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Waterford 3

W3F1-97-0278
A4.05
PR

December 22, 1997

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 (RAI) Regarding Response to Generic Letter 96-06 for the Waterford Steam Electric Station, Unit 3 (TAC NO. M96883)

Gentlemen:

By letter dated October 15, 1997, the NRC requested additional information pertaining to Waterford-3's response to NRC Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design Basis Accident Conditions." Waterford-3's initial response to this GL was provided by letter dated January 28, 1997 (W3F1-97-0017). In this initial response, Waterford-3 identified 12 penetrations that were susceptible to the overpressurization phenomenon described in the GL. By letter dated October 17, 1997 (W3F1-97-0232), Waterford-3 supplemented the initial response. This supplemental response identified one additional susceptible penetration bringing the total number to 13.

As requested in the subject RAI, enclosed is a summary of our evaluations including the analysis methods, assumptions and results, a discussion of our licensing basis compliance, and our schedule for the resolution of this issue. Note that the current schedule is expected to be established by Refueling Outage 10 pending EPRI test results and the outcome of code revisions. Also enclosed are the fabrication drawings for the susceptible piping sections.

Note that a one week extension to the 60 day response schedule was discussed in a telephone conversation between C.P. Patel of your staff and T.J. Gaudet of Waterford 3 on December 15, 1997.

A072 1/1

Drawings located in Central File

If you have any questions concerning this response, please contact E.C. Ewing at (504) 739-6242 or Tim Gaudet at (504) 739-6666.

Very truly yours,

C.M. Dugger
Vice President, Operations
Waterford 3

CMD/PRS/ssf

Enclosures:

- Affidavit
- Response to RAI Regarding GL 96-06
- Piping Isometric Drawing List
- Piping Isometric Drawings

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

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of	)	
	)	
Entergy Operations, Incorporated	)	Docket No. 50-382
Waterford 3 Steam Electric Station	)	

AFFIDAVIT

Charles Marshall Dugger, being duly sworn, hereby deposes and says that he is Vice President, Operations - Waterford 3 of Entergy Operations, Incorporated; that he is duly authorized to sign and file with the Nuclear Regulatory Commission the attached Additional Information Regarding Response to Generic Letter 96-06, that he is familiar with the content thereof; and that the matters set forth therein are true and correct to the best of his knowledge, information and belief.

Charles Marshall Dugger
Vice President, Operations - Waterford 3

STATE OF LOUISIANA)
) ss
PARISH OF ST. CHARLES)

Subscribed and sworn to before me, a Notary Public in and for the Parish and State above named this 22nd day of December, 1997.

Notary Public

My Commission expires at death.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (RAI)
REGARDING GL 96-06

SUMMARY OF EVALUATION:

The calculation performed by Waterford 3 evaluated the peak pressure and stress occurring in thirteen containment piping penetrations after the water isolated inside was heated from ambient temperature to 260°F.

METHOD OF ANALYSIS:

Manual calculations have been performed for each penetration and a finite element analysis, using the ANSYS program, has been performed to verify the manual methods. The manual calculation shows that for each penetration, Primary Membrane stress intensity corresponding to the final internal pressure will be below ASME code service level D allowables. The allowable Primary Membrane stress intensity has been considered as 0.7 S_U or (2/3 S_Y + 1/3 S_U) per ASME Boiler and Pressure Code, Section III, appendices 1995. The allowable Local Membrane plus bending stress intensity is equal to 0.9 S_U. These calculations are conservative in that the stresses due to water expansion are secondary in nature, but are compared to primary allowables. Computations considered the following essential criteria:

1. **Volumetric Balance** (increase in volume due to thermal expansion)

The mass of water at the beginning of the transient was assumed to remain constant throughout the transient. Volumetric changes from plastic deformation of the pipe due to internal pressure increase and the thermal expansion of the pipe due to the temperature increase were considered.

2. **Pipe Burst**

Piping has been qualified for Bursting Pressure using the worst scenario of the following three cases.

a) Thin-walled Cylindrical Vessel

b) Thick-walled Cylindrical Vessel

c) Bursting Pressure due to strain hardening of the material

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.

S. No.	Penetration number	Line number	Pipe Schedules	P_m psi	P_{ma} psi	P_F psi	P_B psi
1	CB-MPEN-0007	2DW2-17A/B	2" Sch 40	37,861	47,600	4,910	6,244
2	CB-MPEN-0024	2CC10-153A/B	10" Sch 40	41,086	42,000	2,790	3,762
3	CB-MPEN-0026	2CH2-60A/B 3CH3-188A/B 2CH2-189A/B 2CH2-59A/B	2" Sch 160 **** 2" Sch 160 2" Sch 160	34,621	47,600	10,000	15,323
4	CB-MPEN-0028	2SL1/2-104 2SL1/2 141	1/2" Sch 160	47,473	47,600	21,250	26,681
5	CB-MPEN-0029	2SL1/2-105 2SL1/2-142	1/2" Sch 160	47,473	47,600	21,250	26,381
6	CB-MPEN-0030	2SL1/2-106 2SL1/2-143	1/2" Sch 160	47,473	47,600	21,250	26,681
7	CB-MPEN-0042	2WM1 1/2-11A/B	1 1/2" Sch 80	38,000	47,600	8,000	10,627
8	CB-MPEN-0043	2BM3-5A/B 3BM3-6A/B	3" Sch 40	36,863	47,600	4,550	5,922
9	CB-MPEN-0044	2CH3/4-99A/B	3/4" Sch 160	43,558	47,600	18,170	24,267
10	CB-MPEN-0051	2FS3-34A/B	3" Sch 40	36,863	47,600	4,550	5,922
11	CB-MPEN-0059	2SI2-80A/B	2" Sch 80	39,493	47,600	7,250	9,118
12	CB-MPEN-0062	2FS6-64A/B	6" Sch 40	36,911	47,600	3,120	3,970
13	CB-MPEN-0071	2DW1 1/2-78 7DW1 1/2-21	1 1/2" Sch 80	38,143	47,600	8,030	10,627

**** Special 3" O.D. Pipe with 1" minimum wall thickness

COMPLIANCE WITH LICENSING BASIS:

The guidance provided in Generic Letter 91-18 permits operability to be determined using good engineering techniques and even engineering judgment. The recent supplements to both Generic Letter 91-18 and 96-06 clearly indicate that ASME Appendix F allowables are within the Waterford 3 Licensing Basis for operability determinations.

SCHEDULE FOR COMPLETION OF REQUIRED MODIFICATIONS:

GL 91-18 (Rev. 0) guidance indicates that the timeliness of corrective action (i.e., the requirements in 10 CFR 50, Appendix B, Criterion XVI, for "prompt" corrective action) should be commensurate with the safety significance of the adverse condition. It also indicates that upon discovery of a nonconformance with piping and pipe supports, licensees may use the criteria in Appendix F of Section III of the ASME Code for operability determinations and that these criteria are valid until the next refueling outage. This guidance along with the results of engineering evaluations for each of the thirteen containment penetrations formed the basis for the commitment in our January 28 and October 17, 1997 letters.

GL 91-18 (Rev. 1), issued October 8, 1997, has changed a portion of the basis for the commitment in our January 28, 1997 submittal. The revised guidance of Part 9900, Section 4.5.1 indicates that;

> "The license authorizes the licensee to operate the plant in accordance with the regulations, license conditions, and the TS. If an SSC is nonconforming but operable, the license establishes an acceptable basis to continue to operate and the licensee does not need to take any further actions. The licensee must, however, promptly identify and correct the condition adverse to safety or quality in accordance with 10 CFR Part 50, Appendix B, Criterion XVI.
>
> The basis for this authority to continue to operate arises because the TS contain the specific characteristics and conditions of operation necessary to obviate the possibility of an abnormal situation or event giving rise to an immediate threat to public health and safety. Thus, if the TS are satisfied, and required equipment is operable, and the licensee is correcting the degraded or nonconforming condition in a timely manner, continued plant operation does not pose an undue risk to public health and safety."

Revised Part 9900, Section 4.8, regarding final corrective action now indicates, "... the licensee may make mode changes, restart from outages, etc., provided that necessary equipment is operable and the degraded condition is not in conflict with the TS or the license."

Since our January 28 and October 17, 1997 submittals, the Electric Power Research Institute (EPRI) has embarked on an EPRI-Industry Collaborative Project to assist in the determination of an appropriate resolution of GL 96-06 overpressurization of isolated piping. Preliminary results of EPRI testing provide correlation with the analysis methodology used to determine operability of the affected Waterford 3 containment penetrations and provide additional support for the conclusion that this issue has little or no safety significance.

In addition, we understand the following ASME Code Case is currently pending in the ASME Main Committee:

Case N-xxx "Rules For Evaluating Fluid Thermal Expansion Effects, Section III, Division 1, Class 2 and 3"

Inquiry: What rules may be used when evaluating increased pressure due to fluid thermal expansion effects, as required by NC/ND-3621.2, when caused by a one time event for which Service Level C or D limits are applicable?

Reply: It is the opinion of the Committee that when evaluating fluid expansion effects caused by ...nts for which Service Level C or D limits are applicable, the r...ting strains are acceptable provided it is demonstrated that the circumferential membrane strain induced by these effects does not exceed 5%.

Furthermore, we understand the code case has received a preliminary verbal vote from the Committee with only one dissension, and that the 5% value is only a place holder at this time. The value of the strain limit is not expected to be established until the results of the EPRI testing are available. Formal code case approval is expected shortly after the final value of the limit is established.

Based on the new information and revised NRC guidance, Entergy now believes the resolution of this nonconformance during RF09 would be premature and could likely not be in the best interest of the plant or public safety. The addition of relief valves for each of the identified penetrations could introduce new failure mechanisms that could result in plant transients leading to unnecessary safety system challenges. The modification would also require additional dose and future testing and maintenance. Engineering analysis and EPRI testing confirm that the penetrations retain their ability to perform their safety function. Since containment integrity is maintained, the added potential safety system challenges and dose with no corresponding gain in safety does not appear to be the proper resolution at this time.

Waterford 3 is committed to resolving this nonconformance and restoring the affected penetrations to their fully qualified state in a manner commensurate with the safety significance. However, as previously discussed, it now appears prudent to delay resolution of this issue until such time that additional analysis may be completed. This new analysis will factor in EPRI test results and possible code revisions while determining the optimum solution for eliminating the nonconformance. Determination of all necessary actions with schedules for completion to resolve the nonconformance are expected to be established by Refueling Outage 10 pending EPRI test results and the outcome of code revisions.

PIPING ISOMETRIC DRAWING LIST

PENETRATION NO.	PIPING ISOMETRIC DRAWING
7	E-3029-LW3-DW-1
24	8469-117 & 4305-6357
26	E-3029-LW3-CH-14 E-3029-LW3-CH-42 E-3029-LW3-CH-15 E-3029-LW3-CH-16 E-3029-LW3-CH-32 8469-1
28	E-3029-LW3-SL-2
29	E-3029-LW3-SL-9
30	E-3029-LW3-SL-7
42	E-3029-LW3-WM-18
43	4305-3463
44	E-3029-LW3-CH-34 E-3029-LW3-CH-56
51	4305-4441 8469-997
59	E-3029-LW3-SI-11 E-3029-LW3-SI-10
62	4305-4440
71	E-9334-LW3-DW-2

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