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Kevin T. Walsh
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Waterford 3

W3F1-2006-0070

December 20, 2006

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

SUBJECT: Entergy Actions to Address RF14 Batwing Failures
Waterford Steam Electric Station, Unit 3
Docket No. 50-382

REFERENCE: Entergy letter dated December 19, 2006, Summary of Cycle 15 Operational Assessment for Steam Generator Batwing Concerns (W3F1-2006-0072)

Dear Sir or Madam:

During the spring 2005 refueling outage, Waterford 3 discovered two batwing supports in Steam Generator (SG) #2 failed at the support bar in the stay cavity region. The batwings serve as a spacer support to prevent tube-to-tube contact during normal operation. The two batwing failures resulted in only minor tube wear, well below the NRC-established tube repair limit of 40% of wall thickness, and did not compromise plant safety. There were no batwing failures found in Steam Generator #1. Appropriate repairs were performed to mitigate potential wear, and actions were taken to provide for loose parts protection for the active SG tubes. Those repairs successfully maintained tube integrity during Cycle 14. As a result of the extensive eddy current and visual inspections conducted during the Fall 2006 outage (RF14), an additional 20 displaced batwings were discovered in the stay cavity region in SG #2. During inspection of the batwing-to-wrapper bar welds at the outer periphery of the tubes, two of the welds in SG #2 were discovered to have failed during the Cycle 14 operation. There were no batwing failures or batwing-to-wrapper bar weld failures discovered in SG #1.

Entergy assembled a diverse team of industry and internal experts to assess and understand the condition and to devise a mitigation strategy that assures defense-in-depth based on empirical findings, the root cause analysis, and the engineering evaluations for Cycle 15 operation. The team's investigative approaches and its findings and conclusions have been reviewed by independent Entergy personnel and consultants. The strategy consists of both a repair plan and additional mitigating measures as outlined in this letter. The implementation of

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this strategy is both necessary and sufficient to ensure that Waterford 3 is operated safely through Cycle 15.

Entergy will implement a comprehensive tube plugging and stabilization and weld repair plan (commitments 1 and 2) that provides a necessary defense-in-depth to protect the integrity of the active tubes of the steam generators. The use of sentinel plugs is an important aspect of this protection and provides detection of tube damage and addresses the concept of bounding potential cascading and undetected tube damage to plugged tubes. To the extent practical based on previous repairs and the plugged tube configuration, additional stabilizers and sentinel plugs will establish a defense-in-depth boundary around the stay cavity area of concern. The comprehensive repair plan includes the following activities:

- In both SG #1 and SG #2, additional stabilizers will be added to the inner circumference of the stay cavity region by removing existing plugs and installing stabilizers to provide protection from potential wear from displaced batwings or from potential loose parts to the greatest extent practical. (commitment 1a)
- In both SG #1 and SG #2, additional sentinel plugs will be added to tubes behind those stabilized at the inner circumference of the stay cavity region to provide detection of potential tube damage that propagates beyond the stabilized tubes due to potential wear from displaced batwings or from potential loose parts. (commitment 1b)
- For both SG #1 and SG #2, any path out of the inner circumference of the stay cavity region will be protected from potential wear from displaced batwings or from potential loose parts by either a full length stabilized tube or a sentinel plugged tube. Tubes in the inner circumference protected by a partial length stabilizer will be backed by a sentinel plugged tube. In most cases there are two rows of protection. (commitment 1c)
- For SG #2, which currently has batwing damage in the stay cavity region five rows of additional tubes will be plugged along the length of the batwings which extend from the stay cavity region to provide protection from potential tube wear due to flow induced vibration generated by a loose batwing in the stay cavity region. (commitment 1d)
- For both SG #1 and SG #2, additional sentinel plugs will be added to the periphery of the region where tubes are plugged along the length of the batwings which extend from the stay cavity region to provide detection of any potential tube damage mechanism that propagates to the periphery of this plugged region. (commitment 1e)
- For both SG #1 and SG #2, a batwing extending from the stay cavity region which does not have an acceptable connection at the upper wrapper bar weld will have the tubes along the entire length of the batwing plugged. Sufficient full length stabilizers will be installed to provide wear protection at egg crate supports, and sentinel plugs will be installed to provide detection of any wear mechanism. (commitment 1f)
- For both SG #1 and SG #2, sentinel plugs will be installed for batwings which extend from the stay cavity region in the tubes at the outer perimeter and at partial egg crate support number eight if not plugged for other purposes. This will provide detection at the most susceptible locations for flow induced wear in the unanticipated event of a batwing upper wrapper bar weld failure and subsequent displacement of the batwing. (commitment 1g)
- Implementation of this strategy will involve the installation in SG #1 of approximately 66 stabilizers and approximately 400 plugs, of which approximately 133 will be sentinel plugs. In SG #2, there will be approximately 66 stabilizers and approximately 774 plugs, of which approximately 158 will be sentinel plugs. (commitment 1h)
- Deficient batwing upper wrapper bar welds in SG #2 will be repaired by additional weld application or installation of a welded retaining clip to provide a structural connection

which will meet required loading conditions and original design requirements. (commitment 2a)

Waterford 3 will also provide additional conservative measures that will mitigate the effects of unexpected tube damage as a result of potential batwing failures during cycle 15 operation. The numbers shown below correlate to commitment numbers as listed in the attached summary of commitments. Some of these actions are implemented in an Operational Decision Making Issue (ODMI) plan regarding the issue of primary to secondary leakage. These measures include:

- Waterford 3 will monitor trends in primary to secondary leakage rate in the steam generators. This monitoring will aid in understanding the probable cause(s) of the increase in leakage and assure early detection of an adverse trend prior to challenging one of the administrative limits below. A typical value of this operational leakage rate has been about 0.25 gpd. (commitment 3)
- Any change in the indicated primary to secondary leakage of greater than or equal to 2 gpd will result in increased monitoring to identify the leaking SG and to evaluate and stabilize the condition. The condition will also be evaluated by the Steam Generator Integrity Committee. (commitment 4)
- Should leakage of between 5 gpd and 15 gpd be detected, Waterford 3 will increase monitoring of the N-16 and Condenser Air Evacuation Radiation Monitors and evaluate data from the loose parts monitor to determine if loose parts exist in the stay cavity area of the steam generators. Waterford 3 procedure UNT-005-032 includes actions to address the loss of one of the radiation monitors, including analyzing the leak rate using grab samples from the main condenser evacuation system or the SG blowdown system. This condition will also be evaluated by the Steam Generator Integrity Committee. (commitment 5)
- The Waterford 3 Technical Specification 3.4.5.2 limit for steam generator primary to secondary leakage is 75 gpd. Waterford 3 will administratively invoke a limit of 15 gpd and require the plant be placed in Cold Shutdown within 36 hours if this limit is exceeded. (commitment 6)
- If Waterford 3 is placed in Cold Shutdown due to exceeding either of these administrative limits, the steam generators will be inspected, the findings and steam generator condition will be analyzed and evaluated, and appropriate repairs will be made. (commitment 7)
- Waterford 3 will install additional accelerometers on the SG shell to aid in detecting possible batwing failures or loose parts in the batwing region of the SG. The accelerometers will be installed prior to startup from RF14; the indicator output will be monitored each shift in a remote local location pending implementation of a modification to provide control room output. (commitment 8)
- The modification to provide control room output of the new loose parts monitor sensors will be implemented. (commitment 9)
- Once sufficient output information has been collected and evaluated, a baseline acceleration value will be established and acceptance criteria and alarm trigger points will be determined. The alarm response procedure actions will include steps to increase monitoring of SG leakage for a valid loose parts alarm in the steam generator. (commitment 10)
- Waterford 3 will also continue to perform augmented inspections of the secondary side of the steam generators in each subsequent refueling outage until the current steam generators are replaced. The augmented inspections will include the upper batwing to

wrapper bar welds, inspection of the stay cavity region, and foreign object search and retrieval (FOSAR) of the secondary side. (commitment 11)

- Waterford 3 operator training will be updated to address the details of the condition of the steam generator. (commitment 12)
- Steam generator leakage transient simulator scenarios will be used in the operator training in alternating cycles. (commitment 13)

Based on the planned repairs and on the mitigating measures described above, Entergy has taken actions to assure that Waterford 3 will be operated safely through Cycle 15.

Entergy has conducted several conference calls with NRC Staff from both the Region IV and the Nuclear Reactor Regulation Offices regarding the batwing failures at Waterford 3. In addition, Waterford 3 is providing a summary of the operational assessment of the steam generator batwing condition in the referenced letter. To ensure that communications are actively maintained and sufficiently detailed, Waterford 3 requests a meeting with the NRC Staff to more comprehensively and effectively explain the batwing findings and repairs. Waterford 3 recommends this meeting be conducted in early 2007. The potential for developing tools or methods to obtain better inspection information, particularly from the stay cavity region can also be discussed at this meeting. Prior to this meeting, Entergy will provide the results of the root cause evaluation conducted under the Entergy 10CFR50, Appendix B corrective action program for NRC review. (commitment 14)

Waterford 3 believes that the evaluations and the scope of repairs, including the protective boundary established within both steam generators to preclude potential degradation of the active tubes, provide high confidence that the integrity of the steam generators can be managed through Cycle 15. Waterford 3 commits to conduct a mid-Cycle 15 outage to visually inspect the secondary side of the steam generators for the purpose of determining any unforeseen extent of condition or change in the critical variables that were the basis for the repair plan and operational assessment, pending discussion with the NRC. (commitment 15) The above requested meeting between Entergy and NRC management will be held to determine the need for a mid-cycle inspection and, if required, to validate the scope of the inspections.

Commitments made in this letter are summarized in the attachment. If you have any questions or require additional information, please contact me or Robert Murillo at 504-739-6715.

Sincerely,

KTW/FGB/cbh

Attachment: List of Regulatory Commitments

cc: Dr. Bruce S. Mallett
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

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

U.S. Nuclear Regulatory Commission
Attn: Mr. Mel Fields MS O-7D1
Washington, DC 20555-0001

Louisiana Department of Environmental Quality
Office of Environmental Compliance
Surveillance Division
P. O. Box 4312
Baton Rouge, LA 70821-4312

American Nuclear Insurers
Attn: Library
Town Center Suite 300S
29th S. Main Street
West Hartford, CT 06107-2445

Attachment

W3F1-2006-0070

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONT COMP	
1. Entergy will implement a comprehensive tube plugging and stabilization plan that provides a defense-in-depth configuration to protect the integrity of the active tubes of the steam generators. The use of sentinel plugs will further provide detection of tube damage and address the concept of bounding potential cascading and undetected tube damage to plugged tubes. To the extent practical based on previous repairs and the plugged tube configuration, additional stabilizers and sentinel plugs will establish a defense-in-depth boundary around the stay cavity area of concern. This includes the following activities: a. In both SG #1 and SG #2, additional stabilizers will be added to the inner circumference of the stay cavity region by removing existing plugs and installing stabilizers to provide protection from potential wear from displaced batwings or from potential loose parts to the greatest extent practical. b. In both SG #1 and SG #2, additional sentinel plugs will be added to tubes behind those stabilized at the inner circumference of the stay cavity region to provide detection of potential tube damage that propagates beyond the stabilized tubes due to potential wear from displaced batwings or from potential loose parts. c. For both SG #1 and SG #2, any path out of the inner circumference of the stay cavity region will be protected from potential wear from displaced batwings or from potential loose parts by either a full length stabilized tube or a sentinel plugged tube. Tubes in the inner circumference protected by a partial length stabilizer will be backed by a sentinel plugged tube. In most cases, there are two rows of protection.	X		Prior to Startup from RF14

d. For SG #2, which currently has batwing damage in the stay cavity region, five rows of additional tubes will be plugged along the length of the batwings which extend from the stay cavity region to provide protection from potential tube wear due to flow induced vibration generated by a loose batwing in the stay cavity region. e. For both SG #1 and SG #2, additional sentinel plugs will be added to the periphery of the region where tubes are plugged along the length of the batwings which extend from the stay cavity region to provide detection of any potential tube damage mechanism that propagates to the periphery of this plugged region. f. For both SG #1 and SG #2, a batwing extending from the stay cavity region which does not have an acceptable connection at the upper wrapper bar weld will have the tubes along the entire length of the batwing plugged. Sufficient full length stabilizers will be installed to provide wear protection at egg crate supports, and sentinel plugs will be installed to provide detection of any wear mechanism. g. For both SG #1 and SG #2, sentinel plugs will be installed for batwings which extend from the stay cavity region in the tubes at the outer perimeter and at partial egg crate support number eight if not plugged for other purposes. This will provide detection at the most susceptible locations for flow induced wear in the unanticipated event of a batwing upper wrapper bar weld failure and subsequent displacement of the batwing. h. Implementation of this strategy will involve the installation in SG #1 of approximately 66 stabilizers and approximately 400 plugs, of which approximately 133 will be sentinel plugs. In SG #2, there will be approximately 66 stabilizers and approximately 774 plugs, of which approximately 127 will be sentinel plugs.			
2. Entergy will implement a comprehensive weld repair plan. The weld repair strategy will address the undersized welds in SG #2. This includes: a. Deficient batwing upper wrapper bar welds in SG #2 will be repaired by additional weld application or installation of a welded retaining clip to provide a structural connection which will meet required loading conditions and original design requirements.	X		Prior to Startup from RF14

3. Waterford 3 will monitor trends in primary to secondary leakage rate in the steam generators. This monitoring will aid in understanding the probable cause(s) of the increase in leakage and assure early detection of an adverse trend prior to challenging one of the administrative limits below. A typical value of this operational leakage rate has been about 0.25 gpd.		X	In ODMI
4. Any change in the indicated primary to secondary leakage of greater than or equal to 2 gpd will result in increased monitoring to identify the leaking SG and to evaluate and stabilize the condition. The condition will also be evaluated by the Steam Generator Integrity Committee.		X	in ODMI
5. Should leakage of between 5 gpd and 15 gpd be detected, Waterford 3 will increase monitoring of the N-16 and Condenser Air Evacuation Radiation Monitors and evaluate data from the loose parts monitor to determine if loose parts exist in the stay cavity area of the steam generators. Waterford 3 procedure UNT-005-032 includes actions to address the loss of one of the radiation monitors, including analyzing the leak rate using grab samples from the main condenser evacuation system or the SG blowdown system. This condition will also be evaluated by the Steam Generator Integrity Committee.		X	In ODMI
6. The Waterford 3 Technical Specification 3.4.5.2 limit for steam generator primary to secondary leakage is 75 gallons per day (gpd). Waterford 3 will administratively invoke a limit of 15 gpd and require the plant be placed in Cold Shutdown within 36 hours if this limit is exceeded.		X	In ODMI
7. If Waterford 3 is placed in Cold Shutdown due to violating either of these administrative limits, the steam generators will be inspected, the findings and steam generator condition will be analyzed and evaluated, and appropriate repairs will be made.		X	in ODMI
8. Waterford 3 will install additional accelerometers on the SG shell to aid in detecting possible batwing failures or loose parts in the batwing region of the SG. The accelerometers will be installed prior to startup from RF14; the indicator output will be monitored each shift in a remote local location pending implementation of a modification to provide control room output.	X		Prior to startup from RF14
9. The modification to provide control room output will be implemented.	X		8/1/2007

10. Once sufficient output information has been collected and evaluated, a baseline acceleration value will be established, and acceptance criteria and alarm trigger points will be determined. The alarm response procedure actions will include steps to increase monitoring of SG leakage for a valid loose parts alarm in the steam generator.		X	1/31/2007
11. Waterford 3 will continue to perform augmented inspections of the secondary side of the steam generators in each subsequent refueling outage until the current steam generators are replaced. The augmented inspections will include the upper batwing to wrapper bar welds, inspection of the stay cavity region, and foreign object search and retrieval (FOSAR) of the secondary side.		X	RF15 (next outage)
12. Waterford 3 operator training will be updated to address the details of the condition of the steam generator.	X		Prior to startup from RF14
13. Steam generator leakage transient simulator scenarios will be used in the operator training in alternating cycles.		X	3/22/2007
14. Entergy will provide the results of the root cause evaluation conducted under the Entergy 10CFR50, Appendix B corrective action program for NRC review.	X		2/1/2007
15. Waterford 3 commits to conduct a mid-Cycle 15 outage to visually inspect the secondary side of the steam generators for the purpose of determining any unforeseen extent of condition or change in the critical variables that were the basis for the repair plan and operational assessment, pending discussion with the NRC.	X		11/30/2007