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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Request For Additional Information Regarding NPF-38-146

Gentlemen:

By letter dated December 6, 1993, as supplemented by letter dated May 12, 1995, Entergy Operations, Inc. submitted a subject Technical Specification change request to allow the installation of tube sleeves as an alternative to plugging defective steam generator tubes at Waterford 3. The request proposed the use of Combustion Engineering Leak Tight Sleeving design at Waterford 3. Per letter dated July 11, 1995, the staff requested additional information concerning the use of the CE sleeves. These requests and Waterford 3's responses are as follows:

1. Please provide, if available, a plot of residual stress levels in the alloy 600 tube at the hydraulic expansion transitions above and below the weld. Compare these stress levels to those remaining in the weld zone after PWHT.

   Waterford 3 Response: Plots of residual stress levels in the Alloy 600 tube at the expansion transitions are not available. The weld joint configuration and the test method employed allowed only for the determination of the maximum stress on the tube I.D. surface. In the case of the as-welded joint, failures occurred both in the circumferential direction adjacent to the weld and axially in the expansion transition zone. The residual stresses appeared to be 10 to 15 ksi higher adjacent to the weld than in the expansion

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transition. After post weld heat treatment, failed samples cracked at the expansion transition in the axial direction. These stresses were no greater than 60% of those found in the non-heat treated joint.

2. Please clarify whether or not the alloy 600 tubes used in the accelerated corrosion test samples were metallurgically examined for cracks at the hydraulic expansion steps on either side of the weld. Provide details regarding crack geometry, cause, frequency of occurrence, and origin (ID or OD).

   Waterford 3 Response: In the case of the tubes used in the I.D. accelerated stress corrosion tests, no further examination was performed other than to confirm that the source of leaks were in fact through wall stress corrosion cracks. As described in the answer to Question No. 1, some cracks did occur in the expansion transition zone. In the case of the O.D. accelerated stress corrosion testing, examination indicated that the majority of cracks were circumferential, through wall, and initiated on the I.D. surface of the tube adjacent to the sleeve to tube weld.

3. Discuss the desirability to perform a heat treatment of the hydraulic expansion transitions in the free span joints. Consider the recent domestic and foreign experiences with circumferential cracking at similar locations in free span rolled joints.

   Waterford 3 Response: ABB Combustion Engineering provides a post weld heat treatment (PWHT) of the weld, weld heat affected zone and pressure boundary portion of the hydraulic expansion transition in the free span joints when the potential for stress corrosion cracking is present. With over seven Effective Full Power Years (EFPY) of operation on some of the over four thousand installed sleeves (most of which have not been post weld heat treated), ABB has never had an inservice failure of either the sleeve or the tube behind the sleeve. Recent domestic and foreign experience with circumferential cracking in free span rolled joints are not applicable. ABB does not offer this type of sleeve and a comparison cannot be made.

4. Discuss the ability for UT to detect weld defects arising from loss or interruption of shielding gas. Specify what kinds of defects were noted during metallurgical examinations of qualification samples and compare with the UT results (see also question 6, following).

   Waterford 3 Response: The Gas Tungsten Arc (GTA) weld process requires shielding gas for the initiation of the arc and for the successful completion of the weld. Shielding gas detection sensors are an integral part of the weld power supply machines and would prevent the initiation of the cycle if a loss of gas occurred prior to the start of welding. A loss or interruption of shielding gas during the welding cycle would result in a significant increase in arc voltage. "High Voltage" sensors in the weld power supply machines would automatically stop the process, resulting in an incomplete weld. Although UT would detect this "lack of fusion", process control requirements relative to arc voltage and weld time would be used to identify this as an unacceptable weld.

5. Discuss whether a leaking expansion bladder would introduce water into the weld zone prior to welding and measures to mitigate the presence of water arising from this source. How is moisture remaining in the tube from service removed prior to welding?

   Waterford 3 Response: During the expansion process, a real-time plot of bladder pressure vs. time is created and monitored. If a bladder develops a leak during the expansion process, the required pressure is most likely never obtained. As a minimum, a significant change in slope for the pressure vs. time plot is seen. Per the requirements of the sleeve installation procedure, the bladder is then replaced, the expansion process repeated and the sleeve ID dried to remove any moisture from the leaking bladder. Bladders are replaced periodically (every 100 expansions) and this off-design condition has occurred rarely.

   Moisture remaining in the tube from service is dried out with a standard site ventilation system. This is a prerequisite of the sleeve installation procedure and has been successfully used since 1984.

6. What kinds of weld defects would result from the presence of moisture in the tube/sleeve and discuss the qualification tests performed to verify the ability of the UT probe to detect such defects.

   Waterford 3 Response: The presence of moisture in the tube/sleeve interface joint would most likely result in the formation of "blowholes" through the sleeve wall at the weld joint. This type of defect occurs as the pressure of the heated water pushes out the molten sleeve material, usually at the edge of the weld. Sleeve UT was developed and qualified to detect weld fusion, not process induced defects. For this reason, a visual examination and/or ECT of each sleeve weld is performed.

7. Has Inconel 606 been previously reviewed by the NRC for use as plug material (ref. page 4-6)?

   Waterford 3 Response: Inconel 606 is the wrought form of Inconel Filler Metal 82. Inconel 82 has been used in literally thousands of welded plugs throughout the nuclear industry. Therefore, Inconel 606 should also be acceptable. It should be noted that the Inconel 606 welded plug is only required for a standard full length tubesheet sleeve. Although it was included in the sleeve licensing report, it is not the preferred sleeve for Waterford 3 and most likely will never be installed.

8. Please provide information regarding whether or not Waterford 3 has, or will adopt, EPRI recommended leak rates. This is the staff position and normal practice and is usually accomplished in conjunction with sleeving amendments.

   Waterford 3 Response: The primary to secondary steam generator leak rate determination methodologies described in EPRI TR-104788, "PWR Primary-to-Secondary Leak Guidelines (DRAFT)," have been incorporated into Waterford 3 chemistry procedure CE-003-705, "Determination of Primary to Secondary Steam Generator Leak Rate." In addition Waterford 3 Administrative Procedure UNT-005-032, "Steam Generator Primary-to- Secondary Leakage requires a reactor shutdown be considered if Steam Generator Tube Leakage exceeds 0.1 gpm (144 gpd)

in either Steam Generator or tube leakage has increased by greater than 0.04 gpm (~60 gpd) in one hour.

Should you have any questions concerning the above, please contact Paul Caropino at (504) 739-6692.

Very truly yours,

R.F. Burski

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Attachment

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