UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 18, 2015

Vice President, Operations
Entergy Operations, Inc.
Waterford Steam Electric Station, Unit 3
17265 River Road
Killona, LA 70057-3093

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 – REGULATORY AUDIT REPORT IN SUPPORT OF LICENSE AMENDMENT REQUEST TO CHANGE THE UPDATED FINAL SAFETY ANALYSIS REPORT CLARIFYING PRESSURIZER HEATERS FUNCTION FOR NATURAL CIRCULATION AT THE ONSET OF A LOSS OF OFFSITE POWER (TAC NO. MF3058)

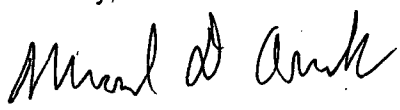
Dear Sir or Madam:

By letter dated November 11, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13316C052), Entergy Operations, Inc. (Entergy, the licensee), submitted a license amendment request (LAR) in which it proposed changes to the Waterford Steam Electric Station, Unit 3 (WF3) Updated Final Safety Analysis Report (UFSAR), which would clarify how the pressurizer heaters function is met for natural circulation at the onset of a loss of offsite power concurrent with a specific single point vulnerability. Specifically, this proposed amendment will provide clarification that manual operator action outside of the control room is needed to energize the pressurizer heaters associated with natural circulation at the onset of a loss of offsite power in the event that a specific common circuit breaker is open concurrently.

During the review of the November 11, 2013, submittal, the U.S. Nuclear Regulatory Commission (NRC) staff identified a need to verify that the natural circulation cooldown analysis identified in the submittal complies with NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Branch Technical Position 5-4, "Design Requirements of the Residual Heat Removal System," Revision 4, dated March 2007 (ADAMS Accession No. ML070850123). The NRC staff performed an audit of the natural circulation cooldown analysis documentation at the offices of Westinghouse Electric Company in Rockville, Maryland on February 11, and 12, 2015. The NRC staff's audit report is enclosed.

If you have any questions, please contact me at 301-415-3229 or via e-mail at Michael.Orenak@nrc.gov.

Sincerely,



Michael D. Orenak, Project Manager
Plant Licensing IV-2 and Decommissioning
Transition Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure:
Regulatory Audit Report

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UNITED STATES
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REGULATORY AUDIT REPORT

REGARDING THE CHANGE TO THE UPDATED FINAL SAFETY ANALYSIS REPORT CLARIFYING PRESSURIZER HEATERS FUNCTION FOR NATURAL CIRCULATION

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

1.0 INTRODUCTION

By letter dated November 11, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13316C052), Entergy Operations, Inc. (Entergy, the licensee), submitted a license amendment request (LAR) in which it proposed changes to the Waterford Steam Electric Station, Unit 3 (WF3) Updated Final Safety Analysis Report (UFSAR), which would clarify how the pressurizer heaters function is met for natural circulation at the onset of a loss of offsite power concurrent with a specific single point vulnerability. Specifically, this proposed amendment will provide clarification that manual operator action outside of the control room is needed to energize the pressurizer heaters associated with natural circulation at the onset of a loss of offsite power in the event a specific common circuit breaker is open concurrently.

In a letter dated October 21, 2014 (ADAMS Accession No. ML14246A015), the U.S. Nuclear Regulatory Commission (NRC) staff requested that Entergy provide additional information to support the review of the LAR. Specifically, the staff requested that Entergy provide documentation that demonstrates NRC approval of the natural circulation cooldown analysis performed to comply with NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Branch Technical Position (BTP) 5-4, "Design Requirements of the Residual Heat Removal System," Revision 4, dated March 2007 (ADAMS Accession No. ML070850123). The staff made this request because the prior licensing action regarding an extended power uprate (EPU) LAR, which was approved on April 15, 2005 (ADAMS Accession No. ML051030068), indicated the staff's acceptance of the shutdown cooling system analysis with respect to BTP 5-1 (now BTP 5-4). However, no calculation documents from Entergy could be located under the EPU LAR review to support the staff's conclusion. Entergy provided a response to the October 21, 2014, request in a letter dated January 13, 2015 (ADAMS Accession No. ML15013A439), which stated that the current WF3 natural circulation cooldown analysis was documented in a design analysis report (DAR) as part of the replacement steam generator (RSG) project. The RSG DAR was not cited or submitted in any previous submittal to the NRC, and therefore, was not available to the NRC staff for consideration.

Enclosure

2.0 SUMMARY OF INFORMATION IN THE LICENSEE'S JANUARY 13, 2015, LETTER

The information in this section of the audit summary report is from the bottom of page 2 of 5 through page 4 of 5 in Attachment 1 of the January 13, 2015, letter.

> The Design Analysis Report (DAR) (Reference 7) was performed by the Analysis of Record (AOR) holder, Westinghouse [Electric Company], to provide a summary of the analyses performed to demonstrate compliance with BTP 5-4. Two separate analyses are performed as part of the BTP 5-4 evaluation. The first analysis performs a full scope computer simulation of the plant cooldown from hot standby conditions to shutdown cooling (SDC) system [SDCS] entry conditions using the functional requirements specified in BTP 5-4. The second analysis models the shutdown cooling system performance and evaluates the plant cooldown from SDCS entry conditions to 200°F [Fahrenheit] following a natural circulation cooldown. The second analysis does not involve the pressurizer heater function and thus is excluded from further discussion as part of this [audit report].
>
> The simulations performed as part of the natural circulation cooldown from hot standby conditions to SDC entry conditions was performed assuming the functional requirements stated in paragraph B of BTP 5-4. In accordance with these requirements, the systems which can be used to take the reactor from normal operating conditions to shutdown cooling conditions must satisfy the following:
>
> 1. The design shall be such that the reactor can be taken from normal operating conditions to cold shutdown using only safety-grade systems satisfying General Design Criteria 1 through 5.
>
> 2. The systems shall have suitable redundancy in components and features, and suitable interconnections, leak detection, and isolation capabilities to assure that for onsite electrical power system operation (assuming offsite power is not available) and for offsite electrical power system operation (assuming onsite power is not available) the system function can be accomplished assuming a single failure.
>
> 3. The systems shall be capable of being operated from the control room with either only onsite or only offsite power available. In demonstrating that the systems can perform their function assuming a single failure, limited operator action outside the control room is considered acceptable if suitably justified.
>
> 4. The systems shall be capable of bringing the reactor to a cold shutdown condition, with only onsite or offsite power available, within a reasonable period of time following shutdown, assuming the most limiting single failure.
>
> Two scenarios are considered in this analysis: failure of one of the steam generator Atmospheric Dump Valves (ADVs) to open, and failure of one of the Emergency Diesel Generators (EDGs). The two scenarios correspond to two

different single failures and are simulated in this analysis in order to assure that the most limiting single failure is identified in accordance with Item 4 above. The results are given in terms of time (in hours) following the reactor trip to reach shutdown cooling entry conditions.

This analysis assumes the plant is operating normally at 100.5% when the initiating event, a loss of offsite power, occurs. Following the initial loss of offsite power, the plant is maintained at hot standby conditions for four hours before cooldown begins and, except where specifically permitted by BTP 5-4, only safety grade systems and equipment are credited. Other significant assumptions, including systems and equipment that are or are not, available are detailed in the DAR.

The DAR notes that the analysis assumes the Pressurizer Heaters, which are non-safety grade, are not available following a loss of offsite power. The analyses results documented in the DAR demonstrate that Waterford-3 will maintain its ability to cool the Reactor Coolant System (RCS) and maintain shutdown margin following shutdown and provide decay heat removal consistent with BTP 5-4 following Replacement Steam Generator implementation.

3.0 AUDIT ACTIVITIES

The audit was conducted on February 11, and 12, 2015 at the offices of Westinghouse Electric Company in Rockville, Maryland.

The NRC Audit Team:

- Dr. Donald Palmrose, Senior Reactor Engineer, Reactor Systems Branch, Office of Nuclear Reactor Regulation (NRR)
- Chris Jackson, Chief, Reactor Systems Branch, NRR
- Michael Orenak, WF3 Project Manager, NRR

Entergy and Westinghouse staff that participated in the Audit:

- Mr. John Jarrell, Manager, Regulatory Assurance for WF3
- Mr. Kendal Bishop, Senior Engineer Transient Design and Analysis for Nuclear Services of Westinghouse

The purpose of the audit was to (1) review the two DARs and associated calculation files for the EPU LAR and the RSG project for compliance with BTP 5-4, and for the consistency with each other, and (2) clarify the information needed to be provided to address the NRC staff's remaining review items for the LAR dated November 11, 2013.

The documents reviewed for the audit are presented in Table 1. The NRC staff first reviewed each set of documents to obtain an overall understanding of the material presented and to gain comprehension on whether each set of analyses (EPU or RSG) supports a conclusion that WF3 complies with BTP 5-4. Next, a comparison was made between the set of the EPU documents

and their RSG counterpart documents to verify that assumptions, values of input parameters, and analysis of the results were consistent between the two sets of documents. This comparison was necessary because the RSG documents had not been previously reviewed by the NRC. Thus, if the RSG documents were confirmed to be revisions of the EPU documents, the staff would have reason to conclude the revised natural circulation cooldown analysis for the RSG project also supported BTP 5-4.

The NRC staff did not directly review the codes or programming used to determine the length of time before SCDS could be reached; however, the licensee's staff did provide a reference to Topical Report WCAP-15996-P/NP-A, "Technical Description Manual for the CENTS Code," Revision 1, dated November 2005 (ADAMS Accession No. ML053290344), addressing the NRC review and acceptance of the CENTS code that is used to determine RCS response from full power to the residual heat removal system (RHRS) entry criteria.

Table 1: Relevant Documents Reviewed

Document	Title	Revision / Date
In support of the EPU		
DAR-PS-03-8	Waterford-3 Branch Technical Position RSB 5-1 Cooldown Report for 3716 MWt [megawatt thermal]	Rev. 1 July 26, 2004
CN-PS-03-14	Natural Circulation Cooldown to 350 F to Support RSB 5-1 Criteria for Waterford-3 at 3716 MWt	Rev. 1 June 14, 2004
CN-PS-03-15	Shutdown Cooling Analysis for the Waterford-3 3716 MWt Power Uprate	Rev. 0 Sept. 24, 2003
In support of the RSG		
DAR-PS-03-8	Waterford Branch Technical Position RSB 5-1 Cooldown Report for 3716 MWt	Rev. 2 March 31, 2010
CN-SEE-II-09-21	Natural Circulation Cooldown to 350 F to Support RSB 5-1 Criteria for Waterford-3 with Replacement Steam Generators	Rev. 0 July 29, 2009
CN-SEE-II-08-6	Shutdown Cooling Analysis for the Waterford-3 RSG Program	Rev. 1 January 28, 2009

Additionally, the NRC staff reviewed the current and past WF3 UFSAR Sections 5.4 and 9.3.6 (the section being modified under this LAR and the section providing a description of the SDCS, respectively) to see if Figures 9.3-8A and 9.3-8B originated from the calculation documents reviewed during the audit.

During the morning of February 12, 2015, the NRC staff and licensee met to address the final review of the questions. A short discussion was held as to the rationale for the January 13, 2015, letter including the Appendix R fire analysis text. The licensee chose to include the Appendix R fire analysis text because it contains prescriptive requirements that at least one train required for hot shutdown must be available and at least one train required for cold shutdown must be available within 72 hours. The staff also confirmed with the licensee that UFSAR Figures 9.3-8A and 9.3-8B are plots taken from the natural circulation cooldown reports

CN-PS-03-14 (for past versions of the UFSAR) or CN-SEE-II-09-21 (for the current version of the UFSAR).

4.0 AUDIT RESULTS

The NRC staff reviewed the documents listed in Table 1 to determine if the two DARs and associated calculations complied with BTP 5-4 and were consistent with each other. The NRC staff found that while the format and outline of the material between the EPU and RSG documents changed, the inputs, assumptions, and results were very similar. Additionally, DAR-PS-03-8, Revision 2, also includes a discussion of boric acid delivery to address the BTP 5-4 requirement associated with boration for cold shutdown. The NRC staff concludes that DAR-PS-03-8, Revision 1, was part of the documents reviewed by the staff for the approval of the EPU LAR in 2005. Additionally, the staff concludes DAR-PS-03-8, Revision 2, complies with BTP 5-4 and is acceptable to be referenced in the November 11, 2013, LAR and supplements.

In addition to the review for compliance with BTP 5-4, the NRC staff identified the following information that is needed to complete the staff's review of the November 11, 2013, LAR:

1. State the limiting failure chosen in the natural circulation cooldown analysis and explain why it is limiting.

2. Verify that the licensee is continuing to follow its current licensing basis assumptions for WF3 in a conservative manner.

3. Provide justification for the power level that is applied in the natural circulation cooldown analyses as to being set at 100.5 percent, as provided in the January 13, 2015, supplement, instead of the normally used 102.0 percent.

4. For the two originally proposed UFSAR inserts in Section 5.4.10.2 concerning BTP 5-4, no references for additional information is present. Provide updated UFSAR pages that include text referring the reader back to UFSAR Section 9.3.6 for additional information about the natural circulation cooldown and BTP 5-4.

5. UFSAR Section 9.3.6 does not explain the use of the CENTS code in the natural circulation cooldown analysis. Provide revised UFSAR pages that both explain the CENTS code applied in the natural circulation cooldown analysis and provide a reference to the latest calculation file applying the CENTS code for natural circulation cooldowns.

6. No reference is provided in Section 9.3.6 for UFSAR Figures 9.3-8A and 9.3-8B. Provide updated UFSAR pages with a reference in Section 9.3.6 where these figures are mentioned as to the source of the reactor coolant temperature versus time plots.

7. Clarify or change the sentence in UFSAR Section 9.3.6 on page 9.3-48 that states, "...shutdown cooling conditions were reached in less than ten hours, when both hot leg temperatures are reduced to 400F." However, the final hot leg temperature reached at 10 hours (36,000 seconds), as shown in Figures 9.3-8A and 9.3-8B, is approximately

350°F, which is the stated entry temperature for the RHRS. Thus, this text appears to be in conflict with Figures 9.3-8A and 9.3-8B.

If you have any questions, please contact me at 301-415-3229 or via e-mail at Michael.Orenak@nrc.gov.

Sincerely,

/RA/

Michael D. Orenak, Project Manager
Plant Licensing IV-2 and Decommissioning
Transition Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-382

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Regulatory Audit Report

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