CP&L

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OCT 1 2 2000

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

HNP-00-133

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
REACTOR VESSEL MATERIAL SURVEILLANCE REPORT SUPPLEMENTAL INFORMATION AND REACTOR VESSEL INTEGRITY DATABASE UPDATE

References:

1. HNP-99-157, 11/9/99, REACTOR VESSEL MATERIAL SURVEILLANCE REPORT
2. HNP-00-065, 4/12/00, REQUEST FOR LICENSE AMENDMENT
3. HNP-00-092, 6/2/00, SUPPLEMENTAL INFORMATION – PRESSURE TEMPERATURE REQUIREMENTS
4. NLS-92-097, 4/2/92, REACTOR VESSEL MATERIAL SURVEILLANCE REPORT
5. NLS-89-257, 9/8/89, REACTOR VESSEL MATERIAL SURVEILLANCE REPORT

Dear Sir or Madam:

This letter transmits additional information requested by the NRC regarding the Reactor Vessel Material Surveillance Report (Reference 1). In addition, updates to the NRC Reactor Vessel Integrity Database (RVID) are provided.

Attachment A summarizes the NRC questions and provides the requested information.

Based on the results of the capsule 'X' analysis, CP&L submitted proposed changes to the HNP Technical Specifications (References 2 and 3). These proposed changes were implemented in Amendment 100 to the HNP Technical Specifications. Updates to the NRC Reactor Vessel Integrity Database (RVID), based upon the analysis of the third reactor vessel surveillance capsule 'X' (Reference 1), have been made to the NRC. CP&L is providing additional changes, which are included as Attachment B and discussed below.

- The existing annotations in the database for the reactor vessel material chemistry data have been revised to clarify that "best estimate" values are only provided for copper and nickel.

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- The existing annotation in the database for the beltline welds chemistry, identifying that the old chemistry data is used to determine chemistry factors, is no longer applicable, since the "best estimate" values were used in the capsule 'X' analyses.

- Two annotations regarding the determination of upper shelf energy (USE) for shell plate B4197-2 and weld 5P6771 are superceded by the capsule 'X' analyses and are no longer applicable.

- The group chemistry factor for weld 5P6771 is calculated as 39.1 as reported in the Surveillance Data Summary table. This differs from the chemistry factor of 49.1 used for this weld in the PTS Summary Report table for the reactor vessel, since the ratio method of Regulatory Guide 1.99 Revision 2 has been applied.

- In the Upper Shelf Energy Summary Report table, the 1/4T Neutron Fluence @ EOL values and the resultant USE @ EOL @ 1/4T and % Drop in USE @ EOL @ 1/4T values, differ from those submitted in the most recent capsule summary report (Reference 1, Table 7-14).

- In the Surveillance Data Summary table, the surveillance material chemistry data for copper and nickel have been revised for all three capsules using available "best estimate" values.

- In the Surveillance Data Summary table, the lead factors for capsules 'U' and 'V' were revised to a value of 2.68. The capsule 'X' summary report (Reference 1, Table 6-5) identifies the lead factor of 2.68 for capsules 'U', 'V', and 'X'. This was intended to represent the lead factor to the capsule locations, however, capsules 'U' and 'V' were withdrawn earlier, and lead factors for these capsules were determined based on the fluence experienced at the time of withdrawal. The appropriate lead factors, as calculated from their respective summary reports, should be 2.875 for capsule 'U' and 3.33 for capsule 'V', as follows:

  Capsule 'U' (Reference 5)

  capsule fluence – 5.52E+18 n/cm^2 (Table 6-4)
  vessel surface fluence – 1.92E+18 n/cm^2 (Table 6-3)
  lead factor – (5.52E+18)/(1.92E+18) = 2.875

  Capsule 'V' (Reference 4)

  capsule fluence – 1.32E+19 n/cm^2 (Table 6-5)
  vessel surface fluence – 3.96E+18 n/cm^2 (Table 6-3)
  lead factor – (1.32E+19)/(3.96E+18) = 3.33

Questions regarding this matter may be referred to Mr. Eric McCartney at (919) 362-2661.

Sincerely,

Richard J. Field
Manager-Regulatory Affairs
Harris Nuclear Plant

MSE/mse
Attachment

cc: Mr. J. B. Brady, NRC Sr. Resident Inspector
Mr. Rich Laufer, NRC Project Manager
Mr. L. A. Reyes, NRC Regional Administrator

Attachment A

Responses to NRC Questions on Shearon Harris Surveillance Capsule Report (BAW-2355)

Question 1: *Section 11.3.3.2 of ASTM E 185-82 requires reporting of: "Certification of calibration of all equipment and instruments used in conducting the tests." This is not provided in the report.*

Response: Certification of calibration of all equipment and instruments used in the capsule testing and measurements is contained in the Laboratory report (BAW-2355, Reference 10). All equipment and instruments used in the capsule testing and measurements are calibrated at least annually using standards traceable to the National Institute for Standards and Technology (NIST).

Question 2: *Section 11.4.1.1 of ASTM E 185-82 requires reporting of: "Trade name and model of the testing machine, gripping devices, extensometer, and recording devices used in the [tensile] tests." Of these items, only the trade name of the testing machine is provided.*

Response: The Trade Name and Model of the testing machine, gripping devices, extensometer, and recording devices used in the [tensile] tests are as follows:

a. Tension Test Machine - MTS® Model 312 Test Frame interfaced with TestStar controller

b. Gripping Devices - Self-aligned grips of BWXT Services, Inc. design for pin-loaded type tension specimen.

c. Extensometer - MTS® Model 632.12B-20

d. Recording Devices - Compac computer, which is part of the TestStar II controller

Question 3: *Sections 11.4.1.4(2) and 11.4.1.4(5) require reporting of: "Methods of measurement of yield strength and uniform elongation." These are not provided in the report.*

Response: A certified computer routine is used to perform an ASTM E 8 analysis. Both yield strength and uniform elongation is determined using the BWXT Services, Inc. certified software "MTAD.L00."

a. Yield Strength - Curve fitting is performed on the elastic region of the stress-strain curve and a linearity equation is generated. A parallel offset line is then drawn at 0.2% strain and the intersection between the offset line and stress-strain line is defined as the yield.

b. Uniform Elongation - The strain reading at the maximum stress is defined as the uniform elongation.

Attachment A

Responses to NRC Questions on Shearon Harris Surveillance Capsule Report (BAW2355)

Question 4: *Section 11.4.2.1 of ASTM E 185-82 requires reporting of: "Temperature conditioning and measuring devices, and a description of the procedure used in the inspection and calibration of the [Charpy] testing machine." These are not provided in the report.*

Response: The temperature conditioning and measuring devices are as follows:

Heating and cooling chambers are of the liquid immersion type. Specimens remain immersed in the liquid medium at the test temperature ±2°F for at least 10 minutes before testing to assure achievement of thermal equilibrium. There are three liquid baths used for heating/cooling the test specimens.

1. Ethyl Alcohol Bath: -100°F to room temperature
2. Dow Corning 200 fluid (100 cSt. viscosity polydimethylsiloxane): 70°F - 300°F
3. Dow Corning 210 H fluid (100 cSt. viscosity): 250°F - 550°F

Temperature measurement device: Omega Model 462

In response to the description of the procedure used in the inspection and calibration of the [Charpy] testing machine the laboratory (BWXT Services, Inc.) has provided Framatome Technologies, Inc. (FTI) with the following information:

> Each year, two sets of Charpy specimens are purchased from NIST and tested on the Charpy test machine. The results are then sent to NIST for evaluation. A letter is then issued by NIST certifying the calibration of the Charpy test machine.

Question 5: *Section 11.4.2.3(1) of ASTM E 185-82 requires reporting of: "Increase in 0.89-mm (35-mil) lateral expansion temperature." This is not provided in the report. (In addition, a single summary table with the various absolute index values, temperatures and upper-shelf energies, would provide a simplified manner to capture the results.)*

Response: Table 1 presents a summary of the Charpy V-notch test results for the HNP surveillance Capsule X. This table includes the 30 ft-lb, 50 ft-lb transition temperature data, 35-mil lateral expansion data, and upper-shelf energy data (i.e., unirradiated, irradiated, and delta values).

Attachment A

Responses to NRC Questions on Shearon Harris Surveillance Capsule Report (BAW-2355)

Table 1. Summary of HNP Reactor Vessel Surveillance Capsule X Charpy V-Notch Test Results Irradiated to 3.25 x 10^{19} n/cm^2

Material	Average 30 ft-lb Transition Temperature, °F			Average 50 ft-lb Transition Temperature, °F			Average 35 mil Lateral Expansion Temperature, °F			Upper-Shelf Energy, ft-lb		
	Unirrad.	Irrad.	ΔT	Unirrad.	Irrad.	ΔT	Unirrad.	Irrad.	ΔT	Unirrad.	Irrad.	Δ
Base Metal Plate, B4197-2, Longitudinal (LT)	51	145	94	99	192	93	87	177	90	87	66	21
Base Metal Plate, B4197-2, Transverse (TL)	72	151	79	139	250	111	110	192	82	70	55	15
Weld Metal, Wire Ht. 5P6771 / Flux Lot 0342	-34	45	79	2	96	94	-9	80	89	92	67	25
Base Metal Plate, B4197-2, Heat-Affected-Zone Material	-44	24	68	-3	84	87	-6	79	85	85	66	19

Reference Documents for RVID Database Updates

Item Number	Description	Reference
1	Chemistry Factor Method	FTI 32-5004664-00, Table 11, footnote at bottom
2	USE @ EOL @ 1/4T	BAW-2355, Table 7-14, column Predicted C_VUSE per RG 1.99/2
3	1/4T Neutron Fluence @ EOL	BAW-2355, Table 7-14, column 1/4T Fluence
4	% Drop in USE @ EOL @ 1/4T	BAW-2355, Table 7-14, column Predicted C_VUSE per RG 1.99/2
5	Capsule V Lead Factor	Capsule V Summary Report BAW-2154: Capsule V Fluence 1.32E+19 n/cm^2 (Table 6-5); Inside Vessel Surface Fluence EOC3 3.96E+18 n/cm^2 (Table 6-3), LF=13.2/3.96 = 3.33
6	Capsule U Lead Factor	Capsule U Summary Report BAW-2083: Capsule U Fluence 5.52E+18 n/cm^2 (Table 6-4); Inside Vessel Surface Fluence EOC1 1.92E+18 n/cm^2 (Table 6-3), LF=5.52/1.92 = 2.875
7	Group CF	FTI 32-5004664-00, Table 9, footnote (b), the calculated slope is the CF; note that for weld material, RG 1.99/2 requires use of a ratio procedure to adjust the CF, so a different CF value is shown in other items.
8	Cu%, Ni%, P% and S% for surveillance metals	FTI 32-5004664-00, Table 9, for Cu% and Ni%; P% and S% are unchanged and repeated for capsule X
9	Notes for best estimate chemistry data	The two existing notes are clarified to indicate that only Cu% and Ni% are best estimate chemistry data, per letter HNP-95-101 dated 11/16/95
10	Notes for use of older chemistry data	These notes applied when revised data was available from the response to GL 92-01. Since surveillance data from capsule 'X' is now being applied, these notes no longer apply.
11	Note for weld 5P6771 initial USE	HNP-96-206 dated 12/30/96

NRC - Reactor Vessel Integrity Database

PTS Summary Report

SHEARON HARRIS

Docket No: 50-400
EOL Date: 10/24/2026

Beltline Identification Type	Heat ID	RTpts @EOL	Neutron Fluence @ EOL	RTndt(u)	RTndt(u) METHOD	ΔRTndt(u) @ EOL	Fluence Factor @ EOL	Chem Factor	Chemistry Factor Method	Margin	Margin Method	Cu %	Ni %	P %	S %
INTERMEDIATE SHELL		174.2	4.550	60.0	PLANT SPECIFIC	80.2	1.383	58.00	TABLE	34.0	POSITION 1.1 (NO S DATA)	0.090	0.460	0.007	0.015
PLATE	A9153-1														
INTERMEDIATE SHELL		196.1	4.550	91.0	PLANT SPECIFIC	71.1	1.383	51.43	SURVEILLANCE NON-RATIO	34.0	POSITION 2.1 (S DATA)	0.090	0.500	0.006	0.017
PLATE	B4197-2														
LOWER SHELL		158.3	4.440	54.0	PLANT SPECIFIC	70.3	1.378	51.00	TABLE	34.0	POSITION 1.1 (NO S DATA)	0.080	0.470	0.005	0.014
PLATE	C9924-1														
LOWER SHELL		161.3	4.440	57.0	PLANT SPECIFIC	70.3	1.378	51.00	TABLE	34.0	POSITION 1.1 (NO S DATA)	0.080	0.470	0.005	0.015
PLATE	C9924-2														
INT. AND LOWER AXIAL WELDS		113.5	1.660	-20.0	PLANT SPECIFIC	77.5	1.140	68.00	TABLE	56.0	POSITION 1.1 (NO S DATA)	0.050	0.910	0.012	0.013
WELD	4P4784														
CIRC. WELD		75.6	4.360	-20.0	PLANT SPECIFIC	67.6	1.375	49.15	SURVEILLANCE RATIO	28.0	POSITION 2.1 (S DATA)	0.030	0.940	0.013	0.011
WELD	5P6771														

Plant References and Beltline Material Notes

Chemistry data for the beltline materials, and the revised UUSE for the circumferential weld (heat number 5P6771) are from the response to GL 92-01, Revision 1, Supplement 1 dated November 16, 1995. Actual data points used for determining the best-estimate chemistry values (Cu% and Ni% only) for the beltline welds were documented in a letter dated September 16, 1998.

Fluence, RTndt(u), and USE data are from the surveillance report, "Analysis of Capsule X," dated October, 1999. Fluence information is for 36 effective full power years (EFPY) at expiration of license (EOL), according to BAW-2355 (October 1999.)

The licensee revised the old chemistry data by providing best-estimate chemistry data (Cu% and Ni% only) for the beltline welds. ~~However, they elected to use the chemistry factors determined from the more conservative old chemistry data.~~

The licensee determined that 2 out of 6 surveillance data points for the intermediate shell plate were not credible, however, all of the data points are within the 2-sigma limits using Regulatory Guide (RG) Position 1.1. Since 2 of the data points are not credible, the licensee used surveillance data to calculate the CF with the full margin to calculate RTpts. The method for the sigma delta value is "override" since the full margin is being applied.

~~By letter dated November 16, 1995, the licensee submitted a USE@EOL (1/4T) of 55 ft. lbs. for the intermediate shell plate (heat number B4197-2) based on Position 1 of RG 1.99, Revision 2. However, the RVID is hard-coded to use available surveillance data (Position 2.2) to calculate USE@EOL (1/4T) if it exists. Therefore, the value shown for plate B4197-2 reflects the use of surveillance data in the calculation.~~

~~The licensee elected not to use surveillance data to determine the % Drop in USE for the circumferential weld (heat number 5P6771). The licensee's conservative EOL USE value of 62 ft lb for this weld could not be entered in the RVID since the database automatically uses surveillance data to calculate the % Drop in USE in accordance with RG 1.99, Revision 2. There is no override for the % Drop in USE calculation in the RVID.~~

For weld 5P6771, two values for unirradiated USE are identified in a letter dated December 30, 1996. The licensee elected to apply the more conservative value for evaluation of surveillance data and for determination of EOL USE.

NRC - Reactor Vessel Integrity Database

Upper Shelf Energy Summary Report

SHEARON HARRIS

Docket No: 50-400
EOL Date: 10/24/2026

Beltline Identification Type	Heat ID	Material Type	USE @ EOL @ 1/4T	1/4 T NeutronFluence @ EOL	Unirradiated USE	Unirradiated USE Method	%Drop in USE @ EOL @ 1/4T	%Drop in USE Method	Cu %
INTERMEDIATE SHELL		A 533B-1	~~62.82~~ 63.9	~~2.858~~ 2.81	83.00	DIRECT	~~24.31~~ 23.0	POSITION 1.2 (NO S DATA)	0.090
PLATE	A9153-1								
INTERMEDIATE SHELL		A 533B-1	~~54.37~~ 54.5	~~2.858~~ 2.81	71.00	DIRECT	~~29.42~~ 23.3	POSITION 2.2 (S DATA)	0.090
PLATE	B4197-2								
LOWER SHELL		A 533B-1	~~74.31~~ 76.8	~~2.709~~ 2.74	98.00	DIRECT	~~24.17~~ 21.6	POSITION 1.2 (NO S DATA)	0.080
PLATE	C9924-1								
LOWER SHELL		A 533B-1	~~66.73~~ 69.0	~~2.709~~ 2.74	88.00	DIRECT	~~24.17~~ 21.6	POSITION 1.2 (NO S DATA)	0.080
PLATE	C9924-2								
INT. AND LOWER AXIAL WELDS		LINDE 124	~~76.00~~ 76.1	~~1.043~~ 1.02	94.00	DIRECT	~~19.15~~ 19.1	POSITION 1.2 (NO S DATA)	0.050
WELD	4P4784								
CIRC. WELD		LINDE 124	~~59.12~~ 59.2	~~2.709~~ 2.69	80.00	SURV WELD	~~26.10~~ 26.0	POSITION 2.2 (S DATA)	0.030
WELD	5P6771								

Plant References and Beltline Material Notes

Chemistry data for the beltline materials, and the revised UUSE for the circumferential weld (heat number 5P6771) are from the response to GL 92-01, Revision 1, Supplement 1 dated November 16, 1995. Actual data points used for determining the best-estimate chemistry values (Cu% and Ni% only) for the beltline welds were documented in a letter dated September 16, 1998.

Fluence, RTndt(u), and USE data are from the surveillance report, "Analysis of Capsule X," dated October, 1999. Fluence information is for 36 effective full power years (EFPY) at expiration of license (EOL), according to BAW-2355 (October 1999.)

The licensee revised the old chemistry data by providing best-estimate chemistry data (Cu% and Ni% only) for the beltline welds. ~~However, they elected to use the chemistry factors determined from the more conservative old chemistry data~~.

The licensee determined that 2 out of 6 surveillance data points for the intermediate shell plate were not credible, however, all of the data points are within the 2-sigma limits using Regulatory Guide (RG) Position 1.1. Since 2 of the data points are not credible, the licensee used surveillance data to calculate the CF with the full margin to calculate RTpts. The method for the sigma delta value is "override" since the full margin is being applied.

~~By letter dated November 16, 1995, the licensee submitted a USE@EOL (1/4T) of 55 ft.-lbs. for the intermediate shell plate (heat number B4197-2) based on Position 1 of RG 1.99, Revision 2. However, the RVID is hard-coded to use available surveillance data (Position 2.2) to calculate USE@EOL (1/4T) if it exists. Therefore, the value shown for plate B4197-2 reflects the use of surveillance data in the calculation.~~

~~The licensee elected not to use surveillance data to determine the % Drop in USE for the circumferential weld (heat number 5P6771). The licensee's conservative EOL USE value of 62 ft-lb for this weld could not be entered in the RVID since the database automatically uses surveillance data to calculate the % Drop in USE in accordance with RG 1.99, Revision 2. There is no override for the % Drop in USE calculation in the RVID.~~

For weld 5P6771, two values for unirradiated USE are identified in a letter dated December 30, 1996. The licensee elected to apply the more conservative value for evaluation of surveillance data and for determination of EOL USE.

NRC - Reactor Vessel Integrity Database

Surveillance Data Summary

SHEARON HARRIS

Docket No: 50-400
EOL Date: 10/24/2026

Type / Direction	Heat ID / Capsule, Lead Factor	Neutron Fluence	Fluence Factor	Group CF	Used in CF Calcs	Predicted ΔRTndt	Measured ΔRTndt	Predicted - Measured ΔRTndt	Credible RG1.99 Scatter	σ of Pred-Meas ΔRTndt	Unir USE	Meas USE	%Drop in USE	%Drop in USE Line Offset	Cu %	Ni %	P %	S %
PLATE	B4197-2	0.55	0.83	51.4	YES	42.9	30.0	12.9	YES	16.2	87.0	92.0	0.00	-3.93897	~~0.073~~ 0.087	~~0.400~~ 0.51	0.014	0.016
LONGITUDINAL	U, ~~2.68~~ 2.875																	
PLATE	B4197-2	0.55	0.83	51.4	YES	42.9	38.0	4.9	YES	16.2	70.0	68.0	2.86	0.51696	~~0.073~~	~~0.400~~	0.014	0.016
TRANSVERSE	U, ~~2.68~~ 2.875																	
PLATE	B4197-2	1.32	1.08	51.4	YES	55.4	43.0	12.4	YES	16.2	87.0	84.0	3.45	0.50909	~~0.073~~	~~0.400~~	0.014	0.016
LONGITUDINAL	V, ~~2.68~~ 3.33																	
PLATE	B4197-2	1.32	1.08	51.4	YES	55.4	35.0	20.4	NO	16.2	70.0	65.0	7.14	0.82536	~~0.073~~	~~0.400~~	0.014	0.016
TRANSVERSE	V, ~~2.68~~ 3.33																	
PLATE	B4197-2	3.25	1.31	51.4	YES	67.4	94.0	-26.6	NO	16.2	87.0	66.0	24.14	1.26165	~~0.073~~	~~0.400~~	0.014	0.016
LONGITUDINAL	X, 2.68																	
PLATE	B4197-2	3.25	1.31	51.4	YES	67.4	79.0	-11.6	YES	16.2	70.0	55.0	21.43	1.20995	~~0.073~~	~~0.400~~	0.014	0.016
TRANSVERSE	X, 2.68																	
WELD	5P6771	0.55	0.83	39.1	YES	32.6	20.0	12.6	YES	22.3	92.0	83.0	9.78	1.05148	0.024	0.957	0.006	0.006
N/A	U, ~~2.68~~ 2.875																	
WELD	5P6771	1.32	1.08	39.1	YES	42.1	18.0	24.1	YES	22.3	92.0	82.0	10.87	1.00770	0.024	0.957	0.006	0.006
N/A	V, ~~2.68~~ 3.33																	
WELD	5P6771	3.25	1.31	39.1	YES	51.2	79.0	-27.8	YES	22.3	92.0	67.0	27.17	1.31310	0.024	0.957	0.006	0.006
N/A	X, 2.68																	