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

May 30, 2013

Mr. Joseph W. Shea
Corporate Manager- Nuclear Licensing
Tennessee Valley Authority
3R Lookout Place
1101 Market Street LP 3D-C3
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 – REVIEW OF TENNESSEE VALLEY AUTHORITY COMMITMENT RELATED TO CORE PLATE BOLT STRESS ANALYSIS (TAC NOS. ME6615, ME6616, AND ME6617)

Dear Mr. Shea:

By letter dated June 15, 2011, the Tennessee Valley Authority (TVA or the licensee), submitted a report on the plant-specific stress analysis of the Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3, core plate hold down bolts. This report was submitted in accordance with Commitment 47 in Appendix A to NUREG-1843, Supplement 1, "Safety Evaluation Report Related to the License Renewal of the Browns Ferry Nuclear Plant, Units 1, 2, and 3," whereby TVA committed to perform a plant-specific stress analysis of the BFN core plate hold down bolts, as described in Boiling Water Reactor Vessel Internals Program (BWRVIP)-25, and submit the results of this analysis 2 years prior to the period of extended operation. The licensee supplemented its June 15, 2011, submittal by letters dated October 25, 2012, and February 19, 2013, in response to the NRC staff requests for additional information.

Further, by letter dated May 28, 2013, the licensee provided the Nuclear Regulatory Commission (NRC) correction and clarification regarding its proprietary information determination for the enclosures to its letters dated June 15, 2011, and October 25, 2012.

By letter dated April 8, 2013, the NRC staff informed you that it completed the review of the technical information provided by the licensee. The NRC staff determined that its documented safety evaluation (SE) (Enclosure 1) contained proprietary information pursuant to Title 10 of the *Code of Federal Regulations*, Section 2.390, "Public inspections, exemptions request for withholding." Accordingly, the NRC staff prepared a redacted, non-proprietary version (Enclosure 2) that was sent to you to ensure that the redacted document did not contain any proprietary information. The NRC requested that you provide your comments within 10 working days of the NRC's letter.

Document transmitted herewith contains Sensitive Unclassified Non-Safeguard Information. When Separated from Enclosure 1, this document is decontrolled.

The licensee did not provide any written comments within the requested period, however, Mr. Tom Hess of your staff informed me that TVA did not have any comments regarding the proprietary determination of the information in the non-proprietary SE. Therefore, the nonproprietary SE in Enclosure 2 of this letter will be made publicly available.

If you have any questions, please contact me at (301) 415-1447.

Sincerely,

Farideh E. Saba

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260, and 50-296

Enclosures:
1. Safety Evaluation (Proprietary Information)
2. Safety Evaluation (Non-Proprietary Information)

cc with Enclosures 1 and 2: Addressee only
cc with Enclosure 2: Distribution via Listserv

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REGARDING CORE PLATE HOLD DOWN BOLT STRESS ANALYSIS

PERFORMED TO ADDRESS LICENSE RENEWAL COMMITMENT

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3

DOCKET NOS. 50- 259, 50-260, AND 50-296

## 1.0 INTRODUCTION

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated June 15, 2011 (Reference 1), as supplemented by responses to NRC staff requests for additional information (RAIs) dated October 25, 2012 (Reference 2), and February 19, 2013 (Reference 3), the Tennessee Valley Authority (TVA or the licensee), submitted the results of a plant-specific stress analysis for the Browns Ferry Nuclear Plant, Units 1, 2, and 3 (BFN or the facility), core plate hold down bolts (core plate bolts). The stress analysis for the BFN core plate bolts was submitted to address Open Item (OI)-4.7.7 in NUREG-1843, "Safety Evaluation Report Related to the License Renewal of the Browns Ferry Nuclear Plant, Units 1, 2, and 3," whereby the NRC staff did not find that the licensee had provided reasonable assurance regarding the structural integrity of the BFN core plate bolts as part of its review of the BFN license renewal application. As such, TVA committed to address this open item by submitting a plant-specific stress analysis of the bolts prior to entering the period of extended operation (PEO).

Further, by letter dated May 28, 2013, the licensee provided the NRC correction and clarification regarding its proprietary information determination for the enclosures to its letters dated June 15, 2011, and October 25, 2012.

## 2.0 REGULATORY EVALUATION

Part 54 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 54) contains the requirements related to the renewal of nuclear power plant operating licenses. For components within the scope of license renewal, as defined in 10 CFR 54.4, and subject to an aging management review (AMR), in accordance with the criteria of 10 CFR 54.21(a)(1) (typically described as long-lived, passive components), applicants for license renewal must demonstrate that the effects of aging will be adequately managed such that their intended function(s) will be maintained consistent with the current licensing basis (CLB) for the PEO. Based on the fact that all components of the BFN core plate assembly are passive and long-lived, including the core plate bolts, these components are subject to an AMR.

Enclosure 2

Further, 10 CFR 54.21(c)(1) requires an evaluation of time-limited aging analyses (TLAAs). As defined in 10 CFR 54.3, TLAAs are those licensee calculations and analyses that: (1) involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a); (2) consider the effects of aging; (3) involve time-limited assumptions defined by the current operating term, for example, 40 years; (4) were determined to be relevant by the licensee in making a safety determination; (5) involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in 10 CFR 54.4(b); and (6) are contained or incorporated by reference in the CLB. If a plant-specific analysis, as identified by an applicant for license renewal, meets the above six criteria, then the analysis is considered a TLAA for license renewal and must be evaluated on a plant-specific basis.

For each TLAA, 10 CFR 54.21(c)(1) requires the applicant for license renewal to demonstrate that: (i) the analyses remain valid for the period of extended operation; (ii) the analyses have been projected to the end of the period of extended operation; or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The BFN core plate bolt operating conditions make the core plate bolts susceptible to stress relaxation and subsequent loss of preload; this results in a potential TLAA issue. As such, in accordance with 10 CFR 54.21(c)(1)(ii), the licensee evaluated the core plate bolts for the PEO to ensure that the loss of preload would not be of a magnitude that would result in a loss of functionality of the core plate bolts.

In NUREG-1843, including Supplement 1 to NUREG-1843, the NRC staff documented its technical review and conclusions related to the extension of the BFN operating license (References 4 and 5, respectively). In concluding that TVA satisfied the applicable regulatory requirements related to the extension of the BFN operating license, the NRC staff also identified a number of OIs and Regulatory Commitments associated with the BFN license renewal (Tables 1 and 2 of Appendix A to NUREG-1843). The NRC staff noted that the licensee's evaluation of the stress relaxation in the core plate bolts assumed a 20-percent loss of preload during the PEO. This 20 percent bounded the value used in Boiling Water Reactor (BWR) Vessel and Internals Project (BWRVIP), BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25) (Reference 6), which was prepared to evaluate the core plate bolts for a majority of plants. However, the NRC staff requested that the licensee demonstrate how the evaluations performed in BWRVIP-25 apply to BFN in order to substantiate the preload loss assumption identified above. This request is identified as OI-4.7.7 in NUREG-1843 and also identified as Commitment 47 in Appendix A of Supplement 1 to NUREG-1843. As indicated in Supplement 1, the licensee committed to perform a plant-specific analysis of the core plate bolts in accordance with BWRVIP-25 to show that the bolts will maintain adequate preload such that they will be able to perform their required safety function during the PEO. If the acceptance criteria related to the bolts were shown not to be satisfied in the analysis, the licensee committed to taking corrective actions. The licensee included its plant-specific analysis in Reference 1.

As indicated in the description of BFN license renewal Commitment 47 above, the guidance used by the NRC staff in assessing the licensee's core bolt stress analysis is based on BWRVIP-25. The initial version of BWRVIP-25 was approved by the NRC staff for providing acceptable guidance for the inspection and evaluation of core plate components (including the core plate bolts) for the current operating period (plants in their initial 40 years of operation) by letter dated December 19, 1999 (Reference 7). By letter dated July 17, 1997, the BWRVIP submitted "License Renewal Appendix B to BWR Vessel and Internals Project BWR Core Plate

Inspection and Flaw Evaluation Guidelines (BWRVIP-25)" (Reference 8). The NRC staff transmitted its safety evaluation (SE) for referencing BWRVIP-25 in license renewal applications via letter dated December 7, 2000 (Reference 9). The NRC staff in Reference 9 concluded that BWRVIP-25 provided an acceptable basis for managing aging of the core plate bolt components, provided that applicants for license renewal meet the limitations and conditions and the plant-specific action items of the enclosed SE. Plant-specific Applicant Action Items 4 and 5 are most relevant. Applicant Action Item 4 of the SE stated that due to the susceptibility of the core plate bolts to stress relaxation, applicants referencing the BWRVIP-25 report for license renewal should identify and evaluate the projected stress relaxation as a potential TLAA issue. Applicant Action Item 5 stated, that until such time as an expanded technical basis for not inspecting the rim hold-down bolts is approved by the staff, applicants referencing the BWRVIP-25 report for license renewal should continue to perform inspections of the rim hold-down bolts.

## 3.0 TECHNICAL EVALUATION

### 3.1 Core Plate Bolt Functions

The core plate bolts at BFN connect the core plate to the core shroud and are initially preloaded during installation. These bolts are connected to a support ledge between the central and lower portions of the core shroud and serve to prevent sliding of the core plate. The core plate assembly consists of a perforated stainless steel plate reinforced by stiffener beams and supported on the perimeter by a circular rim. The core plate is positioned on the shroud ledge by four vertical aligner pins. The stiffener beams welded to the core plate serve to carry the pressure loads resulting from a postulated design basis loss of coolant accident (LOCA) event. The pressure loading from a LOCA causes compressive stresses in the lower edges of the stiffener beams. Cross ties or stabilizer beams are added between the stiffener beams to prevent flange buckling by providing lateral support. The core plate serves to provide lateral support and guidance for the control rod guide tubes, peripheral fuel support pieces, incore flux monitor guide tubes, and startup neutron sources through perforations in the plate. As the BFN Final Safety Analysis Report (FSAR) indicates, these functions of the core plate are maintained by ensuring a sufficient amount of preload exists on the core plate bolts to prevent sliding.

The seismic and other dynamic loads are shared between the friction load of the shroud to core plate bolt connection, and the shear resistance of the aligner pins. During seismic events the core plate provides lateral support for the core to prevent misalignment that could affect the insertion of the control rods. For plants such as BFN that do not have wedges installed between core plate rim and the shroud, the core plate [[ ]][1] According to BWRVIP-25, [[ ]] The critical number of intact hold down bolts required to prevent lateral displacement during a seismic event is plant-specific and, as such, this number can only be determined through a plant-specific analysis. Nonetheless, if hold down bolt failures resulted in significant core plate movement preventing the insertion of control rods, the plant could still be brought to a safe shutdown condition using the standby liquid control system.

[1] The information in [[ ]] contains proprietary information and as such has been redacted in this nonproprietary version of SE.

3.2 Plant-Specific Stress Analysis

Using the ANSYS finite element code, the licensee performed a series of finite element analyses (FEA) to determine the stresses induced in the BFN core plate bolts under the loads and load combinations applicable to the BFN reactor vessel internals. The FEA utilized plant-specific data to perform the analysis, including the number of core plate bolts, core geometry and positioning specific to BFN; the three BFN units are similar enough such that the analyses described here within are applicable to all three units. The plant-specific analysis performed by the licensee for the BFN was carried out using three different scenarios that used different combinations of core plate components to resist the design-basis loads and load combinations, described below, to which the core plate assembly could be subjected. These three scenarios are described as follows:

1) All loads imparted on the core plate assembly are resisted by the core plate bolts and no credit is taken for the aligner pins. In this case, the bolts take all of the horizontal and vertical loads.
2) No credit is taken for the horizontal resistance supplied by the core plate bolts and the aligner pins are subjected to shear-only loading. In this case, the bolts take vertical loads and the aligner pins take all of the horizontal loads.
3) No credit is taken for the aligner pins in this scenario and this case also assumes that the stiffener beam-to-rim weld is cracked. In this case, the core plate bolts are assumed to take all of the horizontal and vertical loads.

The NRC staff considers the licensee's approach to evaluating the core plate bolts acceptable. This acceptance is based on the fact that the approach described above, which incorporates the use of FEA and the three limiting scenarios, is consistent with the approach used in the example core plate bolt analysis found in Appendix A of BWRVIP-25. This approach also addresses the first and fifth NRC staff concerns documented in Section 4.7.7.2 of NUREG-1843 regarding the licensee's previous assumption that the core plate acts as a rigid body.

3.2.1 Loads and Load Combinations

Section 4.2 of BWRVIP-25 states loads should be combined in accordance with the plant's licensing basis. The licensing basis requirements related to the loads and load combinations considered in the design of the BFN reactor vessel internals, including the core plate bolts, are documented in BFN FSAR Section 3.3, "Reactor Vessel Internals Mechanical Design," and BFN FSAR Appendix C, "Structural Qualification of Subsystems and Components." Table C.4-1 in Appendix C of the BFN FSAR summarizes the loads, load combinations, and allowable stresses (based on the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code requirements) for the reactor, reactor vessel internals and supports. The licensee confirmed in Section 4.1 of its stress analysis report that the ASME Code allowable stress limits employed in the present evaluation of the core plate bolts are consistent with the BFN licensing basis. These stress limits are summarized in Table 4-1 of the stress analysis report and are based on material properties found in the 1965 Edition of the ASME Code, which is the code of construction for the BFN reactor vessel internals.

Section 5.0 of Enclosure 1 to the licensee's June 15, 2011, submittal details the loads and load combinations considered in the plant-specific stress analyses performed for the core plate bolts. Table 5-1 in the enclosure provides a detailed synopsis of the values used for the
[[ ]]
loads used in the assessment of the structural integrity of the core plate bolts. In its

October 25, 2012, response to an NRC staff RAI regarding the AC loads used in the analyses, the licensee stated that the AC loads used for the core plate bolt analyses are those that have been previously reviewed and approved by the NRC by letters dated September 8, 1998, March 6, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML042670047 and ML070680307), as part of previous power uprates implemented at BFN. The licensee stated that these loads were combined for the normal, upset, emergency and faulted loading conditions in accordance with the BFN FSAR.

A review of these load combinations in Table 5-2 of the stress analysis report shows that the Normal and Upset loading combinations are bounded by the Emergency loading combination due to the fact that the Normal and Upset loading combinations consider operating-basis earthquake loads, which are one-half of the safe-shutdown earthquake load. However, the allowable stress limit for these two loading combinations is more than half of the stress limit for the Emergency loading combination. Additionally, the licensee notes that the Emergency loading combination is the most limiting combination in this analysis based on the fact that Faulted RIPD loads are used in the Emergency loading combination. This effectively equates the loads considered for the Emergency and Faulted service levels, while the former has a lower allowable stress limit.

The NRC staff notes that the use of the aforementioned design-basis loads and load combinations sufficiently addresses the eighth NRC staff concern identified in Section 4.7.7.2 of NUREG-1843, which indicated that the previous analysis did not explicitly outline whether loads considered in the analysis were consistent with the BFN licensing basis.

3.2.2 Bolt Preload and Friction

One of the key loads considered in the analysis of the BFN core plate bolts is the bolt preload and subsequent relaxation of this preload. The licensee notes in its June 15, 2011, submittal that both irradiation effects (fluence) and thermal relaxation of the core plate bolts result in a loss of preload. This loss of preload results in a lower clamping force and subsequently reduces the amount of frictional resistance available to oppose horizontal loads at the core plate interface. In its October 25, 2012, RAI response, the licensee stated that the preload values used in the core plate bolt stress analyses were derived from the vessel assembly drawing. Based on this RAI response, which provides a quantitative basis for the value of the preload used in the analysis, the NRC staff considers the second and sixth concerns identified in Section 4.7.7.2 of NUREG-1843 resolved. To determine the final clamping force, the preload was reduced by [[ ]] to account for the effects of fluence. The NRC staff notes that this value was previously determined by the NRC staff to be conservative and acceptable as it is applied to the stress relaxation in the BFN core plate bolts resulting from fluence; this determination is discussed at length in NUREG-1843. The clamping force was further reduced by [[ ]] to account for the effects of thermal relaxation. This clamping force is used to determine the static frictional horizontal resistance, based on the coefficient of friction assumed at the interface.

As stated above, the bolt preload is directly related to the interfacial friction available to resist the horizontal loading applied to the core plate. In its October 25, 2012, response to an NRC staff RAI regarding the friction factor chosen for the core plate bolt analysis, the licensee provided additional justification regarding the value used to model the frictional resistance between the core plate and associated support ledge. The licensee stated that completely neglecting friction is extremely conservative and neglecting its contribution to the resistance of horizontal motion of the core plate does not adequately represent the physics of the interface (i.e., horizontal motion is resisted by a combination of aligner pins, bolt shear, bolt bending and friction). The RAI response also includes a discussion regarding the applicability of the coefficient of friction used in BWRVIP-51A, "Jet Pump Repair Design Criteria," to the present stress analysis, with the licensee noting that the clamping interfaces and materials associated with both the core plate and jet pumps are similar enough to warrant the use of the same coefficient of friction in the analysis. Based on the similarities between the analyses performed for BFN and the information contained in BWRVIP-51A, which has been reviewed and approved for use by the NRC, the NRC staff considers the licensee's use of the coefficient of friction value of [[ ]] acceptable as it applies to this analysis. Further, based on the adequate justification regarding the frictional resistance presented above, the NRC staff concludes that the licensee has addressed the third and fourth staff concerns identified in Section 4.7.7.2 of NUREG-1843.

The licensee accounted for the effect of bolt preload by [[

]] As indicated above, the preload used by the licensee in developing the overall core plate bolt stress values accounted for the impact of neutron fluence and thermal relaxation which both act to reduce the preload in the bolts. While the loss of preload reduces the total membrane stress on the core plate bolts, the bending stresses induced in the bolts are increased by this stress relaxation. The NRC staff considers this approach reasonable as it adequately considers the loading present in the core plate bolts and at the core plate-shroud interface and also relies on analysis parameters that, as indicated above, the NRC staff considers acceptable as they are applied to the analysis of the BFN core plate bolts.

### 3.2.3 Results

The results of the licensee's stress analysis are presented in Section 7.0 of the stress analysis report in Reference 1. The results for all three scenarios are tabulated in Tables 7-1 and 7-2 for the Emergency and Faulted Conditions, respectively, with the former being the most limiting based on the discussion above regarding the loads and allowable stresses considered for each service level. In Figures 7-1 and 7-2 of the stress analysis report, the licensee also provides the limiting horizontal and vertical loads acting on each individual bolt around the circumference of the core plate for the first and third loading scenarios described above; the results for Scenario 2 are not depicted graphically but are included in the tables identified above. The licensee notes that the [[

]]

The NRC staff issued an RAI to the licensee regarding [[

]]. In its October 25, 2012, RAI response, the licensee stated that when the effects of preload are included in the plots, the amplitude variation is dampened permitting the use of an averaging technique. The NRC staff issued a follow-up RAI that requested the licensee to present the results of the stress analysis for the most limiting core plate bolt(s) for the first and third loading scenarios. In its February 19, 2013, RAI response, the licensee stated that the most limiting bolt, as depicted in Figure 1 of the stress analysis report in its June 15, 2011, submittal, sees vertical forces that are 11 percent greater than the average vertical force in all the bolts. Similarly, the most limiting bolt with respect to horizontal forces sees forces which are 10-percent greater than the average horizontal force present in the bolts. By increasing the limiting membrane plus bending stress seen in Table 7-1 of stress analysis report by 11 percent, the licensee was able to show that adequate margin is still available when compared against the ASME Code allowable stress for the bolt under the applicable load combinations.

By demonstrating that the most limiting core plate bolt satisfies the stress limits prescribed by the BFN design and licensing basis requirements, the licensee confirmed that all core plate bolts will be able to maintain their structural integrity under the aforementioned loads and load combinations while considering the effects of a loss of preload in these bolts during the PEO. Furthermore, the NRC staff notes that by considering the bolts' structural capacity in a discrete manner, the licensee has adequately addressed the NRC staff's seventh concern in Section 4.7.7.2 of NUREG-1843 regarding the load distribution and the effects on the subsequent core plate bolt stresses.

3.2.4 Conclusion

The NRC staff has reviewed the stress analysis portion of the licensee's submittal and applicable supplements which address Commitment 47 in Appendix A of Supplement 1 to NUREG-1843 and finds this portion of the licensee's submittal acceptable. This conclusion is based on the fact that the licensee's analysis shows that under design-basis loads and load combinations, the most limiting core bolts were shown to have stresses that remain below the stress limits prescribed by the ASME Code provisions applicable to the bolts. Furthermore, as discussed in the sections above, the NRC staff concludes that the licensee has adequately addressed the eight concerns associated with the previous core plate bolt analysis, which are identified in Section 4.7.7.2 of NUREG-1843.

3.3 Core Plate Bolt Inspections

Core plate bolts are prone to intergranular stress corrosion cracking (IGSCC) and the aging management program (AMP) associated with core plate bolts is addressed in BWRVIP-25. The functionality of the core plate depends on the structural integrity of the core plate bolts and frequent inspections of these bolts as part of their AMP is prescribed in Table 3-2 in the BWRVIP-25 report. In its October 25, 2012, response to the NRC staff's RAI, the licensee stated that the visual testing (VT-3) examinations (consistent with Section XI of the ASME Code) of the all core plate hold down bolts were performed from above the core plate during each outage at the BFN units. Visual inspection from the top of the core plate would potentially identify that their locking devices are in place, and that the bolts have not loosened and rotated due to a combination of vibration and failure of the welds on the locking device. The licensee has used the VT-3 examination technique to inspect all of the core plate bolts from above the core plate during each outage at all of the BFN units and thus far, the inspection results are acceptable. The licensee must continue to inspect all the core plate bolts in all BFN units using the VT-3 technique from above the core plate during every outage to ensure that their locking devices are in place. The VT-3 technique is able to show that the bolts have not loosened and rotated due to a combination of vibration and failure of the welds on the locking device.

In its February 19, 2013, RAI response, the licensee stated that implementation of hydrogen water chemistry and noble metal chemical addition at the BFN units should alleviate IGSCC in the core plate bolts. Furthermore, the licensee stated that the core plate bolts are resistant to any IGSCC because they are solution annealed and proper controls were implemented during the threading process of the bolts and that the applied stresses are low in these bolts. Since these bolts are not welded, no weld residual stresses are present in them. The staff agrees that there is less likelihood that these bolts would be susceptible to IGSCC. The NRC staff considers the inspection aspects of the licensee's assessment acceptable based on (1) the ongoing inspections of the core plate bolts and (2) the information presented by the licensee that demonstrates the low likelihood that the core plate bolts are vulnerable to cracking.

## 4.0 CONCLUSION

The NRC staff has completed its assessment of the information presented by the licensee to address Commitment 47 of Appendix A to NUREG-1843 related to the BFN license renewal efforts. As stated in NUREG-1843, the licensee committed to perform a plant-specific analysis of the core plate bolts in accordance with BWRVIP-25 to show that the bolts will maintain adequate preload such that they will be able to perform their required safety function during the PEO. Based on the information presented by the licensee, the NRC staff finds the licensee's assessment of the stresses in the core plate bolts acceptable for the PEO, considering the effects of stress relaxation and subsequent loss of preload, such that these bolts would be expected to maintain adequate structural integrity to withstand applicable design-basis loads throughout the 60-year period of licensed operation of BFN. Additionally, the NRC staff considers the licensee's inspection strategy associated with core plate bolts acceptable based on the fact that the licensee has a deviation and is performing VT-3 inspections, which the NRC staff considers adequate. Therefore, the NRC staff concludes that the licensee has satisfactorily addressed Commitment 47 of NUREG-1843 and the regulatory requirements associated with this commitment.

## 5.0 REFERENCES

1) Letter from R. M. Krich, Tennessee Valley Authority, to NRC Document Control Desk, "BWRVIP-25 Core Plate Bolt Stress Analysis," dated June 15, 2011 (ADAMS Accession No. ML111710054).

2) Letter from J. W. Shea, Tennessee Valley Authority, to NRC Document Control Desk, "Response to Request for Additional Information Regarding BWRVIP-25 Core Plate Bolt Stress Analysis for BFN Units 1, 2, and 3," dated October 25, 2012 (ADAMS Accession No. ML12307A225).

3) Letter from J. W. Shea, Tennessee Valley Authority, to NRC Document Control Desk, "Response to Request for Additional Information Regarding BWRVIP-25 Core Plate Bolt Stress Analysis for BFN Units 1, 2, and 3 (TAC Nos. ME6615, ME6616, ME6617)," dated February 19, 2013 (ADAMS Accession No. ML13052A741).

4) Safety Evaluation Report Related to the License Renewal of the Browns Ferry Nuclear Plant, Units 1, 2, and 3 (NUREG-1843), April 2006 (ADAMS Accession No. ML061030029)

5) Supplement 1 to Safety Evaluation Report Related to the License Renewal of the Browns Ferry Nuclear Plant, Units 1, 2, and 3 (NUREG-1843, Supplement 1), April 2006 (ADAMS Accession No. ML061160258)

6) BWR Vessel and Internals Project BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25), Electric Power Research Institute (EPRI) Report TR-107284, December 1996 (Proprietary Information - Not Publicly Available)

7) Letter from Jack Strosnider, NRC, to Carl Terry, BWRVIP Chairman, "Final Safety Evaluation of BWRVIP Vessel and Internals Project, 'BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guideline (BWRVIP-25),' EPRI Report TR-107284, December 1996 (TAC No. M97802)," dated December 19, 1999. (Proprietary Information - Not Publicly Available)

8) Letter from Vaughn Wagoner to NRC Document Control Desk, dated July 17, 1997, "License Renewal Appendix B to BWR Vessel and Internals Project BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25), EPRI Report TR-107284, December 1996."

9) Letter from Christopher Grimes, NRC, to Carl Terry, BWRVIP Chairman, dated December 7, 2000, "Safety Evaluation for Referencing of BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25) Report for Compliance With the License Renewal Rule (10 CFR Part 54) and Appendix 0, BWR Core Plate Demonstration of Compliance with the Technical information Requirements of the License Renewal Rule (10 CFR 54.21)," dated December 7, 2000 (ADAMS Accession No. ML003775989).

Principle Contributor: W. Jessup
G. Cheruvenki

Date of Issuance: May 30, 2013

The licensee did not provide any written comments within the requested period, however, Mr. Tom Hess of your staff informed me that TVA did not have any comments regarding the proprietary determination of the information in the non-proprietary SE. Therefore, the non-proprietary SE in Enclosure 2 of this letter will be made publicly available.

If you have any questions, please contact me at (301) 415-1447.

Sincerely,

*/RA/*

Farideh E. Saba, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260, and 50-296

Enclosures:
1. Safety Evaluation (Proprietary Information)
2. Safety Evaluation (Non-Proprietary Information)

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**ADAMS Accession No.: Proprietary SE ML13150A041 Non-Proprietary SE ML13150A060**
***By a memorandum**

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