October 10, 2000

Mr. H. L. Sumner, Jr.
Vice President - Nuclear
Hatch Project
Southern Nuclear Operating
Company, Inc.
Post Office Box 1295
Birmingham, Alabama 35201-1295

SUBJECT: EDWIN I. HATCH NUCLEAR PLANT, UNITS 1 AND 2 RE: THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM ADOPTION OF BWRVIP-75 (TAC NOS. MA9454 AND MA9455)

Dear Mr. Sumner:

By letter dated June 23, 2000, Southern Nuclear Operating Company (SNC), the licensee for the Edwin I. Hatch Nuclear Plant, Units 1 and 2, submitted a request to adopt the guidance contained in the Electric Power Research Institute (EPRI) proprietary report TR-113932, "BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules (BWRVIP-75)," dated October 1999, for weld examination sample determination and scope expansion criteria, beginning with the Unit 1 Fall 2000 refueling outage. SNC would adjust the weld examination scope for the forthcoming Unit 1 outage and apply the sample size criteria described in BWRVIP-75 for plants maintaining effective Hydrogen Water Chemistry (HWC).

In accordance with 10 CFR 50.55a(3)(i), SNC requested approval to utilize the BWRVIP-75 report as an alternative to the ASME Section XI, Table IWB-2500-1 for Examination Categories B-F and B-J. SNC proposes to utilize the criteria in the BWRVIP-75 report as the sole criteria for all weld examinations within the scope of existing NUREG-0313 and Generic Letter 88-01 inspections with no consideration of the examination requirements of Section XI Table IWB-2500-1.

The staff has reviewed the licensee's proposal to adopt and utilize the guidance contained in the BWRVIP-75 report as an alternative, in accordance with 10 CFR 50.55a(3)(i), to the ASME Section XI, Table IWB-2500-1 for Examination Categories B-F and B-J, for weld examination sample determination and scope expansion criteria, for plants maintaining effective HWC, beginning with the Unit 1 Fall 2000 refueling outage.

During a conference call held on October 4, 2000, the licensee agreed to the ranking process discussed in Open Item 3.9 of the staff's September 15, 2000, safety evaluation (SE) of the BWRVIP-75 report. The staff requests that the licensee, in its report of inspection results following the outage, discuss the ranking process utilized and the ranking of the weldments.

Based on the staff's review of the licensee's proposed justification, on the licensee's accomplishment of the inspections as discussed in the enclosed SE and on the licensee's response to the BWRVIP-75 SE's open items, the staff finds the licensee's usage of the BWRVIP-75 report to be acceptable for one operating cycle, with one exception. The staff has not found acceptable the requested alternative to use the criteria contained in the BWRVIP-75 report in lieu of the examination requirements contained in IWB-2500-1. The staff finds that

insufficient basis has been provided to eliminate the surface examinations. However, the staff would find a volumetric examination of the volume and the surface, as specified in Figure IWB-2500-8, to be an acceptable alternative provided that the volumetric examination procedure and examiners are qualified in accordance with ASME Section XI, Appendix VIII for intergranular stress corrosion cracking examinations of piping.

Upon the issuance of the staff's final SE on the BWRVIP-75 report, the licensee should address any modifications to the as-revised BWRVIP-75 report that affect its inspections of the subject welds, and inform the staff of any deviations from the as-revised guidance.

Sincerely,

/RA/

Richard L. Emch, Jr., Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-321 and 50-366

Enclosure: As stated

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insufficient basis has been provided to eliminate the surface examinations. However, the staff would find a volumetric examination of the volume and the surface, as specified in Figure IWB-2500-8, to be an acceptable alternative provided that the volumetric examination procedure and examiners are qualified in accordance with ASME Section XI, Appendix VIII for intergranular stress corrosion cracking examinations of piping.

Upon the issuance of the staff's final SE on the BWRVIP-75 report, the licensee should address any modifications to the as-revised BWRVIP-75 report that affect its inspections of the subject welds, and inform the staff of any deviations from the as-revised guidance.

Sincerely,

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SOUTHERN NUCLEAR OPERATING COMPANY

EDWIN I. HATCH NUCLEAR PLANT

THIRD 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM

ADOPTION OF BWRVIP-75

DOCKET NOS. 50-321 AND 50-366

1.0 INTRODUCTION

1.1 Background

By letter dated June 23, 2000, Southern Nuclear Operating Company (SNC), licensee for the Edwin I. Hatch Nuclear Plant, Units 1 and 2, submitted a request to adopt the guidance contained in the Electric Power Research Institute (EPRI) proprietary report TR-113932, "BWR Vessel and Internals Project, Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules (BWRVIP-75)," dated October 1999, for weld examination sample determination and scope expansion criteria, beginning with the Unit 1 Fall 2000 refueling outage. SNC would adjust the weld examination scope for the forthcoming Unit 1 outage and apply the sample size criteria described in BWRVIP-75 for plants maintaining effective Hydrogen Water Chemistry (HWC).

SNC is requesting approval to utilize the BWRVIP-75 report as an alternative, in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(3)(i), to the American Society of Mechanical Engineers (ASME) Section XI, Table IWB-2500-1 for Examination Categories B-F and B-J. SNC proposes to utilize the criteria in the BWRVIP-75 report as the sole criteria for all weld examinations within the scope of existing NUREG-0313 and Generic Letter (GL) 88-01 inspections with no consideration of the examination requirements of Section XI Table IWB-2500-1.

1.2 BWRVIP-75 Report

By letter dated October 27, 1999, the BWRVIP-75 report was submitted to the U.S. Nuclear Regulatory Commission (NRC) for staff review. The BWRVIP-75 report proposed revisions to the extent and frequencies of piping inspections contained in GL 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," dated January 25, 1988, and NUREG-0313, Revision 2, "Technical Report on Material Selection and Process Guidelines for BWR Coolant

Pressure Boundary Piping," dated January 1988. The proposed revisions were based on the consideration of inspection results and service experience gained by the industry since the issuance of GL 88-01, and included additional knowledge regarding the benefits of improved BWR water chemistry. The BWRVIP-75 report also provided justification for the proposed inspection criteria for Category A through E welds for the respective conditions of normal water chemistry (NWC) and hydrogen water chemistry (HWC).

2.0 STAFF EVALUATION

2.1 BWRVIP-75 Review

The NRC staff has reviewed the BWRVIP-75 report and issued its Safety Evaluation (SE) in a letter dated September 15, 2000. With the exception of the open items discussed in the staff's SE, the BWRVIP-75 guidance is acceptable to reference as the technical basis for relief from, or as an alternative to, the requirements of Section XI to the ASME Code and 10 CFR 50.55a, in order to use the sample schedules and frequencies specified in the BWRVIP-75 report that are less than those required by the ASME Code. The staff's approval of the BWRVIP-75 report also allows licensees to utilize the BWRVIP-75 guidance, which will be revised to reflect the resolution of the open items in the staff's SE, in lieu of licensees' commitments to GL 88-01 and NUREG-0313, Rev. 2, or as the technical basis for a plant-specific request for a license amendment to change technical specifications requiring GL 88-01 or NUREG-0313, Rev. 2 inspections.

The stated inspection extent and frequency in the as-revised BWRVIP-75 report must be satisfied for each category. These inspections may be credited toward ASME Section XI requirements; however, inspections of those welds outside the GL 88-01 scope are not affected and will not to be included in any relief or alternative based on the staff's BWRVIP-75 SE. The findings and conclusions in the staff's BWRVIP-75 SE are not applicable to any welds or piping (e.g., socket welds, carbon steel piping, etc.) other than those within the original scope of GL 88-01 and NUREG-0313, Rev. 2 (e.g., those in BWR piping made of austenitic stainless steel four inches or larger in nominal diameter and exposed to reactor coolant at a temperature above 200 ^{o}F during power operation, and to reactor pressure vessel attachments and appurtenances).

The BWRVIP-75 report's proposal regarding NWC conditions, which significantly reduces the inspection schedule from that originally specified in GL 88-01, follows the intent of the staff's position delineated in the GL that improved water chemistry could justify reductions in inspection schedules. Further, when HWC is implemented, the required inspections are further reduced from those recommended for NWC. There is no change in the inspection schedule for Categories F and G welds, which will continue to be inspected every refueling outage. In addition, the report also provides new sample expansion criteria for Category E welds and a definition for effective HWC. The proposed reduction in inspections, with the exceptions for the below open items, is adequately justified by the described industry-wide inspection results, plant operating experience, and improved water chemistry.

2.2 SNC Technical Justification

SNC provided an enclosure to the June 23, 2000, letter, which stated the proposed justification for adoption of the BWRVIP-75 report's inspection scope and frequency for a plant with effective HWC. The staff has reviewed this and it is evaluated below.

The licensee stated:

1. The Chemistry Monitoring Program at Plant Hatch provides guidance for operating both Units in accordance with the EPRI BWR Water Chemistry Guidelines. Water chemistry control parameters are monitored and action level values are used by plant staff members to correct water chemistry conditions and evaluate those conditions, as required.

Staff's Evaluation:

1. The staff's evaluation of the BWRVIP-75 report stated in Open Item 3.7, Reactor Water Coolant Conductivity, that, to qualify for the reduced inspection frequency, the average conductivity in reactor water coolant should not exceed the recommendations in the EPRI BWR Water Chemistry Guidelines, 1996 Revision (BWRVIP-29), or later revisions. The average conductivity can be calculated from the measurements made during the entire inspection interval based on the total operating time at a temperature at or above 200 ^{o}F. Based on the above statement by the licensee, Units 1 and 2 are operated in accordance with the EPRI BWR Water Chemistry Guidelines; the staff finds the licensee's response to this open item in the BWRVIP-75 SE to be acceptable.

The licensee stated:

2. Hatch Unit 1 has been operated with Hydrogen Water Chemistry (HWC) since September, 1987. From May 1994 to March 1999 (Cycles 16, 17, & 18), Unit 1 has operated under moderate HWC with hydrogen injection at 45 - 55 SCFM, conductivity measured in the 0.08 to 0.14 µS/cm range, and Electro-Chemical Potential (ECP) measurements in the -400 to -450 [standard hydrogen electrode] SHE range. HWC availability has been maintained at > 80% since initial implementation. At the shutdown of Cycle 18 (Spring 1999), NobleChem (NMCA) was added to Unit 1. The NobleChem addition was implemented with both Reactor Coolant System (RCS) Recirculation Pumps in operation to achieve as much distribution to the RCS piping as possible. During Cycle 19 (current cycle), hydrogen injection has been maintained at 6 to 8 SCFM and ECP is measured at -450 to -480 SHE.

Staff's Evaluation:

2. The staff's evaluation of the BWRVIP-75 report stated in Open Item 3.8, Effective HWC and NMCA Programs, that, to have an effective HWC program, four acceptance criteria need to be met. Specifically, ECP measurements, using either reference electrodes or by monitoring of secondary parameters (e.g., feedwater hydrogen flow

rate or concentration, reactor coolant dissolved oxygen, reactor coolant dissolved hydrogen, main steam line radiation level, and/or conductivity) with a monitoring frequency of at least once every 12 hours, should meet -230 mV or less; HWC should be available at least 80 percent of the time; conductivity transients (e.g., conductivity > 0.3 μS/cm) shall be of short duration (e.g., for a duration of 24 hours or less) in order for the time associated with the transients not to be subtracted from the acceptable HWC service time; and, when the hydrogen injection is interrupted for less than 10 hours, the interrupted time need not be excluded from the calculation of the acceptable HWC service time as long as the ECP is still below -230 mV or the secondary parameters meet the acceptance criteria.

Further, the staff's SE of the BWRVIP-75 report stated in Open Item 3.8 that, to have an effective NMCA program, four acceptance criteria need to be met. Specifically, the hydrogen vs. oxygen molar ratio should be measured and maintained at 4 and above; the acceptable NWCA program should have a monitoring program to determine if the NMCA remains applied and to determine when the process needs to be re-applied; NMCA is only applicable when HWC is available, and must be available at greater than 90 percent of the hot operating time; otherwise, the inspection frequency should be increased to that of the HWC or NWC condition, as appropriate; and, conductivity transients (e.g., conductivity >0.3 μS/cm) should be of short duration (e.g, for a duration of 24 hours or less) in order for the time associated with the transients not to be subtracted from the acceptable HWC service time.

Since ECP is monitored at the bottom head drain line of both Units 1 and 2 using four reference electrodes at least once every 12 hours, the staff finds the licensee's response to this open item in the BWRVIP-75 SE to be acceptable for Unit 1.

The licensee stated:

3. Hatch Unit 2 has been operated with HWC since September of 1991. From May 1994 to March 2000 (Cycles 12, 13, 14 & 15), Unit 2 has operated under moderate HWC with hydrogen injection at 35 - 55 SCFM, conductivity measured in the 0.08 to 0.14 μS/cm range, and Electro-Chemical Potential (ECP) measurements in the -400 to -450 SHE range. HWC availability has been maintained at > 80% since initial implementation. At the shutdown of Cycle 15 (Spring 2000), NobleChem was added to Unit 2. The NMCA was implemented with both Reactor Coolant System (RCS) Recirculation Pumps in operation to achieve as much distribution to the RCS piping as possible. During Cycle 16 (current cycle), hydrogen injection has been maintained at 6 to 8 SCFM and ECP is measured at -450 to -480 SHE.

Staff's Evaluation:

3. For the same reasons stated above in the staff's response to item 2, the staff finds the licensee's response to this open item in the BWRVIP-75 SE to be acceptable for Unit 2.

The licensee stated:

4. Adoption of BWRVIP-75 will allow deletion of fifteen (15) mechanized UT and eight (8) manual UT examinations, which are NUREG-0313 Category C welds, and two (2) manual UT examinations, which are NUREG-0313 Category A welds, during the Hatch Unit 1 2000 outage. Additionally, approval of BWRVIP-75 as an alternative to the ASME XI examination requirements results in deletion of eighteen (18) surface (liquid penetrant) examinations. The estimated savings are: $8K/weld for UT, $1K/weld for PT, $18.5K/week mechanized equipment rental (3-weeks), plus mobilization expenses for 8 contractor personnel. SNC estimates a total cost of $287.5K for examinations only. Most of these examinations require erection of scaffolding for access, and all require insulation removal, some surface preparation, radiation shielding, and restoration after examination. The associated craft support cost[s] are estimated at another $75K. All of these examinations are located in the primary containment (drywell), which is a high radiation area, and Health Physics personnel estimate total dose for ISI and craft support at 10-15 man-rem. Therefore, SNC could also benefit from an approximate $500K cost savings for the fall 2000 Unit 1 outage and resultant future ISI cost savings on both units.

Staff's Evaluation:

4. The staff's evaluation of the BWRVIP-75 report stated in Open Item 3.9, Identification of Safety Significant Locations, that the safety significance of the locations to be inspected should be determined using a ranking process, similar to that discussed in Section 4 of the BWRVIP-75 report, by a panel knowledgeable of the intergranular stress-corrosion cracking (IGSCC) mechanism and its impact on the subject piping systems to identify the locations of greatest safety significance with respect to changes in the IGSCC inspection program. The staff recommends that inspection locations should be distributed among the weldments in each category until the required percentage of locations have been selected, with the highest safety-significant locations being selected first. During the selection of inspection locations, licensees should give additional consideration to those locations having attributes that would promote IGSCC, or where IGSCC could be accelerated by crevice corrosion or thermal fatigue. The attributes to be considered are: high carbon or low ferrite content, crevice or stagnant flow condition, evidence of weld repair, surface cold work, and high fit-up, residual and operating stresses. These locations should have higher inspection priority.

   Based on the above, the licensee should rank the welds proposed not to be inspected during the upcoming outage utilizing the recommended ranking process to determine the safety significance of the weldments. If these weldments rank in the top 10 percent of safety significance, they should be inspected within the period specified by the proposed revisions to the BWRVIP-75 report. The staff requests that the licensee, in its report of inspection results following the outage, discuss in general terms the ranking process utilized, and the ranking of the weldments in general. During a conference call held on October 4, 2000, the licensee agreed to utilize this ranking process. Based on the licensee's performing the above stated rankings of the

weldments, the staff finds the licensee's response to this open item in the BWRVIP-75 SE to be acceptable.

However, the requested alternative to use the criteria contained in the BWRVIP-75 report in lieu of the surface examination requirements contained in IWB-2500-1 is not acceptable. The staff finds that insufficient basis has been provided to eliminate the surface examinations. The staff would find a volumetric examination of the volume and the surface, as specified in Figure IWB-2500-8, to be an acceptable alternative examination. The volumetric examination procedure and examiners must be qualified in accordance with ASME Section XI, Appendix VIII for IGSSC examinations of piping.

2.3 Additional BWRVIP-75 Open Items

In addition to the open items discussed above (Open Items 3.7, 3.8 and 3.9), the staff's SE for the BWRVIP-75 report contained Open Items 3.1 through 3.6. Specifically, these open items are as follows:

Open Item 3.1, Proposed Inspection Frequency and Scope for Category A Welds, states that, to reduce the inspection sample size below 25 percent for Category A welds, the stainless steel piping needs the application of two mitigation measures, with the resistant material considered to be one mitigating measure. An effective second mitigating measure would be heat sink welding (HSW), mechanical stress improvement process, induction heating stress improvement (IHSI), and/or HWC.

Open Item 3.2, Proposed Inspection Frequency for Category B Welds, discusses the staff's concern regarding the long term effectiveness of the stress improvement mitigation measure in combination with non-resistant materials. Specifically, the staff recommends, for plants that used IHSI to mitigate IGSCC, but do not comply fully with the recommendations of the EPRI report TR-112076, "Induction Heating Stress Improvement Effectiveness on Crack Growth in Operating Plants (BWRVIP-61)," January 1999 (i.e. properly applied SI and qualified UT), that the inspection frequency for Category B welds be revised to 25 percent of the population every 6 years under NWC conditions, or 25 percent every 10 years under HWC conditions. When noble metal chemical addition (NMCA) is implemented with HWC, the inspection frequency may be reduced to a schedule of 10 percent of the population in 10 years. For plants in compliance with the recommendations of the BWRVIP-61 report, the staff approves the BWRVIP-75 report's proposed new inspection criteria for Category B welds.

Open Item 3.3, Proposed Inspection Frequency for Category C Welds, discusses how, for the same considerations given in Open Item 3.2, the staff recommends that the inspection frequency for Category C welds treated with the IHSI process be 50 percent every 10 years and 25 percent every 10 years under NWC and HWC conditions, respectively. When NMCA is implemented in HWC condition, the inspection frequency may be reduced to 10 percent of the population every 10 years. For plants in compliance with the recommendations of the BWRVIP-61 report, the staff approves the BWRVIP-75 report's proposed new inspection criteria for Category C welds.

Open Item 3.4, Proposed Inspection Frequency for Category E Welds (weld overlay repair), discusses the concern that the BWRVIP-75 report's proposed inspection criteria may not provide the required assurance needed to conclude that the structural integrity of the overlay

repaired welds will be maintained in cases where the overlay material is less resistant to IGSCC. Further, the staff disagrees with the BWRVIP's categorization of weld overlay repairs made with material not resistant to IGSCC (e.g., Alloy 182) as Category E, since both the base material of the piping and the overlay material are not resistant to IGSCC; therefore, there is little likelihood that the cracks could be arrested in the weld overlay. The staff does not agree that inspection relief should be given to such welds, and they should be categorized as Category F. Accordingly, the staff recommends the following inspection schedule; after three successive satisfactory inspections (once every two refueling cycles) where no indication of crack growth or new cracking is found, the Category E welds repaired by weld overlay using resistant materials may be inspected at a frequency of 25 percent of the population every 10 years under NWC, and 10 percent every 10 years when HWC and/or NMCA is implemented.

Open Item 3.5, Inspection of Category E Welds (Stress Improved) with Existing Cracks, discussed the staff's disagreement with Section 3.5.1.2 of the BWRVIP-75 report, which provides inspection guidelines for cracked welds that have been mitigated by a stress improvement process. One of the proposed guidelines states that examination of welds with existing cracking prior to stress improvement will be examined at a frequency specified in the flaw evaluation. The staff does not agree with the proposed inspection frequency because proper flaw evaluation can not be performed without a precise knowledge of residual stress distribution. After four successive inspections of welds that were stress improved and have no indication of crack growth or no new cracking found, the inspection schedule may be upgraded to that of the corresponding Category D welds. The staff recommends that all welds with active cracks should be inspected every refueling outage, since these welds should be categorized as Category F.

Open Item 3.6, Sample Expansion, discusses the staff's finding, based on the information provided in the BWRVIP-75 report, that the proposed sample expansion criteria for Category A, B and C weldments are not acceptable and that the sample expansion criteria delineated in GL 88-01 should continue to be used. The staff does not agree with the proposed criterion that sample expansion for Category E welds is not required if the in-service crack extension is limited to a layer of the weld overlay that was not credited in the weld overlay design. The staff considers that inspection samples should be expanded when significant circumferential crack growth (i.e., 25 percent increase of what was previously examined) is detected. The staff recommends that the sample expansion criteria for Category E welds should follow the same scheme as originally proposed in the BWRVIP-75 report for Category A, B and C welds, and that such welds should follow the inspection schedule of corresponding Category D welds.

The licensee should respond to the open items in the BWRVIP-75 report and state, in its report of inspection results following the outage, that inspections of the subject weldments were performed in accordance with the staff's September 15, 2000, SE of the BWRVIP-75 report. Based on the licensee's accomplishment of the inspections as discussed above, the staff finds the licensee's response to the remaining open items in the BWRVIP-75 SE to be acceptable.

3.0 CONCLUSION

The staff has reviewed the licensee's proposal to adopt and utilize the guidance contained in the BWRVIP-75 report as an alternative, in accordance with 10 CFR 50.55a(3)(i), to the ASME Section XI, Table IWB-2500-1 for Examination Categories B-F and B-J, for weld examination sample determination and scope expansion criteria, for plants maintaining effective HWC, beginning with the Unit 1 Fall 2000 refueling outage.

The staff requests that the licensee, in its report of inspection results following the outage, discuss the ranking process utilized and the ranking of the weldments. Further, the licensee should also state that inspections of the subject weldments were performed in accordance with the staff's September 15, 2000, SE of the BWRVIP-75 report.

Based on the staff's review of the licensee's proposed justification, on the licensee's accomplishment of the inspections as discussed above, and on the licensee's response to the BWRVIP-75 SE's open items, the staff finds the licensee's usage of the BWRVIP-75 report (as revised to reflect the response to the open items in the staff's September 15, 2000, BWRVIP-75 SE), to be acceptable for one operating cycle with one exception. The exception is the requested alternative to use the criteria contained in the BWRVIP-75 report in lieu of the examination requirements contained in IWB-2500-1. The staff finds that insufficient basis has been provided to eliminate the surface examinations.

Upon the issuance of the staff's final SE on the BWRVIP-75 report, the licensee should address any modifications to the as-revised BWRVIP-75 report as it affects its inspections of the subject weldsments, and inform the staff of any deviations from the as-revised guidance.

Principal Contributor: C. E. Carpenter

Date: October 10, 2000

cc:

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