Southern Nuclear
Operating Company, Inc.
Post Office Box 1295
Birmingham, Alabama 35201-1295

Tel 205.992.5000

SOUTHERN COMPANY
Energy to Serve Your World℠

August 14, 2007

Docket No.: 50-321

NL-07-1155

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

Edwin I. Hatch Nuclear Plant
Proposed Modification of the
Unit 1 Core Shroud Stabilizer Assemblies

Ladies and Gentlemen:

Pursuant to 10 CFR 50.55a(a)(3)(i), Southern Nuclear Operating Company (SNC) requests NRC approval of a proposed modification to each of the four core shroud stabilizer assemblies. During the upcoming 2008 Refueling Outage (1RFO23), SNC proposes to replace the Hatch Unit 1 stabilizer assembly upper supports and tie rod top nuts due to their potential for cracking.

Historically, in References 1 and 2, SNC proposed a preemptive repair to the Hatch Unit 1 core shroud by installation of four stabilizer assemblies (i.e., tie rods). By Reference 3, the NRC found the proposed repair acceptable as an alternative to the American Society of Mechanical Engineers (ASME) Code as allowed by 10 CFR 50.55a(a)(3)(i). This repair was installed during the 1994 Refueling Outage (1RFO15).

Subsequently, a technical concern was identified and evaluated regarding the possibility of gaps at the lower core shroud welds during normal operation (References 4 through 7). By References 8 and 9, SNC notified the NRC that the concern would be resolved by increasing the shroud stabilizer mechanical preload by applying additional torque to the shroud stabilizer nut. By Reference 10, the NRC concurred with this resolution and it was performed during the 1996 Refueling Outage (1RFO16).

During the 2006 Refueling Outage (1RFO22) two of four shroud stabilizer assembly upper supports were found cracked. This condition was the subject of several GE 10 CFR Part 21 communications (References 11 through 14). The core shroud horizontal welds were examined during the same outage and it was determined that the core shroud horizontal welds were structurally redundant to the core shroud stabilizers for at least one operating cycle (Reference 15).

A047

MRR

Enclosure 1 contains a summary of the evaluations performed to confirm that the proposed core shroud stabilizer modifications provide an acceptable level of quality and safety. The presentation of this information generally follows the format of BWRVIP-04-A, "BWR Vessel and Internals Project Guide for Format and Content of Core Shroud Repair Design Submittals," dated April 2002, as applicable, considering the scope of the proposed modification.

Enclosure 2 contains the design documentation that describes the proposed modification. This is a GE proprietary report considered by its preparer to contain proprietary information exempt from disclosure pursuant to 10 CFR 2.390. Therefore, on behalf of GE, SNC hereby makes application to withhold Enclosure 2 from public disclosure in accordance with 10 CFR 2.390(b)(1). Enclosure 3 contains the non-proprietary GE report containing design documentation that describes the proposed modification. The GE Affidavit requesting the proprietary information be withheld is included in Enclosure 4. Enclosure 5 is a summary of regulatory commitments associated with this submittal.

The core shroud stabilizers are not included under the ASME Code Section XI definition for repair or replacement. As such, the design details of the proposed modification are being submitted to the NRC for review and approval as an alternative repair pursuant to 10 CFR 50.55a(a)(3)(i). This submittal contains the basis for concluding that the modification provides an acceptable level of quality and safety. Note that this submittal is similar to the Nine Mile Point Station submittal of February 12, 2007, and the Pilgrim Nuclear Power Station submittal of March 22, 2007, on the same topic.

NRC authorization to use this proposed alternative is requested by February 1, 2008, to support the scheduled startup of Hatch Unit 1 following 1RFO23.

If you have any questions, please advise.

Sincerely,

B. J. George
Manager, Nuclear Licensing

BJG/MNW/daj

Enclosures:
1. Core Shroud Stabilizer Modification Evaluation Summary
2. GE Core Shroud Stabilizer Modification Design Report (Proprietary)
3. GE Core Shroud Stabilizer Modification Design Report (Nonproprietary)
4. General Electric Company Letter, GBS-07-03-af, Affidavit
5. List of Regulatory Commitments

cc: Southern Nuclear Operating Company
Mr. J. T. Gasser, Executive Vice President
Mr. D. R. Madison, Vice President – Hatch
Mr. D. H. Jones, Vice President – Engineering
RTYPE: CHA02.004

U. S. Nuclear Regulatory Commission
Dr. W. D. Travers, Regional Administrator
Mr. R. E. Martin, NRR Project Manager – Hatch
Mr. J. A. Hickey, Senior Resident Inspector – Hatch

References:

1. Georgia Power Company (GPC) Letter HL-4683, Hatch Unit 1 Core Shroud Stabilizer Design Submittal, dated September 2, 1994.

2. GPC Letter HL-4696, Hatch Unit 1 Response to Request for Additional Information for Core Shroud Stabilizer Design Submittal, dated September 23, 1994.

3. NRC Safety Evaluation Report for Core Shroud Stabilizer Design for Hatch Unit 1 (TAC No. M90270), dated September 30, 1994.

4. GPC Letter HL-4781, Hatch Unit 1 Response to Request for Additional Information for Core Shroud Modification, dated February 20, 1995.

5. GPC Letter HL-4844, Hatch Unit 1 Response to Second Request for Additional Information for Core Shroud Modification, dated May 18, 1995.

6. GPC Letter HL-4868, Hatch Unit 1 Response to Follow-Up Request for Additional Information Regarding Core Shroud Modification, dated June 21, 1995.

7. NRC Supplemental Safety Evaluation for Core Shroud Stabilizer Design for Hatch Unit 1 (TAC No. M91091), dated August 10, 1995.

8. GPC Letter HL-5110, Hatch Unit 1 Resolution of Issue of Conformance Relative to Core Shroud Stabilizer Design, dated February 20, 1996.

9. GPC Letter HL-5119, Hatch Unit 1 Resolution of Issue of Conformance Relative to Core Shroud Stabilizer Design, dated March 4, 1996.

10. NRC Supplement 2 to the Safety Evaluation for Hatch Unit 1 Core Shroud Stabilizer Modification (TAC No. 94910), dated May 30, 1996.

11. GE Letter MFN 06-133, Part 21 60-Day Interim Report Notification: Core Shroud Repair Tie Rod Upper Support Cracking, dated May 12, 2006.

12. GE Letter MFN 06-292, Update to Part 21 Interim Report Notification: Failure Analysis of Core Shroud Repair Tie Rod Upper Support Cracking, dated August 21, 2006.

13. GE Letter MFN 06-374, Part 21 Notification: Completion of GE Evaluation on Core Shroud Repair Tie Rod Upper Support Cracking, dated October 9, 2006.

14. GE Letter MFN 07-005, GE Part 21 Communication: Potential for Intergranular Stress Corrosion Cracking in Shroud Repair Tie Rod Threaded Components, dated January 5, 2007.

15. SNC Letter NL-06-1251, Hatch Unit 1 Submittal of Plant Specific Analysis of Core Shroud Horizontal Weld Indications, dated July 3, 2006.

Edwin I. Hatch Nuclear Plant
Proposed Modification of the Unit 1 Core Shroud Stabilizer Assemblies

Enclosure 1

Core Shroud Stabilizer Modification Evaluation Summary

Enclosure 1

Edwin I. Hatch Nuclear Plant - Unit 1
Core Shroud Stabilizer Modification Evaluation Summary

TABLE OF CONTENTS

Edwin I. Hatch Nuclear Plant - Unit 1
Core Shroud Stabilizer Modification Evaluation Summary

1. INTRODUCTION AND SUMMARY

This request involves the modification of certain components of the existing Hatch Unit 1 core shroud stabilizer assemblies (i.e., the upper supports and the tie rod nuts). This proposed modification to the previously reviewed and accepted core shroud repair is not included under the American Society of Mechanical Engineers (ASME) Code, Section XI, definition for repair or replacement. Thus, the design details of the proposed core shroud repair modification are being submitted to the NRC for review and authorization for use as an alternative repair, pursuant to 10 CFR 50.55a(a)(3)(i). The proposed modification addresses the potential for intergranular stress corrosion cracking (IGSCC) of the tie rod upper supports that were identified in a General Electric Company (GE) 10 CFR Part 21 notification dated October 9, 2006 (Reference 13).

By letters dated September 2, 1994 and September 23, 1994, Southern Nuclear Operating Company (SNC) proposed a preemptive repair to the Hatch Unit 1 core shroud by installation of four stabilizer assemblies (i.e., tie rods) (References 1 and 2). In its letter dated September 30, 1994 (Reference 3), the NRC found the proposed repair acceptable as an alternative to the American Society of Mechanical Engineers (ASME) Code as allowed by 10 CFR 50.55a(a)(3)(i). This repair was installed during the 1994 Refueling Outage (1RFO15).

Subsequently, a technical concern was identified and evaluated regarding the possibility of gaps at the lower core shroud welds during normal operation (References 4 through 7). By letters dated February 20, 1996 and March 4, 1996 (References 8 and 9), SNC notified the NRC that the concern would be resolved by increasing the shroud stabilizer mechanical preload by applying additional torque to the shroud stabilizer nut. In its letter dated May 30, 1996 (Reference 10), the NRC concurred with this resolution and it was performed during the 1996 Refueling Outage (1RFO16).

The purpose of this enclosure is to describe the design of the Hatch Unit 1 core shroud stabilizer assembly modification and to summarize the evaluations performed to confirm that the tie rod assembly modification provides an acceptable level of quality and safety. These descriptions and evaluations focus on the differences between the previously reviewed and accepted core shroud tie rod design and the proposed modifications to that design.

The repair conforms to the requirements of the core shroud repair criteria provided in BWRVIP-02-A (Reference 19) without any alternate approaches or exceptions.

2. BACKGROUND

Hatch Unit 1 installed core shroud stabilizers in 1994 (1RFO15) on a pre-emptive basis in lieu of ultrasonic (UT) inspection of the core shroud horizontal welds. The stabilizers functionally replace the shroud horizontal welds H1 through H8. The stabilizer assembly is shown in Figure 1. The General Electric Company (GE) designed and installed the Hatch Unit 1 tie rod assemblies.

During the 2006 Refueling Outage (1RFO22) two of four shroud stabilizer assembly upper supports were found cracked. This condition was the subject of several GE

10 CFR Part 21 communications (References 11 through 13). The core shroud horizontal welds were examined during the same outage and it was determined that the core shroud horizontal welds were structurally redundant to the core shroud stabilizers for at least one operating cycle (Reference 15).

The apparent root cause of the condition is intergranular stress corrosion cracking (IGSCC) in the Alloy X-750 tie rod upper support material. Alloy X-750 material is susceptible to IGSCC if subjected to sustained, large peak stress conditions.

The potential for high peak stress in the shroud stabilizer upper bracket design is attributed to the lack of a specified radius at the corner junction between horizontal and vertical legs of the bracket (see Figure 2), which creates a high stress concentration. This high peak stress reduces the design life of the shroud stabilizer upper support.

GE conducted an extent of condition review to determine if other Alloy X-750 shroud stabilizer components have similar potential for high peak stress. GE has identified that the root radii of the threads in the shroud stabilizer threaded components may be smaller than the nominal values used in previous design evaluations. GE submitted a 10 CFR Part 21 communication by letter dated January 5, 2007 (Reference 14) to address the potential for IGSCC in shroud stabilizer threaded components. The proposed modification includes a modified nut that incorporates an improved locking mechanism. To improve IGSCC resistance, the new nuts will include a specified root radius sufficient to minimize the peak principle stress to within the same criterion as used for the upper support.

The focus of this submittal is on the proposed replacement shroud stabilizer upper supports and the impact that this modification has on previously performed analyses and evaluations.

2.1 Shroud Operational and Safety Functions

The core shroud operational and safety functions have previously been described in the initial core shroud repair submittals (References 1, 2, 4, 5, 6, 8, and 9), and are also described in the Hatch Unit 1 Updated Final Safety Analysis Report (UFSAR), Section 4.2.4.2. Additional information is contained in the Hatch Unit 2 Updated Final Safety Analysis Report (UFSAR), Sections 4.1.2.2, 4.2.2.2, 3.7B.2.1.6.3, and 5.4.6.3.2. In summary, the core shroud provides a partition to separate the upward flow of coolant through the core from the downward recirculation flow on the outside of the shroud, supports the top guide and core plate which maintain core geometry, and houses the core spray spargers, which provide emergency core cooling.

The four (4) core shroud repair stabilizer assemblies (tie rods) are designed to structurally replace horizontal (circumferential) shroud welds H1 through H8 and thereby maintain the above shroud functions. Core shroud weld numbers H1 through H8 are all horizontal (circumferential) shroud welds. Weld H8 attaches the shroud support ring to the shroud support plate. Each tie-rod assembly consists of a tie-rod, upper support, upper spring, middle support, lower spring, lower support with clevis hook, and other minor components. The ends of the tie-rod assemblies are attached at the top to the upper shroud head flange and at the bottom to clevis pins installed in shroud support

plate gussets. The shroud head is notched at four azimuth locations (eight notches) using electric discharge machining (EDM) to accommodate the installation of the upper stabilizer support. At the bottom, holes are machined in shroud support plate gussets at the same four azimuth locations for attaching each tie-rod assembly.

The upper supports combined with the upper lateral spring are designed to restrain lateral movement of the shroud shell between welds H1 and H2, the ring between H2 and H3 and the shell between H3 and H4. The top of the tie rod has male threads that attach to the upper support by a tie rod top nut. The function of this threaded joint is to transfer the vertical preload from the upper support down through the tie rod and the lower tie rod components. The mechanical preload applied to the nut during installation plus the thermal preload developed during normal operating conditions is sufficient to ensure that the core shroud will perform its safety functions and meet power generation objectives.

2.2 NRC and Industry Actions

The NRC issued Generic Letter (GL) 94-03 (Reference 16) on July 25, 1994 requesting operating BWR licensees to address the core shroud cracking issue. For the more recent issues associated with the above-referenced GE Part 21 notifications, the BWRVIP has issued several communications to the NRC and BWRVIP member utilities. As discussed in the NRC safety evaluation (SE) for BWRVIP-76, dated July 27, 2006 (References 17 and 18), the BWRVIP has addressed the generic impact of the tie rod cracking operating experience on the BWRVIP-76 report inspection guidelines. Actions that the BWRVIP committed to take included: (1) work with the industry to understand the root cause; (2) require plants to inspect the tie rods at their next scheduled outage; and (3) take appropriate follow-up actions including revision of applicable BWRVIP documents.

In their SE for BWRVIP-76, the NRC acknowledged the BWRVIP's position and requested that if the BWRVIP determines that the root cause indicates that changes are needed to the BWRVIP material requirements or to the BWRVIP inspection guidelines, the BWRVIP take appropriate action to address the impact of the industry core shroud tie rod repair cracking as needed.

The BWRVIP is working with GE to develop an ongoing strategy to address the potential limited life of Alloy X-750 components under high-sustained peak stress. At this time, the BWRVIP has not changed the BWRVIP-84 requirement that the maximum allowable peak stress for Alloy X-750 be less than 80% of the yield strength of the material at the intended operating temperature. SNC considers the major concern to be the lack of a radius sufficient to maintain the peak principle stress below the BWRVIP-84 criterion of 0.8Sy. Thus, SNC is applying a conservative criterion (i.e., lower allowable yield strength, compared to the BWRVIP-84 criterion) for the proposed tie rod modification.

2.3 SNC Response to Generic Letter 94-03

Shroud

The shroud stabilizer design modification was initially installed during 1RFO15 as a preemptive repair. Following the installation, SNC began performing visual exams on the shroud vertical welds as required by BWRVIP-76 beginning in 1RFO16 (1996). An ultrasonic volumetric examination (UT) was performed on welds V3 through V8 during 1RFO17 (1997) and repeated during 1RFO21 (2004) for welds V5 and V6. Indications of varying length have been recorded on V5, V6, V4, and V8 both visually and with UT. The indications on V4 and V8 are sufficiently small to meet BWRVIP-76 guidance for a 10-year end of inspection interval (EOI). The EOI of 10 years for the indications on V5 and V6 required plant specific analyses (Reference 27). As part of the recovery effort in 1RFO22, UT was conducted on shroud horizontal welds H1-H7 and an EVT-1 of approximately 20% of H8. The results of these examinations were used to determine the shroud to be acceptable without functional tie rods, (i.e. redundant), for at least one operating cycle. The scheduled ultrasonic examination of approximately 25% of the shroud support plate to RPV wall weld H9 was also completed during 1R22 (2006) with no indications recorded.

Shroud Tie Rods

During 1RFO16 the torque to all 4 tie rods was increased. The tie rod at the 315^0 azimuth was found with less than desirable preload and was corrected. All others were acceptable. A tightness check was repeated on all four tie rods during 1RFO17 with the 315^0 azimuth tie rod again corrected for less than desirable preload. All others were acceptable. Tightness at the 315^0 location was checked again in 1RFO18 and found acceptable but with less than desirable preload. The disposition of the 315^0 tie rod at that time was that the lower pre-load had been predicted prior to the outage confirming the previous disposition that mechanical shakedown was the cause of the loss of preload.

A reexamination of the repair hardware was conducted during 1RFO22 which discovered cracking in two upper supports at the 135^0 and 225^0 locations. The more severely cracked 135^0 upper support was replaced with like-kind material (X-750). The 225^0 location was deemed acceptable for one cycle based on shroud horizontal weld redundancy. In addition, the 315^0 tie rod again had a lower pre-load but with values in agreement with predictions made prior to the outage.

3. DESCRIPTION OF THE PROPOSED TIE ROD ASSEMBLY MODIFICATIONS

3.1 Design Objectives

The objective of the proposed tie rod modifications is to design and install replacement upper support assemblies and tie rod top nuts that will remain resistant to IGSCC over the remaining plant life (i.e., until 2034) and that interface correctly with the existing shroud repair hardware.

3.2 Design Criteria

The modified upper support and tie rod top nut comply with the criteria delineated in BWRVIP-02-A and BWRVIP-84 (References 19 and 20, respectively), with no exceptions taken. The original codes and design standards used for construction of the original tie rod assemblies were delineated in GE Specification 25A5572 Rev. 2 which was included in the 1994 core shroud repair submittals (References 1). The original codes and design standards remain applicable to the proposed modifications, as well as other more recent standards (e.g., BWRVIP-84), as discussed in later sections of this attachment.

3.3 Description of Repair Components and Design Features

The geometry of the replacement hardware (upper support, tie rod nut, and other associated upper support components) is shown in the attached GE design Documents. These newly-designed components incorporate features that improve their ability to resist IGSCC. These features include: (1) a large fillet radius at the corner of the upper support; (2) increased width and thickness of the upper support; (3) sharp edges eliminated; and (4) a larger root radius of the tie rod nut threads. The original tie rod installation required that cutouts be made in the shroud head flange to accommodate the upper supports, which hang over the shroud flange. The width of the cutouts will be increased to accommodate the increased width of the modified upper supports.

4. STRUCTURAL AND DESIGN EVALUATION

4.1 Analysis Models and Methodology

4.1.1 <u>Description of Structural Models and Analysis</u>

4.1.1.1 Description of Seismic Model

An input to the seismic model was the stiffness of the tie rod system. As discussed in Section 4.3 below, the overall tie rod assembly stiffness is changed by a small amount due to the modification to the tie rod upper support. The stiffness change has a negligible effect on the overall dynamic characteristics of the vessel and internals primary structure. Therefore, the seismic loads are judged to remain unchanged and the original seismic model (described in the original 1994 core shroud repair submittal – Reference 1) was not revised.

4.1.1.2 Description of Structural Models

Finite element analysis (FEA) and/or hand calculations were used to structurally analyze the modified upper support components and the tie rod nut. The original FEA of the upper support brackets used the COSMOS finite element code. The mesh size in the original model was coarse and not suitable for capturing peak stresses. A revised finite element analysis (FEA) of the replacement upper support bracket with refined mesh sizes has been performed using the ANSYS computer program. Details of the analysis, such as input criteria, applied loading, material properties, boundary conditions, and analysis methods are provided in Attachment 2. SNC also contracted Structural Integrity

Associates, Inc. (SIA) to perform an independent third party review of the GE upper support finite element analysis methodology. SIA developed a similar ANSYS model and their results compared favorably to the GE results for the maximum principle tensile stress.

The replacement hardware components (upper support, tie rod nut, and other associated upper support components) were evaluated for their susceptibility to IGSCC. The design goal established by SNC was to maintain total stress, which includes peak stress, below 0.6Sy for all the new Alloy X-750 upper support components and the Alloy X-750 tie rod nut, thereby providing margin to the BWRVIP-84 criteria of 0.8Sy.

The replacement hardware components are also being evaluated against ASME Code allowable stresses. The values of Sm and Sy for Alloy X-750 material were specified in accordance with Code Case N-60-5 (Reference 21). This is consistent with BWRVIP-84, Section B.6.2. The membrane and bending stresses are calculated for these components to meet the ASME Code allowable stress limits. The results of the structural integrity evaluation are provided in Attachment 2.

4.1.2 Linear vs. Non-Linear Analysis Method

As noted above, the proposed modification has an insignificant affect on the original seismic dynamic analysis; therefore, the original dynamic analysis methods are not changed by the proposed modification.

4.1.3 Weld Crack Model

The proposed modification does not impact the original cracked shroud weld analysis that was included in the original 1996 core shroud repair submittal (Reference 9). Therefore, modeling of the individual cracked shroud welds remains unchanged from the original analysis.

4.1.4 Load Cases and Load Combinations

The applicable normal, upset, emergency and faulted loading combinations remain consistent with the original design basis of the shroud repair tie rods. The original design basis load combinations are presented in the original 1994 and 1996 core shroud repair submittals (References 1 and 9). The loads and load combinations are also in accordance with BWRVIP-02-A.

These original load combinations were:

Normal
Upset Seismic D Wt + OBE + N-ΔP
Upset Thermal D Wt + Upset ΔT + N-ΔP
Emergency 1 D Wt + N-ΔP + DBE
Emergency 2 D Wt + MSL LOCA
Emergency 3 D Wt + N-ΔP + ½ SME
Faulted 1 D Wt + MSL LOCA + DBE
Faulted 2 D Wt + RSL LOCA + DBE

Faulted 3 D Wt + MSL LOCA + ½ SME

The original Normal and Upset load combinations were used in the replacement upper support design. Emergency 2 and Faulted 3 conditions were determined to be bounding and were also used in the replacement upper support design.

4.1.5 Shroud Deflections

The original shroud horizontal and vertical deflections presented in the original 1994 core shroud repair submittal (Reference 1) are not increased by the proposed modification. Hence, there is no reduction in margin to the allowable horizontal displacements for control rod insertion. Also, since there is no increase in the shroud emergency/faulted vertical deflections, there is no additional strain imposed on shroud attached core spray piping as compared to the original analysis. For normal/upset pressure conditions, the small change in the overall tie rod assembly stiffness as compared to the stiffness used in the original weld separation analysis slightly reduces the weld separation under upset pressure conditions and assures that no separation occurs under normal operating pressure conditions.

4.2 Reactor Pressure Vessel and Reactor Internals

The original tie rod design included an evaluation of the stress in the reactor pressure vessel (RPV) shell due to the horizontal load in the radial direction applied to the vessel by the upper tie rod support/spring assembly. The horizontal load is not changed as a result of the proposed upper support and tie rod nut modifications. As such, the original RPV stress report is not impacted by the proposed change.

4.3 Evaluation of Shroud Shell, Shroud Head, and Shroud Support Plate

The new upper support brackets are larger than the original brackets which increases the stiffness. The increased upper support stiffness is offset by including the stiffness of the lower support assembly (which was conservatively neglected in the original design) in the calculation of the overall tie rod assembly stiffness. The inclusion of the lower support stiffness results in a small net reduction in the overall stiffness of about 0.3%. This reduction is conservatively neglected by maintaining the original design tie rod normal and upset thermal preloads in the stress evaluations for the new replacement parts.

With the original tie rod thermal preloads maintained; there is no impact on available stress safety margins in existing tie rod components that are not being modified or in tie rod attachment points such as the shroud support plate. Since the tie rod horizontal seismic loads and the tie rod thermal preload are not changed, there is also no change in the load imparted to the shroud shell adjacent to tie rod contact points.

4.4 Flow Induced Vibration

The GE design goal for the original tie rod design was to maintain a factor of three between the vortex shedding (excitation) frequency and the lowest natural frequency of the core shroud tie rod repair. The proposed tie rod modifications result in an increased

upper support stiffness and an insignificant increase in annulus flow velocity as compared to the original flow induced vibration (FIV) analysis. The original FIV analysis was included in the original 1994 core shroud repair submittal (Reference 1). There is negligible change to the original tie rod natural frequency and vortex shedding frequency calculation and the factor of three-design goal is maintained.

4.5 Radiation Effects

The replacement of these components does not adversely impact the original radiation effects evaluation.

4.6 Loose Parts Consideration

The redesigned upper support and tie rod nut have design features that ensure capture of all threaded parts with the potential to work loose within the reactor vessel environment. These features, such as retainer pins and ratchet mechanisms, prevent rotation of threaded fasteners by mechanically obstructing movement. The capturing mechanisms are designed to last for the design life of the repair.

5. SYSTEMS EVALUATION

5.1 Bypass Flow

The original tie rod systems evaluation summarized the leakage flows at rated conditions through the shroud head cutouts and shroud welds assumed to be cracked through-wall. The evaluation concluded that the impact of the leakage flows is sufficiently small such that there was negligible impact on steam separation system performance, core monitoring, fuel thermal margin, fuel cycle length, and emergency core cooling system (ECCS) performance. This evaluation is not impacted by the proposed modification.

6. MATERIALS AND FABRICATION

6.1 Materials Selection

The material specified for the replacement tie rod upper supports and nut are listed in the table below.

Component ID	Material	ASME or Other Description
Tie Rod Upper Support Main Load Path Bearing Parts and Miscellaneous Smaller Parts Not in the Main Load Path	Alloy X-750	ASME SB-637/ASTM B637 UNS N07750 Type 3
Tie Rod Nut	Alloy X-750	ASME SB-637/ASTM B637 UNS N07750 Type 3
Tie Rod Upper Support Dowel Pin	Type 316 Stainless Steel	ASME SA-479/ASTM A479, Type 316

	or Alloy X-750	or ASME SA-240/ASTM A240, Type 316 or ASME SA-479/ASTM A479, Type 316L or ASME SA-240/ASTM A240, Type 316L or ASME SB-637/ASTM B637 UNS N07750 Type 3
Tie Rod Upper Hex Nuts	Type 316 Stainless Steel	ASME SA-479/ASTM A479, Type 316 or ASME SA-240/ASTM A240, Type 316 or ASME SA-479/ASTM A479, Type 316L or ASME SA-240/ASTM A240, Type 316L

The above-listed materials have been used for many other reactor internal components and have demonstrated good resistance to stress corrosion cracking in laboratory testing and long-term service experience in the non-welded and low sustained operating stress condition. Both Alloy X-750 and Type 316 austenitic stainless steel are acceptable BWRVIP-84 and ASME Code Section III materials. The proposed materials for the replacement parts are consistent with those used in the original Hatch 1 tie rod design, which was found acceptable by the NRC as documented in the NRC SE dated September 30, 1994.

6.2 Material Procurement Specifications

GE Materials Specification 26A5733, Revision 5 was used for procurement of the tie rod upper support and nut components. It has subsequently been determined that this material meets the requirements of GE Materials Specification, Revision 7 which complies with the material requirements of BWRVIP-84 including the latest BWRVIP positions documented in BWRVIP Letter 2004-288, dated December 5, 2006 (Reference 26). No exceptions to the material and material processing practices as described in BWRVIP-84 have been taken.

6.3 Materials Fabrication

GE Fabrication Specification 26A5734, Revision 7 is being used for fabrication of the tie rod upper support and nut components. This specification complies with the fabrication requirements of BWRVIP-84 including the latest BWRVIP positions documented in BWRVIP Letter 2006-500, dated July 30, 2004 (Reference 22). No exceptions to the previous NRC-accepted fabrication standards in BWRVIP-84 have been taken.

Furthermore, review of GE Fabrication Specification 26A5734, Revision 7 confirms that the applicable replacement hardware conforms specifically to the conditions described in Sections 3.5.2, 3.6.2, and 3.6.3 of the NRC staff's safety evaluation for BWRVIP-84 dated September 9, 2005.

The replacement upper supports are similar to the original tie rod assemblies in that they do contain threaded connections that could potentially act as crevices. No other avoidable crevices have been added to the replacement upper bracket design. BWRVIP-02-A states that it is recognized that fasteners and mechanical joints may contain crevices and it suggests the following requirements when crevices can not be avoided: (1) The design of such features should avoid sensitized areas and should utilize IGSCC-resistant materials, and (2) such features should be vented to the extent practical to minimize stagnant conditions. There are no welds in the replacement upper supports assemblies. The replacement upper support materials have been procured and processed to prevent sensitized material by meeting the requirements of BWRVIP-84. There are no threaded fasteners associated with the modification where venting is judged practical or effective.

7. PRE-MODIFICATION AND POST-MODIFICATION INSPECTION

7.1 Pre-Modification Inspection

Because the Hatch Unit 1 shroud stabilizers were recently inspected in 2006 and because the core shroud horizontal welds were inspected and determined redundant to the shroud stabilizers (Reference 15), only the examinations necessary to support successful installation of the proposed modification will be performed.

7.2 Post-Modification Inspection

7.2.1 Inspections Prior to RPV Reassembly

A post-modification inspection prior to RPV reassembly will include a general post-maintenance visual inspection and recording of the fit of the shroud support hardware onto the shroud to confirm that there are no interferences at the support locations and that the installation is in accordance with the requirements of the modification drawings and the GE installation specification 26A7163. This inspection will include, as a minimum, the following attributes:

a. All retainer clips and latches are in place for the upper spring, the mid-support, the lower spring, and the tie rod nut.

b. The upper spring, the mid-support, and the lower spring are all in contact with the RPV wall.

c. Support plate gusset and attachment welds.

d. Contact between the lower support clevis pin and hook and on both sides of the hook.

e. Contact exists between the mid-support and shroud, and between upper support and shroud.

f. The "as-left" inspection cleanliness is equal to or better than the "as-found" inspection.

7.2.2 Inspections During Subsequent Refueling Outages

In the first refueling outage following installation of the modified tie rod upper supports, SNC will inspect the tie rod assemblies in accordance with the requirements defined in BWRVIP-76, Section 3.5, Option 1 or 2, and SNC will repeat the post-installation inspections described in Section 7.2.1 (items a through f) above.

Furthermore, the table below indicates previous examination history and current projected examination plans for the shroud support plate gussets associated with the shroud tie rods.

Location	Initial	1st re-exam	2nd re-exam	3rd re-exam	4th re-exam	5th re-exam	6th re-exam	7th re-exam	8th re-exam
45°	**1R15**	**1R16**	**1R17**	**1R22**	1R23[2]	1R24[2]	1R28	1R32	
135°	**1R15**	**1R16**	**1R17**	**1R22**	1R23[2]	1R24[2]	1R28	1R32	
225°	**1R15**	**1R16**	**1R17**	**1R22**	1R23[2]	1R24[2]	1R28	1R32	
315°	**1R15**	**1R16**	**1R17**	**1R18**	**1R22**	1R23[2]	1R24[2]	1R28	1R32

Note: 1. Unit 1 includes a requirement for EVT-1 of the corresponding anchorage locations (gussets)
2. The frequency assumes tie rod parts are replaced in 1R23 thus requiring baseline examination and assumes 100% re-examination during the next refueling outage.

SNC will work with GE and the BWRVIP to establish the appropriate re-inspection criteria for Alloy X-750 components.

REFERENCES

REFERENCES:

1. Georgia Power Company (GPC) Letter HL-4683, Hatch Unit 1 Core Shroud Stabilizer Design Submittal, dated September 2, 1994.

2. GPC Letter HL-4696, Hatch Unit 1 Response to Request for Additional Information for Core Shroud Stabilizer Design Submittal, dated September 23, 1994.

3. NRC Safety Evaluation Report for Core Shroud Stabilizer Design for Hatch Unit 1 (TAC No. M90270), dated September 30, 1994.

4. GPC Letter HL-4781, Hatch Unit 1 Response to Request for Additional Information for Core Shroud Modification, dated February 20, 1995.

5. GPC Letter HL-4844, Hatch Unit 1 Response to Second Request for Additional Information for Core Shroud Modification, dated May 18, 1995.

6. GPC Letter HL-4868, Hatch Unit 1 Response to Follow-Up Request for Additional Information Regarding Core Shroud Modification, dated June 21, 1995.

7. NRC Supplemental Safety Evaluation for Core Shroud Stabilizer Design for Hatch Unit 1 (TAC No. M91091), dated August 10, 1995.

8. GPC Letter HL-5110, Hatch Unit 1 Resolution of Issue of Conformance Relative to Core Shroud Stabilizer Design, dated February 20, 1996.

9. GPC Letter HL-5119, Hatch Unit 1 Resolution of Issue of Conformance Relative to Core Shroud Stabilizer Design, dated March 4, 1996.

10. NRC Supplement 2 to the Safety Evaluation for Hatch Unit 1 Core Shroud Stabilizer Modification (TAC No. 94910), dated May 30, 1996.

11. GE Letter MFN 06-133, Part 21 60-Day Interim Report Notification: Core Shroud Repair Tie Rod Upper Support Cracking, dated May 12, 2006.

12. GE Letter MFN 06-292, Update to Part 21 Interim Report Notification: Failure Analysis of Core Shroud Repair Tie Rod Upper Support Cracking, dated August 21, 2006.

13. GE Letter MFN 06-374, Part 21 Notification: Completion of GE Evaluation on Core Shroud Repair Tie Rod Upper Support Cracking, dated October 9, 2006.

14. GE Letter MFN 07-005, GE Part 21 Communication: Potential for Intergranular Stress Corrosion Cracking in Shroud Repair Tie Rod Threaded Components, dated January 5, 2007.

15. SNC Letter NL-06-1251, Hatch Unit 1 Submittal of Plant Specific Analysis of Core Shroud Horizontal Weld Indications, dated July 3, 2006.

16. NRC Generic Letter 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors," July 25, 1994.

17. BWRVIP-76, "BWR Vessel and Internals Project BWR Core Shroud Inspection and Flaw Evaluation Guidelines," November 1999.

18. Letter from M. A. Mitchell (NRC) to W. Eaton (BWRVIP) dated July 27, 2006, Safety Evaluation of Proprietary EPRI Report, "BWR Vessel and Internals Project, BWR Core Shroud and Inspection and Flaw Evaluation Guidelines (BWRVIP-76)."

19. BWRVIP-02-A, "BWR Vessel and Internals Project BWR Core Shroud Repair Design Criteria, Rev. 2," October 2005.

20. BWRVIP-84, "BWR Vessel and Internals Project Guidelines for Selection and Use of Materials for Repairs to BWR Internal Components," October 2000.

21. ASME Code Case N-60-5, Material for Core Support Structures, Section III, Division 1, February 15, 1994.

22. Letter from W. Eaton (BWRVIP) to Document Control Desk (NRC), dated December 5, 2006, Project 704 – BWRVIP Response to NRC Safety Evaluation of BWRVIP-84 (Letter 2006-500).

23. Letter from W. Eaton (BWRVIP) to All BWRVIP Committee Members, dated March 29, 2006, BWRVIP Recommendation to Inspect Core Shroud Tie Rod Repairs.

24. Letter from R. Dyle/T. Mulford (BWRVIP) to All BWRVIP Committee Members, dated April 3, 2006, Clarification to BWRVIP Recommendation to Inspect Core Shroud Tie Rod Repairs.

25. BWRVIP-04-A, "BWR Vessel and Internals Project Guide for Format and Content of Core Shroud Repair Design Submittals, Rev. 0" April 2002.

26. Letter from W. Eaton (BWRVIP) to Document Control Desk (NRC), dated July 30, 2004, Project 704 – BWRVIP Response to NRC Supplementary Request for Additional Information on BWRVIP-84 (Letter 2004-288).

27. SNC Letter NL-04-2265, Unit 1 Updated Analysis of Core Shroud Vertical Welds and Supplemental Information, dated December 3, 2004.

Edwin I. Hatch Nuclear Plant - Unit 1
Core Shroud Stabilizer Modification Evaluation Summary

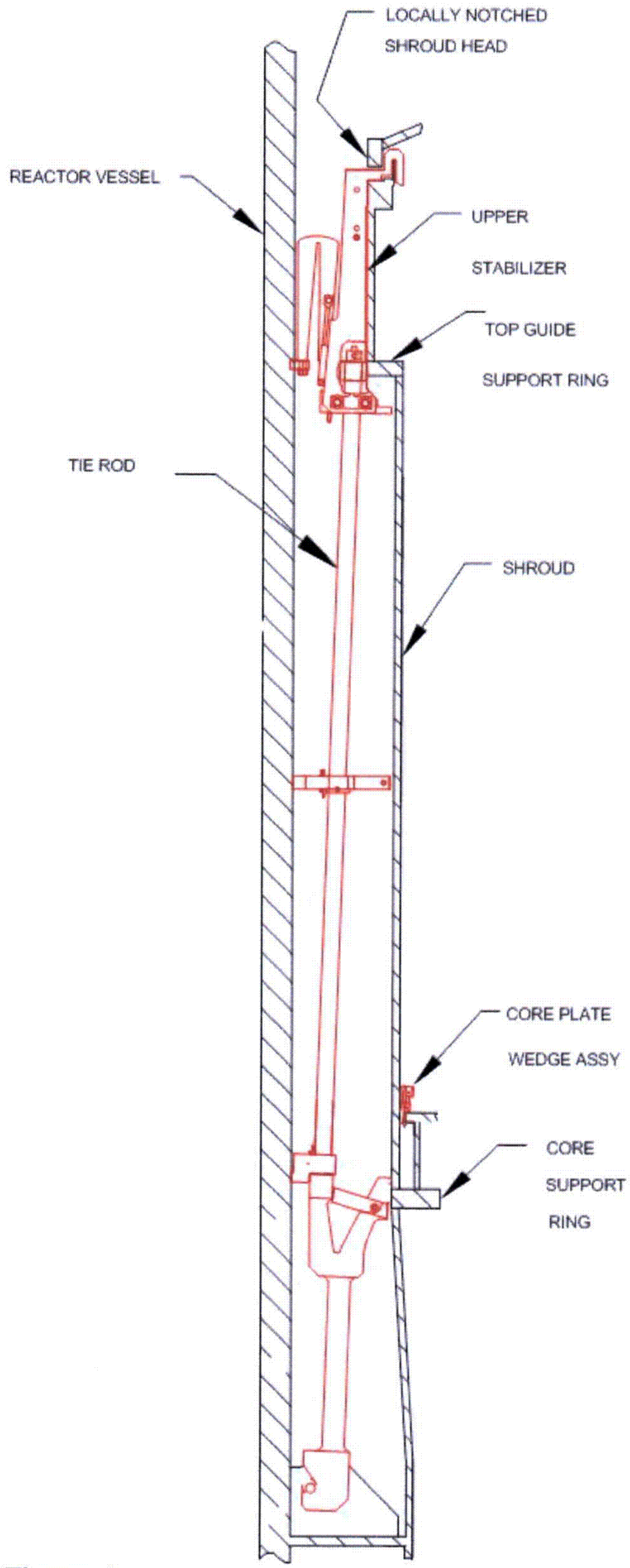

Figure 1

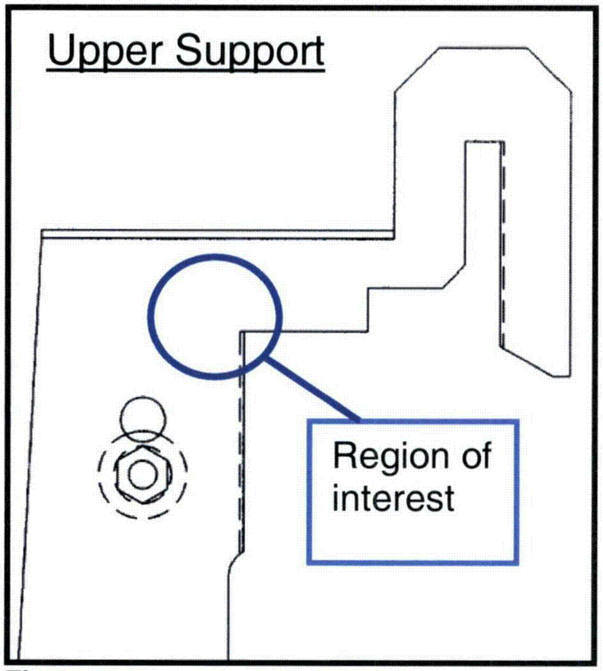

Figure 2