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Nine Mile Point Nuclear Station

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February 12, 2007

U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

ATTENTION: Document Control Desk

SUBJECT: Nine Mile Point Nuclear Station
Unit No. 1; Docket No. 50-220

Generic Letter 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors," Request for Authorization Under the Provision of 10 CFR 50.55a(a)(3)(i) for Modification of the Core Shroud Stabilizer Assemblies (Tie Rods)

By letters dated January 6, 1995 and January 23, 1995, Niagara Mohawk Power Corporation (NMPC), the previous licensee, proposed a repair of the Nine Mile Point Unit 1 (NMP1) core shroud by installation of four stabilizer assemblies (i.e., tie rods). In its letter dated March 31, 1995 (TAC No. M91273), 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 1995 refueling outage (RFO13).

Subsequently, NMPC identified the need for modifications to the tie rod repair, as follows:

1. A modification of the tie rod lower wedge assemblies was submitted for NRC review and approval by NMPC letter dated April 8, 1997. The NRC found this modification acceptable as an alternative to the ASME Code by letter dated May 8, 1997 (TAC No. M98170), and the modification was installed during the 1997 refueling outage (RFO14).

2. A modification of the tie rod upper spring assemblies was submitted for NRC review and approval by NMPC letter dated May 21, 1999. The NRC found this modification acceptable as an alternative to the ASME Code by letter dated June 7, 1999 (TAC No. MA5433), and the modification was installed during the 1999 refueling outage (RFO15).

The purpose of this submittal is to request that the NRC authorize the use of a proposed modification to each of the four tie rod assemblies pursuant to 10 CFR 50.55a(a)(3)(i). During the upcoming refueling outage (RFO19), Nine Mile Point Nuclear Station, LLC (NMPNS) proposes to replace the NMP1 core shroud tie rod upper supports and tie rod top nut due to their potential for cracking. This work is planned in response to recent industry operating experience where a domestic boiling water reactor plant discovered cracking in their similar core shroud tie rod upper supports and an assessment by the General

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Electric Company (GE) that concluded that NMP1 may have a similar condition (reference the GE 10 CFR Part 21 Notification dated October 9, 2006). Although there is currently no indication that NMP1 is experiencing the same condition as experienced in the industry, and tie rod inspections performed during each refueling outage could justify continued operation on a cycle-by-cycle basis, NMPNS has determined that the most prudent course of action and the best long-term economic solution is pre-emptive replacement of the tie rod upper support with a modified upper support design capable of operation through the end of the renewed operating license term (2029). However, as a contingency, NMPNS is preparing plans for inspection of the tie rod upper supports to confirm the structural integrity of the existing supports for at least one cycle of operation. If this inspection option is implemented during the upcoming refueling outage (RFO19), NMPNS is planning to perform EVT-1 inspection of the accessible portions of the tie rod upper supports to confirm no evidence of IGSCC crack initiation. This inspection is equivalent to the inspection used to detect cracking of the Hatch Unit 1 upper supports. In addition, NMPNS is developing a supplemental ultrasonic (UT) exam capability of the upper supports to allow interrogation of the inaccessible region. The intent of the UT exam would be detection and not sizing. If the development is successful, the UT will be demonstrated on a NMP1-specific mockup for detection and would be used to supplement the EVT-1 inspection.

Attachments (1) and (5) contain the design documentation that describes the proposed modification to the tie rod assemblies. Specifically, Attachment (1) contains a summary of the evaluations performed to confirm that the tie rod modification provides an acceptable level of quality and safety. The presentation of this information generally follows the format outlined in 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. Attachment (5) is the design stress report, which contains figures that depict the modification details. Attachment (2) provides a summary of the 10 CFR 50.59 screening of the proposed changes associated with the modification to the core shroud repair tie rods. This screening determined that the modification to the core shroud repair does not require preparation of a 10 CFR 50.59 evaluation and does not result in a change requiring a license amendment per 10 CFR 50.90.

The information contained in Attachment (5) is considered by its preparer, the General Electric Company (GE), to contain proprietary information exempt from disclosure pursuant to 10 CFR 2.390. Therefore, on behalf of GE, NMPNS hereby makes application to withhold Attachment (5) from public disclosure in accordance with 10 CFR 2.390(b)(1). An affidavit executed by GE detailing the reasons for the request to withhold the proprietary information is included as Attachment (4). A non-proprietary version of the design stress report is included with this letter as Attachment (3).

The tie rod assemblies are not included under the ASME Code Section XI definition for repair or replacement. As such, the design details of the proposed tie rod modification are being submitted to the NRC for review and authorization to use 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. To support the scheduled startup of NMP1 following the upcoming RFO19, NRC authorization to use this proposed alternative is requested by April 6, 2007.

Should you have any questions regarding the information in this submittal, please contact M. H. Miller, Licensing Director, at (315) 349-5219.

Very truly yours,

Gary Harland
Acting Manager Engineering Services

GH/DEV

Attachments:
(1) Tie Rod Modification Evaluation Summary
(2) 10 CFR 50.59 Screening Summary
(3) Shroud Repair Replacement Upper Support Stress Analysis Report (Non-Proprietary Version)
(4) Affidavit by the General Electric Company
(5) Shroud Repair Replacement Upper Support Stress Analysis Report (Proprietary Version)

cc: S. J. Collins, NRC
D. V. Pickett, NRC
Resident Inspector, NRC

COMMITMENTS IDENTIFIED IN THIS CORRESPONDENCE:	
• Based on NMPNS review of tie rod assembly X-750 components in the primary vertical and horizontal load paths, inspect high-stress X-750 locations consistent with the BWRVIP recommendations provided in BWRVIP letters dated March 29, 2006 and April 3, 2006.	
Responsible Person/Organization:	Design Engineering – Fiorenza / Lee
Due Date:	Prior to completion of RFO19
SAR/TSB Revision Required?	No
NCTS No.:	504630
• Perform a post-modification inspection prior to RPV reassembly, including a general post-maintenance visual inspection and recording of the fit of the shroud 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 26A7095. Include the inspection attributes identified in Attachment (1), Section 7.2.1 (items a through h) of this submittal.	
Responsible Person/Organization:	Design Engineering – Fiorenza / Lee
Due Date:	Prior to completion of RFO19
SAR/TSB Revision Required?	No
NCTS No.:	504630
• Inspect the tie rod assemblies in accordance with the requirements defined in BWRVIP-76, Section 3.5, Option 1 or 2, and repeat the post-installation inspections described in Section 7.2.1 (items a through h) of this submittal. (Revise appropriate program documents)	
Responsible Person/Organization:	Design Engineering – Fiorenza / Lee
Due Date:	During the first refueling outage following installation of the modified tie rod upper supports.
SAR/TSB Revision Required?	No
NCTS No.:	504630

Posting Requirements for Responses -- NOV/Order **No**

ATTACHMENT (1)

TIE ROD MODIFICATION EVALUATION SUMMARY

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1. INTRODUCTION AND SUMMARY

This request involves the modification of certain components of the existing Nine Mile Point Unit 1 (NMP1) core shroud tie rod assemblies (i.e., the upper support 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 was identified in a General Electric Company (GE) 10 CFR Part 21 notification dated October 9, 2006 (Reference 1).

By letters dated January 6, 1995 and January 23, 1995 (References 2 and 3, respectively), Niagara Mohawk Power Corporation (NMPC), the previous licensee, proposed a repair of the Nine Mile Point Unit 1 (NMP1) core shroud by installation of four stabilizer assemblies (i.e., tie rods). In its letter dated March 31, 1995 (Reference 4), 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 1995 refueling outage (RFO13).

Subsequently, NMPC identified the need for modifications to the tie rod repair, as follows:

1. A modification of the tie rod lower wedge assemblies was submitted for NRC review and approval by NMPC letter dated April 8, 1997 (Reference 5). The NRC found this modification acceptable as an alternative to the ASME Code by letter dated May 8, 1997 (Reference 6), and the modification was installed during the 1997 refueling outage (RFO14).

2. A modification of the tie rod upper spring assemblies was submitted for NRC review and approval by NMPC letter dated May 21, 1999 (Reference 7). The NRC found this modification acceptable as an alternative to the ASME Code by letter dated June 7, 1999 (Reference 8), and the modification was installed during the 1999 refueling outage (RFO15).

The purpose of this attachment is to describe the design of the NMP1 core shroud tie rod 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 submittal includes several documents that are provided as individual attachments to the submittal, as follows:

- Shroud Repair Replacement Upper Support Stress Analysis Report (Attachment 5 - Proprietary Version, and Attachment 3 – Non-Proprietary Version).

- 10CFR50.59 Screening Summary for the installation of the core shroud repair modification (Attachment 2).

The installation of the proposed repair modification satisfies the applicable regulatory requirements and guidance and is consistent with the current plant licensing basis. The repair conforms to the requirements of the core shroud repair criteria provided in BWRVIP-02-A (Reference 9) without any alternate approaches or exceptions.

2. BACKGROUND

NMP1 installed core shroud tie rod assemblies in 1995 on a pre-emptive basis in lieu of ultrasonic (UT) inspection of the core shroud horizontal welds. The tie rods functionally replace the shroud horizontal welds H1 through H7. The tie rod assemblies are shown in Figure A1-1. The General Electric Company (GE) designed and installed the NMP1 tie rod assemblies. GE provided core shroud repairs using tie rods to many other domestic boiling water reactor (BWR) plants. Recently it was discovered during an in-vessel visual inspection (IVVI) that tie rod upper supports at Hatch Unit 1 experienced cracking. The apparent root cause 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. GE conducted an internal evaluation to determine if the potential IGSCC in the X-750 tie rod structural components of other BWR core shroud repairs designed by GE could be a reportable condition under 10 CFR Part 21. GE used the criterion provided in the BWR Vessel and Internals Project (BWRVIP) report BWRVIP-84 (Reference 10) for the IGSCC susceptibility assessment of the X-750 components in the tie rod vertical load path. BWRVIP-84 was issued in 2000, approximately five years following the NMP1 tie rod installation in 1995.

GE has determined that several other BWRs including NMP1 exceed the BWRVIP-84 criteria for the upper supports (in addition to the Hatch Unit 1 as-found condition). The results of the evaluation are included in the GE 10 CFR Part 21 Notification dated October 9, 2006 (Reference 1). Based on the Hatch Unit 1 finding, GE has revised the assessment of the GE tie rod upper support design life and determined that the potential for a high peak surface stress exists for the NMP1 tie rod design. This high peak stress reduces the design life of the tie rod upper support. Tie rod inspections performed during each refueling outage could justify continued operation on a cycle-by-cycle basis, and such an inspection was being planned as a contingency for the upcoming NMP1 refueling outage (RFO19); however, Nine Mile Point Nuclear Station, LLC (NMPNS) has determined that the most prudent course of action and the best long-term economic solution is pre-emptive replacement of the tie rod upper support with a modified upper support design capable of operation through the end of the renewed operating license term (2029).

The potential for high peak stress in the tie rod upper bracket design at NMP1 and the other affected plants is attributed to the lack of a specified radius at the corner junction between horizontal and vertical legs of the bracket (see Figure A1-2), which creates a high stress concentration.

GE conducted an extent of condition review to determine if other Alloy X-750 tie rod components had similar potential for high peak stress. GE has identified that the root radii of the threads in the tie rod 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 11) to address the potential for IGSCC in tie rod threaded components. The proposed modification includes a modified tie rod nut that incorporates an improved locking mechanism. To improve IGSCC resistance, the new tie rod 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 tie rod upper supports and the impact that this modification has on previously performed analyses and evaluations. No other modifications to the existing tie rod assembly components are planned for the upcoming RFO19.

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 dated January 6, 1995 and January 23, 1995 (References 2 and 3), and are also described

in the NMP1 Updated Final Safety Analysis Report (UFSAR), Section IV-B.7.0. In summary, the core shroud: (1) provides a partition to separate the upward flow of coolant through the core from the downward recirculation flow on the outside of the shroud, (2) supports the top guide and core plate which support the fuel and maintain core geometry, and (3) 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 H7 and thereby maintain the above shroud functions. Core shroud weld numbers H1 through H6B are all horizontal (circumferential) shroud welds. Weld H7 attaches the shroud to the forged stainless steel shroud support ring. Each tie-rod assembly consists of a tie-rod, upper support, upper spring, middle support, lower lateral and axial springs, lower support with two toggle bolts, and other minor components (see Figure A1-1). The ends of the tie-rod assemblies are attached at the top to the upper shroud head flange and at the bottom to the Inconel shroud conical support. 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, two holes are machined at the same four azimuth locations (eight holes) through the angled conical support 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 tie rod nut is installed with a minimal mechanical preload which is less than 4% of the thermal preload developed during normal operating conditions. The initial mechanical preload on the tie rods is sufficient to ensure that the tie rod assemblies remain properly positioned.

2.2 NRC and Industry Actions

The NRC issued Generic Letter (GL) 94-03 (Reference 12) 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 (Reference 14), the BWRVIP has addressed the generic impact of the tie rod cracking operating experience on the BWRVIP-76 report inspection guidelines (Reference 13) in a letter dated May 30, 2006. 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. NMPNS 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, NMPNS is applying a conservative criterion (i.e., a maximum allowable peak

stress that is a lower percentage of allowable yield strength, compared to the BWRVIP-84 criterion) for the proposed tie rod modification.

2.3 NMP1 Response to Generic Letter 94-03

By letters dated January 6, 1995 and January 23, 1995, Niagara Mohawk Power Corporation (NMPC), the previous licensee, proposed a repair of the NMP1 core shroud, as requested by GL 94-03. The repair consisted of the installation of four stabilizer assemblies (i.e., tie rods) combined with core plate wedges to replace horizontal (circumferential) welds H1 through H7. This preemptive repair was installed during the 1995 refueling outage (RFO13).

Inspections performed during the 1997 refueling outage found that the tie rod nuts had lost some preload and that the lower wedge retainer clips on three tie rods were damaged. The root cause for the tie rod degradation, affecting both the tie rod nuts and the lower retainer clips, was attributed to the movement of the toggle bolts within oversized lower bolt holes. New tie rod installation procedures were developed to include measures to prevent tie rod looseness and maintain tie rod vertical forces as intended in the original design. In addition, the lower wedge retainer clip was redesigned to accommodate movement during normal and transient conditions while maintaining its original function of locking the wedge to the lower spring structure. The modified lower wedge retainer clips were installed during the 1997 refueling outage (RFO14).

Tie rod visual examinations performed during the 1999 refueling outage revealed that a cap screw connecting the upper spring bracket to the upper spring had failed, and that there were areas of scratches and some evidence of wear of the reactor pressure vessel (RPV) cladding where the upper spring of each of the four tie rods contacts the RPV cladding. The root cause of the cap screw failure was determined to be IGSCC in the Alloy X-750 screw material in conjunction with large, sustained differential thermal expansion stress due to fastening of dissimilar materials with the cap screws. Potential contributing causes were sustained stresses that were attributed to torquing of the cap screw associated with original assembly of the tie rods, and stresses associated with friction between the RPV wall and the upper spring contact points. The upper spring assemblies were modified by the addition of a stainless steel clamp fastened by XM-19 bolts to replace the function of the cap screws and to prevent the cap screws from loosening or dislodging and becoming loose parts. In addition, the leading edges of the upper wedge and upper contact of the spring for each of the four tie rods was rounded off as a preventive measure to reduce stresses on the tie rods and to reduce the likelihood of future wear on the RPV cladding. These modifications were installed during the 1999 refueling outage (RFO15).

The NRC reviewed and accepted the original core shroud repair and the subsequent modifications described above as an alternative to the ASME Code, pursuant to 10 CFR 50.55a(a)(3)(i). The associated NRC safety evaluations are identified in Section 1, Introduction and Summary. Inservice inspections of the core shroud and its repair components are performed in accordance with BWRVIP-76 (Reference 13).

NMPNS has been and continues to actively participate in BWRVIP activities to resolve core shroud repair issues.

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 2029) and that the replacement components 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 9 and 10, 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 25A5583, which was included in the 1995 core shroud repair submittals (References 2 and 3). 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 on Figure 1 of the GE stress analysis report (Attachment 5). 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. Additional details of the improvements made are provided in Attachment (5). 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 Description of Structural Models and Analysis

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 stress analysis report (Attachment 5) concludes that 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 1995 core shroud repair submittal – Reference 2) 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 (5). NMPNS also contracted Structural Integrity Associates, Inc. (SIA) to perform an independent third party review of the GE upper support finite element analysis. SIA developed a separate 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 NMPNS 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. Results of the IGSCC susceptibility review show that the calculated stresses are below the BWRVIP-84 criteria and the design goal of 0.6Sy.

The replacement hardware components were also 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 15). This is consistent with BWRVIP-84, Section B.6.2. The calculated membrane and bending stresses for these components meet the ASME Code allowable stress limits. The results of the structural integrity evaluation are provided in Attachment (5).

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 1995 core shroud repair submittals (References 2 and 3). 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 loads are defined in the GE stress analysis report (Attachment 5). The original design basis load combinations are presented in the original 1995 core shroud repair submittals (References 2 and 3). The loads and load combinations are also in accordance with BWRVIP-02-A and the NMP1 UFSAR (Section XVI-A.2.7.1).

4.1.5 Shroud Deflections

The original shroud horizontal and vertical deflections presented in the original 1995 core shroud repair submittals (References 2 and 3) are not increased by the proposed modification, as discussed in the stress analysis report (Attachment 5). 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 documented in GE document 24A6426 (included in the 1995 core shroud repair submittal, Reference 2) 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. 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. The details are provided in Attachment (5).

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.

The original stress report evaluated the maximum stress in the shroud head due to the cutouts made to accommodate the tie rod upper support brackets. The width of the cutouts will be increased by ¾ inch to accommodate the larger upper supports. The shroud head stresses were re-evaluated for the larger cutouts and determined to be within the allowable stress criteria. Details of the shroud head analysis are provided in Attachment (5).

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 1995 core shroud repair submittals (References 2 and 3) and in the 1997 tie rod modification submittal (Reference 5). Thus, as discussed in the stress analysis report (Attachment 5), 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

Neutron fluence estimates for the tie rods that were developed for the NMP1 license renewal application show that the maximum fluence level at end of the renewed operating license in 2029 remains below the threshold for impacting the material properties of the tie rod components. Radiation effects as they relate to design controls and material selection for the new upper supports and tie rod nut are the same as those considered for the original parts. Thus, there is no adverse change to the previous radiation effects

evaluation that was included in the original 1995 core shroud repair submittals (References 2 and 3) and in the 1997 tie rod modification submittal (Reference 5).

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.

4.7 Installation Cleanliness

The EDM work to be performed at NMP1 will be in the dryer/separator pool and not in the reactor vessel. The material generated during the EDM process will be collected in a filtration system and will be removed and disposed of. The amount of debris (swarf) will be a small amount considering the small amount of separator material that will be removed. The filter system will have a 2 micron capability and will remove 99% of the debris. There will be no debris remaining in the vessel and therefore no impact on plant components or fuel due to this process.

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, shroud welds assumed to be cracked through-wall, and the shroud support cone holes (see GE document GE-NE-B13-01739-05 that was included in the original 1995 core shroud repair submittals - References 2 and 3). 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.

The proposed modification increases the width of the upper support and the eight (8) upper support cutouts in the shroud head by 0.75 inch. The increase in the leakage area due to this modification is 0.023" x .75" x 8 = 0.138 sq. in. This is approximately 2.5% of the total shroud head leakage area of 5.33 sq. in used in the original NMP1 tie rod leakage evaluation (GE-NE-B13-01739-05). This would result in an increase in leakage of approximately 19 gpm at the shroud head location.

The shroud head cutouts are above the top guide, which is in a region where two-phase flow exists. The acceptance criterion for increased leakage through the larger shroud head cutouts is that the combined bypass leakage of steam through the enlarged cutouts shall be less than 0.080 wt% of the core flow minus steam flow for normal differential pressure. This criterion is based on the design basis carryunder criteria established in GE Report GE-NE-B13-01739-05 for the original tie rod repair. The 0.080 wt% of the core flow minus steam flow was determined by subtracting 0.17 wt% (tie rod repair and carryunder from the separators at 85 to 100% rated core flow) from 0.25 wt% (the design value). According to the above acceptance criterion, the allowable leakage for the enlarged area of the shroud cutouts is 96 gpm, as established in NMPC letters dated February 3, 1999 (Reference 20) and April 14, 1999 (Reference 21). The calculated increased leakage of 19 gpm for the widened shroud head cutouts is less than the acceptance criteria of 96 gpm. Therefore, the combined effective carryunder from the separators and the

shroud head leakage (for the modified tie rod upper supports) at 85% to 100% rated flow is less than the design value of 0.25 wt% and is acceptable.

5.2 Downcomer Flow Characteristics

The original tie rod design evaluation included an analysis of the available flow area in the downcomer region with the four tie rod assemblies installed (see Attachment 5 to NMPC letter dated February 24, 1995 - Reference 16). The original calculations showed that the downcomer flow area in the upper annulus region would be reduced by 5.3% with the tie rods installed. This resulted in an upper annulus region flow velocity increase from 7.9 ft/sec without tie rods installed to 8.3 ft/sec with tie rods installed. The NRC concluded in their SE (Reference 4) that the corresponding pressure drop is insignificant and would not affect the recirculation flow in the reactor. The redesign of the upper supports results in the upper support width being increased by 0.75 inch. This causes a small reduction in the total annulus flow area of an additional 0.6%. The reduced flow area increases the upper annulus region flow velocity to 8.4 ft/sec. The original conclusions that the corresponding pressure drop is insignificant and would not affect the recirculation flow in the reactor remain unchanged.

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 Pins	Type 316 Stainless Steel	ASME SA-479/ASTM A479, Type 316 or ASME SA-240/ASTM A240, Type 316

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 NMP1 tie rod design, which was found acceptable by the NRC as documented in the NRC SE dated March 31, 1995 (Reference 4).

6.2 Material Procurement Specifications

GE Materials Specification 26A5733, Revision 8 is being used for procurement of the tie rod upper support and nut components. This specification complies with the material requirements of BWRVIP-84 including the latest BWRVIP positions documented in BWRVIP Letter 2006-500, dated December 5, 2006 (Reference 17). 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 December 5, 2006 (Reference 17). No exceptions to the previous NRC-accepted fabrication standards in BWRVIP-84 have been taken.

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

The pre-modification inspection will include a video recording of the as-found condition of the shroud repair tie rod assemblies. This inspection is intended to confirm tie rod integrity and will satisfy the BWRVIP-76 requirements for verification of tie rod tightness.

The BWRVIP issued letters requiring plants with core shroud tie rod repairs to inspect their tie rod repairs at their next scheduled refueling outage (References 18 and 19). These letters indicated that inspections should include all the same or similar locations where the Hatch Unit 1 indications were observed and that consideration should also be given to other locations in the tie rod repair using X-750 material that may experience high sustained loads (thus increasing the possibility of IGSCC). NMPNS will perform inspection of the existing tie rod upper supports when access is provided during the planned replacement activity. The upper support inspection will be an EVT-1 exam of the high stress locations identified in the GE Part 21 notification dated October 9, 2006 (Reference 1). In addition, when access to the tie rod threads and the removed tie rod nut threads is available, an EVT-1 exam of the upper and lower tie rod and tie rod nut threads will be performed to the extent accessible. NMPNS is reviewing all of the tie rod assembly X-750 components in the primary vertical and horizontal load paths. Based on this review, inspection of other similar high stress X-750 locations will be performed consistent with the BWRVIP recommendations provided in References 18 and 19. These inspections will satisfy the BWRVIP recommendation to consider inspection of other X-750 components that may experience high sustained loads.

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 26A7095. 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. There are no gaps between the toggle bolts and the shroud side of the shroud support cone holes.

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

d. The upper supports are located between the shroud head bolt lugs (90, 270, and 350-degree locations) and straddle the shroud head bolt lugs at the 166-degree location. The upper supports are fully engaged over the shroud head support ring, and there is contact between the upper support and the shroud at the top guide ring elevation.

e. There is contact between the lower support clevis pin and hook at the 10 o'clock and 2 o'clock points on both sides of the hook.

f. Required gaps exist between the mid-support and shroud, and between top support and shroud shelf.

g. Lower wedge has been pulled up flush with the lower spring.

h. The "as-left" video inspection confirms that cleanliness is equal to or better than the "as-found" video inspection.

7.2.2 Inspections During Subsequent Refueling Outages

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

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

8. REFERENCES

1. Letter from J. S. Post (GE) to Document Control Desk (NRC), dated October 9, 2006, Part 21 Notification: Completion of GE Evaluation on Core Shroud Repair Tie Rod Upper Support Cracking

2. Letter from C. D. Terry (NMPC) to Document Control Desk (NRC), dated January 6, 1995, Generic Letter 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors" (TAC No. M90102)

3. Letter from C. D. Terry (NMPC) to Document Control Desk (NRC), dated January 23, 1995, Generic Letter 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors" (TAC No. M90102)

4. Letter from L. B. Marsh (NRC) to B. R. Sylvia (NMPC), dated March 31, 1995, Nine Mile Point Nuclear Station Unit No. 1 (NMP1), Evaluation of Core Shroud Stabilizer Design (TAC No. M91273)

5. Letter from M. J. McCormick, Jr. (NMPC) to Document Control Desk (NRC), dated April 8, 1997, Generic Letter 94-03 "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors"

6. Letter from D. S. Hood (NRC) to B. R. Sylvia (NMPC), dated May 8, 1997, Modifications to Core Shroud Stabilizer Lower Wedge Retaining Clip and Evaluation of Shroud Vertical Weld Cracking, Nine Mile Point Nuclear Station, Unit No. 1 (TAC No. M98170)

7. Letter from R. B. Abbott (NMPC) to Document Control Desk (NRC), dated May 21, 1999, Generic Letter 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors," Request for Approval Under the Provision of 10CFR50.55a(a)(3)(i) for Modification of the Four Stabilizer Assemblies (Tie Rods) for Nine Mile Point Unit 1 (NMP1)

8. Letter from S. S. Bajwa (NRC) to J. H. Mueller (NMPC), dated June 7, 1999, Alternative Repair of the Core Shroud Tie Rod Upper Spring Assembly, Nine Mile Point Nuclear Station, Unit No. 1 (TAC No. MA5433)

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

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

11. Letter from J. S. Post (GE) to Document Control Desk (NRC), dated January 5, 2007, GE Part 21 Communication: Potential for Intergranular Stress Corrosion Cracking in Shroud Repair Tie Rod Threaded Components

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

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

14. 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)"

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

16. Letter from C. D. Terry (NMPC) to Document Control Desk (NRC), dated February 24, 1995, Response to Request for Additional Information Regarding the Nine Mile Point Unit 1 Core Shroud Repair (TAC No. M90102)

17. 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)

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

19. 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

20. Letter from R. B. Abbott (NMPC) to Document Control Desk (NRC), dated February 3, 1999, Generic Letter 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors," Contingency Repair Plans for the Nine Mile Point Unit 1 (NMP1) Core Shroud

21. Letter from R. B. Abbott (NMPC) to Document Control Desk (NRC), dated April 14, 1999, Request for Additional Information Regarding Contingency Repair Plans for the Core Shroud Vertical Welds, Nine Mile Point Nuclear Station Unit 1 (NMP1)

9. REGULATORY COMMITMENTS

The following table identifies those actions committed to by NMPNS in this submittal. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

REGULATORY COMMITMENTS	DUE DATE
Perform pre-modification inspection that includes a video recording of the as-found condition of the shroud repair tie rod assemblies, to confirm tie rod integrity and to satisfy the BWRVIP-76 requirements for verification of tie rod tightness.	Prior to completion of the upcoming refueling outage (RFO19).
Perform inspection of the existing tie rod upper supports when access is provided during the planned replacement activity. The upper support inspection will be an EVT-1 exam of the high stress locations identified in the GE Part 21 notification letter dated October 9, 2006.	Prior to completion of the upcoming refueling outage (RFO19).
Perform an EVT-1 exam of the upper and lower tie rod and tie rod nut threads, to the extent accessible, when access to the tie rod threads and the tie rod nut threads is available.	Prior to completion of the upcoming refueling outage (RFO19).
Based on NMPNS review of tie rod assembly X-750 components in the primary vertical and horizontal load paths, inspect high-stress X-750 locations consistent with the BWRVIP recommendations provided in BWRVIP letters dated March 29, 2006 and April 3, 2006.	Prior to completion of the upcoming refueling outage (RFO19).
Perform a post-modification inspection prior to RPV reassembly, including a general post-maintenance visual inspection and recording of the fit of the shroud 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 26A7095. Include the inspection attributes identified in Attachment (1), Section 7.2.1 (items a through h) of this submittal.	Prior to completion of the upcoming refueling outage (RFO19).
Inspect the tie rod assemblies in accordance with the requirements defined in BWRVIP-76, Section 3.5, Option 1 or 2, and repeat the post-installation inspections described in Section 7.2.1 (items a through h) of this submittal.	During the first refueling outage following installation of the modified tie rod upper supports.

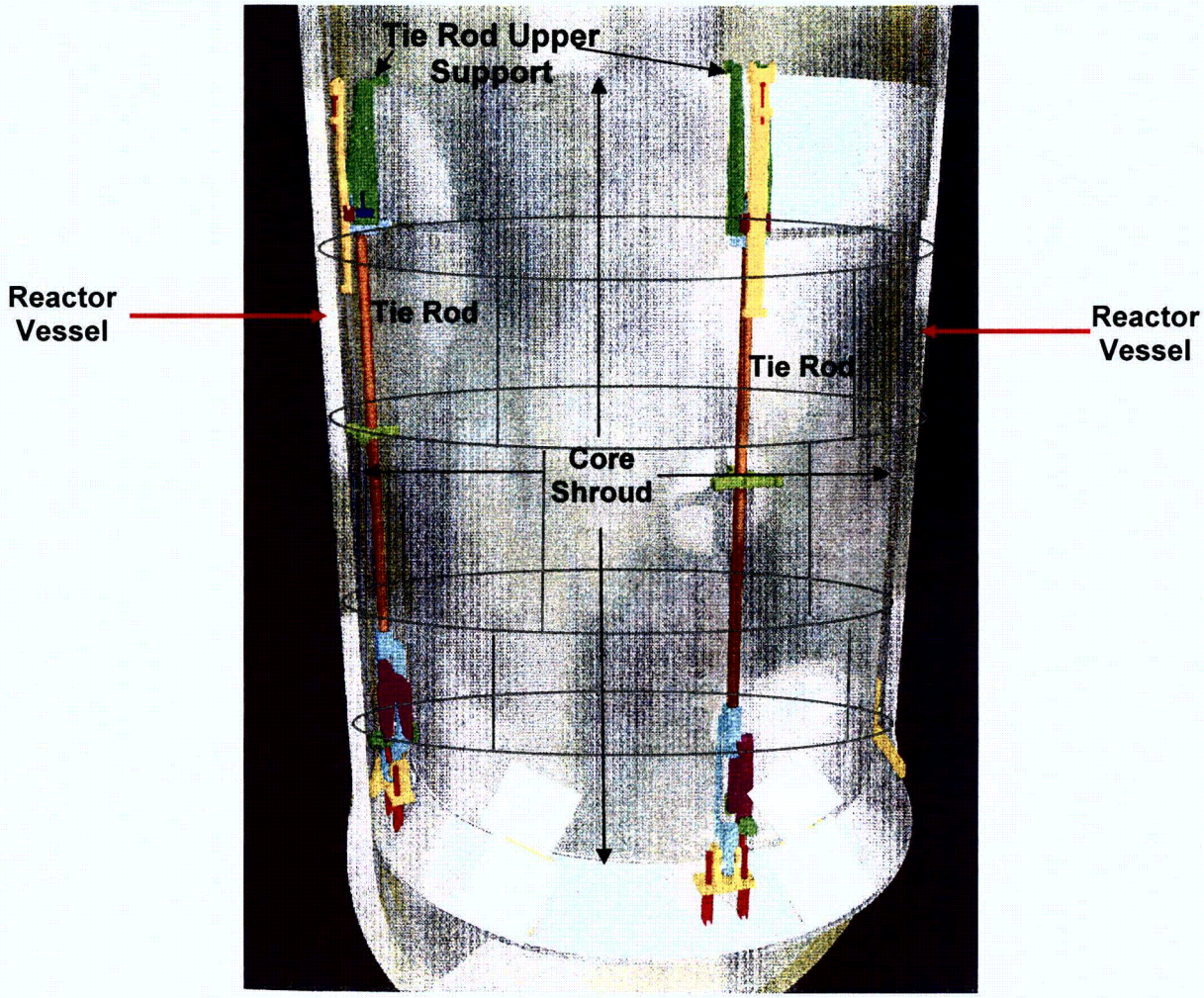

Figure A1-1

NMP1 Core Shroud Tie Rod Repair Assembly Hardware

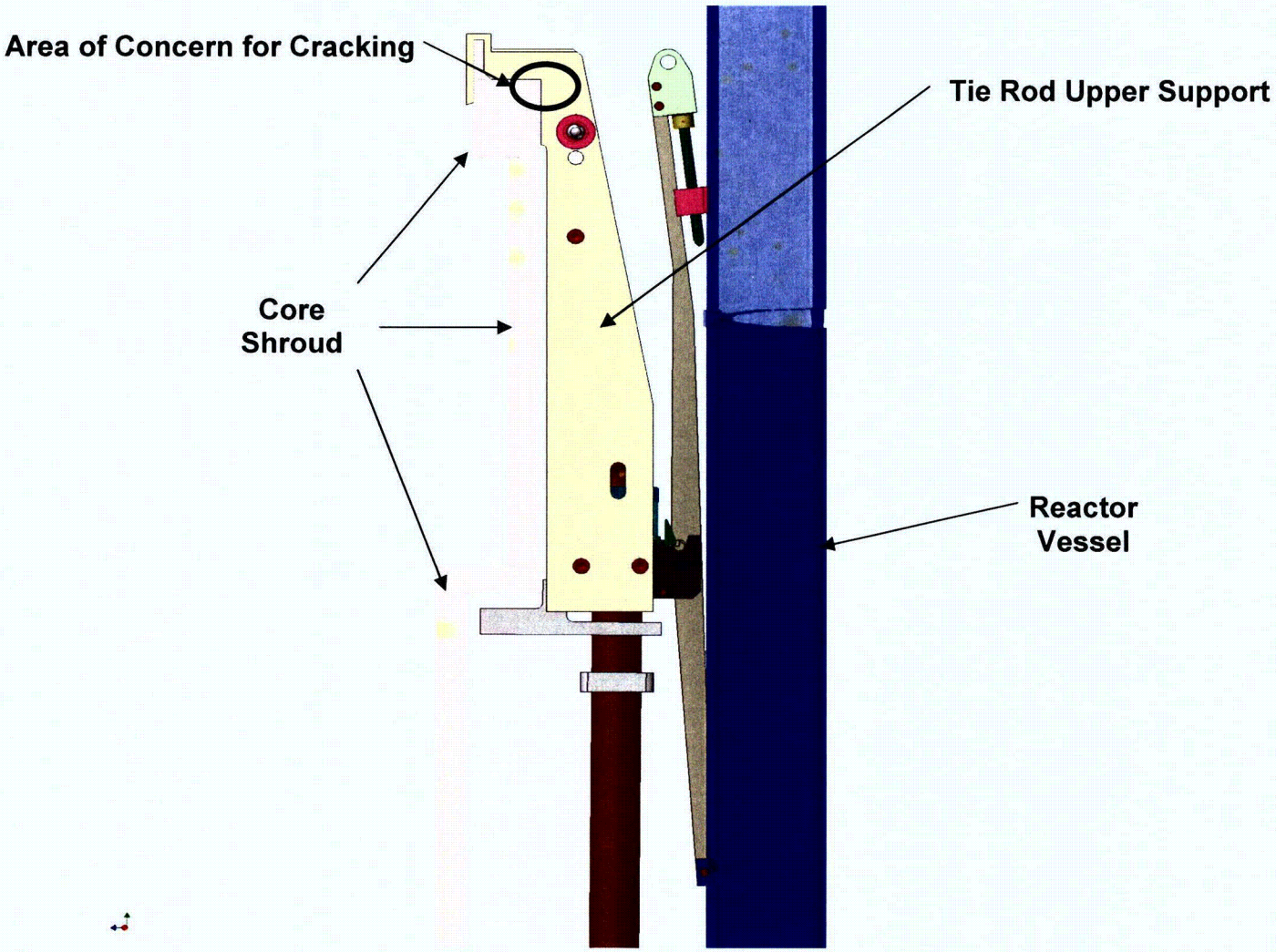

Figure A1-2

Tie Rod Upper Support

ATTACHMENT (2)

10 CFR 50.59 SCREENING SUMMARY

The following is a summary of the 10 CFR 50.59 screening performed for the proposed modification to the Nine Mile Point Unit 1 (NMP1) core shroud tie rod assemblies.

A. Brief Description of the Proposed Activity

The scope of the proposed change is to modify certain components of the existing core shroud tie rod assemblies (i.e., the upper support and the tie rod nuts). This modification is to the previously NRC reviewed and accepted core shroud repair which was performed as an alternative to ASME Section XI, definition for repair or replacement.

Revised stress analyses for the existing tie rod upper support and tie rod nut have identified a high sustained peak stress condition at stress risers in the upper support and tie rod nut threads that increases the components' susceptibility to intergranular stress corrosion cracking (IGSCC). The increased IGSCC susceptibility decreases the design life of the components as originally described in the NRC safety evaluation (SE) dated March 31, 1995. The NRC SE stated that the core shroud repair hardware design life was 25 years based on information contained in the original NMP1 core shroud repair submittals. The design 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 2029). The modification to the tie rod upper support and nut will include features to reduce the sustained peak stress in the components, thus reducing the susceptibility of the Alloy X-750 material to cracking.

B. Changes to Facility/Procedures

1. Does the *proposed activity* involve a modification, addition to, or removal from, the facility that adversely affects <u>any</u> UFSAR described design function? **No**
2. Does the *proposed activity* involve a modification, addition to, or removal from, a procedure that adversely affects how <u>any</u> UFSAR described design functions are performed or controlled? **No**

Justification:

The four (4) core shroud repair stabilizer assemblies (tie rods) are designed to structurally replace horizontal (circumferential) shroud welds H1 through H7 such that the shroud functions described in the Updated Final Safety Analysis Report (UFSAR) are maintained. The function of the tie rod upper supports as described in UFSAR Section IV-7.1.9 is to restrain the lateral movement of the shell between welds H1 and H2, the ring between H2 and H3 and the shell between H3 and H4. The upper support combined with the tie rod nut also functions to provide the vertical load path between the tie rod and the shroud. The upper supports are being replaced with upper supports that are more robust and with features to remove stress risers. The tie rod nut is being replaced with a nut that has larger thread root radii. These modifications will improve the components resistance to IGSCC to extend the design life of the components. These modifications do not affect the function of the upper supports. Because the replacement tie rod components are equivalent in function to the original components, the tie rods continue to meet the same shroud support functional requirements described in the UFSAR.

The referenced design criteria specified for the original tie rod design were reviewed to ensure the proposed modification does not cause an adverse affect on other UFSAR described design functions discussed in the UFSAR (including the March 31, 1995 NRC safety evaluation). The following criteria were addressed in the design:

- BWRVIP-02-A provides design criteria for core shroud repairs which NMP1 is committed to follow. The design of the replacement upper support and tie rod nut comply with the BWRVIP-02-A criteria.

- BWRVIP-84 provides criteria for shroud repair materials and fabrication which NMP1 is committed to follow. Materials and fabrication for the replacement parts meet the BWRVIP-84 criteria.

- BWRVIP-76 provides re-inspection requirements for core shroud repair hardware to which NMP1 is committed to follow. Inspection requirements comply with BWRVIP.

The original topical areas in the BWRVIP repair criteria were addressed in the design as appropriate for the changes being made. For example, seismic analysis, structural analysis, flow induced vibration, bypass leakage, shroud weld separation, crevices, downcomer flow restriction, etc. were all addressed in the design package. Many of the topical areas were not impacted by the proposed modification and in these cases bases were provided to conclude no or negligible impact. Brief summaries of some the impacted topical areas are provided below:

Structural Evaluation

The replacement upper supports and nut were structurally evaluated in the General Electric (GE) stress analysis report (GE-NE-0000-0061-6180). The applicable normal, upset, emergency and faulted loading combinations remain consistent with the original design basis of the shroud repair tie rods as defined in the various documents listed in UFSAR Table XVI-9a. The loads are defined in the reference GE stress analysis report. The loads and load combinations are also in accordance with BWRVIP-02-A and the NMP1 UFSAR (Section XVI-A.2.7.1). The stress analysis report concluded that the replacement hardware is structurally qualified consistent with the original design specification as amended, for improved IGSCC resistance. The replacement hardware is also structurally qualified in accordance with the ASME Code, Section III, Subsection NG allowable stress values including fatigue evaluation.

Bypass Leakage Evaluation

This modification increases the width of the upper support and the upper support cutouts in the shroud head. The increase in the leakage due to this modification is estimated to be 19 gpm. The acceptance criterion for increased leakage through the larger shroud head cutouts is that the combined bypass leakage of steam through the enlarged cutouts shall be less than 0.080 wt% of the core flow minus steam flow for normal differential pressure. This criterion is based on the design basis carryunder criteria established in GE Report GE-NE-B13-01739-05 for the original tie rod repair, which is referenced in UFSAR Table XVI-9a. The 0.080 wt% of the core flow minus steam flow was determined by subtracting 0.17 wt% (tie rod repair and carryunder from the separators at 85 to 100% rated core flow) from 0.25 wt% (design value). The 0.080 wt% acceptance criterion equates to approximately 96 gpm. Therefore, the increased leakage from this modification of 19 gpm is below the acceptance criterion of 96 gpm and is acceptable.

Downcomer Flow Evaluation

The redesign of the upper supports results in the upper support width being increased by 0.75 inches. This causes a small reduction in the total annulus flow area of an additional 0.6%. The reduced flow area increases the upper annulus region flow velocity a small amount. The original conclusions that the corresponding pressure drop is insignificant and would not affect the recirculation flow in the reactor remain unchanged.

Other Areas of the UFSAR Reviewed for Potential Impact by the Proposed Modification

UFSAR Section IV-B.7.1.9 describes the tie rod assemblies. The modification of the upper supports and nut does not affect the UFSAR description.

UFSAR Section IV-B.7.1.1 discusses leakage through shroud vertical welds V9 and V10 and concludes that at rated power and flow the leakage is sufficiently small such that the steam separation system performance, cavitation protection, core monitoring, fuel thermal margin and fuel cycle length remain adequate. The additional leakage through the shroud head cutouts is sufficiently small such that the same conclusions apply.

UFSAR Section XVI-A.2.4.1 describes the core shroud tie rod seismic analysis. The modification has a minor impact on the tie rod assembly stiffness which is an input to the seismic analysis described in the UFSAR. The GE stress analysis report concludes that the stiffness change has a negligible effect on the overall dynamic characteristics of the vessel and internals primary structure. Therefore, the seismic analysis as described in the UFSAR is not adversely impacted.

UFSAR Section XVI-A.5.1 describes the tie rod design being in accordance with BWRVIP criteria. The revised design also complies with the latest revision of the BWRVIP shroud repair criteria (BWRVIP-02-A).

UFSAR Table XVI-2 provides a listing of steady-state 100% full power stresses in various reactor vessel and reactor vessel internal components. The table reports stresses in the shroud support cone. As discussed in footnote (8) of the table, the highest stress location is adjacent to the tie rod attachment points to the shroud support cone. Because the modification does not change the tie rod normal operating load, the reported stresses also remain unchanged.

UFSAR Table XVI-9a provides a listing of shroud repair design and licensing documentation including the NRC safety evaluations. The UFSAR table will be updated to include the latest pertinent design and licensing documents associated with the modified upper supports.

UFSAR Figure XVI-12b provides an illustration of a tie rod assembly. The level of detail in the figure is not sufficient to illustrate the change to the upper support and nut. Therefore, the figure is not considered to be impacted by the modification.

UFSAR Appendix C (License Renewal Supplement), Section C.2.2.4, states that the core shroud tie rods were evaluated for fatigue using ASME Section III methods to calculate alternating stresses and determine cumulative usage factor (CUF) values. It also states that fatigue-tolerant design is demonstrated for the tie rods with CUFs less than 1.0. The GE stress analysis report evaluated the replacement upper support and tie rod nut for fatigue in accordance with ASME Section III and concluded that CUFs are well below a CUF of 1.0. Therefore, the revised design complies with the fatigue criteria committed to for the license renewal period as described in the UFSAR.

Based on the above evaluations and because the replacement tie rod components are equivalent in function to the original components, the tie rods continue to meet the same shroud support functional requirements described in the UFSAR.

There are no procedures described in the UFSAR that are impacted by the proposed modification to the tie rod upper assemblies.

C. Changes to Evaluation Methodologies

Does the *proposed activity* involve revising or replacing an UFSAR described Method of Evaluation, used in establishing the Design Bases or in the Safety Analyses? **No**.

Justification:

UFSAR Section XVI-A.2.7.1 describes the method of evaluation for the structural analysis of the reactor internal components. It describes the load combinations used in the analyses and states that all internal components meet the primary and secondary stress requirements of ASME Section III. The upper support and tie rod nut were structurally evaluated using the same load combinations as described in the UFSAR in addition to load combinations defined by BWRVIP-02-A. The modified upper support and tie rod nut stresses also were evaluated in accordance with ASME Section III Subsection NG. The original tie rod components were evaluated using the COSMOS Structural Analysis Program. The use of COSMOS was specifically addressed and approved by the NRC in their safety evaluation dated March 31, 1995, which is referenced in UFSAR Table XVI-9a. GE used ANSYS to structurally evaluate the replacement components. The ANSYS software is a controlled, safety-related program and GE has established that the ANSYS software as implemented for NMP1 is equivalent to the original design analysis COSMOS software. The NRC has accepted ANSYS for GE tie rod analysis, most recently for the Clinton tie rod repair. In conclusion, the ANSYS software does not represent a different method of evaluation and the original design specification remains unchanged. As such, the UFSAR described method of evaluation, including those methods approved by the NRC for the original tie rod repair, remain unchanged for the replacement upper support/nut evaluations which establish the design bases of the tie rods.

D. Conclusion

The 10 CFR 50.59 screening concludes that the proposed modification to the core shroud tie rod assemblies does not require preparation of a 10 CFR 50.59 evaluation and does not result in a change requiring a license amendment per 10 CFR 50.90.