Progress Energy

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SERIAL: BSEP 04-0157

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62
Response to Request for Additional Information
Relief Request RR-34, Control Rod Drive System Hydraulic Lines

Reference: Letter from Edward T. O'Neil to the U. S. Nuclear Regulatory Commission (Serial: BSEP 04-0146), "Relief Request RR-34, Control Rod Drive System Hydraulic Lines," dated November 4, 2004

Ladies and Gentlemen:

On November 4, 2004, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc. (PEC), submitted a relief request (i.e., Serial: BSEP 04-0146) from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 1989 Edition, for the third 10-year interval Inservice Inspection Program for the Brunswick Steam Electric Plant, Unit Nos. 1 and 2. The request for relief pertained to structural integrity of insert, withdrawal, and charging water piping for the Control Rod Drive System.

During a conference call on November 22, 2004, the NRC requested additional information regarding the requested relief. The enclosure to this letter provides the requested information.

Please refer any questions regarding this submittal to Mr. Leonard R. Beller, Supervisor - Licensing/Regulatory Programs, at (910) 457-2073.

Sincerely,

Leonard R. Beller

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MAT/mat

Enclosure:

Response to Request for Additional Information - Request No. RR-34

cc (with enclosure):

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Response to Request for Additional Information - Request No. RR-34

Background

On November 4, 2004, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc. (PEC), submitted a relief request (i.e., Serial: BSEP 04-0146) from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 1989 Edition, for the third 10-year interval Inservice Inspection Program for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The request for relief (i.e., Request No. RR-34) pertained to structural integrity of insert, withdrawal, and charging water piping for the Control Rod Drive (CRD) System. Specifically, RR-34 proposed that defects identified in CRD piping would be dispositioned through an engineering evaluation that demonstrates the affected piping will maintain structural integrity in lieu of the ASME Section XI Code, Subarticle IWA-4300 requirement to remove the defect or reduce it to an acceptable limit.

During a conference call on November 22, 2004, the NRC requested additional information regarding the requested relief. The response to this request for additional information (RAI) follows.

NRC Question 1

Enclosure 1 of BSEP 04-0146 page 3 of 7, next to the last paragraph: The second sentence states: "As part of PEC's action plan, suspect CRD piping will be cleaned and examined." Provide more details regarding the action plan. Are the visual inspections performed to identify suspect CRD piping VT-1 examinations?

Response to NRC Question 1

The initial examination is not a VT-1 examination. A system engineer will identify piping with evidence of surface corrosion caused by salt-water wetting. This identification will be performed by direct visual inspection, using an appropriate platform (e.g., ladder or scaffolding) for the overhead lines. Once the suspect piping is cleaned, a surface examination will be performed to identify any flaws. Performance of the surface examination obviates the need to perform a VT-1 examination. The surface examination will be an ASME Code-compliant liquid penetrant examination. The liquid penetrant examination will be performed in accordance with procedure NDEP 201, "Liquid Penetrant Examination (Visible Dye, Solvent, Removable)." The methods in NDEP 201 meet the requirement of the 1989 Edition of the ASME Section XI Code.

NRC Question 2

Enclosure 1 of BSEP 04-0146 page 3 of 7, next to the last paragraph: The third sentence states: "The examination of the suspect areas will involve..." Define "suspect areas."

Response to NRC Question 2

The suspect areas are the portions of the piping containing evidence of corrosion staining. The suspect areas are to be identified by a system engineer during the initial inspection. The system engineer will be focusing of those areas wetted by salt water (i.e. suspect areas).

NRC Question 3

Enclosure 1 of BSEP 04-0146 page 3 of 7, next to the last paragraph: The third sentence states: "...performed in accordance with an approved BSEP non-destructive examination procedure." Confirm that the BSEP examination procedure meets/is consistent with Code requirements.

Response to NRC Question 3

The liquid penetrant examination will be performed in accordance with NDEP 201, "Liquid Penetrant Examination (Visible Dye, Solvent, Removable)." The methods in NDEP 201 meet the requirement of the 1989 Edition of the ASME Section XI Code.

NRC Question 4

Enclosure 1 of BSEP 04-0146 page 4 of 7, fourth paragraph. The first sentence states: "In lieu of these actions, PEC proposes..." Confirm that "these actions" are those described in the previous four paragraphs.

Response to NRC Question 4

The actions this paragraph refers to are those in IWA-4300. IWA-4300 requires the removal of the defect or reducing the defect to an acceptable size. In lieu of doing the requirement of IWA-4300, PEC will disposition any CRD piping defects through an engineering evaluation that demonstrates the structural integrity of the affected piping.

NRC Question 5

Enclosure 1 of BSEP 04-0146 page 5 of 7, first paragraph (i.e., continued from page 4). The paragraph states: "The monitoring requirements of Code Case N-523-2 will be performed until the ASME repair/replacement activity can be performed for the affected piping. These monitoring requirements include volumetric monitoring, at least every three months..." Previously it was stated that the affected piping was too small to perform volumetric monitoring. Confirm what type of monitoring will be performed; does this meet Code Case N-523-2?

Response to NRC Question 5

Based on pipe size, flaw depth cannot be determined by ultrasonic testing (UT). However, UT can be used to determine flaw length. The requirement of Code Case N-523-2 is to ensure the flaw growth (i.e. length) does not extend beyond the clamp. Code Case N-523-2, Section 9.0, "Monitoring Requirements" requires this periodic inspection to be performed using a volumetric method. Therefore, PEC will use UT to meet the monitoring requirements of Code Case N-523-2.

NRC Question 6

Enclosure 1 of BSEP 04-0146 page 5 of 7, first paragraph (i.e., continued from page 4). The paragraph states: "...of the area immediately adjacent to the clamping device and monitoring at least weekly for leakage." Will this be VT-2 monitoring?

Response to NRC Question 6

The NRC approved monitoring requirements of Code Case N-523-2 do not specify a VT-2 examination. Therefore, PEC does not intend to perform VT-2 monitoring for leakage. The weekly monitoring will consist of a visual inspection performed by operations shift personnel. This will be a direct visual inspection of the piping, using an appropriate platform (e.g., ladder or scaffolding) for the overhead lines.

NRC Question 7

Enclosure 1 of BSEP 04-0146, page 5 of 7, last paragraph. The first sentence states: ". . . to disposition any identified CRD piping defects through an engineering evaluation." Define "CRD piping defects" and provide a completion time for the engineering evaluation.

Response to NRC Question 7

A CRD piping defect is a linear indication that remains after material removal (i.e., 12-1/2 percent of the nominal wall thickness). Because of the nominal pipe size of the affected CRD piping (i.e., less than 1 inch diameter), there are no surface examination acceptance standards for this piping in the 1989 Edition of the Section XI Code. Therefore, the requirements of the ASME Code Section XI, Subparagraph IWA-3100(b) will be followed. Subparagraph IWA-3100(b) would require that flaws on the identified CRD piping be evaluated using the acceptance standards for materials and welds specified in ASME Code Section III Edition applicable to the construction of the component. Since BSEP is not an ASME Section III plant, the applicable requirement of USAS B31.1.0 (i.e., the construction code of record) and material specification A/SA-376 will be followed. Under specification SA-376, surface imperfections that penetrate greater than 12-1/2 percent of the nominal wall thickness are considered defects. If an engineering evaluation is required, it will be completed within 48 hours of identification of the defect.

NRC Question 8

Enclosure 1 of BSEP 04-0146 page 6 of 7, first paragraph (i.e., continued from page 5). The last sentence states that the completed evaluation will be provided to the NRC no later than 90 days following completion. Ninety days is too long, provide a more expedited submittal schedule.

Response to NRC Question 8

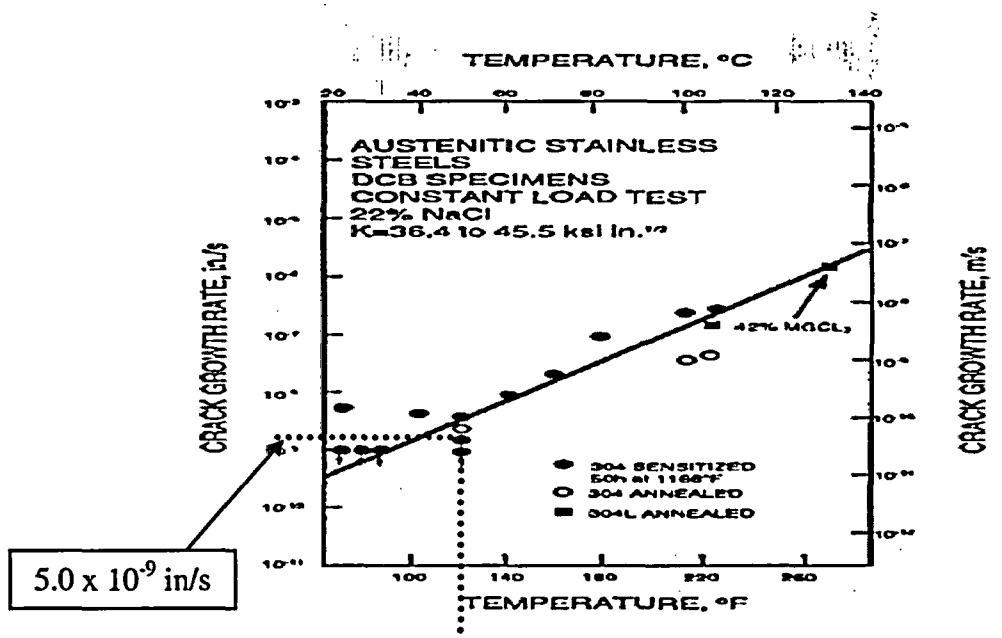
PEC will submit any engineering evaluation which is performed in accordance with Relief No. 34 no later than 5 working days following completion.

NRC Question 9

Enclosure 1 of BSEP 04-0146 page 6 of 7, last paragraph. This paragraph discusses assumed growth rate. The growth rate is not that of a saltwater environment. Provide data that demonstrates the assumed rate is conservative.

Response to NRC Question 9

PEC has determined that use of a $5x10^{-5}$ in/hr crack growth rate in this application is conservative. Stress corrosion cracking (SCC) of stainless steels due to concentration of chlorides during "dryout" is discussed in EPRI Final Report 1002792, "Materials Handbook for Nuclear Plant Pressure Boundary Applications, December 2002." It is well known that austenitic stainless steels are susceptible to chloride induced SCC, even at ambient temperatures, when subjected to chloride bearing environments followed by dryout. The effects of chloride concentration and exposure time on susceptibility of 304 stainless steel to chloride induced SCC under dryout conditions were researched in A. J. Sedriks, "Stress Corrosion Cracking of Stainless Steels," *Stress Corrosion Cracking*, R.H. Jones, ASM International, 1992, which is applicable to the conditions experienced by the affected CRD hydraulic lines.



The results of this research is summarized in the graph above (from page (I) 3-63 of EPRI Final Report 1002792), showing the effect of temperature on crack growth rate in highly concentrated chlorides, noting that most of the data is for sensitized 304 stainless steel. Using the normal service temperature of the CRD insert and withdraw lines of 120ºF and converting to in/hr, a crack growth rate of 1.8×10^{-5} in/hr is estimated which is a factor of 2.8 less than the crack growth rate of 5.0×10^{-5} in/hr used in the structural integrity evaluation. This crack growth rate taken from the graph above is considered to be conservative for the following reasons:

1. Chlorides produced in laboratory tests are typically more concentrated than actual conditions.
2. Efforts to clean the surfaces where defects were discovered were performed.
3. No further wetting of the surface is expected since the source of chloride contamination has been stopped and surfaces inside the crack should remain dry.

Therefore, the 5×10^{-5} in/hr crack growth rate used in the structural integrity evaluation is bounding based on data that is more representative of the actual condition of the CRD hydraulic lines.

NRC Question 10

Enclosure 2 of BSEP 04-0146, Commitments 1 and 2. Clarify the meaning of "Committed date or outage" which is currently identified as N/A.

Response to NRC Question 10

Since these were event driven commitments, they are not associated to a specific date or outage. As clarification, the Commitments 1 and 2 are restated as follows:

1. PEC commits to submit any engineering evaluation which is performed in accordance with Relief No. 34 no later than 5 working days following completion.

2. PEC commits to install an ASME Code-compliant mechanical clamping device, in accordance with ASME Code Case N-523-2, as a repair within 30 days of either (1) the identification of leakage from a degraded CRD pipe or (2) identification of defect growth beyond that considered in the engineering evaluation.

NRC Question 11

Provide / discuss the safety factor which will be applied if an engineering evaluation is performed in accordance with the Relief No. 34.

Response to NRC Question 11

The maximum critical flaw length (L_{ac}) depends on the maximum pipe hoop stress and can be found by resolving ASME Section XI, 1989, Appendix C, C-3420(b) equation 6. The limit ($3*Sm$) imposed by equation 6 ensures that surface flaws will remain below critical size (i.e., based on plastic collapse condition) if they should grow through the component wall.

$$Lac = [(\frac{(3*S_m)^2}{\sigma_h^2} - 1)(4R\frac{t}{1.61})]^{\frac{1}{2}}$$

In order to assure component integrity, the safety factor (SF) of 3 for Level A and B Service Loadings, and Safety Factor of 1.5 for level C and D Service Loadings per C-3420 (a) will be used when evaluating the predicted crack length.