Entergy Nuclear South
Entergy Operations, Inc.
17265 River Road
Killona, LA 70057-3093
Tel 504-739-6660
Fax 504-739-6678
jkowale@entergy.com

Joseph A. Kowalewski
Vice President, Operations
Waterford 3

W3F1-2010-0087

December 21, 2010

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Additional Responses to NRC Requests for Additional Information Regarding License Amendment Request for Leak-Before-Break of the Pressurizer Surge Line
Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

REFERENCES:
1. W3F1-2010-0003, Entergy letter dated February 22, 2010, “License Amendment Request for Approval of Leak-Before-Break of the Pressurizer Surge Line” (ADAMS Accession No. ML100550606).
2. W3F1-2010-0064, Entergy Letter dated August 12, 2010, “Response to NRC Requests for Additional Information Regarding License Amendment Request for Leak-Before-Break of the Pressurizer Surge Line” (ADAMS Accession No. ML102300176).
3. W3F1-2010-0083, Entergy Letter dated November 23, 2010, Supplemental Response to NRC Requests for Additional Information Regarding License Amendment Request for Leak-Before-Break of the Pressurizer Surge Line (ADAMS Accession No. 103300039).

Dear Sir or Madam:

In letter dated February 22, 2010 (Reference 1), Entergy Operations, Inc. (Entergy) requested NRC review and approval of a proposed license amendment request to eliminate the dynamic protection requirements for the Waterford Steam Electric Station, Unit 3 (Waterford 3) pressurizer surge line. This request was prepared in accordance with General Design Criterion (GDC) 4, "Environmental and Dynamic Effects Design Bases" using the guidance of Standard Review Plan (SRP) 3.6.3, “Leak-Before-Break Evaluation Procedures” (NUREG-0800). The Waterford 3 pressurizer Leak-Before-Break (LBB) surge line analyses were provided in Westinghouse WCAP-17187-P, “Technical Justification for Eliminating Pressurizer Surge Line Rupture as the Structural Design Basis for Waterford Steam Electric Station, Unit 3 Using Leak-Before-Break Methodology."

On April 21, 2010, the NRC staff issued a request for additional information to Entergy in order to complete review of the license amendment request. Entergy provided responses to the NRC requests for additional information on August 12, 2010 (Reference 2). On September 15, 2010, the NRC provided an additional request for information regarding the Waterford 3 leakage detection system. A public meeting was subsequently conducted between Entergy and the NRC Staff on November 10, 2010 at NRC headquarters. Entergy submitted the response to these RAIs based on the resolutions discussed in the November 10th meeting (Reference 3). A subsequent NRC request was informally received on December 1, 2010. A conference call was subsequently conducted between Entergy and NRC on December 7, 2010. Based on the proposed resolutions discussed during this call, Entergy is providing the response to the subsequent request for additional information as contained in Attachment 1.

The letter contains no new commitments and no information that is proprietary. If you have any questions or require additional information, please contact William J. Steelman at 504-739-6685.

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 21, 2010.

Sincerely,

JAK/SAB

Attachment:
1. Additional Responses to NRC Requests for Additional Information for License Amendment Request Regarding Leak-Before-Break of the Waterford 3 Pressurizer Surge Line

cc: Mr. Elmo E. Collins, Jr.
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
612 E. Lamar Blvd., Suite 400
Arlington, TX 76011-8064

NRC Senior Resident Inspector
Waterford Steam Electric Station, Unit 3
P.O. Box 822
Killona, LA 70066-0751

U.S. Nuclear Regulatory Commission
Attn: Mr. N. Kalyanam
MS O-07 D1
Washington, DC 20555-0001

Attachment 1 to

W3F1-2010-0087

Additional Responses to NRC Requests for Additional Information for License Amendment Request Regarding Leak-Before-Break of the Waterford 3 Pressurizer Surge Line

Additional Responses to NRC Requests for Additional Information for License Amendment Request Regarding Leak-Before-Break of the Waterford 3 Pressurizer Surge Line

On December 1, 2010, Entergy received two additional NRC Requests for Additional Information (RAIs) associated with the leakage detection system for the Waterford 3 surge line leak-before-break (LBB) analysis license amendment request. However, based on a conference call conducted on December 7, 2010, only the second of the two requests would require response based on it providing satisfactory resolution to both requests. Therefore, Entergy is only responding to the following single RAI.

NRC RAI:

The response cites representative industry data from EPRI MRP-109 in determining that the existing RCS leakage TS LCO 3.4.5.2 limit of 1.0 gpm provides ample response time to prevent rupture. However, the response does not address how the industry data satisfies SRP 3.6.3 guidance regarding margin to account for uncertainties in the determination of leakage from postulated cracks in piping. These uncertainties include the accuracy of leakage prediction for cracks of undetermined configuration and the potential for particulate material to partially plug the crack and reduce leakage. Without adequate margin to the leakage crack size considered in the LBB analysis, and, therefore, would not provide the necessary assurance that the plant could be shutdown and depressurized in time to prevent pipe rupture. The response to Question 3 from the public meeting did not resolve the concern that rupture of an unstrained pressurizer surge line could lead to a beyond-design basis accident. Thus the maintenance of a significant margin between the TS LCO for unidentified leakage and the LBB leakage crack leak rate is very important to safety. Therefore, explain how the EPRI MRP-109 data cited in the response demonstrate adequate margin to account for these types of uncertainties, or provide a revised TS LCO for unidentified leakage that provides adequate margin for uncertainties.

Entergy Response:

The evaluation of margins and uncertainties utilized for the Waterford 3 leak-before-break (LBB) performed in WCAP-17187-P is in accordance with guidance from Standard Review Plan (SRP) 3.6.3, Section III.4. As discussed in SRP 3.6.3, Section III.4, determination of leakage from a piping system under pressure involves uncertainties and, therefore, margins are needed. Sources of uncertainties include plugging of the leakage crack with particulate material over time, leakage prediction, measurement techniques, personnel, and frequency of inspections. The SRP goes on to state that unless a detailed justification that accounts for the effects of these sources of uncertainties in the leakage measurement can be presented, a margin of 10 on the predicted leakage rate is required for determining the leakage size flaw. Entergy believes that there is substantial conservatism in the leakage detection uncertainty margin of 10. The Waterford 3 reactor coolant system (RCS) water chemistry is maintained free of debris to the extent practical through feed and bleed chemistry control. Minute wear particulates would be limited and would not be conducive for a flaw plugging environment. Additionally, RCS monitoring programs have shown to be highly sensitive to RCS leakage and the Waterford 3 sump level instrumentation has relatively low uncertainty values. While a factor of 10 is considered to be highly conservative, Entergy adopted this margin as part of the Waterford 3 surge line technical evaluation in WCAP-17187-P which supports a 0.25 gpm leakage detection capability.

EPRI MRP-109 discusses the relationship of a leakage flaw against the leak detection capability required to detect the flaw. EPRI MRP-109, Section 6.1 states that by comparing the critical flaw sizes with the leakage rate sizes, the margins between detectable leakage and an assumed break can be determined. Furthermore, the time required for a crack to progress from a detectable leak to a break can be quantified. These results are provided in Table 5-5 for the Combustion Engineering (CE) designed plants. Table 5-5 of EPRI MRP-109 reports the period of time for a 1 gpm and a 10 gpm leakage flaw for Case N (bounds Waterford 3) to reach a critical flaw would be 5.3 years and 1.6 years respectively. Figure 1 provided in our November 23, 2010 response further extrapolates this data for a 2.5 gpm leakage period. Assuming a leakage flaw is masked by various instrument and flaw plugging uncertainties and that the RCS leakage flaw of 2.5 gpm can only be detected at a 0.25 gpm rate, there is still in excess of 3 years for the flaw to reach a critical flaw condition. Similarly, if no action was taken prior to reaching the shutdown action requirement under Technical Specification (TS) Limiting Condition for Operation (LCO) 3.4.5.2 for an unidentified operational leakage of 1.0 gpm, a 1.0 gpm detectable leakage rate that would represent an actual leakage flaw size of 10 gpm, there is still in excess of an operating cycle (>1.5 years) prior to reaching a critical flaw state. Therefore, RCS leakage detection uncertainty is sufficiently bounded by the stability periods represented in EPRI MRP-109 for a flaw that is 10 times larger than the control room operators may be able to detect.

The through wall leakage flaws evaluated in EPRI MRP-109 are conservatively applicable to the Waterford 3 LBB analysis performed in WCAP-17187-P. EPRI MRP-109 utilized the design configuration for the CE plant surge line with Alloy 82/182 weld locations, surge line temperature and pressures, piping load combinations, and two-phase leakage flow that envelopes the Waterford 3 surge line. The EPRI MRP-109 document evaluated the time duration for a through-wall leakage flaw to reach a through-wall critical flaw size for multiple leakage rates. Even though flaw aspect ratios were applied in both reports, these aspect ratios are only relevant for surface flaws prior to becoming a through wall leakage path. The leakage rates considered in EPRI MRP-109 bound the leakage detection capability for Waterford 3 as discussed in WCAP-17187-P. The Alloy 82/182 flaws have a higher surface roughness that requires a somewhat longer flaw length than a fatigue flaw for similar leakage rates. These flaws bound both the Waterford 3 Alloy 82/182 structural weld overlays and cast austenitic stainless steel material. The increased leakage rate that would occur in the stainless steel surge line material for similar sized flaw lengths provides a conservative margin for leak detection as a result of increased through wall leakage. In summary, the through wall leakage flaws evaluated in EPRI MRP-109 were modeled using inputs including flaw calculations, material conditions, and loads that conservatively bound the Waterford 3 plant surge line .

Along with a factor of 10 for leakage detection sensitivity, additional conservative margins were applied from uncertainties in the LBB evaluation. The fracture mechanics analysis performed for WCAP-17187-P shows that the SRP 3.6.3 analytical margin of 2 between a leakage flaw and a critical flaw is exceeded by more than 50% for the limiting Waterford 3 surge line case using limit load analysis (see WCAP-17187-P, Tables 8-1 and 8-2) which provides additional conservatism to reaching a critical flaw. The fracture analysis in WCAP-17187-P, Section 6 also demonstrates the surge line piping has less than the required crack initiation J-integral values and that postulated flaws remain stable without resulting in the rupture of the surge line pipe.

During normal operations a leakage rate of 0.25 gpm is operationally significant. A flaw with a leakage rate of 0.25 gpm after 24 hours will result in a containment sump water volume of 360 gallons after the containment leakage rate has reached equilibrium. A one inch change in the deep end (normal monitoring range) of the Waterford 3 containment sump represents a water volume of approximately 22.5 gallons. A volume of 360 gallons would equate to 16 inches in the deep end of the sump. The usable monitoring range of the deep end of the containment sump is between 12 and 18 inches. Therefore, in less than a 24 hour period a 0.25 gpm leakage rate would initiate drawing down the sump several times to keep this equivalent leakage rate on scale. This leakage rate is easily and readily detectable.

In summary, the fracture analysis demonstrates that a postulated flaw in the Waterford 3 surge line piping system will remain stable. The margin of 10 for leakage detection capability per SRP 3.6.3 has been satisfactorily demonstrated by the Waterford 3 leakage detection system. Even though this margin is highly conservative, the stability periods predicted in EPRI MRP-109, conclude that appropriate actions will be performed well in advance of the postulated leakage flaw of 2.5 gpm (leaking at 0.25 gpm) becoming a critical flaw. If this flaw grows to a 10 gpm leakage rate size prior to taking action per the TS 3.4.5.2 limit of 1.0 gpm unidentified RCS leakage, it will still not progress to the critical flaw size for greater than 1.5 years. Therefore, adequate margin to account for these uncertainties is demonstrated in the EPRI MRP-109 data to allow sufficient operator response time to mitigate the assumed leakage flaw well ahead it becoming an unanalyzed accident once the dynamic restraints are removed. The analyses performed under WCAP-17187-P are in agreement with that of EPRI-MRP-109 and complies with SRP 3.6.3.