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Waterford 3

W3F1-2000-0035
A4.05
PR

April 5, 2000

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
Supplement to Request for Additional Information
Response to Generic Letter 96-06 for the Waterford
Steam Electric Station, Unit 3 (TAC NO. M96883)

Gentlemen:

Based on discussions with the NRC Staff, Entergy is submitting additional information to clarify Letter W3F1-97-0278, dated December 22, 1997, that addressed Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design Basis Accident Conditions." The December 22, 1997 letter presented a summary of the post-yield stress evaluations of the materials being evaluated and included analysis methods, assumptions and results.

The NRC Staff requested clarification of the reference to the strain value of 5.8% for the materials being evaluated. The 5.8% strain value was used only for study purposes. The 5.8% value has no relationship to the actual materials being evaluated, which exhibit much higher ultimate strains. The discussion concerning the 5.8% strain value in Letter W3F1-97-0278 (Attachment 2, page 2 of 5) under ASSUMPTIONS has been removed. The paragraph has been corrected to address the post-yield ultimate strain value of 10%, which is supported by the data included in the correspondence. The RESULTS section of Letter W3F1-97-0278 (Attachment 2, page 2 of 5) has been updated to reflect the aforementioned information. Based on the discussions with the NRC Staff, Entergy has also evaluated the final hoop strain values of the affected piping and the overall conclusion has been addressed in the RESULTS section. While the above discussion is focused on strains, Entergy would like to re-emphasize that the acceptance criteria is based on the stress intensity allowables from Appendix F of Section III of the ASME Code. Entergy is also correcting the ASME Code paragraph reference under RESULTS from F-3141.2 to F-1341.2.

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Attachment 'A' contains the original page 2 of 5 of Attachment 2 submitted by Letter W3F1-97-0278 for convenience of review. Attachment 'B' includes the changes to page 2 of 5 of Attachment 2. Therefore, the page in Attachment 'B' replaces the original page wholly.

Entergy reviewed a supplemental response (Letter W3F1-99-0149 dated October 28, 1999) to insure the information presented was consistent and accurate with the previous mentioned evaluations. Entergy has concluded the information provided in the response remains consistent and accurate with the evaluations. Entergy has also concluded the plan proposed by the supplemental response for addressing and correcting the identified GL 96-06 issues remains valid and no changes to the proposed plan will be instituted.

There are no new commitments generated by this correspondence.

Pursuant to 28 U.S.C.A. Section 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed on April 5, 2000.

Very truly yours,

E.P. Perkins, Jr.
Director,
Nuclear Safety Assurance

EPP/AEW/rtk
Attachment

cc: E.W. Merschoff, NRC Region IV
N. Kalyanam, NRC-NRR
J. Smith
N.S. Reynolds
NRC Resident Inspectors Office

NPF-38 Supplement to Request for Additional Information
Response to Generic Letter 96-06 for the Waterford
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ATTACHMENT A

Original Page 2 of 5 of Attachment 2 of Letter W3F1-97-0278

The internal water pressure, resulting from the change in the final water volumetric density at the temperature of 260°F, has been computed and determined to be lower than the pipe burst pressure. The Volumetric Balance plus Pipe Hoop stress due to internal pressure has been compared to allowable Primary stress Intensity P_{ma}.

ASSUMPTIONS:

- The temperature of the piping and trapped water at the end of the analysis are constant and equal to 260 °F.

- Pipe longitudinal stresses remain below yield. The longitudinal stress due to internal pressure is about one half the hoop stress. The piping will yield in the hoop direction to the required amount of volumetric expansion before the longitudinal stresses reach the yield point.

- The post-yield strain of piping materials at temperature is at least 10%. A strain of 5.8% was used conservatively. The stress-strain curve of the piping material can be conservatively approximated as a multi-linear curve. This assumption is valid because steels regularly exhibit elongation's over 50% before reaching the ultimate stress. (Ref. American Society of Metals and EPRI document NP-6301-D).

- Pipe hoop stresses are constant across the pipe wall thickness. This assumption is based upon the thin wall of the pipe and the re-distribution of plastic stresses.

RESULTS:

The above referenced calculation demonstrates that for each penetration, primary membrane stress intensity (Pm) is below the Service Level D allowable (P_{ma}) of ASME Code paragraph F-3141.2 of appendices, 1995.

In addition, the internal water pressure resulting from the final water volumetric density at the final temperature of 260°F (P_F) does not exceed the pipe burst pressure (P_B). The following table illustrates the above qualification for each of the thirteen penetrations.

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ATTACHMENT B

Corrected and Updated Page 2 of 5 of Attachment 2 of Letter W3F1-97-0278

The internal water pressure, resulting from the change in the final water volumetric density at the temperature of 260°F, has been computed and determined to be lower than the pipe burst pressure. The Volumetric Balance plus Pipe Hoop stress due to internal pressure has been compared to allowable Primary stress Intensity P_{ma}.

ASSUMPTIONS:

- The temperature of the piping and trapped water at the end of the analysis are constant and equal to 260 °F.

- Pipe longitudinal stresses remain below yield. The longitudinal stress due to internal pressure is about one half the hoop stress. The piping will yield in the hoop direction to the required amount of volumetric expansion before the longitudinal stresses reach the yield point.

- The post-yield ultimate strain of piping materials at temperature is at least 10%. This is a reasonable assumption, based on specimen test data from the USNRC Pipe Fracture Mechanics Database (PIFRAC), Version 3.1. The minimum ultimate strain for A106B carbon steel specimens below 300°F was 10.6%, with TP304 stainless steels being higher. The stress-strain curve for the piping materials is reasonably approximated as a bi-linear curve for the purposes of the operability evaluation.

- Pipe hoop stresses are constant across the pipe wall thickness. This assumption is based upon the thin wall of the pipe and the re-distribution of plastic stresses.

RESULTS:

The above referenced calculation demonstrates that for each penetration, primary membrane stress intensity (P_m) is below the Service Level D allowable (P_{ma}) of ASME Code paragraph F-1341.2 of appendices, 1995.

In addition to meeting the Appendix F stress intensity allowables, as added assurance, the internal pressure resulting from the final water specific volume at 260°F (P_F) was shown not to exceed the lowest value of burst pressure (P_B) calculated using three different methods. The final hoop strain resulting from the final water pressure was below 2.60% in all of the penetrations. The following table illustrates the stress and pressure qualification for each of the thirteen penetrations.