TENNESSEE VALLEY AUTHORITY

Sequoyah Nuclear Plant, P.O. Box 2000, Soddy Daisy, Tennessee 37384

December 19, 2022

10 CFR 72.7

ATTN: Document Control Desk
Director, Division of Fuel Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Sequoyah Nuclear Plant, Units 1 and 2
Renewed Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327, 50-328, and 72-034

Subject: **Sequoyah Nuclear Plant – Response to Request for Supplemental Information (D-RSI) Request for Exemption from Non-Destruction-Examination Compliance (EPID No. L-2022-LLE-0027)**

Reference:

1. TVA letter to NRC , "Sequoyah Nuclear Plant – Request for Exemption from Various 10 CFR Part 72 Regulations Resulting from Non-Destruction-Examination Compliance," dated August 4, 2022

2. NRC letter to SQN, "Request For Supplemental Information – Request for Exemption from Various 10 CFR Part 72 Regulations Related to Non-Destructive Examination Compliance, Sequoyah Nuclear Plant Independent Spent Fuel Storage Installation [Enterprise Project Identification Number L-2022-LLE-0027]," dated November 18, 2022

3. Holtec International letter to NRC, "Supporting Document for Sequoyah Nuclear Plant ISFSI Exemption Request," dated December 12, 2022"

Pursuant to 10 CFR 72.7, "Specific exemption," TVA requested an exemption from the requirements of 10 CFR 72.212(a)(2), 72.212(b)(3), 72.212(b)(5)(i), 72.212(b)(11) and 72.214 by Reference 1.

The NRC review of the exemption request identified information necessary to continue evaluation. This necessary information is sought under Reference 2. Enclosure 1 provides the TVA's response to Reference 2. In response to the NRC Structural Discipline RSI-S1, Holtec International has submitted a copy of Holtec Report HI-2094418, "Structural Calculation Package for HI-STORM FW System," in Reference 3. The Holtec letter refers to the Sequoyah Nuclear Plant docket numbers and the Enterprise Project Identification Number associated with this license activity.

This document contains no new regulatory commitments. If you have any questions, please contact Rick Medina, Site Licensing Manager, at (423) 843-8129.

Respectfully,

Reneau, William Christopher

Digitally signed by Reneau, William Christopher
Date: 2022.12.19 07:53:54 -05'00'

Thomas Marshall
Site Vice President
Sequoyah Nuclear Plant

Enclosure:
TVA Response to Request for Supplemental Information

cc:
NRC Regional Administrator - Region II
NRR Project Manager - Sequoyah Nuclear Plant
NRC Senior Resident Inspector – Sequoyah Nuclear Plant

ENCLOSURE

TENNESSEE VALLEY AUTHORITY (TVA)
SEQUOYAH NUCLEAR PLANT (SQN)
INDEPENDENT SPENT FUEL STORAGE INSTALLATION

TVA RESPONSE TO REQUEST FOR SUPPLEMENTAL INFORMATION

NRC Material Discipline
RSI-M1

Provide the following supplemental information on the original shell-to-shell longitudinal weld, the radiography testing (RT) results that identified a defect located in the shell-to-shell longitudinal weld between 4 to 14 inches from the bottom of the multipurpose canister (MPC) baseplate, and the method used in the repair weld.

(a) Describe the welding process used for the original weld.
(b) Describe the original RT results that identified the initial defect(s) located between 4 to 14 inches from the bottom of the MPC baseplate including the size, location, orientation, and type of defect(s).
(c) Describe the original weld joint geometry and a sketch or detailed dimensions of the weld excavation.
(d) Describe the welding process was used for the first repair weld.

The applicant provided that the original RT identified a defect which located in the shell-to-shell longitudinal weld between 4 to 14 inches from the bottom of the MPC baseplate. The applicant stated that this defect required an excavation of approximately 6.5” long, 5/8” wide, and 9/32” deep. However, it is unclear where the defect was located with respect to the original joint configuration. In addition, the welding process used for the repair weld is not described in the exemption request.

This information is necessary to determine compliance with Title 10 of the *Code of Federal Regulations* (10 CFR), 72.236(g), (j), and (l).

TVA Response to RSI-M1
(a) The original weld was welded from both sides using the submerged arc welding (SAW) process utilizing WPS-227HC. SAW is a welding process that involves the formation of an electric arc between a continuously fed consumable electrode and the workpiece. The molten weld pool is shielded from the atmosphere beneath a blanket of powdered flux.

(b) The initial RT identified 3.7 inches of lack of fusion within view 0-1 for Weld No. 21 which is located approximately 4 to 14 inches from the bottom of the MPC baseplate with 0 being at the toe of the circumferential weld as illustrated in Figure 1 on the following page.

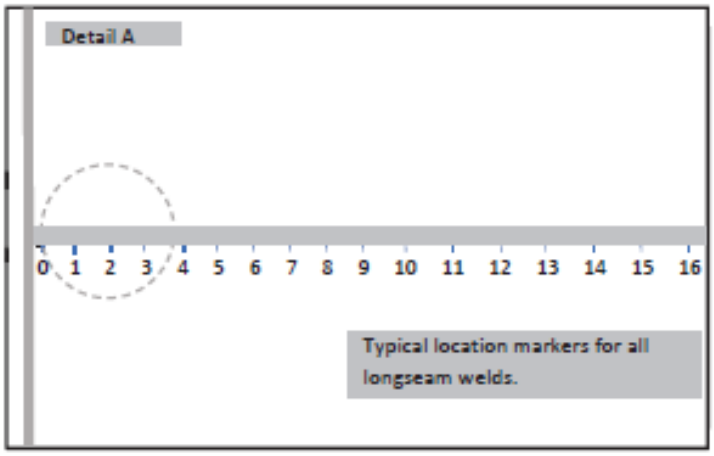


Figure 1: Location Markers on Longitudinal Weld

(c) The original MPC shell-to-shell longitudinal weld joint was a double V-groove. See Figure 2 for additional details. Refer to Weld No. 21 on Figure 3 (MTR 12306-657) for dimensions of the weld excavation area.

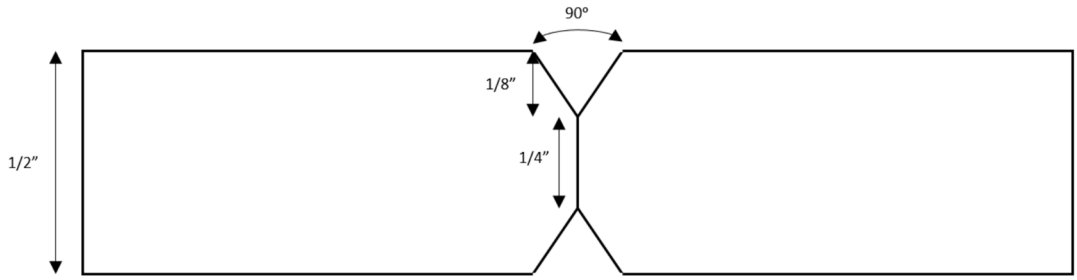


Figure 2: Original MPC shell-to-shell longitudinal weld joint

MANUFACTURING DIVISION
HOLTEC INTERNATIONAL

MTR 12306-657 Rev 0

Report Number			
12306-278 Rev 0			
Page	2	of	2

REPAIR EXCAVATION MAP

NCR or PWRP	12306-888392-52	Operation No.	05

Weld No.	Location/Description	Sketch of excavation (identify length, width, and average depth)
4	13-14 L: 1-1/2" W: 5/8" D: 1/2"	13 14
21	0-1 L: 6-5/8" W: 5/8" D: 9/32"	0 1

Figure 3: MTR 12306-657 Repair Excavation Map

(d) The repair of the MPC shell-to-shell longitudinal weld involved the excavation of the weld defect from a single side using mechanical means (grinding). A sketch of the shell-to-shell joint after excavation of the weld defect is displayed in Figure 4. Once the defect was verified to be removed through visual and liquid penetrant examination, the excavated area was blended uniformly into the surrounding surface with not less than a 3:1 taper and re-welded using the gas tungsten arc welding (GTAW) process utilizing WPS 47HC. GTAW is a welding process that involves the formation of an electric arc between a non-consumable tungsten electrode and the workpiece. During welding the weld filler wire is manually fed into the molten weld pool to create the weld. The molten weld pool is shielded from the atmosphere using inert gas (Argon). The weld repair area is examined by the method(s) Visual (VT), Liquid Penetrant (PT) and RT that originally disclosed the defect.

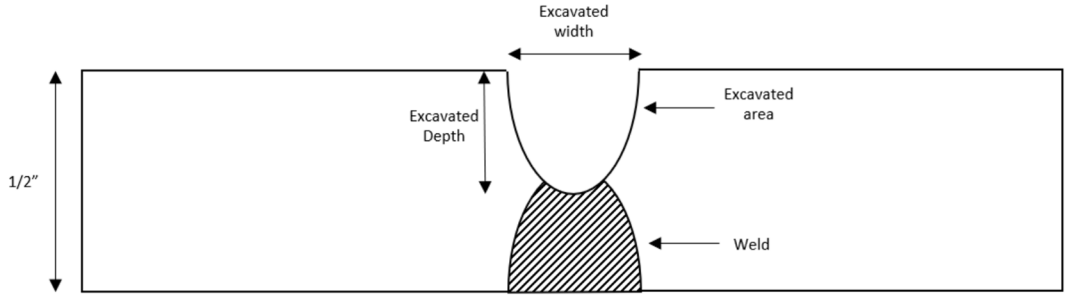


Figure 4: MPC shell-to-shell joint after excavation of the weld defect

NRC Material Discipline
RSI-M2

Provide the following supplemental information on the RT results of the repaired shell-to-shell longitudinal weld that identified a defect located in the shell-to-shell longitudinal weld between 8.5 to 25 inches from the bottom of the MPC baseplate.

(a) Describe the RT results for the repaired weld that identified the defect(s) located between 8.5 to 25 inches from the bottom of the MPC baseplate.
(b) Clarify whether the initial RT did not identify indications that were observed in a second RT in the area from 8.5 to 25 inches from the bottom of the MPC baseplate.
(c) Describe the RT results that identified the defect(s) located between 8.5 to 25 inches from the bottom of the MPC baseplate including the size, location, orientation, and type of defect(s).
(d) Describe the original and repair weld joint geometry and a sketch or detailed dimensions of the weld excavation between 8.5 to 25 inches from the bottom of the MPC baseplate.
(e) Describe the welding process that was used for the second repair weld. The applicant stated that a second RT was performed after the first repair which identified another defect located in the shell-to-shell longitudinal weld. This defect required an excavation of approximately 16.5" long, 5/8" wide, and 1/4" deep. It appears that there is an overlap of 5.5 inches between the two repairs. It is unclear whether the second defect was missed by the original RT, or this excavation was necessary to remove defect(s) in the first repair weld.

This information is necessary to determine compliance with 10 CFR 72.236(g), (j), and (l).

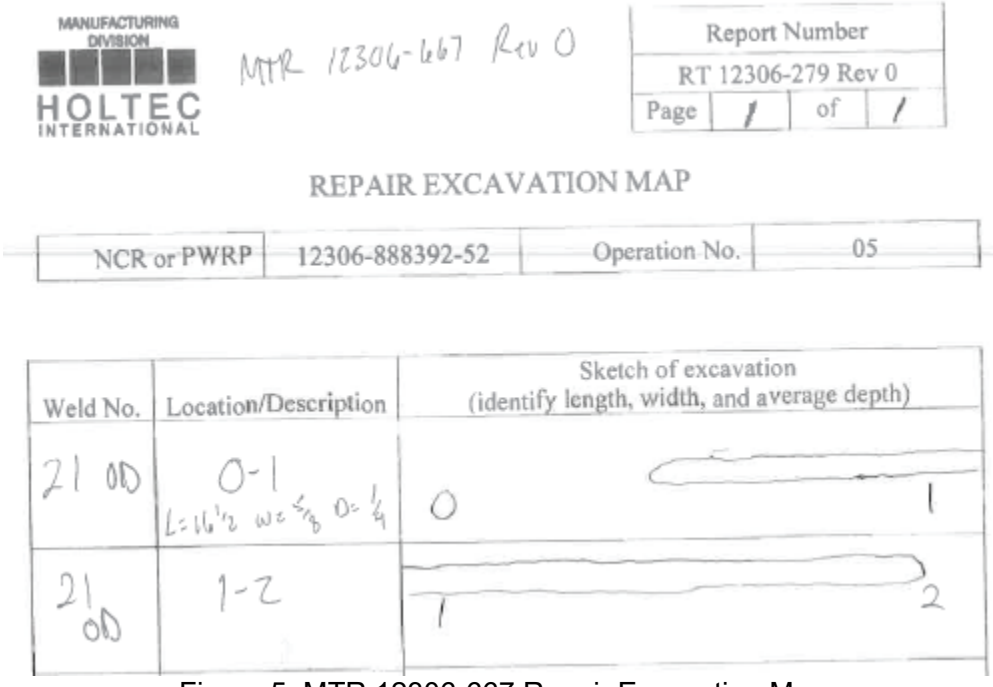
TVA Response to <u>RSI-M2</u>

(a) The RT of the repair area on Weld No. 21 did not identify defect(s) located between 8.5 to 25 inches from the bottom of the MPC baseplate.

(b) The initial RT of view 1-2 which is approximately between 8.5 to 25 inches from the bottom of the MPC baseplate was acceptable and free of any indications. The second iteration of RT identified 0.327 inches of lack of fusion within view 0-1 for Weld No. 21 which is located approximately 4 to 14 inches from the bottom of the MPC baseplate. The removal of the defect via excavation caused the repair area to extend into the adjacent view 1-2 which is approximately 8.5 to 25 inches from the bottom of the baseplate.

(c) No defects were identified within view 1-2 which is approximately 8.5 to 25 inches from the bottom of the baseplate. The second iteration of RT identified 0.327 inches of lack of fusion within view 0-1 for Weld No. 21 which is located approximately 4 to 14 inches from the bottom of the MPC baseplate. The removal of the defect via excavation caused the repair area to extend into the adjacent view 1-2 which is approximately 8.5 to 25 inches from the bottom of the baseplate.

(d) The original MPC shell-to-shell longitudinal weld joint was a double V-groove. See Figure 2 for additional details. A sketch of the shell-to-shell joint after excavation of the weld defect is displayed in Figure 4. Refer to Weld No. 21 on Figure 5 (MTR 12306-667) for dimensions of the weld excavation area.


MANUFACTURING DIVISION
HOLTEC INTERNATIONAL

MTR 12306-667 Rev 0

Report Number			
RT 12306-279 Rev 0			
Page	1	of	1

REPAIR EXCAVATION MAP

NCR or PWRP	12306-888392-52	Operation No.	05

Weld No.	Location/Description	Sketch of excavation (identify length, width, and average depth)
21 OD	0-1 L=16 1/2 W=5/8 D=1/4	0 … 1
21 OD	1-2	1 … 2

Figure 5: MTR 12306-667 Repair Excavation Map

(e) The second defect was not missed by the initial RT. The second iteration of RT identified 0.327 inches of lack of fusion in the repaired weld. The excavation was necessary to remove the lack of fusion in the repaired weld.

NRC Structural Discipline
RSI-S1

Provide revision 20 of Holtec Report HI-2094418, "Structural Calculation Package for HI-STORM FW System," and state why revision 20 is the version used and/or applicable for this exemption request.

As stated in safety evaluation report for the missing radiographic examination (RT), the evaluation mirrors the methodology, acceptance criteria, and finite element model from Supplement 1 of Holtec Report HI-2094418, revision 20, with some exemptions. The evaluation also utilizes the stress results from the finite element analysis provided in the report. However, this analysis report was not included in support of the evaluation.

This information is necessary to evaluate the requested exemption, under 10 CFR 72.7, from the requirements of 10 CFR 72.154(b), 10 CFR 72.212(a)(2), 10 CFR 72.212(b)(5)(i), 10 CFR 72.212(b)(11) and 10 CFR 72.214.

TVA Response to RSI-S1
A copy of Holtec Report HI-2094418, Revision 20, has been provided in Holtec letter from Kimberly Manzione to NRC, "Supporting Document for Sequoyah Nuclear Plant ISFSI Exemption Request," dated December 12, 2022. The Holtec letter references SQN's docket numbers and the Enterprise Project Identification Number for this request.

Revision 20 of the report is consistent with HI-STORM FW Final Safety Analysis Report (FSAR), Revision 6 and Certificate of Compliance, Amendment 3, which are applicable to SQN Independent Spent Fuel Storage Facility licensing basis for this loaded cask.

NRC Structural Discipline
RSI-S2

Evaluate the potential of crack propagation from thermal cycling on potential flaws or imperfections on sections of the multipurpose canister (MPC) longitudinal shell-to-shell weld where the RT was missed.

As described in Holtec Report No. HI-2114830, "HI-STORM FW FSAR," structural welds rely, in part, in welding operations to be performed in accordance with the requirements of codes and standards to ensure, in part, that no risk of crack propagation under the applicable stress levels will occur. However, the structural evaluation does not address the potential of crack propagation of flaws or imperfections that may have not been identified at the MPC longitudinal shell-to-shell weld sections where the RT was missed.

This information is necessary to evaluate the requested exemption, under 10 CFR 72.7, from the requirements of 10 CFR 72.154(b), 10 CFR 72.212(a)(2), 10 CFR 72.212(b)(5)(i), 10 CFR 72.212(b)(11) and 10 CFR 72.214.

TVA Response to RSI-S2
A detailed analysis for crack propagation of flaws or imperfections is not deemed necessary for the section of the MPC shell-to-shell weld that cannot be confirmed by documentary evidence to be radiographed since there is no potential for stress cycling in the unexamined portion of the

repair. As discussed in Paragraph 3.1.2.5 of HI-STORM FW FSAR, Revision 6, fatigue failure is not a credible concern for the MPC since it is not an active system (i.e., no moving parts) and is not subject to significant stress cycling due to rapid temperature changes or significant pressure changes. Therefore, there is no credible concern of fatigue failure even if the unlikely scenario of a flaw introduction during the weld repair is considered.

NRC Structural Discipline
RSI-S3

The safety analysis does not address the effects of local membrane plus primary bending stress at the sections of the MPC longitudinal shell-to-shell weld where the RT was missed.

The safety evaluation of the missing RT on the MPC longitudinal shell-to-shell weld did not consider the impact of local membrane plus primary bending stresses at the affected region. Therefore, it is not clear whether the proposed stress-reduction factor (SRF) the MPC confinement boundary stress intensity limits are met.

This information will be necessary to evaluate the requested exemption, under 10 CFR 72.7, from the requirements of 10 CFR 72.154(b), 10 CFR 72.212(a)(2), 10 CFR 72.212(b)(5)(i), 10 CFR 72.212(b)(11) and 10 CFR 72.214.

TVA Response to RSI-S3
The safety analysis presented in Holtec RRTI-3087-007, Revision 2, presents the maximum stress intensity in the MPC shell between 10 inches and 30 inches from the bottom of the MPC baseplate for all five (5) cases. The presented maximum stress intensity includes contributions from primary membrane, local membrane plus primary bending and secondary stresses although the contributions from local membrane plus primary bending and secondary stresses are expected to be minimal given the separation distance from the shell-to-baseplate or shell-to-lid discontinuities. The maximum stress intensity values are then compared conservatively with the applicable primary membrane stress limits (which are lower than local membrane plus primary bending stress and secondary stress limits) to compute the safety factors.

Therefore, the presented safety analysis considers the effects of local membrane plus primary bending stress and compares the maximum stress intensity results for all cases against the primary membrane stress limits to arrive at conservative safety factors.

NRC Observations: Structural Discipline

The staff has observed the following based on the preliminary review of the information as provided by Sequoyah Nuclear Plant. Note that additional information will be required for resolution. The staff notes that a response to this observational question is not required at this time as part of the RSI response from SQN.

> Adequate technical justification is necessary to demonstrate why a qualification factor of 0.75, as required in ASME Section III, Subsection NG, for a Category A full penetration, is not applicable for the safety evaluation of the missing RT on MPC longitudinal shell-to-shell weld.

Section 3 of exemption request states that the use of a quality factor of 0.75 is an overly conservative lower bound for the SRF associated with the shell-to-shell plate weld since more than 98% of the weld has been examined by RT. However, this argument does not provide adequate technical basis to justify the use of less conservative SRF (e.g., 0.8 vs. 0.75).

This information will be necessary to evaluate the requested exemption, under 10 CFR 72.7, from the requirements of 10 CFR 72.154(b), 10 CFR 72.212(a)(2), 10 CFR 72.212(b)(5)(i), 10 CFR 72.212(b)(11) and 10 CFR 72.214.

TVA Response to Observation

The basis for using a stress reduction factor (SRF) of 0.8 is based on the known condition of the MPC shell-to-shell longitudinal weld and consideration of Interim Staff Guidance (ISG)-15, NUREG-2215, American Society of Mechanical Engineers (ASME) Section VIII, Division 1, and ASME Section III, Subsections ND and NG. The detailed justification is presented below.

As discussed in the request for exemption, the shell-to-shell weld that cannot be confirmed by documentary evidence to be radiographed after repair is about 7.5 inches in length, 5/8 inch wide and 1/4 inch deep. Root and final PT examinations were performed on the entire repaired weld, and the results were acceptable with no further indications.

The MPC shell-to-shell weld is a full penetration joint, which is classified as a Category A joint per Subsection NB. Full penetration welds that are 100% examined using volumetric methods are considered fully effective under Subsection NB of the ASME Code, meaning the stress reduction factor (SRF) is equal to 1.0.

Interim Staff Guidance (ISG)-15 and Standard Review Plan for Spent Fuel Dry Storage Systems and Facilities - Final Report (NUREG-2215) both endorse a SRF of 0.8 for austenitic canisters with lid-to-shell (LTS) weld subject to progressive PT examination. The overall level of inspection performed on the shell-to-shell weld for MPC # 234 is more thorough and statistically more significant than that of a progressive PT examination over the full length of the weld.

ASME Section VIII, Div. 1 (Table UW-12) and ASME Section III, Subsection ND (Paragraph ND-3352) both specify a SRF of 0.85 for Category A joints subject to spot radiography. The level of inspection performed on the entirety of shell-to-shell weld for MPC # 234 far exceeds the minimum Code requirements for spot radiography (6-inch section to be examined for every 50-foot increment of weld per Section UW-52 of ASME Section VIII, Div. 1). It is also noted that, for SA-240 304 stainless steel, the design stress values applicable to Section VIII, Div. 1 and Section III, Subsection ND are generally equal to the design stress intensity values applicable to Section III, Subsection NB, except for minor variances at 300 and 400 degrees Fahrenheit.

ASME Section III, Subsection NG, which applies to core support structures and has the same design stress intensity values as Subsection NB, specifies a joint efficiency (also known as SRF) of 0.75 for a Category A full penetration weld subjected to root and final PT only (i.e., no RT) per Table NG-3352-1. Clearly, this is a conservative lower bound for the SRF associated with the shell-to-shell plate weld for MPC # 234 since more than 98% of the MPC welds has been examined by RT.

Based on the above, it is concluded that a SRF of 0.8 is an appropriate and justifiable value for the re-evaluation of the shell-to-shell repaired weld for MPC # 234. Per the re-evaluation in Holtec RRTI 3087-007, Revision 2, all calculated safety factors remain above 1.0 for all design basis load conditions. This indicates that the shell-to-shell weld has sufficient strength even in

the presence of possible, albeit unlikely, flaws in the small volume of weld that was not volumetrically examined after repair. It is also noted that all calculated safety factors for the MPC shell-to-shell weld would continue to remain above 1.0 even if a SRF of 0.75 is used.