



Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

June 18, 2020

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

Browns Ferry Nuclear Plant, Unit 3
Renewed Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Unit 3 Replacement Steam Dryer Visual Inspection Results (U3R19)**

Enclosed is a summary of the results of the visual inspections of the Unit 3 Replacement Steam Dryer that were performed during the recent refueling outage (U3R19). The inspections are required to be performed in accordance with Operating License Condition 2.C(14)(e) during the first two scheduled refueling outages after reaching full Extended Power Uprate conditions. This first report for Unit 3 is being submitted pursuant to Operating License Condition 2.C(14)(f) which requires that the results of the inspection be submitted in a report within 90 days following startup.

There are no new regulatory commitments in this letter. Should you have any questions concerning this submittal, please contact J. L. Paul, Site Licensing Manager, at (256) 729-2636.

Respectfully,

A handwritten signature in black ink, appearing to read "S. M. Bono", with a stylized flourish at the end.

S. M. Bono
Site Vice President

U.S. Nuclear Regulatory Commission

Page 2

June 18, 2020

Enclosure: Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

cc (w/ Enclosure):

NRC Regional Administrator - Region II

NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

Enclosure

Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

See Attached

Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

Purpose

This report provides the results of visual inspections of the Replacement Steam Dryer (RSD) as required by the Browns Ferry Unit 3 Renewed Facility Operating License No. DPR-68, License Condition 2.C(14)(f). This license condition requires that the results of the visual inspections of the RSD be submitted to the NRC within 90 days following startup from each of the first two respective refueling outages.

Summary

The Unit 3 RSD was inspected from February 25 through March 11, 2020, during the Spring 2020 refueling outage (Unit 3 Refueling Outage 19: U3R19). This was the first refueling outage following installation of the RSD in March 2018 during Unit 3 Refueling Outage 18 (U3R18) and operation at Extended Power Uprate (EPU) conditions since July 13, 2018. The inspections were performed in accordance with GE Hitachi Nuclear Energy Report No. 003N5663, Revision 2 ("Tennessee Valley Authority (TVA) Browns Ferry Nuclear Station (BFNS): Recommendations for Future Inspections - Replacement Steam Dryer"). The RSD design and the materials and fabrication processes utilized are expected to result in significantly improved resistance to stress corrosion cracking. Therefore, the inspection recommendations in the GEH report focus primarily on the locations that may be susceptible to fatigue from flow-induced vibration. The locations identified are those indicated to have relatively significant cyclic loading during the dryer's operation, as determined by detailed stress analyses. In addition, the GE report provides recommendations for future inspections of the remnants of the removed flow induced vibration (FIV) instrumentation at the Browns Ferry Nuclear Station (BFNS) Unit 3 steam dryer. The FIV instrumentation was associated with the steam dryer vibration and acoustic pressure measurements recorded during the initial startup and first cycle of operation, and was removed during the first outage after the dryer was put into service.

Tables 1 ("Frequency of Recommended Locations Based on Analysis" and 2 ("Description of Recommended Inspections Locations") of the GEH Report list locations that are considered the most susceptible for fatigue cracking based on BWR dryer experience and stress analysis. All accessible weld and weld heat-affected zone (HAZ) base metal surfaces of the RSD were visually inspected during U3R19, with a total scope of 1,079 points. The summary results of the inspections can be found in the table starting on the next page.

The following explanations apply to the table:

NRI: No Relevant Indication

RI: Relevant Indication

The parentheses after each Inspection Location refer to the number of points inspected for each.

Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

Inspection Location	Method	Inspection Result	Condition Report (if RI)	Disposition
STEAM DRYER ID				
Divider Plate to Trough Side Plate Weld & HAZs (32)	VT-1-89	NRI		
Trough Side Plate to Base Plate Weld & HAZs (6)	VT-1-89	NRI		
Trough Spacer Pin Weld & HAZs (6)	VT-1-89	NRI		
Trough Side Plate to Bank End Plate Weld & HAZs (12)	VT-1-89	NRI		
Skirt to Support Beam Weld & HAZs (8)	VT-1-89	NRI		
Guide Channel to Tee Weld & HAZs (4)	VT-1-89	NRI		
Skirt to Tee Weld & HAZs (12)	VT-1-89	NRI		
Drain Pipe to Trough Base Plate Weld & HAZs (12)	VT-1-89	NRI		
Drain Pipe to Elbow Weld & HAZs (21)	VT-1-89	NRI		
Drain Elbow to Pipe Weld & HAZs (11)	VT-1-89	NRI		
Drain Elbow to Skirt Weld & HAZs (12)	VT-1-89	NRI		
Collar to Skirt Weld & HAZs (12)	VT-1-89	NRI		
Divider Plate to Hood Tee Weld & HAZs (32)	VT-1-89	NRI		
Perforated Plate to Trough Side Plate Weld & HAZs (22)	VT-1-89	NRI		
Perforated Plate to Bank End Plate Weld & HAZs (12)	VT-1-89	NRI		
Perforated Plate to Divider Plate Weld & HAZs (32)	VT-1-89	NRI		
Hood to Hood Inlet End Plate Weld & HAZs (11)	VT-1-89	NRI		
Hood to Hood Tee Weld & HAZs (33)	VT-1-89	NRI		
Cover Plate to Hood Weld & HAZs (2)	VT-1-89	NRI		
Trough Base Plate to Hood Weld & HAZs (4)	VT-1-89	NRI		
Perforated Plate to Bank Top Cap Weld & HAZs (1)	VT-1-89	NRI		
Hood Support Stiffener Assembly, Divider Plate to Stiffener Horizontal Weld & HAZs, 000 degree side (16)	VT-1-89	NRI		
Hood Support Stiffener Assembly, Divider Plate to Stiffener Horizontal Weld & HAZs, 180 degree side (16)	VT-1-89	NRI		
Hood Support Stiffener Assembly, Stiffener to Hood Support Tee Weld & HAZs, 360 degree weld (16)	VT-1-89	NRI		
Hood Support Stiffener Assembly, Stiffener to Trough Weld & HAZs, 360 degree weld (16)	VT-1-89	NRI		
Lifting Assembly Anchor Welds and HAZs (4)	VT-1-89	NRI		
Guide Channel to Lower Support Ring Welds & HAZs (2)	VT-1-89	NRI		

Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

Inspection Location	Method	Inspection Result	Condition Report (if RI)	Disposition
Skirt to Lower Support Ring Welds & HAZs (6)	VT-1-89	NRI		
Splice Bar Attachment Weld and HAZs (8)	VT-1-89	NRI		
Trans Brace to Upper Support Ring Weld & HAZs (2)	VT-1-89	NRI		
Trans Brace Coupler Weld & HAZs (1)	VT-1-89	NRI		
Trans Brace Plate Welds & HAZs (8)	VT-1-89	NRI		
Trans Brace Support Welds & HAZs (12)	VT-1-89	NRI		
Hood to Upper Support Ring Weld & HAZs (12)	VT-1-89	NRI		
Base Plate to Upper Support Ring Weld & HAZs (8)	VT-1-89	NRI		
Cover Plate to Upper Support Ring Weld & HAZs (2)	VT-1-89	NRI		
Splice Bar to Upper Support Ring and Trough Welds & HAZs (2)	VT-1-89	NRI		
Upper Support Ring Splice Bar - Taper Pin & Bolting - Welds & HAZs (2)	VT-1-89	NRI		
USR Segment Weld & HAZs (4)	VT-1-89	NRI		
Skirt to Upper Support Ring Weld & HAZs (8)	VT-1-89	NRI		
STEAM DRYER OD				
000 Degree Pad Welds & HAZs (1)	VT-1-89	NRI		
Steam Dryer Outer Banks Access Panel Welds & HAZs 000 Side (6)	VT-1-89	NRI		
Steam Dryer Outer Banks Access Panel Welds & HAZs 180 Side (6)	VT-1-89	NRI		
Bank to Divider Plate Weld & HAZs (32)	VT-1-89	NRI		
Bank A to End Plate Outside Vertical Weld & HAZs (4)	VT-1-89	NRI		
Bank to Trough Base Plate Horizontal Weld & HAZs (6)	VT-1-89	NRI		
Hood Support to Trough Weld & HAZs (32)	VT-1-89	NRI		
Trough Spacer Pin Weld & HAZs (6)	VT-1-89	NRI		
Bank Tie Rod Bolting Weld & HAZs (72)	VT-1-89	NRI		
Bank B to End Plate Outside Vertical Weld & HAZs (4)	VT-1-89	NRI		
Bank B to End Plate Inside Vertical Weld & HAZs (4)	VT-1-89	NRI		
Bank C to End Plate Outside Vertical Weld & HAZs (6)	VT-1-89	NRI		
Divider Plate to Inner Plate Weld & HAZs (12)	VT-1-89	NRI		
Bank D to End Plate Outside Vertical Weld & HAZs (6)	VT-1-89	NRI		

Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

Inspection Location	Method	Inspection Result	Condition Report (if RI)	Disposition
Bank E to End Plate Outside Vertical Weld & HAZs (6)	VT-1-89	NRI		
Bank F to End Plate Inside Vertical Weld & HAZs (4)	VT-1-89	NRI		
Drain Channel to Upper Support Ring Horizontal Weld & HAZs (4)	VT-1-89	NRI		
Drain Channel to Support Beam Weld & HAZs (8)	VT-1-89	NRI		
Drain Channel to Support Ring Tab Welds & HAZs (20)	VT-1-89	NRI		
Guide Channel to Drain Channel Tee Vertical Weld & HAZs (4)	VT-1-89	NRI		
Drain Channel to Drain Channel Tee Vertical Weld & HAZs (8)	VT-1-89	NRI		
Skirt to Drain Channel Tee Vertical Weld & HAZs (4)	VT-1-89	NRI		
Doubler Plate to Upper Support Ring & HAZs (8)	VT-1-89	NRI		
General Overview - Surfaces Side (4)	VT-1-89	NRI		
General Overview - Top Surfaces (1)	VT-1-89	NRI		
Hood to Cover Plate Horizontal Weld & HAZs (2)	VT-1-89	NRI		
Hood to Bank Top Cap Horizontal Weld & HAZs (6)	VT-1-89	NRI		
Perforated Plate to Trough Side Plate Weld & HAZs (22)	VT-1-89	NRI		
Perforated Plate to Bank Top Cap Weld & HAZs (22)	VT-1-89	NRI		
Perforated Plate to Bank End Plate Weld & HAZs (23)	VT-1-89	NRI		
Perforated Plate to Divider Plate Weld & HAZs (21)	VT-1-89	NRI		
Hood to Inlet End Plate Vertical Weld & HAZs (18)	VT-1-89	NRI		
Hood to Hood Tee Vertical Weld & HAZs (26)	VT-1-89	NRI		
Hood to Trough Base Plate Horizontal Weld & HAZs (4)	VT-1-89	NRI		
Bank C to End Plate Inside Vertical Weld & HAZs (2)	VT-1-89	NRI		
Bank D to End Plate Inside Vertical Weld & HAZs (2)	VT-1-89	NRI		
Hold Down Assembly to End Plate Weld & HAZs (8)	VT-1-89	NRI		
Hold Down Assembly to Trough Base Plate Horizontal Weld & HAZs (2)	VT-1-89	NRI		
Bank E to End Plate Inside Vertical Weld & HAZs (2)	VT-1-89	NRI		
Lifting Assembly - Support Ring Anchor Weld & HAZs (4)	VT-1-89	NRI		

Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

Inspection Location	Method	Inspection Result	Condition Report (if RI)	Disposition
Lifting Assembly - Bolting and Tack Weld & HAZs (4)	VT-1-89	NRI		
Lifting Assembly - Lower Bracket and Welds Plus HAZs (4)	VT-1-89	NRI		
Lifting Assembly - Middle Bracket and Welds Plus HAZs (4)	VT-1-89	NRI		
Lifting Assembly - Rod to Anchor Weld & HAZs (4)	VT-1-89	NRI		
Lifting Assembly - Upper Bracket and Welds Plus HAZs (4)	VT-1-89	NRI		
Latch Box General Condition for Evidence of Handling Damage (2)	VT-3	NRI		
Lower Guide Channel General Condition for Evidence of Handling Damage (2)	VT-3	NRI		
Lower Guide Vertical Welds & HAZs (8)	VT-1-89	NRI		
Lower Support Ring to Guide Channel Horizontal Weld & HAZs (2)	VT-1-89	NRI		
Lower Support Ring to Skirt Horizontal Weld & HAZs (6)	VT-1-89	NRI		
Lower Support Ring Splice Bar General Condition for Evidence of Handling Damage (2)	VT-3	NRI		
Splice Bar Attachment Weld & HAZs (8)	VT-1-89	NRI		
Seismic Lug and Associated Bolting, also Welds & HAZs (2)	VT-1-89	RI	1593820	Accepted as-is
Seismic Lug General Condition for Evidence of Handling Damage (2)	VT-3	NRI		
Bank Tie Bar Welds & HAZs (68)	VT-1-89	NRI		
Trough Base Plate Center Horizontal Weld & HAZs (1)	VT-1-89	NRI		
Top Flange to C-Channel to Hood Cover Weld & HAZs (2)	VT-1-89	NRI		
Upper Support Ring Horizontal Weld & HAZs (26)	VT-1-89	NRI		
Upper Support Ring Tapered Pin Seal Weld & HAZs (8)	VT-1-89	NRI		
Upper Support Ring to Splice Bar Vertical Weld & HAZs (4)	VT-1-89	NRI		
Upper Support Ring to Guide Channel Horizontal Weld & HAZs (2)	VT-1-89	NRI		
Upper Support Ring to Skirt Horizontal Weld & HAZs (2)	VT-1-89	NRI		
Instrumentation Pads on the Bank Cap Plate for As-Left Condition (6)	VT-1	NRI		
Instrumentation Pads Between Banks C and D on the 180 Side for As-Left Condition (1)	VT-1	NRI		
Conduit and Standoff Blocks from the Instrumentation Terminator Block to the Terminator Block at the end of the run for missing material (4)	VT-3	NRI		

Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

Inspection Location	Method	Inspection Result	Condition Report (if RI)	Disposition
As-Found Condition Inspection looking for As-Installed Condition & Missing Pieces (1)	VT-3	NRI		
Instrument Cable & Sensors for Missing Material (8)	VT-3	NRI		
Instrument Pads on the Hood End Plate, 180 Side for As-Left Condition (1)	VT-1	NRI		
Instrument Pads on the Hood End Plate, 000 Side for As-Left Condition (1)	VT-1	NRI		
Instrument Tower Pads & HAZs for As-Left Condition (4)	VT-1	RI	1593835	Accepted as-is
As-Left Condition of the Underwater Weld Repair (2)	VT-1	NRI		
Instrument Sensor Housing for As-Left Condition (8)	VT-1	NRI		
Instrumentation Pads on Upper Support Ring, 145 Degree Area for As-Left Condition (1)	VT-1	NRI		
Instrumentation Pads on Upper Support Ring, 225 Degree Area for As-Left Condition (1)	VT-1	NRI		

Inspection Results

Two relevant indications were noted during inspections performed during U3R19. They are described as follows:

(1) BFN3-SD OD Seismic Lug 005 and BFN-3 SD OD Seismic Lug 185: A relevant indication of wear was observed at the contact point of the Steam Dryer Support Lug for the Steam Dryer Seismic Blocks at 5 degrees and 185 degrees. This wear was the result of mechanical damage incurred by removal and reinstallation of the RSD.

(2) BFN3-SD OD VIB Instrument Tower Pads As Left: Steam Dryer Instrument Tower Pads 1, 2, and 3 had twisted crimp collar shafts.

Disposition of Indications

Condition Reports (CRs) were initiated for both relevant indications, and an Engineering Evaluation was prepared as part of the corrective action plan for each CR to disposition the indications. Each disposition is as follows:

(1) BFN3-SD OD Seismic Lug 005 and BFN-3 SD OD Seismic Lug 185: The main purpose of the Steam Dryer Seismic Blocks is to transfer the lateral load from the RSD to the RPV support brackets. The indications that were observed during U3R19 on the Steam Dryer Seismic Blocks at 5 degrees and 185 degrees was the result of mechanical damage incurred by the removal and reinstallation of the RSD, and are not expected in any way to interfere with the ability of the

Browns Ferry Unit 3 Replacement Steam Dryer (RSD) Inspection Results from the First Refueling Outage (U3R19) Following Installation of RSD and Implementation of Extended Power Uprate

seismic blocks to perform their required function to transfer the lateral load from the RSD to the RPV support brackets. Therefore, these indications have no bearing on the structural integrity of the seismic blocks and are acceptable as-is with no repair required.

(2) BFN3-SD OD VIB Instrument Tower Pads As Left: Because instrumentation (pressure sensors, strain gages, and accelerometers) was required during the Unit 3 Cycle 19 Fuel Cycle to access in-situ dryer conditions during operation, an instrumentation package was installed. A means was required for the instrumentation leads to exit the vessel via a penetration in the reactor head, so an instrument mast/tower was installed on top of the RSD that was held in place by pads that were welded to the RSD and whose sole function was to hold the mast/tower in place. Inspections performed during U3R19 showed that Steam Dryer Instrument Tower Pads 1, 2, and 3 had twisted crimp collar shafts. Since the instrument package was only required to provide monitoring for the first cycle of EPU operation, the instrument package, as well as the mast/tower, were removed during U3R19. Therefore, the Instrument Tower Pads no longer have a function with the mast/tower removed, and any observed indications can be accepted as-is.

Conclusion

A completed baseline inspection of the Browns Ferry Unit 3 Replacement Steam Dryer (RSD) was performed during the Spring 2020 Refueling Outage 19. This baseline inspection included successful visual inspection of all inspection locations required by the Facility Operating License Condition 2.C(14)(f) for inspection of the RSD. All observations were acceptable for the locations inspected. There were two relevant indications that were dispositioned acceptable as-is. The subsequent inspection scope of the RSD will be performed during Unit 3 Refueling Outage 20 (U3R20) in Spring 2022, and the results will be provided at that time consistent with the Browns Ferry Operating License.