



Post Office Box 2000, Decatur, Alabama 35609-2000

January 24, 2023

10 CFR 50.4

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

Browns Ferry Nuclear Plant, Unit 1
Renewed Facility Operating License No. DPR-33
NRC Docket No. 50-259

Subject: Unit 1 Replacement Steam Dryer Visual Inspection Results (U1R14)

Enclosed is a summary of the results of the visual inspections of the Unit 1 Replacement Steam Dryer that were performed during the recent refueling outage (U1R14). The inspections are required to be performed in accordance with Operating License Condition 2.C(18)(g) during the first two scheduled refueling outages after reaching full Extended Power Uprate conditions which requires that the results of the inspection be submitted in a report within 90 days following startup. This second report for Unit 1 is being submitted pursuant to Operating License Condition 2.C(18)(h) which requires that the results of the inspection be submitted in a report within 90 days following startup.

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

Respectfully,

A handwritten signature in black ink, appearing to read 'Manu Sivaraman', is written over a light blue horizontal line.

Manu Sivaraman
BFN Site Vice President

U.S. Nuclear Regulatory Commission
Page 2
January 24, 2023

Enclosure: Browns Ferry Unit 1 Replacement Steam Dryer (RSD) Inspection Results from the
Second Refueling Outage (U1R14) 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 Nuclear Plant
Unit 1**

**Browns Ferry Unit 1 Replacement Steam Dryer (RSD) Inspection Results from the
Second Refueling Outage (U1R14) Following Installation of RSD and Implementation of
Extended Power Uprate**

See Enclosed

Browns Ferry Unit 1 Replacement Steam Dryer (RSD) Inspection Results from the Second Refueling Outage (U1R14) 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 1 Renewed Facility Operating License No. DPR-33, License Condition 2.C.(18).(h). 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 1 RSD was inspected from October 3 through 15, 2022, during the Fall 2022 refueling outage (Unit 1 Refueling Outage 14: U1R14). This was the second refueling outage following installation of the RSD in October 2018 during Unit 1 Refueling Outage 12 (U1R12) and operation at Extended Power Uprate (EPU) conditions since January 2019. 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.

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 U1R14, with a total scope of 646 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 1 Replacement Steam Dryer (RSD) Inspection Results from the
Second Refueling Outage (U1R14) 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 Welds & HAZs (32)	VT-1-89	NRI		
Trough Side Plate to Base Plate Weld & HAZs (6)	VT-1-89	NRI		
Hood Vertical / Horizontal Welds & HAZs (12)	VT-1-89	NRI		
Perforated Plate to Trough Side Plate Weld & HAZs (22)	VT-1-89	NRI		
Trough Spacer Pin Weld & HAZs (6)	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		
Cover Plate to Hood Weld & HAZs (2)	VT-1-89	NRI		
Trough Base Plate to Hood Weld & HAZs (4)	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		
Skirt to Lower Support Ring Weld plus 2 Splice Bars & HAZs (2)	VT-1-89	NRI		
Skirt to Lower Support Ring Weld & HAZs (6)	VT-1-89	NRI		
Splice Bar Attachment Weld and HAZs (4)	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		
Base Plate to Upper Support Ring Weld & HAZs (4)	VT-1-89	NRI		
Base Plate to Upper Support Ring/Latch Assembly Welds & HAZs (2)	VT-1-89	NRI		
Base Plate to Upper Support Ring/Lifting Assembly Welds & HAZs (2)	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		
USR Segment Weld & HAZs (4)	VT-1-89	NRI		

**Browns Ferry Unit 1 Replacement Steam Dryer (RSD) Inspection Results from the
Second Refueling Outage (U1R14) Following Installation of RSD and
Implementation of Extended Power Uprate**

Inspection Location	Method	Inspection Result	Condition Report (if RI)	Disposition
Skirt to Upper Support Ring Weld & HAZs (6)	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		
Both Sides of the Bank to Divider Plate Weld & HAZs (16)	VT-1-89	NRI		
Both Sides of the Bank to Exhaust Plenum Plate Vertical Weld & HAZs (20)	VT-1-89	NRI		
Hood to Cover Plate Horizontal Weld & HAZs (2)	VT-1-89	NRI		
Hood to Top Cap Horizontal Weld & HAZs (6)	VT-1-89	NRI		
Perforated Plate to Bank Top Cap Weld & HAZs (6)	VT-1-89	NRI		
Perforated Plate to Trough Side Plate Weld & HAZs (6)	VT-1-89	NRI		
Trough Side Plate to Base Plate Weld & HAZs (6)	VT-1-89	NRI		
Both Sides of the Hood Support to Trough Weld & HAZs (16)	VT-1-89	NRI		
Perforated Plate to End Plate Weld & HAZs (4)	VT-1-89	NRI		
Perforated Plate to Perforated Plate Weld & HAZs (16)	VT-1-89	NRI		
Perforated Plate to End Plate Weld & HAZs from Trough Base Plate to Hood Cap (8)	VT-1-89	NRI		
Trough Spacer Pin Weld & HAZs (6)	VT-1-89	NRI		
Bank Tie Rod Bolting Welds & HAZs for all 6 locations on the 000 Deg Side (6)	VT-1-89	NRI		
Bank Tie Rod Bolting Welds & HAZs for all 6 locations on the 180 Deg Side (6)	VT-1-89	NRI		
Hood to Trough Base Plate Horizontal Weld & HAZs (4)	VT-1-89	NRI		
Both Sides of the Divider Plate to Inner Plate Welds & HAZs (6)	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		

**Browns Ferry Unit 1 Replacement Steam Dryer (RSD) Inspection Results from the
Second Refueling Outage (U1R14) Following Installation of RSD and
Implementation of Extended Power Uprate**

Inspection Location	Method	Inspection Result	Condition Report (if RI)	Disposition
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 of the Side Surfaces (4)	VT-1-89	NRI		
General Overview of the Top Surfaces (1)	VT-1-89	NRI		
Hood to Inlet End Plate Vertical Weld & HAZs (18)	VT-1-89	NRI		
Both Hood to Hood Tee Vertical Welds & HAZs (4)	VT-1-89	NRI		
Hood to Hood Tee Vertical Weld & HAZs (18)	VT-1-89	NRI		
Both Sides of the Hold Down Assembly to Exhaust Plenum Plate Vertical Weld & HAZs (4)	VT-1-89	NRI		
Hold Down Assembly to Trough Base Plate Horizontal Weld & HAZs (2)	VT-1-89	NRI		
Lifting Assembly - Support Ring Anchor Weld & HAZs (4)	VT-1-89	NRI		
Lifting Assembly - Bolting (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-1-89	NRI		
Lower Guide Channel General Condition for Evidence of Handling Damage (2)	VT-1-89	RI	1810040	Accepted as-is
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-1-89	NRI		
Splice Bar Attachment Weld & HAZs (8)	VT-1-89	NRI		
Seismic Lug General Condition for Evidence of Handling Damage, also Associated Bolting, Welds & HAZs (2)	VT-1-89	RI	1808890	Accepted as-is
Bank Tie Bar Welds & HAZs (34)	VT-1-89	NRI		
Trough Base Plate Center Horizontal Weld & HAZs (1)	VT-1-89	NRI		

Browns Ferry Unit 1 Replacement Steam Dryer (RSD) Inspection Results from the Second Refueling Outage (U1R14) Following Installation of RSD and Implementation of Extended Power Uprate

Inspection Location	Method	Inspection Result	Condition Report (if RI)	Disposition
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		

Inspection Results

Relevant indications were noted and evaluated at two locations during inspections performed in U1R14. They are described as follows:

(1) BFN1-SD OD LGC General 000: Examinations revealed indications described as wear and rolled metal on the 0° RSD Guide Channel inside surfaces on the 270° side of the channel. The indications reported appear to be the result of mechanical damage incurred by removal and reinstallation of the RSD.

(2) BFN1-SD OD Seismic Lug 005 and BFN1-SD OD Seismic Lug 185: Two of the four seismic blocks showed indications of wear during their initial inspection in Unit 1 Refueling Outage 13 (U1R13). These locations were reexamined during U1R14. The previously reported indications showed no change in U1R14 and are described as wear at the contact point of the Steam Dryer Support Lug for the Steam Dryer Seismic Block at 5°, and wear observed on the contact surface and leading edge of the Steam Dryer Seismic Block at 185°. There were two new indications reported on the lower edge of the 185° seismic block lead-ins that saddle the Dryer Support Bracket during installation and normal operations. These new indications were described as rolled metal on the left side of the seismic block and a gouge on the right side. All these indications appear to be the result of mechanical damage incurred by removal and reinstallation of the Replacement Steam Dryer (RSD).

Disposition of Indications

Condition Reports (CRs) were initiated to document and disposition the relevant indications reported on the RSD. The dispositions are as follows:

(1) BFN1-SD OD LGC General 000: The main purpose of the guide channel is to encompass the Guide Rod in the Reactor Pressure Vessel and direct the Steam Dryer to and from its installed position during refueling operations. The indications reported appear to be the result of mechanical damage incurred by removal and reinstallation of the RSD and are not expected in any way to interfere with the ability of the Lower Guide Channel to perform its required function.

Browns Ferry Unit 1 Replacement Steam Dryer (RSD) Inspection Results from the Second Refueling Outage (U1R14) Following Installation of RSD and Implementation of Extended Power Uprate

Therefore, an Engineering Evaluation was prepared which concluded that these indications have no bearing on the structural integrity of the Lower Guide Channel at 000 and are acceptable as-is with no repair required.

(2) BFN1-SD OD Seismic Lug 005 and BFN1-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 on the Steam Dryer Seismic Blocks at 5 degrees and 185 degrees appeared to be 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 seismic blocks to perform their required function to transfer the lateral load from the RSD to the RPV support brackets. Therefore, an Engineering Evaluation was prepared which concluded that these indications have no bearing on the structural integrity of the seismic blocks and are acceptable as-is with no repair required.

Conclusion

A completed second baseline inspection of the Browns Ferry Unit 1 Replacement Steam Dryer (RSD) was performed during the Fall 2022 Refueling Outage 14. This re-baseline inspection included successful visual inspection of all RSD locations required by the Facility Operating License Condition 2.C.(18).(h). All observations were acceptable for the locations inspected. There were two inspection areas with relevant indications that were adequately dispositioned. Since two baseline inspections of the RSD have now been completed, future inspections will be performed in accordance with the guidelines specified in GE Hitachi Nuclear Energy Report No. 007N4785, Revision 0 ("Tennessee Valley Authority (TVA) Browns Ferry Nuclear Station (BFNS): Recommendations for Future Inspections - Replacement Steam Dryer").