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

Edwin I. Hatch Nuclear Plant – Unit 1
Technical Justification Regarding Scope Expansion for
Dissimilar Metal Weld Examination

Ladies and Gentlemen:

Based on industry operating experience and the Boiling Water Reactor Vessel Internals Program (BWRVIP) memo 2007-367 "Recommendations Regarding Dissimilar Metal Weld Examinations," ultrasonic (UT) inspections of two Category C reactor vessel dissimilar metal (DM) welds were performed at Plant Hatch Unit 1 during the spring 2008 refueling outage (1RFO23). An indication was identified in the N9 nozzle to cap weld that was evaluated to be a defect 2.3 inches long on the inside diameter and 60% through wall.

The examination and scope expansion criteria, as identified in "BWRVIP-75A: BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules" (VIP-75A) specifies that an additional sample of equal size and approximately the same distribution be examined in the same outage. It also notes that "the size or distribution of the expanded sample may be altered if technical justification exists." The N8B nozzle weld was selected as the most applicable weld to include in the expanded scope. The examination of N8B revealed no indications. Based on current examinations and the review of previous UT data, limiting the scope expansion to one additional weld (N8B) is warranted. This limited scope expansion was discussed in a telephone conversation between SNC and the NRC on February 28, 2008.

The technical justification regarding scope expansion is provided in Enclosure 1. This letter contains no commitments. If you have any questions, please contact Ray Baker at 205-992-7367.

Sincerely,

D. H. Jones
Vice President - Engineering

DHJ/MNW/daj

Enclosures: 1. Technical Justification Regarding Scope Expansion for Dissimilar Metal Weld Examination

cc: Southern Nuclear Operating Company
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Mr. R. E. Martin, NRR Project Manager – Hatch
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Edwin I. Hatch Nuclear Plant

Enclosure 1

Technical Justification Regarding Scope Expansion for Dissimilar Metal Weld Examination

Enclosure 1

Edwin I. Hatch Nuclear Plant
Technical Justification Regarding Scope Expansion for
Dissimilar Metal Weld Examination

Description

Based on industry operating experience and the BWRVIP memo 2007-367 "Recommendations Regarding Dissimilar Metal Weld Examinations (Includes Needed Requirement per NEI 03-08)," ultrasonic (UT) inspections of two (2) Category C reactor vessel dissimilar metal (DM) welds were performed at Plant Hatch Unit 1 during the spring 2008 refueling outage (1RFO23). During the initial scope of examinations performed using manual UT in accordance with Section XI of the ASME Boiler and Pressure Vessel Code Appendix VIII (Appendix VIII), an indication was identified in the N9 nozzle to cap weld on the top of the pipe between the weld and butter transition area. Phased array UT was then used to characterize the indication. The indication was evaluated to be a circumferentially oriented defect that was 2.3 inches long on the inside diameter and maximum of 60% through wall in a pipe thickness of 0.74 inches.

This cap was installed in 1977 after the Control Rod Drive (CRD) return line was re-routed to Feedwater per the requirements of NUREG-0619. It is located in a region that is not effectively protected from intergranular stress corrosion cracking (IGSCC) by the hydrogen water chemistry process in use at Plant Hatch. In 1993, the weld was treated with mechanical stress improvement (MSIP) to mitigate IGSCC concerns with DM welds in a BWR environment. The weld was examined prior to and after the MSIP treatment with an inside diameter (ID) indication characterized as geometric. A reexamination in 1994 identified the same indication at the ID of the weld in the area of the current defect, but the indication was again characterized as geometry because there was no observable depth. At the time of the 1994 examination, it was noted that the surface condition was irregular and that there was an acceptable, low amplitude geometric indication on the ID. This is the location that has now been characterized as containing a defect. A detailed inspection history follows.

N9 Inspection History

1977 – 1990

The N9 nozzle DM weld was examined immediately after the modification in 1977 and during four additional outages (1982, 1987, 1988 and 1990). The most extensive documentation of an indication occurred in 1990. During the 1990 outage, a 45 degree refracted longitudinal wave (45RL) transducer identified a low amplitude, 0.4" long ID geometric indication in the 0 to 1" region. An examination using a 60 degree RL transducer (60RL) found no recordable indications. Also, examination with a 45 degree shear wave (45S) found no recordable indications.

1993 pre- and post-MSIP

Examinations were conducted using 45RL and 60RL transducers. The pre- and post-examinations identified a low amplitude, 0.5" long ID geometric indication in the 0 to 1" region.

Due to the low amplitude and lack of examiner concerns, the disposition was attributed to ID geometry, as in previous evaluations.

1994
Examinations were conducted using a 45RL transducer. This examination identified the same low amplitude ID geometric indication of 0.4" long in the 0 to 1" region.

2008
Due to the data review process conducted prior to the outage that identified weld surface concerns, Appendix VIII qualified manual examinations were conducted using 45RL and 60RL transducers after surface conditioning. A high amplitude 1.6 inch long indication in the -1.0 to +1.0 region was identified. Manual plots indicated a potential flaw that appeared to extend upward from the root area along the interface of the replacement weld and the original nickel alloy butter fusion line. Phased array UT (Appendix VIII qualified) was then used to fully interrogate the weld and characterize the indication. The indication was evaluated to be a circumferentially oriented defect that was 2.3 inches long on the inside diameter and 60% through wall in a pipe thickness of 0.74 inches.

Water Chemistry

Hatch Unit 1 began commercial operation in December 1975. Injection of hydrogen to mitigate IGSCC, known as HWC, was initially implemented on Unit 1 in 1987. In March 1999, Hatch Unit 1 switched from hydrogen injection alone as a mitigation tool for IGSCC to the use of noble metal chemical addition (NMCA) in conjunction with hydrogen injection. This continues in use today.

Scope Expansion

Examination and scope expansion criteria are identified in “BWRVIP-75A: BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules” (VIP-75A). For Category C welds, VIP-75A specifies that if one or more welds are determined to be cracked, an additional sample of equal size and approximately the same distribution will be examined in the same outage. It also notes that “the size or distribution of the expanded sample may be altered if technical justification exists.”

During this outage at Hatch Unit 1, two Category C DM welds not mitigated by HWC/NMCA were scheduled for examination using Appendix VIII methods. These welds are the N9 nozzle to cap weld containing the identified defect and the N8A jet pump instrumentation nozzle to safe-end weld. The N8A weld examination resulted in no indications being identified. However, the N9 defect mandates additional examinations. After review of examination histories, nozzle

size, weld configurations, and weld surface conditions, N8B was selected as the most appropriate weld to include in the expanded scope. The examination of N8B revealed no indications. All three welds required surface conditioning in order to perform an Appendix VIII examination.

Extent of Condition

As noted earlier, in addition to the examinations conducted this outage, Plant Hatch has reviewed its examination history of DM welds in accordance with BWRVIP memo 2007-367, "Recommendations Regarding Dissimilar Metal Weld Examinations (Includes Needed Requirement per NEI 03-08)." There are 18 Category C DM welds in Unit 1. (All other DM welds have been overlayed.) Category C is defined in NRC Generic Letter 88-01 as welds made of material considered susceptible to IGSCC, but mitigated by stress improvement after more than two cycles of operation. Of the 18 welds, ten are considered to be effectively mitigated by use of HWC/NMCA and eight are not considered to have this additional mitigative protection. This weld population is described below.

Category C with Effective HWC/NMCA

Ten welds are in this population and all are in the recirculation piping which is effectively protected by HWC/NMCA. These welds include two 28" diameter recirculation outlet nozzle (N1) to safe-end welds and eight 12" diameter recirculation inlet nozzle (N2) to safe-end welds. All ten of these welds were treated with Induction Heating Stress Improvement (IHSI) in 1986. (As noted above, HWC was started in 1987.) In addition to the 1986 baseline examination, each was examined by UT at least four times prior to implementation of Appendix VIII. Five of these welds, two 28" and three 12" diameter welds, were examined in 2006 with Appendix VIII procedures and found to be acceptable. The remaining five 12" diameter welds are scheduled for examination in 2010.

For the five 12" welds which are scheduled for 2010 but have not yet been examined in accordance with Appendix VIII, Plant Hatch had General Electric Hitachi (GEH) perform a review of the most recent UT data (1997). The data reviewed was automated UT data that was evaluated using the current data analysis software. The data from all welds exhibited loss of contact that resulted in intermittent coverage. The evaluation results are:

a) two welds showed no indications;
b) one weld identified an embedded flaw with no ID connection based on UT evidence of sound metal under the flaw;
c) one weld had two embedded flaws with no ID connection based on UT evidence of sound metal under the flaw; and

d) one weld had an indication identified at the weld to butter interface when viewed using a 45S that was characterized as beam redirection or weld interface. Data from the opposite side of the weld using 45RL and 60RL data showed intermittent indications but, they did not have flaw-like characteristics.

Based on these results, Plant Hatch concluded that the scheduled examination of these welds in 2010 is appropriate and no additional examinations are warranted for this outage.

Category C without effective HWC/NMCA

Eight welds are in this population. They include:

a) the N9 nozzle weld discussed above treated with MSIP in 1993 and examined in accordance with Appendix VII methods in 2008;
b) two N8 jet pump instrumentation nozzle welds discussed above treated with MSIP in 1993 and examined in accordance with Appendix VII methods in 2008;
c) four 10” core spray safe-end to nozzle welds and pipe to safe-end extension welds treated with MSIP in 1993; and
d) one 24” RHR carbon steel valve to stainless steel pipe weld treated by IHSI in 1986.

The four core spray welds were examined in 1993 as part of the MSIP work and again in 1994. They were examined in 2006 using Appendix VIII procedures and found to be acceptable. The N8 nozzle welds were examined in 1993 as part of the MSIP work and two more times prior to the Appendix VIII examinations conducted this outage. The 24” RHR weld was examined in 1986 as part of the IHSI work and four additional times prior to the use of Appendix VIII procedures. In 2006, an Appendix VIII examination was conducted on this weld. The carbon steel valve examination coverage is limited, but IGSCC is not a concern in that material. While the inner diameter of the nickel based weld and the heat affected zone of the stainless pipe material were adequately interrogated to show no circumferentially oriented IGSCC and to assure safety, the coverage was insufficient to meet Appendix VIII criteria. Therefore, Plant Hatch is evaluating UT options or the possible application of a weld overlay in the future.

Status

Given the history of these type welds in the BWR environment, the source of the defect is attributed to IGSCC. This is not uncommon in the industry. In fact, there have been instances where the cut/capped N9 nozzles have actually leaked. Therefore, it is reasonable to postulate that this field repair had high weld residual stresses and after some incubation period, a flaw developed and propagated some distance into the wall. However, after MSIP treatment, the flaw growth would have stalled and the flaw would have remained at the same size. Fourteen years later with several improvements in how the industry conducts UT examinations, including

the surface conditioning and the use of Appendix VIII qualified techniques/procedures, it is not unexpected to now find dormant flaws. This has occurred in the last several years in BWRs.

Plant Hatch plans to repair the N9 weld during the current outage by application of a full structural weld overlay. Based on current examinations and the review of previous UT data, limiting the scope expansion to one additional weld (N8B) is warranted. This conclusion is based on:

- All three small diameter welds not mitigated by hydrogen water chemistry and not previously examined per Appendix VIII have now been examined per Appendix VIII.
- The four core spray nozzle welds not mitigated by hydrogen water chemistry were examined per Appendix VIII in 2006.
- The 24" RHR stainless to carbon weld not mitigated by hydrogen water chemistry that has limited coverage is being evaluated for additional UT options or the possible application of a weld overlay in the future. However, the exams performed in 2006 using Appendix VIII methods did adequately interrogate the ID of the weld to confirm no circumferentially oriented flaws.
- Three of the 12" recirculation inlet nozzle welds and the two 28" recirculation outlet nozzles that are mitigated by hydrogen water chemistry were examined per Appendix VIII in 2006.
- The five remaining 12" recirculation inlet nozzle welds that are mitigated by hydrogen water chemistry, but not yet examined in accordance with Appendix VIII, have no flaws identified based on the data review. They are scheduled to be examined in 2010.