



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-16-098

June 30, 2016

10 CFR 50.4

Attn: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2, and 3  
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68  
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Tennessee Valley Authority's Browns Ferry Nuclear Plant Fourth Six-Month Status Report in Response to the June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)**

- References:
1. NRC Order Number EA-13-109, "Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," dated June 6, 2013 (ML13143A321)
  2. NRC Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated November 14, 2013 (ML13304B836)
  3. NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109, BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 1, dated April 23, 2015 (ML15113B318)
  4. Letter from TVA to NRC, "Tennessee Valley Authority's Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident (Order Number EA-13-109)," dated June 30, 2014 (ML14181B169)
  5. Letter from TVA to NRC, "Tennessee Valley Authority's Browns Ferry Nuclear Plant First Six-Month Status Report in Response to the June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)," dated December 19, 2014 (ML14353A428)

6. Letter from NRC to TVA, "Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4540, MF4541 and MF4542)," dated February 11, 2015 (ML14356A362)
7. NRC Interim Staff Guidance JLD-ISG-2015-01, "Compliance with Phase 2 of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions," Revision 0, dated April 29, 2015 (ML15104A118)
8. Letter from TVA to NRC, "Tennessee Valley Authority's Browns Ferry Nuclear Plant Second Six-Month Status Report in Response to the June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)," dated June 29, 2015 (ML15181A338)
9. Letter from TVA to NRC, "Tennessee Valley Authority's Browns Ferry Nuclear Plant Third Six-Month Status Report and Phase 1 and Phase 2 Overall Integrated Plan in Response to the June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)," dated December 29, 2015 (ML15365A554)

On June 6, 2013, the Nuclear Regulatory Commission (NRC) issued an Order (Reference 1) to Tennessee Valley Authority (TVA). Reference 1 was immediately effective and directed TVA to install a reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of a Phase 1 and Phase 2 Overall Integrated Plan (OIP) pursuant to Section IV, Condition D for Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3. References 2 and 7 endorse industry guidance document Nuclear Energy Institute (NEI) 13-02, Revision 1 (Reference 3) with clarifications and exceptions identified in References 2 and 7. Reference 3 provides direction regarding the content of the Phase 1 and Phase 2 OIPs and includes guidance for combining the OIPs.

Reference 4 provided TVA's Phase 1 OIP. The NRC issued its Interim Staff Evaluation relating to the BFN Phase 1 OIP on February 11, 2015 (Reference 6).

Reference 1 also requires submission of status reports at six-month intervals following submittal of the OIP. Reference 3 provides direction regarding the content of the status reports. TVA submitted the first six-month status report on December 19, 2014 (Reference 5), the second six-month status report on June 29, 2015 (Reference 8), and the third six-month status report on December 29, 2015 (Reference 9).

The purpose of this letter is to provide the combined Phase 1 and Phase 2 OIP six-month status report pursuant to Section IV, Condition D of Reference 1, that delineates progress made in implementing the requirements of Reference 1. The Enclosure provides an update of milestone accomplishments since submittal of the Phase 1 OIP (Reference 4) and previous updates (References 5, 8, and 9), and the initial Phase 2 OIP (Reference 9) including any changes to the compliance method, schedule, or need for relief and the basis, if any.

There are no new regulatory commitments resulting from this submittal. If you have any question regarding this submittal, please contact Mike Oliver at (256) 729-7874.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 30th day of June 2016.

Respectfully,



J. W. Shea  
Vice President, Nuclear Licensing

Enclosure: Tennessee Valley Authority Browns Ferry Nuclear Plant's Fourth Six-Month Status Report for the Implementation of Order EA-13-109, "Issuance of Order to Modify Licenses With Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions"

cc (w/Enclosure):

NRR Director - NRC Headquarters  
NRO Director - NRC Headquarters  
NRR JLD Director - NRC Headquarters  
NRC Regional Administrator - Region II  
NRR Project Manager - Browns Ferry Nuclear Plant  
NRR JLD Project Manager - Browns Ferry Nuclear Plant  
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

## **ENCLOSURE**

### **Tennessee Valley Authority Browns Ferry Nuclear Plant's Fourth Six Month Status Report for the Implementation of Order EA-13-109, "Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions"**

#### **1 Introduction**

Browns Ferry Nuclear Plant (BFN) developed an Overall Integrated Plan (Reference 1 in Section 8) documenting the installation of a Hardened Containment Vent System (HCVS) that provides a reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris, in response to Reference 2. Starting with this six month status report, updates of milestone accomplishments will be based on the combined Phase 1 and 2 Overall Integrated Plan dated December 29, 2015.

BFN developed an updated and combined Phase 1 and 2 Overall Integrated Plan (Reference 7 in Section 8) documenting:

1. The installation of a Hardened Containment Vent System (HCVS) that provides a reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris, in response to Reference 2.
2. An alternative venting strategy that makes it unlikely that a drywell vent is needed to protect the containment from overpressure related failure under severe accident conditions, including those that involve a breach of the reactor vessel by molten core debris, in response to Reference 2

This enclosure provides an update of milestone accomplishments since submittal of the combined Phase 1 and 2 Overall Integrated Plan including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

#### **2 Milestone Accomplishments**

The following milestone(s) have been completed since the development of the combined Phase 1 and 2 Overall Integrated Plan, and are current as of June 1, 2016.

None

#### **3 Milestone Schedule Status**

The following provides an update to Part 5 of the combined Phase 1 and 2 Overall Integrated Plan. It provides the activity status of each item, and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

The revised milestone target completion dates do not impact the order implementation date.

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
<b>Phase 1 and 2 HCVS Milestone Table</b>			
Submit Overall Integrated Plan	June 2014	Complete	
<b>Submit 6 Month Updates:</b>			
Update 1	December 2014	Complete	
Update 2	June 2015	Complete	
Update 3 [Simultaneous with Phase 2 OIP]	December 2015	Complete	
Update 4	<b>June 2016</b>	<b>Complete with this submittal</b>	
Update 5	December 2016	Not Started	
Update 6	June 2017	Not Started	
Update 7	December 2017	Not Started	
Update 8	June 2018	Not Started	
Update 9	December 2018	Not Started	
<b>Phase 1 Specific Milestones</b>			
<b>Phase 1 Modifications:</b>			
Hold preliminary/conceptual design meeting	November 2014	Complete	
Modifications Evaluation	November 2015	Complete	
Unit 1 Design Engineering On-site/Complete	April 2016	In Progress	<b>June 2016</b>
Unit 1 Implementation Outage	November 2016	Not Started	

<b>Milestone</b>	<b>Target Completion Date</b>	<b>Activity Status</b>	<b>Comments {Include date changes in this column}</b>
Unit 1 Walk Through Demonstration/Functional Test	November 2016	Not Started	
Unit 2 Design Engineering On-site/Complete	June 2016	<b>In Progress</b>	<b>October 2016</b>
Unit 2 Implementation Outage	March 2017	Not Started	
Unit 2 Walk Through Demonstration/Functional Test	April 2017	Not Started	
Unit 3 Design Engineering On-site/Complete	July 2017	Not Started	
Unit 3 Implementation Outage	March 2018	Not Started	
Unit 3 Walk Through Demonstration/Functional Test	April 2018	Not Started	
<b>Phase 1 Procedure Changes Active</b>			
Operations Procedure Changes Developed	July 2016	<b>In Progress</b>	
Site Specific Maintenance Procedure Developed	July 2016	<b>In Progress</b>	
Procedure Changes Active	November 2016	Not Started	
<b>Phase 1 Training:</b>			
Training Complete	September 2016	Not Started	
<b>Phase 1 Completion</b>			
Unit 1 HCVS Implementation	December 2016	Not Started	
Unit 2 HCVS Implementation	April 2017	Not Started	
Unit 3 HCVS Implementation	March 2018	Not Started	
Full Site HCVS Implementation	March 2018	Not Started	
Submit Completion Report [60 days after full site compliance]	June 2018	Not Started	

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
<b>Phase 2 Specific Milestones</b>			
<b>Phase 2 Modifications:</b>			
Hold preliminary/conceptual design meeting	January 2017	Not Started	
Modifications Evaluation	April 2017	Not Started	
Unit 3 Design Engineering On-site/Complete	May 2017	Not Started	
Unit 3 Implementation Outage	March 2018	Not Started	
Unit 3 Walk Through Demonstration/Functional Test	March 2018	Not Started	
Unit 1 Design Engineering On-site/Complete	December 2017	Not Started	
Unit 1 Implementation Outage	October 2018	Not Started	
Unit 1 Walk Through Demonstration/Functional Test	October 2018	Not Started	
Unit 2 Design Engineering On-site/Complete	May 2018	Not Started	
Unit 2 Implementation Outage	March 2019	Not Started	
Unit 2 Walk Through Demonstration/Functional Test	March 2019	Not Started	
<b>Phase 2 Procedure Changes Active</b>			
Operations Procedure Changes Developed	September 2017	Not Started	
Site Specific Maintenance Procedures Developed	December 2017	Not Started	
Procedure Changes Active	March 2018	Not Started	
<b>Phase 2 Training:</b>			
Training Complete	December 2017	Not Started	
<b>Phase 2 Completion</b>			
Unit 3 HCVS Implementation	March 2018	Not Started	

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
Unit 1 HCVS Implementation	October 2018	Not Started	
Unit 2 HCVS Implementation	March 2019	Not Started	
Full Site HCVS Implementation	March 2019	Not Started	
Submit Completion Report [60 days after full site compliance]	May 2019	Not Started	

#### 4 Changes to Compliance Method

The following is a list of changes made to the information provided in the Combined Phase 1 and 2 Overall Integrated Plan (Reference 7). These changes were performed to clarify the OIP and provide more accurate information due to being further along in the design process. These changes meet the NEI 13-02 compliance method.

- Page 3 of 80. Removed words “core from” from the 2nd bullet under “The Phase 2 actions can be summarized as follows”. These words were removed for clarification.
- Page 24 of 80. Second paragraph changed “Following load shed” to “Following realignment” which is a more accurate description.
- Page 48 of 80. Completed the sentence in the 3rd bullet for out of service times to state the following: The cause(s) of the non-functionality will be entered in the corrective action program.
- Page 52 and 53 of 80. Updated the Phase 1 and Phase 2 milestone schedule
- Page 79 of 80. Updated Interim Staff Evaluation Phase 1 Open item 7 to closed due to the performance of an evaluation that concluded the containment isolation valves will open under the maximum expected differential pressure and is documented in FLOWSERVE Report RAL-70181, Design Review Report of Size 14 Class 150 Wafer Butterfly Valve with Pneumatic Actuator, Rev. 1

There are no changes to the compliance method as documented in the combined Phase 1 and 2 Overall Integrated Plan (Reference 7).

#### 5 Need for Relief/Relaxation and Basis for the Relief/Relaxation

BFN expects to comply with the order implementation date and no relief/relaxation is required at this time.

#### 6 Open Items from Combined Phase 1 and 2 Overall Integrated Plan and Interim Staff Evaluations

The following tables provide a summary of the open items documented in the combined Phase 1 and 2 Overall Integrated Plan or the Interim Staff Evaluation (ISE) and the status of each item.



Combined Phase 1 and 2 OIP Open Item	Status
<b>Phase 1 Open Items</b>	
1. Perform an assessment of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls at the Remote Operating Station based on time constraints listed in Attachment 2.	Open
2. Perform an evaluation for HCVS ability to operate from the MCR and has the ability to be supplied adequate amounts of pneumatic pressure for 24 hour actions.	Closed - Evaluation has been completed and documented in Calculation MDQ0000322015000347 R0, HCVS Nitrogen System Sizing Analysis, and DCN 71389.
3. Perform an evaluation for FLEX portable generators and nitrogen cylinders use past 24 hour actions.	Open
4. Revise 1/2/3-EOI Appendix 13 to include venting for loss of DC power.	Open
5. Perform an evaluation for FLEX portable generators use for post 24 hour actions in Severe Accident conditions.	Open
6. Electrical load shedding will be performed in 1 hour of the event.	Closed (Reference 6) - Calculation EDQ0009992013000202 R3, 250V DC Unit Batteries, 1, 2, & 3 Evaluation for the Beyond Design Basis External Event (BDBEE) Extended Loss of AC Power (ELAP), has been issued to determine load shedding impact on the unit batteries.
7. The implementation of the HCVS DCN's will be staged so that there is no effect on the operating units.	Closed (Reference 6) - A conceptual meeting was held in November 2014, and a staging plan was used to separate the existing HWWV from the HCVS.
8. The wetwell vent will be designed to remove 1% of rated thermal power at EPU conditions.	Closed (Reference 6) - The existing wetwell vent (CLTP) and the HCVS (EPU) have been designed for 1 percent of rated thermal power at EPU conditions.
9. Implement the Harris Radio System for communication between the MCR and the ROS.	Closed - A communication system has been implemented that uses hand held radios for communication between the main control room and the remote operating station. (DCN 70852)

Combined Phase 1 and 2 OIP Open Item	Status
<b>Phase 2 Open Items</b>	
1. Perform an evaluation for the locations of the SAWA equipment and controls, as well as ingress and egress paths for the expected Severe Accident conditions (temperature, humidity, radiation) for the Sustained Operating period.	Open
2. Perform an hydraulic evaluation to ensure flow adequacy can be met for all 3 units using 1 FLEX pump to support SAWA flow requirement	Open

Phase 1 Interim Staff Evaluation Open Item	Status
1. Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.	In Progress
2. Make available for NRC audit documentation that procedure 1/2/3-EOI Appendix 13 to has been revised to include venting for loss of dc power.	In Progress
3. Make available for NRC staff audit documentation demonstrating that all load sheds will be accomplished within one hour of event initiation and will occur in an area not impacted by a possible radiological event.	Closed (Reference 6) - Calculation EDQ0009992013000202 R3, 250V DC Unit Batteries, 1, 2, & 3 Evaluation for the Beyond Design Basis External Event (BDBEE) Extended Loss of AC Power (ELAP), has been issued to determine load shedding impact on the unit batteries.
4. Make available for NRC staff audit documentation that demonstrates that operating units that have not implemented the order will be able to vent through the existing vent system unaffected by the implementation of HCVS on other units.	Closed (Reference 6) - A conceptual meeting was held in November 2014, and a staging plan was used to separate the existing HWWV from the HCVS.
5. Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary	Closed (Reference 6) - The existing wetwell vent (CLTP) and the HCVS (EPU) have been designed for 1 percent of rated thermal power at EPU conditions.

containment pressure limit.	
6. Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions.	Closed - A communication system has been implemented that uses hand held radios for communication between the main control room and the remote operating station. (DCN 70852)
7. Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.	<b>Closed- An evaluation was performed and concluded that the containment isolation valves will open under the maximum expected differential pressure and is documented in FLOWSERVE Report RAL-70181, Design Review Report of Size 14 Class 150 Wafer Butterfly Valve with Pneumatic Actuator R1</b>
8. Make available for NRC staff audit documentation of a seismic qualification evaluation of HCVS components.	In Progress
9. Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	In Progress
10. Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	In Progress
11. Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	In Progress
12. Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	In Progress
13. Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.	In Progress
14. Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	In Progress

15. Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings.	In Progress
16. Provide design details that minimize unintended cross flow of vented fluids within a unit and between units on the site.	In Progress
<b>Phase 2 Interim Staff Evaluation Open Item</b>	<b>Status</b>
TBD	NA

## 7 Interim Staff Evaluation Impacts

There are no potential impacts to the Interim Staff Evaluation(s) identified at this time.

## 8 References

The following references support the updates to the combined Phase 1 and 2 Overall Integrated Plan described in this enclosure.

1. Letter from TVA to NRC, "Tennessee Valley Authority's Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident (Order Number EA-13-109)," dated June 30, 2014 (ML14181B169)
2. NRC Order Number EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," dated June 6, 2013. (ML13143A321)
3. NEI 13-02, "Industry Guidance for Compliance with NRC Order EA-13-109, 'To Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions,' Revision 1, dated April 2015. (ML15113B318)
4. NRC Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated November 2013 (ML13304B836).
5. NRC Endorsement of industry "Hardened Containment Venting System (HCVS) Phase 1 Overall Integrated Plan Template (EA-13-109) Rev 0" (Accession No. ML14128A219).
6. JLD-ISG-2012-01, "Compliance with Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events," dated August 29, 2012 (ML12229A174)
7. Letter from TVA to NRC, "Tennessee Valley Authority's Browns Ferry Nuclear Plant Third Six-Month Status Report and Phase 1 and Phase 2 Overall Integrated Plan in Response to the June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)," dated December 29, 2015 (ML15365A554)
8. NRC Interim Staff Guidance JLD-ISG-2015-01, "Compliance with Phase 2 of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated April 2015 (ML15104A118).