

RAI-5 Calculation C-CSS-099.20-54, Rev 0, assumes in Section 4.0 that the circumferential cracking only affects the confinement of SB vertical reinforcement in the flute areas. Please provide the basis of this assumption and explain why the shell outer face hoop reinforcement is not affected.

RAI-6 Calculation C-CSS-099.20-54, Rev 0, does not address the impact of the observed SB laminar crack on shell stresses in the hoop direction for any of the design load combinations. Please explain indicating the controlling load combination for stresses in the hoop direction.

RAI-7 What is the maximum observed laminar crack length that along the outer hoop rebar on the outer face of the Shield Building cylindrical shell?

D/5

Questions on CR-2011-03346 (Mode Hold Restraint)

RAI-8 The response section in CR-2011-03346 states, with reference to **study** calculation C-CSS-099.20-54 that *"This analysis conservatively ignores the embedded vertical reinforcement steel (rebar) at each of the 16 architectural shoulders, Ref. Dwg. C-110. This analysis evaluated the structure for the design basis seismic event (controlling load case for this analysis) using a sectional model for the walls. This is a very conservative modeling technique since all of the main shield building rebar is expected to remain effective. Even with the conservative model, this analysis concluded that the Shield Building is structurally adequate for this controlling load case."*

FSAR Section 3.8.2.2.6 states that the smallest safety margin provided on the shield building based on ultimate strength design was for vertical reinforcement under load combination DL + LL + E' + T_A, which was the controlling load combination. From brief review of study calculation C-CSS-099.20-54, it is the staff's understanding that the vertical reinforcement (outerface only) was removed for evaluating the SB structural integrity only under the DL + E' load combination (which is not the controlling case), and that no rebar is removed for evaluating the thermal loading. Thus, it appears that the controlling load case was not evaluated using the conservative model and the conclusion stated above (in CR-2011-03346) with regard to the conservative model does not appear to be accurate. Please characterize the evaluation in study calculation C-CSS-099.20-54 stating the elevations between which the outer vertical rebar was removed and the load combination considered in the evaluation.

RAI-9 Please address the impact of the observed laminar crack apparently characterized to be located along the outer face of the outer hoop rebar of the cylindrical shell on: (i) the effective depth under flexure for the inner face shell reinforcement in the design calculations for all design basis load combinations; (2) depth used for membrane compressive stress calculations for all design basis load combinations.

RAI-10 Please provide a typical or worst-case graphical characterization, with regard to location relative to the deformed ribs of the outer face shell hoop rebar, of the observed Shield Building laminar crack. Please provide this information on or using Figure 4 "Bond Force Transfer Mechanism" on page 12 of Bechtel Technical Assessment Report No. 25539-200-C0R-0000-00001 clearly indicating the outer face and inner face of the outer hoop rebar, to facilitate understanding of the force transfer mechanism in perspective as it relates to the location and orientation of observed crack relative to the hoop rebar.

RAI-11 The discussion in Item 6 on page 5 of Bechtel Technical Assessment Report No. 25539-200-C0R-0000-00001 states, in part, that: "The calculated reinforcing stresses are far

below code allowable values and therefore full development length or splice length of bars is not required for actual load transfer. The maximum stress in reinforcement at the critical section due to controlling design basis loads is only 40% [of yield] (a margin of 2.5, per Calculation C-CSS-099.20-046...) which indicates that actual expected bond stress demand will be significantly less." Please clarify if this discussion applies to hoop or vertical reinforcement. Further, FSAR Section 3.8.2.2.6 states that the smallest safety margin provided on the shield building [based on ultimate strength design] is greater than ACI 318-63 requirements by 3 percent and applies to the vertical reinforcement. Please clarify the discrepancy between stress margin indicated in the FSAR and the discussion in the Technical Assessment Report.

RAI-12 Item 1 on page 4 Bechtel Technical Assessment Report No. 25539-200-C0R-0000-00001 states that the laminar cracks are located along the outside face of reinforcing steel (hoop steel) in the shell. Figure 3 of Attachment B in Calculation C-CSS-099.20-54, Rev 0, indicates the laminar crack to be generally located between the outer face hoop and vertical rebar. Please clarify the characterization of the location of the laminar crack with respect to the shell outer face reinforcement mat.