Niagara Mohawk®

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NMP1L 1603

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63
TAC No. MB2528

Subject: ***Inspection Results for Core Shroud Support Welds H8 and H9***

Gentlemen:

During the Spring 2001 refueling outage (RFO-16), Niagara Mohawk Power Corporation (NMPC) completed inspections of the Nine Mile Point Unit 1 (NMP1) core shroud support welds H8 and H9. The purpose of this letter is to provide the results of these inspections. Attachment A summarizes the inspection results for the H8 and H9 welds, and Attachment B evaluates the H9 weld indications. The inspection results for the H9 weld were previously discussed with the NRC staff in a telephone conference call on April 12, 2001.

The scope of the NMP1 inspection of the H8 and H9 welds was submitted for NRC approval in an NMPC letter dated December 15, 2000 (NMP1L 1562), and was approved in an NRC safety evaluation dated April 5, 2001. As discussed in the attachments, the results of these inspections and the associated evaluations demonstrate that: (1) the H8 weld has no structurally significant indications; (2) the H9 weld structural integrity is maintained with significant margins for continued operation; and (3) the probability of H9 weld indications progressing into the low alloy steel vessel is extremely low. Evaluation of the H9 indications has considered the circumferential and axial cracking conditions that have been observed at the Tsuruga (Japan) plant.

As requested in the April 12, 2001 telephone call with the NRC staff, Attachment A includes a discussion of NMPC's plans for H9 weld inspections at the next refueling outage (RFO-17).

A P01

Attachment B is considered by its preparer, General Electric, to contain proprietary information exempt from disclosure pursuant to 10 CFR 2.790. Therefore, on behalf of General Electric, NMPC hereby makes application to withhold this document from public disclosure in accordance with 10 CFR 2.790(b)(1). A non-proprietary version of this document has been included with this letter as Attachment C. An affidavit executed by General Electric detailing the reasons for the request to withhold the proprietary information has been included as Attachment D.

Very truly yours,

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RBA/DEV/mlg
Attachments

cc: Mr. H. J. Miller, NRC Regional Administrator, Region I
Mr. R. P. Correia, Acting Section Chief PD-I, Section 1, NRR
Mr. G. K. Hunegs, NRC Senior Resident Inspector
Mr. P. S. Tam, Senior Project Manager, NRR
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ATTACHMENT A

NINE MILE POINT UNIT 1
RFO-16 CORE SHROUD SUPPORT WELD INSPECTION RESULTS SUMMARY

INTRODUCTION

During the Spring 2001 refueling outage (RFO-16), Nine Mile Point Unit 1 (NMP1) completed inspection of the core shroud support welds H8 and H9. The scope of the NMP1 inspection of the H8 and H9 welds was submitted for NRC approval in an NMPC letter dated December 15, 2000, and approved in an NRC safety evaluation dated April 5, 2001. These inspections were performed in accordance with the requirements of BWRVIP-07, "Guidelines for Reinspection of BWR Core Shrouds," and BWRVIP-38, "BWR Shroud Support Inspection and Flaw Evaluation Guidelines." The NMP1 H8 weld inspection is specified by both the core shroud inspection guidelines and the shroud support guidelines. The NMP1 inspection scope commitment was to complete volumetric inspection (ultrasonic testing - UT) of the H8 weld using an inspection method qualified per BWRVIP-03, "Reactor Pressure Vessel and Internals Examination Guidelines." The inspection scope also included a commitment to inspect, using UT methods, the H9 weld for circumferential cracking on a best effort basis. The intent of the NMP1 H9 weld UT inspection was to establish the baseline condition of the H9 weld inside diameter (ID) surface (below core plate), as requested in the NRC July 24, 2000, final safety evaluation to BWRVIP-38.

INSPECTION TECHNIQUE QUALIFICATION

The H8 and H9 weld inspection method deployed was an ultrasonic phased array technique using a two-axis manipulator. The technique was developed to satisfy the coverage requirements of BWRVIP-07 (greater than 50%) and BWRVIP-38 required inspection scope for the NMP1 H8 weld and to provide H9 weld ID baseline information. The primary emphasis of the inspection performed in RFO-16 was circumferential flaw detection.

1. BWRVIP-03 H8 Qualification

The H8 weld UT demonstrated detection capability of flaws initiating on the bottom side of the Alloy 182 weld and in the stainless steel ring HAZ. This qualification was able to eliminate the previous qualification detection uncertainty associated with the H8 weld bottom side. The qualification of the UT top side surface detection capability remains limited to the Alloy 182 weld lower HAZ of the H8 weld location, similar to previous UT methods (General Electric OD tracker deployed in 1995 and 1997). The UT qualification does detect topside flaws greater than approximately 0.5 inch in depth.

2. *BWRVIP-03 H9 Qualification*

The qualification testing demonstrated bottom and topside circumferential flaw detection within the H9 weld. The inspection technique qualification concluded that axial flaw detection was not possible in the H9 weld. The qualification testing also showed that this ID UT inspection technique is not qualified for detection of flaws propagating circumferentially or axially in the low allow steel (LAS) vessel at the H9 weld location.

INSPECTION RESULTS, EVALUATION, AND CONCLUSIONS

1. *H8 Weld*

Inspection Results

The H8 weld inspection during RFO-16 was able to achieve 80.2% coverage (about 289 degrees of the H8 weld circumference). The RFO-16 inspection identified a total of 3 indications initiating from the weld bottom side. Table 1 shows the H8 weld UT indications. The indication originally identified in the H8 weld in 1995 located at 126.4 degrees was confirmed to remain essentially unchanged. The inspection of the 126-degree location is the third inspection of this indication within a 6-year interval with no growth in depth or length evident. The two newly identified indications are in locations previously not inspected with UT.

Inspections performed in 1995, 1997 and 1999 included enhanced visual examinations (EVT-1) of the topside of the H8 weld. The combined coverage of these three H8 weld inspections using EVT-1 was approximately 80% of the H8 weld topside surface. The EVT-1 inspections identified a total of 6 separate indications (shown in Table 1). The EVT-1 indications previously identified at 3 locations were re-inspected in RFO-16. The RFO-16 EVT-1 inspections showed no growth at these locations. In addition, the UT at these locations did not detect the indications, which demonstrates that the indications are shallow and not propagating through the weld thickness.

Evaluation and Conclusions

The combined EVT-1 coverage achieved for the H8 weld topside and the UT coverage achieved in RFO-16 indicate that the H8 weld indications are not structurally significant. The total percentage of indications identified in the H8 weld remains less than 10% of the inspection length with 80% volumetric coverage of the circumference. Using the BWRVIP-07 generic reinspection tables, the H8 weld qualifies for a 10-year reinspection. The H8 weld satisfies the BWRVIP-38 defined uncracked ligament, assuming a 10-year reinspection interval. The H8 weld also satisfies the NMP1 plant specific H8 analysis, assuming a 10-year reinspection interval. Based on the combined inspection results from 1995, 1997, 1999, and 2001 it is concluded that the H8 weld has no structurally significant indications and qualifies for a 10 year reinspection interval.

2. *H9 Weld*

Inspection Results

The BWRVIP-38 required inspection of the H9 weld was performed in 1999. The technique was the specified EVT-1 inspection of the topside of the H9 weld. This inspection had no reportable indications. The inspection performed in 2001 was a supplemental inspection designed to achieve the baseline coverage of the H9 weld below the core plate region, as requested by the NRC in the BWRVIP-38 final safety evaluation.

The H9 weld inspection achieved 79.7% coverage (about 287 degrees of the H9 weld circumference). Regions of the H9 weld that were not covered are identified in Attachment B. Table 2 shows the circumferential indications that were found. The inspection shows 34 indications for a total of 51.5 degrees. The longest indication is 4.34 degrees. The H9 weld indications represent 17.96% of the examined length. The majority of the 34 indications are 1.5 degrees or less in length and in three of four of the quadrants. The detected indications are limited and fairly evenly spaced. Only in the 180-to-270 degree quadrant are there longer and more densely spaced UT indications. The inspection indicates that all of the indications are located in the weld and initiate from the ID. Of these 34 indications, only 4 had amplitudes similar to those in the qualification mockup. The other indications had lower amplitude, which may suggest that the indications are either shallow or potentially oriented differently than flaws within the BWRVIP mockup. While the information was not able to better characterize the indication orientation, it is possible that these 30 indications could be axial or have axial components. The H9 weld indications are located within the Alloy 182 weld material consistent with the H9 BWRVIP-03 qualification mockup; however, because of the inspection technique limitations, the potential for additional undetected axial indications in the Alloy 182 weld similar to Tsuruga exists.

Evaluation and Conclusions

Attachment B provides the results of the H9 weld evaluation. Consistent with the BWRVIP-38 requirements, the H9 weld structural integrity was evaluated for the H9 weld shroud support function, and the extent of condition was evaluated to determine if the observed H9 weld cracking indications could affect vessel integrity. This evaluation concluded the following:

- The core shroud support structural integrity of the H9 weld is maintained with margin for at least 10 years of operation. The analysis applied all of the required BWRVIP-38 conservative analysis assumptions.
- The NMP1 identified indications are consistent with the Tsuruga observed circumferential indications. The potential for an axial cracking condition similar to Tsuruga is likely considering the similarity in the weld geometry and fabrication sequence. The Tsuruga inspection data showed that no propagation into the LAS vessel occurred, even with significant H9 Alloy 182 attachment weld cracking present. The overall conclusion is that the potential for axial or circumferential crack growth into the LAS for NMP1 is equivalent to Tsuruga.

- The impact of a Tsuruga-like axial cracking condition in combination with the NMP1 observed circumferential indications has been demonstrated to not change the structural margins defined by BWRVIP-38 methods.
- The H9 Alloy 182 weld is fully mitigated by Noble Metal Chemical Addition (NMCA) implemented at NMP1. The H9 weld location is in a region that is fully protected by NMCA provided that the hydrogen to oxygen molar ratio is maintained at greater than 2:1, which is the case at NMP1.
- The potential for H9 weld indications to progress into the reactor vessel LAS is extremely low. The analysis shows an operating interval of 100,000 hours is justified based on ASME Code IWB-3600 allowable flaw depths, and conservatively assuming the H9 weld indications and/or Tsuruga-like axial cracking grow into the low alloy steel. The crack growth assumptions used in this evaluation are in accordance with the NRC-approved BWRVIP-60 "Evaluation of Stress Corrosion Crack Growth in Low Alloy Steel Vessel Materials in the BWR Environment," crack growth assumptions for low alloy steel.

In addition to these evaluations, a supplemental probabilistic fracture mechanics (PFM) review of the significance of the H9 Alloy 182 weld indications on vessel integrity was performed. The review determined that the probability of failure associated with the observed NMP1 circumferential indications, assuming the indications are in the LAS, is extremely low (the same or lower than those in BWRVIP-05, "BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations," for circumferential welds in the irradiated conditions). The probability of failure, assuming Tsuruga-like axial cracking in combination with the NMP1 observed circumferential indications and with the extremely conservative assumption of growth in the LAS, remains lower than the failure probabilities of the vessel axial welds in the beltline defined in BWRVIP-05. The overall conclusion of the PFM review is consistent with the deterministic analysis conclusions in Attachment B.

H9 Weld Re-Inspection Requirements

The reinspection interval for the H9 weld shroud support function (i.e., inspections to detect Alloy 182 circumferential cracking) is planned based on a 10-year operating interval. This is based on the results of the plant-specific analyses described above that demonstrate the integrity of the H9 weld shroud support function for a 10-year operating interval. These analyses apply the BWRVIP-38 analysis methods, which have been approved by the NRC. In addition, NMP1 currently utilizes hydrogen water chemistry (HCW) and NMCA, which provide mitigation for the H9 weld and significantly reduce the potential for new crack initiation or crack growth.

Volumetric inspection of the vessel at the H9 weld attachment location, on a sampling basis, is planned during RFO-17 to confirm that indications in the H9 Alloy 182 weld material remain confined to the weld material. The inspection method will be qualified per BWRVIP-03. The plant-specific analyses described above, which considered the conditions observed at Tsuruga, have concluded that the required American Society of Mechanical Engineers (ASME) Section XI margins are maintained for the reactor vessel for at least one two-year operating cycle prior to performing these volumetric inspections.

Inspection of the LAS at the H9 weld location requires a vessel OD examination based on current inspection technology. The NMP1 vessel OD clearances restrict the locations of the inspection to the regions near the recirculation N1 nozzles. During RFO-17 three of the N1 nozzles are scheduled for ASME Section XI nozzle to vessel weld inspection. These locations should allow coverage of two of the four higher amplitude indications and six of the lower amplitude indications, as shown in Table 3. These locations will provide adequate sampling to confirm that the H9 Alloy 182 weld indications are confined to the weld metal.

Table 1
H8 Weld Indications

Indication/ Notes	Indication Start (Degrees)	Length (Degrees)	Length (Inches)	Depth(Inches)/ Notes
1 - UT/ bottom	9.93	0.80	1.26	0.24
2 - UT/ bottom	25.36	0.95	1.50	0.36
3 - UT/ bottom*	126.40	1.75	2.76	0.40
1 –EVT/ top (indication 95-5)	5	---	≈ .5	No UT overlap coverage in 2001
2 –EVT/ top (indication 97-21) EVT-1 reinspection 2001	80	---	≈1 No change based on 2001 EVT-1	Shallow < .5, UT coverage with no detection
3 –EVT/ top (indication 97-22) EVT-1 reinspection 2001	85 (location verified to be at 80 degrees)	---	≈3.5 No change based on 2001 EVT-1	No UT overlap coverage in 2001
4 –EVT/ top (indication 97-57) EVT-1 reinspection 2001	132	---	≈9.5 No change based on 2001 EVT-1	Shallow < .5, UT coverage with no detection
5 –EVT/ top (indication 97-9)	270	---	≈1	No UT overlap coverage in 2001
6 –EVT/ top (indications 95-1,2,3,4) Post tie rod installation indication at 352 only visible	4 indications (348,352,355,356) identified 1995 352 Reinspected after tie rod installation	---	≈.5 (356°, ≈.75) ≈.5	No UT overlap coverage in 2001 352 location inspection in 1997 & 1999 show no change

***Note**: UT indication #3 previously recorded

Table 2
H9 Weld UT Indications

Indication Number	Indication Start (Degrees)	Length (Degrees)	Length (Inches)
1	-2.17	0.56	1.04
2	21.91	0.70	1.29
3	55.65	1.12	2.07
4	58.45	1.96	3.62
5	63.07	1.40	2.59
6	64.89	1.12	2.07
7	72.45	1.82	3.37
8	75.39	1.26	2.33
9	117.99	0.56	1.04
10	135.35	0.84	1.55
11	147.53	0.42	0.78
12	148.65	1.82	3.37
13	152.71	0.98	1.81
14	172.99	0.70	1.29
15 *	173.97	3.08	5.69
16	177.61	0.70	1.29
17 *	192.03	4.06	7.51
18	196.23	0.84	1.55
19	197.63	4.34	8.02
20	203.23	4.06	7.51
21	208.55	0.42	0.78
22	211.35	1.40	2.59
23	222.13	1.96	3.62
24	234.59	1.26	2.33
25	243.83	1.96	3.62
26	248.73	2.24	4.14
27	256.01	0.56	1.04
28	256.71	0.42	0.78
29	257.83	0.98	1.81
30 *	318.01	0.84	1.55
31	324.59	3.36	6.21
32	328.23	0.42	0.78
33	331.87	0.84	1.55
34 *	336.49	2.52	4.66

*Indications 15, 17, 30, and 34 match the BWRVIP amplitude for BWRVIP mockup indications h and i.

Table 3
H9 Vessel OD Coverage Estimates

Recirculation Suction Nozzle	Access Location and Coverage Estimate	Indications Covered
N1A RFO-17 inspection	42° ≈ ± 10°	#3
N1C RFO-17 inspection	186° ≈ ± 10°	#16,#17,#19
N1E RFO-17 inspection	330° ≈ ± 10°	#31,#32,#33,#34

Note: Indications 17 and 34 are two of the four indications that match the BWRVIP-03 mockup.

ATTACHMENT B

GE Nuclear Energy Report GE-NE-B13-02097-00, Section 5-Rev. 1

The Evaluation of Observed Cracking at Nine Mile Point Unit 1 H9 Weld for Continued Operation

(Proprietary Version)