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December 9, 2021

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

H.B. Robinson Steam Electric Plant, Unit No. 2
Docket No. 50-261
Renewed License No. DPR-23

Subject: Application to Revise Technical Specifications to Adopt TSTF-577, "Revised Frequencies for Steam Generator Tube Inspections"

Pursuant to 10 CFR 50.90, Duke Energy Progress, LLC (Duke Energy) is submitting a request for an amendment to the Technical Specifications (TS) for H.B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2).

Duke Energy requests adoption of TSTF 577, "Revised Frequencies for Steam Generator Tube Inspections," which is an approved change to the Standard Technical Specifications (STS), into the HBRSEP2 TS. The TS related to steam generator (SG) tube inspections and reporting are revised based on operating history. Additionally, Duke Energy is proposing a SG tube inspection period of 72 effective full power months (EFPM) for the inspection period that began December 8, 2020. This is a variation from the TS changes described in TSTF-577 because enhanced probes have not previously been used for SG tube inspections at HBRSEP2. For all future SG tube inspections, enhanced probe techniques will be utilized.

The Enclosure provides a description and assessment of the proposed changes. Attachment 1 provides the existing TS pages marked to show the proposed changes. Attachment 2 provides revised (clean) TS pages. The TS Bases are not affected by the proposed changes. Attachment 3 provides justification for the technical variation from TSTF-577.

Approval of the proposed amendment is requested within one year of completion of the NRC's acceptance review. Once approved, the amendment shall be implemented within 90 days.

There are no regulatory commitments made in this submittal.

In accordance with 10 CFR 50.91, a copy of this application, with attachments, is being provided to the designated South Carolina Official.

If there are any questions or if additional information is needed, please contact Mr. Lee Grzeck, Manager – Nuclear Fleet Licensing (Acting) at 980-373-1530.

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 9, 2021.

Sincerely,

Ernest J. Kapopoulos, Jr.
Site Vice President

EJK/jlv

Enclosure: Description and Assessment

Attachments:
1. Proposed Technical Specification Changes (Mark-Up)
2. Revised Technical Specification Pages
3. Justification for Technical Variation from TSTF-577

cc (with enclosure and attachments):

L. Dudes, USNRC Region II – Regional Administrator
M. Fannon, USNRC Senior Resident Inspector – RNP
T. Hood, NRR Project Manager – RNP
A. Gantt, Chief, Bureau of Radiological Health (SC)
A. Wilson, Attorney General (SC)
S. E. Jenkins, Manager, Radioactive and Infectious Waste Management (SC)

ENCLOSURE

DESCRIPTION AND ASSESSMENT

1. DESCRIPTION

Duke Energy Progress, LLC (Duke Energy) requests adoption of TSTF-577, "Revised Frequencies for Steam Generator Tube Inspections," which is an approved change to the Standard Technical Specifications (STS), into the H.B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2) Technical Specifications (TS). The TS related to steam generator (SG) tube inspections and reporting are revised based on operating history.

2. ASSESSMENT

2.1 Applicability of Safety Evaluation

Duke Energy has reviewed the safety evaluation for TSTF-577 provided to the Technical Specifications Task Force in a letter dated April 14, 2021. This review included a review of the NRC staff's evaluation, as well as the information provided in TSTF-577. As described herein, Duke Energy has concluded that the justifications presented in TSTF-577 and the safety evaluation prepared by the NRC staff are applicable to HBRSEP2 and justify this amendment for the incorporation of the changes to the HBRSEP2 TS.

The current SG TS requirements are based on TSTF-510, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection." HBRSEP2 is a single unit site. The Unit No. 2 SGs have Alloy 600 thermally treated (Alloy 600TT) tubes.

The initial inspection period described in the SG Program, paragraph d.2, began December 8, 2020. Duke Energy will submit a SG Tube Inspection Report meeting the revised TS 5.6.8 requirements within 30 days after implementation of the license amendment.

2.2 Variations

Duke Energy is proposing the following variations from the TS changes described in TSTF-577 or the applicable parts of the NRC staff's safety evaluation:

1. The HBRSEP2 TS utilize different numbering than the Standard Technical Specifications on which TSTF-577 was based. Specifically, the NUREG-1431 STS for Westinghouse plants uses TS 5.6.7 for the Steam Generator Tube Inspection Report TS and HBRSEP2 uses TS 5.6.8. This difference is administrative and does not affect the applicability of TSTF-577 to the HBRSEP2 TS.

2. Duke Energy is proposing a HBRSEP2 SG tube inspection period of 72 effective full power months (EFPM) for the inspection period that began December 8, 2020. This is a variation because HBRSEP2 has not previously performed a SG inspection with enhanced probes. However, for all future HBRSEP SG tube inspections, enhanced probes will be utilized in accordance with TSTF-577. None of the HBRSEP2 SG tubes have ever experienced cracking other than in regions that are exempt from inspection by alternate repair criteria.

The justification for this technical variation from TSTF-577 is provided in Attachment 3 and reflects discussions between Duke Energy and the NRC staff regarding the proposed amendment from a public meeting on June 24, 2021 (ADAMS Accession No. ML21182A220).

The HBRSEP2 SG Program TS currently contains a provision for an alternate tube plugging criteria. The description of the alternate tube plugging criteria in the proposed change are equivalent to the descriptions in the current TS.

3.0 REGULATORY ANALYSIS

3.1 No Significant Hazards Consideration Analysis

Duke Energy Progress, LLC (Duke Energy) requests adoption of TSTF-577, "Revised Frequencies for Steam Generator Tube Inspections," which is an approved change to the Standard Technical Specifications (STS), into the H.B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2) Technical Specifications (TS). The TS related to steam generator (SG) tube inspections and reporting are revised based on operating history. Duke Energy is proposing a HBRSEP2 SG tube inspection period of 72 effective full power months (EFPM) for the inspection period that began December 8, 2020, which is a variation from the TS changes described in TSTF-577 because 100% of the SG tubes have not been inspected with enhanced probes.

Duke Energy has evaluated if a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The proposed change revises the inspection frequencies for SG tube inspections and associated reporting requirements. The SG inspections are conducted as part of the SG Program to ensure and demonstrate that performance criteria for tube structural integrity and accident leakage integrity are met. These performance criteria are consistent with the plant design and licensing basis. With the proposed changes to the inspection frequencies, the SG Program must still demonstrate that the performance criteria are met. As a result, the probability of any accident previously evaluated is not significantly increased and the consequences of any accident previously evaluated are not significantly increased.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No

   The proposed change revises the inspection frequencies for SG tube inspections and associated reporting requirements. The proposed change does not alter the design function or operation of the SGs or the ability of an SG to perform the design function. The SG tubes continue to be required to meet the SG Program performance criteria. The proposed change does not create the possibility of a new or different kind of accident due to credible new failure mechanisms, malfunctions, or accident initiators that are not considered in the design and licensing bases.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

   Response: No

   The proposed change revises the inspection frequencies for SG tube inspections and associated reporting requirements. The proposed change does not change any of the controlling values of parameters used to avoid exceeding regulatory or licensing limits. The proposed change does not affect a design basis or safety limit, or any controlling value for a parameter established in the Updated Final Safety Analysis Report (UFSAR) or the license.

   Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, Duke Energy concludes that the proposed change presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

3.2 Conclusion

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

4.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

ATTACHMENT 1

PROPOSED TECHNICAL SPECIFICATION CHANGES (MARK-UP)

[7 pages follow this cover page]

5.5.9 Steam Generator (SG) Program

~~A Steam Generator~~ An SG Program shall be established and implemented to ensure that SG tube integrity is maintained. In addition, the ~~Steam Generator~~ SG Program shall include the following:

a. Provisions for condition monitoring assessments. Condition monitoring assessment means an evaluation of the "as found" condition of the tubing with respect to the performance criteria for structural integrity and accident induced leakage. The "as found" condition refers to the condition of the tubing during an SG inspection outage, as determined from the inservice inspection results or by other means, prior to the plugging of tubes. Condition monitoring assessments shall be conducted during each outage during which the SG tubes are inspected or plugged to confirm that the performance criteria are being met.

b. Performance criteria for SG tube integrity. SG tube integrity shall be maintained by meeting the performance criteria for tube structural integrity, accident induced leakage, and operational LEAKAGE.

   1. Structural integrity performance criterion: All in-service ~~steam generator~~ SG tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down) and all anticipated transients included in the design specification, and design basis accidents. This includes retaining a safety factor of 3.0 against burst under normal steady state full power operation primary-to-secondary pressure differential and a safety factor of 1.4 against burst applied to the design basis accident primary-to-secondary pressure differentials. Apart from the above requirements, additional loading conditions associated with the design basis accidents, or combination of accidents in accordance with the design and licensing basis, shall also be evaluated to determine if the associated loads contribute significantly to burst or collapse. In the assessment of tube integrity, those loads that do significantly affect burst or collapse shall be determined and assessed in combination with the loads due to pressure with a safety factor of 1.2 on the combined primary loads and 1.0 on axial secondary loads.

   2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG. Leakage is not to exceed 150 gallons per day per SG.

   3. The operational LEAKAGE performance criterion is specified in LCO 3.4.13, "RCS Operational LEAKAGE."

(continued)

5.5.9 Steam Generator (SG) Program
(continued)

c. Provisions for SG tube plugging criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding the following criteria shall be plugged: 47% of the nominal tube wall thickness if the next inspection interval of that tube is ≤ 12 months, and a 2% reduction in the plugging criteria for each 12 month period until the next inspection of the tube.

The following alternate tube plugging criteria shall be applied as an alternative to the preceding criteria:

Tubes with service-induced flaws located greater than 18.11 inches below the top of the tubesheet do not require plugging. Tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to 18.11 inches below the top of the tubesheet shall be plugged upon detection.

INSERT 1

d. Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet and that may satisfy the applicable tube plugging criteria. The tube-to-tubesheet weld is not part of the tube. In addition to meeting the requirements of d.1, d.2, and d.3 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube integrity is maintained until the next SG inspection. An degradation assessment shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations.

1. Inspect 100% of the tubes in each SG during the first refueling outage following SG installation.

INSERT 2

2. ~~After the first refueling outage following SG installation, inspect each SG at least every 48 effective full power months or at least every other refueling outage (whichever results in more frequent inspections). In addition, the minimum number of tubes inspected at each scheduled inspection shall be the number of tubes In all SGs divided by the number of SG inspection outages scheduled in each Inspection period as defined in a, b, and c below. If a degradation assessment indicates the potential for a type of degradation to occur at a location not previously Inspected with a technique capable of detecting this type of degradation at this location and that may satisfy~~

(continued)

5.5.9 Steam Generator (SG) Program
(continued)

~~the applicable tube plugging criteria, the minimum number of locations inspected with such a capable inspection technique during the remainder of the inspection period may be prorated. The fraction of locations to be inspected for this potential type or degradation at this location at the end of the inspection period shall be no less than the ratio of the number of times the SG is scheduled to be inspected in the inspection period after the determination that a new form of degradation could potentially be occurring at this location divided by the total number of times the SG is scheduled to be inspected in the inspection period. Each inspection period defined below may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period and the subsequent inspection period begins at the conclusion of the included SG inspection outage.~~

~~a) After the first refueling outage following SG installation, inspect 100% of the tubes during the next 120 effective full power months. This constitutes the first inspection period;~~

~~b) During the next 96 effective full power months, inspect 100% of the tubes. This constitutes the second inspection period; and~~

~~c) During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power months. This constitutes the third and subsequent inspection periods.~~

INSERT 3

3. If crack indications are found in any portion of a SG tube ~~not excluded above~~, then the next inspection for each affected and potentially affected SG for the degradation mechanism that caused the crack indication shall [be at the next] ~~not exceed 24 effective full power months or one~~ refueling outage ~~(whichever results in more frequent inspections)~~ [INSERT 4]. If definitive information, such as from examination of a pulled tube, diagnostic non-destructive testing, or engineering evaluation indicates that a crack-like indication is not associated with a crack(s), then the indication need not be treated as a crack.

e. Provisions for monitoring operational primary to secondary LEAKAGE.

5.5.10 Secondary Water Chemistry Program

This program provides controls for monitoring secondary water chemistry to inhibit SG tube degradation. The program shall include:

a. Identification of critical parameters, their sampling frequency, sampling points, and control band limits;

(continued)

5.6 Reporting Requirements (continued)

5.6.7 Tendon Surveillance Report

a. Notification of a pending sample tendon test, along with detailed acceptance criteria, shall be submitted to the NRC at least two months prior to the actual test.

b. A report containing the sample tendon test evaluation shall be submitted to the NRC within six months of conducting the test.

5.6.8 Steam Generator Tube Inspection Report

A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:

INSERT 5

~~a. The scope of inspections performed on each SG.~~

~~b. Degradation mechanisms found.~~

~~c. Nondestructive examination techniques utilized for each degradation mechanism.~~

~~d. Location, orientation (if linear), and measured sizes (if available) of service induced indications.~~

~~e. Number of tubes plugged during the inspection outage for each active degradation mechanism.~~

~~f. The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator.~~

~~g. The results of condition monitoring, including the results of tube pulls and in-situ testing.~~

~~h. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of the report,~~

~~i. The calculated accident induced leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than 1.87 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined, and~~

5.6 Reporting Requirements (continued)

5.6.8 Steam Generator Tube Inspection Report (continued)

i ~~j~~. The results of monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

INSERT 1

, except for any portions of the tube that are exempt from inspection by alternate repair criteria,

INSERT 2

After the first refueling outage following SG installation, inspect 100% of the tubes in each SG at least every 54 effective full power months, which defines the inspection period. If none of the SG tubes have ever experienced cracking other than in regions that are exempt from inspection by alternate repair criteria and the SG inspection was performed with enhanced probes, the inspection period may be extended to 72 effective full power months. Additionally, the inspection period that began December 8, 2020 may be 72 effective full power months without prior performance of a SG inspection using enhanced probes. Enhanced probes have a capability to detect flaws of any type equivalent to or better than array probe technology. The enhanced probes shall be used from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet except any portions of the tube that are exempt from inspection by alternate repair criteria. If there are regions where enhanced probes cannot be used, the tube inspection techniques shall be capable of detecting all forms of existing and potential degradation in that region.

INSERT 3

, excluding any region that is exempt from inspection by alternate repair criteria

INSERT 4

, but may be deferred to the following refueling outage if the 100% inspection of all SGs was performed with enhanced probes as described in paragraph d.2

INSERT 5

a. The scope of inspections performed on each SG;

b. The nondestructive examination techniques utilized for tubes with increased degradation susceptibility;

c. For each degradation mechanism found:

    1. The nondestructive examination techniques utilized;

    2. The location, orientation (if linear), measured size (if available), and voltage response for each indication. For tube wear at support structures less than 20 percent through-wall, only the total number of indications needs to be reported;

3. A description of the condition monitoring assessment and results, including the margin to the tube integrity performance criteria and comparison with the margin predicted to exist at the inspection by the previous forward-looking tube integrity assessment;

4. The number of tubes plugged during the inspection outage.

d. An analysis summary of the tube integrity conditions predicted to exist at the next scheduled inspection (the forward-looking tube integrity assessment) relative to the applicable performance criteria, including the analysis methodology, inputs, and results;

e. The number and percentage of tubes plugged to date, and the effective plugging percentage in each SG;

f. The results of any SG secondary side inspections;

g. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of the report;

h. The calculated accident induced leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than 1.87 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined; and

ATTACHMENT 2

REVISED TECHNICAL SPECIFICATION PAGES

[5 pages follow this cover page]

5.5.9 Steam Generator (SG) Program

An SG Program shall be established and implemented to ensure that SG tube integrity is maintained. In addition, the SG Program shall include the following:

a. Provisions for condition monitoring assessments. Condition monitoring assessment means an evaluation of the "as found" condition of the tubing with respect to the performance criteria for structural integrity and accident induced leakage. The "as found" condition refers to the condition of the tubing during an SG inspection outage, as determined from the inservice inspection results or by other means, prior to the plugging of tubes. Condition monitoring assessments shall be conducted during each outage during which the SG tubes are inspected or plugged to confirm that the performance criteria are being met.

b. Performance criteria for SG tube integrity. SG tube integrity shall be maintained by meeting the performance criteria for tube structural integrity, accident induced leakage, and operational LEAKAGE.

   1. Structural integrity performance criterion: All in-service SG tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cool down) and all anticipated transients included in the design specification, and design basis accidents. This includes retaining a safety factor of 3.0 against burst under normal steady state full power operation primary-to-secondary pressure differential and a safety factor of 1.4 against burst applied to the design basis accident primary-to-secondary pressure differentials. Apart from the above requirements, additional loading conditions associated with the design basis accidents, or combination of accidents in accordance with the design and licensing basis, shall also be evaluated to determine if the associated loads contribute significantly to burst or collapse. In the assessment of tube integrity, those loads that do significantly affect burst or collapse shall be determined and assessed in combination with the loads due to pressure with a safety factor of 1.2 on the combined primary loads and 1.0 on axial secondary loads.

   2. Accident induced leakage performance criterion: The primary to secondary accident induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG. Leakage is not to exceed 150 gallons per day per SG.

   3. The operational LEAKAGE performance criterion is specified in LCO 3.4.13, "RCS Operational LEAKAGE."

(continued)

5.5.9 Steam Generator (SG) Program
(continued)

c. Provisions for SG tube plugging criteria. Tubes found by inservice inspection to contain flaws with a depth equal to or exceeding the following criteria shall be plugged: 47% of the nominal tube wall thickness if the next inspection interval of that tube is ≤ 12 months, and a 2% reduction in the plugging criteria for each 12 month period until the next inspection of the tube.

The following alternate tube plugging criteria shall be applied as an alternative to the preceding criteria:

Tubes with service-induced flaws located greater than 18.11 inches below the top of the tubesheet do not require plugging. Tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to 18.11 inches below the top of the tubesheet shall be plugged upon detection.

d. Provisions for SG tube inspections. Periodic SG tube inspections shall be performed. The number and portions of the tubes inspected and methods of inspection shall be performed with the objective of detecting flaws of any type (e.g., volumetric flaws, axial and circumferential cracks) that may be present along the length of the tube, from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet, except for any portions of the tube that are exempt from inspection by alternate repair criteria, and that may satisfy the applicable tube plugging criteria. The tube-to-tubesheet weld is not part of the tube. In addition to meeting the requirements of d.1, d.2, and d.3 below, the inspection scope, inspection methods, and inspection intervals shall be such as to ensure that SG tube integrity is maintained until the next SG inspection. An degradation assessment shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations.

1. Inspect 100% of the tubes in each SG during the first refueling outage following SG installation.

2. After the first refueling outage following SG installation, inspect 100% of the tubes in each SG at least every 54 effective full power months, which defines the inspection period. If none of the SG tubes have ever experienced cracking other than in regions that are exempt from inspection by alternate repair criteria and the SG inspection was performed with enhanced probes, the inspection period may be extended to 72 effective full power months. Additionally, the inspection

(continued)

5.5.9 Steam Generator (SG) Program
(continued)

period that began December 8, 2020 may be 72 effective full power months without prior performance of a SG inspection using enhanced probes. Enhanced probes have a capability to detect flaws of any type equivalent to or better than array probe technology. The enhanced probes shall be used from the tube-to-tubesheet weld at the tube inlet to the tube-to-tubesheet weld at the tube outlet except any portions of the tube that are exempt from inspection by alternate repair criteria. If there are regions where enhanced probes cannot be used, the tube inspection techniques shall be capable of detecting all forms of existing and potential degradation in that region.

3. If crack indications are found in any portion of a SG tube, excluding any region that is exempt from inspection by alternate repair criteria, then the next inspection for each affected and potentially affected SG for the degradation mechanism that caused the crack indication shall be at the next refueling outage, but may be deferred to the following refueling outage if the 100% inspection of all SGs was performed with enhanced probes as described in paragraph d.2. If definitive information, such as from examination of a pulled tube, diagnostic non-destructive testing, or engineering evaluation indicates that a crack-like indication is not associated with a crack(s), then the indication need not be treated as a crack.

e. Provisions for monitoring operational primary to secondary LEAKAGE.

5.5.10 Secondary Water Chemistry Program

This program provides controls for monitoring secondary water chemistry to inhibit SG tube degradation. The program shall include:

a. Identification of critical parameters, their sampling frequency, sampling points, and control band limits;

(continued)

5.6 Reporting Requirements (continued)

5.6.7 Tendon Surveillance Report

a. Notification of a pending sample tendon test, along with detailed acceptance criteria, shall be submitted to the NRC at least two months prior to the actual test.

b. A report containing the sample tendon test evaluation shall be submitted to the NRC within six months of conducting the test.

5.6.8 Steam Generator Tube Inspection Report

A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:

a. The scope of inspections performed on each SG;

b. The nondestructive examination techniques utilized for tubes with increased degradation susceptibility;

c. For each degradation mechanism found:

1. The nondestructive examination techniques utilized;

2. The location, orientation (if linear), measured size (if available), and voltage response for each indication. For tube wear at support structures less than 20 percent through-wall, only the total number of indications needs to be reported;

3. A description of the condition monitoring assessment and results, including the margin to the tube integrity performance criteria and comparison with the margin predicted to exist at the inspection by the previous forward-looking tube integrity assessment;

4. The number of tubes plugged during the inspection outage.

d. An analysis summary of the tube integrity conditions predicted to exist at the next scheduled inspection (the forward-looking tube integrity assessment) relative to the applicable performance criteria, including the analysis methodology, inputs, and results;

e. The number and percentage of tubes plugged to date, and the effective plugging percentage in each SG;

f. The results of any SG secondary side inspections;

(continued)

5.0 ADMINISTRATIVE CONTROLS

5.6 Reporting Requirements (continued)

5.6.8 Steam Generator Tube Inspection Report (continued)

g. The primary to secondary leakage rate observed in each SG (if it is not practical to assign the leakage to an individual SG, the entire primary to secondary leakage should be conservatively assumed to be from one SG) during the cycle preceding the inspection that is the subject of this report;

h. The calculated accident induced leakage rate from the portion of the tubes below 18.11 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than 1.87 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined; and

i. The results of monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

ATTACHMENT 3

JUSTIFICATION FOR TECHNICAL VARIATION FROM TSTF-577

[5 pages follow this cover page]

The following information is provided to justify the H.B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2) technical variation from TSTF-577, “Revised Frequencies for Steam Generator Tube Inspections," that is described in Section 2.2 of the Enclosure to the license amendment request. The information provided in this Attachment reflects discussions between Duke Energy and the U.S. Nuclear Regulatory Commission (NRC) staff from a public meeting on June 24, 2021 (ADAMS Accession No. ML21182A220). Specifically, Duke Energy Progress, LLC (Duke Energy) proposes a steam generator (SG) tube inspection period of 72 effective full power months (EFPM) for HBRSEP2 for the inspection period that began December 8, 2020 without performance of an inspection with enhanced probes.

The original SGs (tube bundle without channel heads) at HBRSEP2 were replaced at the end of cycle (EOC) 9 in 1984 and the replacement SGs have been operating since 1985. A stretch and measurement uncertainty recapture (MUR) uprate have been implemented at HBRSEP2, which were approved in 1979 and 2002, respectively.

The three Westinghouse Model 44F SGs have 3,214 thermally treated U-tubes, fabricated from Inconel Alloy 600TT. The outside diameter of each U-tube is 0.875 inch and has an average wall thickness of 0.050 inch. The tubes are supported on the secondary side by six broached tube support plates (TSPs), fabricated from ferritic stainless steel. A flow distribution baffle (FDB) with round holes fabricated from ferritic stainless steel is located between the bottom TSP and the tubesheet. Also, the center portion of the FDB is missing by design. Figure 1 demonstrates the relative position of these tube supports. There are forty-five rows and ninety-two columns in the tube bundle.

Cycle 32 was 1.86 effective full power years (EFPY), a nominal 24-month fuel cycle. The HBRSEP2 steam generators had operated 29.6 EFPY at the last SG tube inspection at the EOC 32 when the current 100% bobbin inspection was performed. The inspection prior to that was completed at the EOC 30. The SGs had operated 3.29 EFPY from the EOC 30 inspection up to the performance of the EOC 32 inspection.

The T_{hot} is less than 605 degrees Fahrenheit in all loops. Corrosion in the SG tubes is not expected for such a relatively low T_{hot} value.

On the secondary side, the SG utilizes a feed ring design with J tubes which would not preclude the introduction of foreign objects into one of the SGs. Therefore, Duke Energy implemented a robust foreign material exclusion (FME) procedure in 2014 to preclude the introduction of foreign material into the plant and therefore the SGs. Recent self-assessments and health monitoring indicate the FME program is performing well.

In 2010, HBRSEP2 initiated a review to identify components that could contain spiral wound gaskets lacking an inner ring to prevent unwinding of the gasket into the process flow, and to replace those components with gaskets containing an inner ring. Actions included revising the piping specification to eliminate gaskets without an inner ring, removing such gaskets from the warehouse, replacing gaskets without an inner ring in the secondary system and training maintenance to recognize the difference between gaskets with and without an inner ring.

For the proposed change described in this license amendment request for HBRSEP2, Duke Energy is not deviating from the requirements described in NEI 97-06, "Steam Generator Guidelines,” which is supported by several EPRI guidelines, such as:

- PWR Steam Generator Examination Guidelines
- Steam Generator Integrity Assessment Guidelines
- Steam Generator In-Situ Pressure Test Guidelines
- PWR Primary-to-Secondary Leak Guidelines
- PWR Primary Water Chemistry Guidelines
- PWR Secondary Water Chemistry Guidelines

The inspection report for the most recent HBRSEP2 SG inspection at the EOC 32 contains the recent operational experience and condition monitoring summary (ADAMS Accession No. ML21147A263)

Twenty-five (25) indications of Anti-Vibration Bar (AVB) wear were reported in eighteen tubes. The deepest of these flaws measured 34% through wall (TW). The maximum growth rate was 0.91 %TW/EFPY. Five indications of TSP wear were reported in five tubes. The deepest of these flaws measured 27%TW. The maximum growth rate was 0.61 %TW/EFPY. Fifty-four (54) indications of foreign object wear were reported in forty-eight (48) tubes. The deepest foreign object wear indication measured 38%TW. Of the fifty-four (54) indications, there were 20 new foreign object wear indications identified in EOC 32. There was not a foreign object identified at these locations that remains in service, which would indicate the foreign objects are continuing to enter the SGs. Historically, the foreign object indications wear and stop growing. All these wear indications are easily detected by the bobbin coil.

The HBRSEP2 SG tubes have never experienced cracking other than in regions that are exempt from inspection by Technical Specification 5.5.9, “Steam Generator (SG) Program.” Recent (April 2021) operating experience within the Duke Energy fleet at Catawba Nuclear Station, Unit 2 demonstrated that an inspection using enhanced probes did not identify additional crack like indications.

To further support the proposed variation from TSTF-577, Foreign Object Search and Retrieval (FOSAR) was performed in all three HBRSEP2 SGs. A total of six metallic objects were identified:

- Two of those objects were removed.
- One (machine curl) was previously bounded by plugging and stabilizing around the identified tube during EOC 30. This object was still present at the EOC 32.
- Three objects were evaluated to be left in place as-is. The wear evaluation concluded that the metallic objects could remain in the SG for 6 EFPY (three cycles) of operation.

At the EOC 28, there were six metallic objects identified. All six metallic objects were removed from the SGs.

At the EOC 30, there were nine metallic objects identified. Two of those objects were in a low flow region or fixed in place. Six were removed. One was plugged due to wear and preventively plugged around.

At the EOC 32, there were metallic foreign objects found in the sludge lance filters that would indicate that legacy foreign objects are continuing to be removed from the SGs. There were four foreign objects that had the potential to cause wear if they had been in a high-flow region and remained there.

There is currently no detectable primary-to-secondary leakage.

A chemical cleaning of the steam generators (Deposit Minimization Treatment (DMT)) was performed in 2013 at EOC 28 and a total of 4597 pounds of deposit was removed. Currently the total iron accumulated in the HBRSEP2 SGs is projected to be 3603 pounds by iron transport.

The current HBRSEP2 operational assessment (OA) was predicted for 6 EFPY or three cycles. The existing mechanisms considered in the OA were tube wear from AVBs, broached and drill TSPs, and presumed foreign objects. All mechanisms were projected deterministically.

For AVB wear, a bounding growth rate of 1.5% TW/EFPY, which exceeds the largest observed growth rate of 0.91% TW/EFPY, is applied for the OA. For most existing flaws, no growth was observed from EOC 30 to EOC 32.

For broached TSP wear, a bounding growth rate of 5.0% TW/EFPY, which exceeds the largest observed growth rate of 0.61% TW/EFPY, is applied to the OA. For the few flaws that have measurements at both EOC 30 to EOC 32, negligible growth was exhibited.

No drilled TSP wear indications were observed at EOC 32.

Predicted Margin to the Tube Integrity Performance Criteria					
Degradation Mechanism (Wear)	Largest indication depth left in service (%TW)	NDE Uncertainty	Growth	Projected depth at EOC 35 (%TW)	OA limit depth (%TW)
AVB	34	Yes	Yes	49.7	54
Broached	22	Yes	Yes	60.2	63.5
Drilled	10	Yes	Yes	40	57.6
FO	38	Yes	No	38	54.3

There are 42 high stress tubes remaining in service. In 2020, the data was rereviewed by Westinghouse and no additional tubes were identified. The 42 tubes were inspected full length with the array probe and there was no degradation noted during the EOC 32 inspection.

HBRSEP2 has not experienced any stress corrosion cracking (SCC) degradation to date (except in regions that are exempt from inspection by the alternate repair criteria in Technical Specification (TS) 5.5.9). However, an operational assessment was performed for the most likely potential SCC mechanisms to occur based on industry experience. The potential mechanisms considered were circumferential outside diameter stress corrosion at the expansion transition (Circ ODSCC), axial outside diameter stress corrosion at the expansion transition (Axial ODSCC) and axial outside diameter stress corrosion at the tube support plate intersections (TSP ODSCC). These assessments bound the remaining SCC mechanisms. The following table provides the results of the probabilistic assessments for each SCC mechanism considered:

Predicted Margin to the Tube Integrity Performance Criteria for Potential Mechanisms						
Degradation Mechanism (SCC)	Number of non-detected flaws	Cycle duration (EFPY)	Number of cycles	Probability of burst (POB) (%)	Probability of accident induced leakage (POAIL) (%)	Leak rate at lower 5% burst pressure (gpm)
Circ ODSCC	2	2	2	1.213	0.936	0.00
Circ ODSCC	2	2	3	2.911	2.159	0.00
Axial ODSCC	2	2	2	1.465	0.038	0.00
Axial ODSCC	2	2	3	3.085	0.084	0.0004
TSP ODSCC	2	2	2	1.709	0.377	0.00
TSP ODSCC	2	2	3	4.274	1.232	0.011
Acceptance Criterion				≤5%	≤5%	≤0.06 gpm

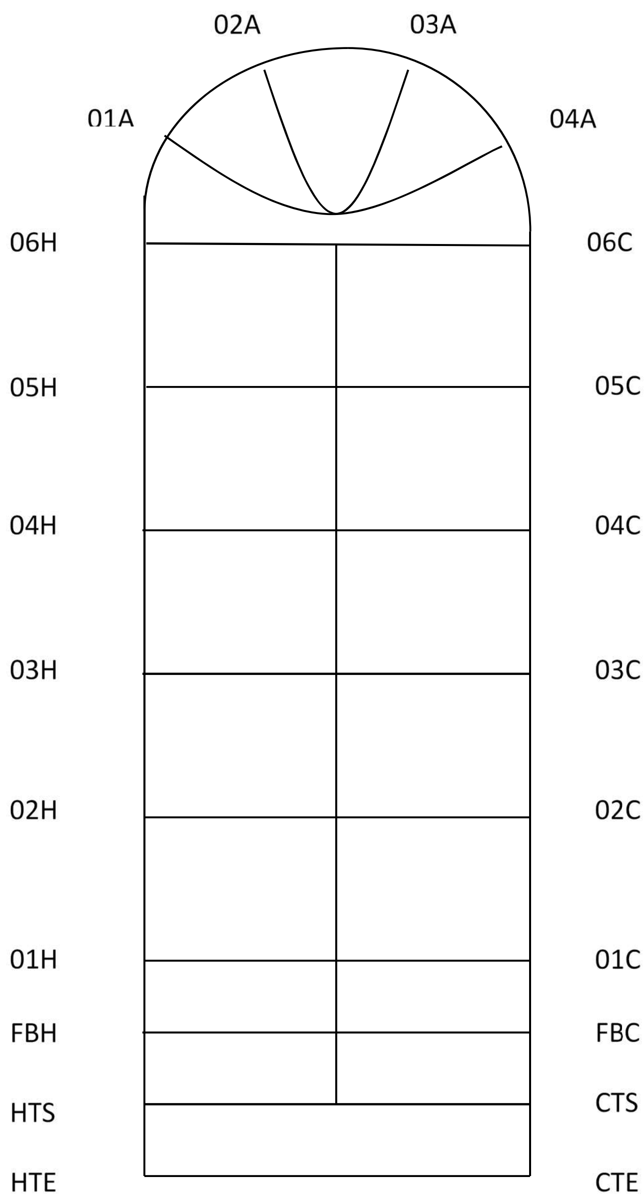
There are no administrative limits on primary to secondary leakage (mitigating strategies) planned because of the proposed change and associated variation from TSTF-577 for the first two cycles. The HBRSEP2 TS primary to secondary leakage limit through any one SG is 75 gallons per day (gpd). The action levels as specified in the EPRI PWR Primary-to-Secondary Leak Guidelines are followed. This leakage rate limit is a defense-in-depth strategy to defend against a single foreign object or a foreign object intrusion event.

In accordance with the H* alternate repair criteria in TS taking into consideration potential degradation mechanisms and then projecting leakage, the administrative primary to secondary leakage limit for HBRSEP2 cycle 35 would be 63.8 gpd.

In conclusion, after 29.6 EFPY of operation at HBRSEP2, the SG tube degradation is minimal, predictable, and easily detected by the bobbin coil. Corrosion is not expected due to the low T_{hot}. The existing and potential degradation mechanisms have been projected to meet the structural and leakage performance criterion for three cycles or six EFPY or until the EOC 35. HBRSEP2 has programmatically minimized the potential impact of foreign objects.

Duke Energy is requesting a SG tube inspection period of 72 EFPM without an enhanced probe inspection for the HBRSEP2 inspection period that began December 8, 2020 and finds that such a period is acceptable based on the low amount and severity of degradation, the low T_{hot}, the history of cracking in the Alloy 600 TT fleet, and projecting to meet the structural and leakage performance criteria for 6 EFPY for existing and potential degradation mechanisms.

Figure 1: Robinson Elevation Map



Westinghouse Model 44 F

Tube Information
Number of tubes: 3214 Flush
Material: Alloy 600 TT
Nominal Dia: 0.875”
Nominal Wall: 0.050”

Tube Support Plate Information
Type: Quatrefoil broached
Material: Ferritic SS
FDB Type: Round hole
FDB Material: Ferritic SS