ENCLOSURE 1

NINE MILE POINT 1
CORE SHROUD REPAIR
MODIFICATION SUMMARY REPORT

GE Nuclear Energy

GENE B13-01739-31
Revision 0
August 1996

Nine Mile Point 1
Core Shroud Repair Modification
Summary Report

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Summary Report

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REVISION STATUS SHEET

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1. INTRODUCTION

A core shroud repair modification was installed in Nine Mile Point 1 Nuclear Power Plant to provide an alternate load path for the Type 304 stainless steel circumferential welds, H1 through H7. The core shroud repair ensures the structural integrity of the core shroud by replacing the function of welds Hl through H7 with 4 stabilizer assemblies, and four core plate wedges.

In the course of the post-installation inspection of the shroud repair, three deviations were identified, evaluated and were found acceptable for continued plant operation through the next cycle. After additional review and evaluation, two additional modifications are proposed to provide the long term corrective actions.

1.1 Modification 1: 270° Tie Rod Replacement

The lower spring of one stabilizer assembly bears on the blend radius of the 270° recirculation nozzle. The proposed modification is to replace the tie rod and spring assembly with one having the spring on the opposite side of the tie rod. This proposed modification relocates the spring to bear on the RPV as intended.

1.2 Modification 2: Contact Extension at Weld H6A

The lower spring contact with the shroud does not extend beyond weld H6A at any of the four locations. As a result, if weld H6A is fully cracked, and if the design condition of a steam line LOCA plus seismic event were to occur, the shroud would not be laterally constrained to the extent intended by design. The proposed modification adds an extension piece to extend the spring contact beyond weld H6A and restore this feature to its intended function. The extended contact and the core plate wedges also provide a redundant load path between the core plate and the lower spring as was intended in the original design. This modification applies to the 90°, 166° and 350° stabilizer assemblies. The deviation is corrected for the replacement assembly at 270°.

2. SUMMARY AND CONCLUSIONS

2.1 270° Tie Rod Replacement

The shroud repair stabilizer assemblies are designed with the lower spring located on the side of the tie rod. The proposed modification is to replace the tie rod and spring assembly with one having the spring on the opposite side. The modification moves the spring sufficiently such that it will bear on the RPV as intended. The modification utilizes

existing hardware which was built as a spare along with the other stabilizer assemblies. Only minor rework is required to relocate the lower spring and the rework has no affect on the hardware function. The modification does not require additional penetrations through the shroud support cone or any additional EDM work. The modification uses the same lower support and upper spring assemblies and there is no change to the actual tie rod location.

Additional analysis has been done to address the design where the lower springs are no longer located 90° apart. The non-uniform lower spring spacing affects the net spring characteristic when the horizontal seismic load is directed between two springs. The analysis show the loads and displacements remain acceptable for all conditions.

2.2 H6A Contact Extension

The lower spring contacts with the shroud do not extend above the H6A weld as was intended. The design function can be restored by adding a U shaped extension piece to extend beyond weld H6A. The extension piece fits over the existing lower contact and is captured on the lower extension in all directions. The extension is designed to provide a positive spring clamping force against the sides of the lower contact. The spring force is not required to capture the part but is sufficient to prevent any free movement or vibrations. With this arrangement, the added extension piece is captured in all directions and is held secure by the spring loaded clamping force.

2.3 Conclusions

The modifications to the shroud repair stabilizers at Nine Mile Point 1 will restore them to their intended design function. The plant licensing bases have been reviewed. This review demonstrates that these modifications can be installed (1) without an increase in the probability or consequences of an accident or malfunction previously evaluated, (2) without creating the possibility of an accident or malfunction of a new or different kind from any previously evaluated, (3) and without reducing the margin of safety in the bases of a Technical Specification.

3. TIE ROD REPLACEMENT MODIFICATION

3.1 Background

The lower wedge on the 270° tie rod was found to bear against the blend radius on a recirculation nozzle rather than on the vessel wall. This situation is documented per FDDR EA1-0032 and further evaluated in GENE B13-01739-25. That report addressed concerns about the contact area and the stability of the contact on the inclined surface of the nozzle blend radius.

The lower wedge can be relocated to a position with more completed contact (Figure 3.1) on the vessel by moving the lower spring to the opposite side of the stabilizer assembly. By relocating the lower spring, the concerns about contact stability and contact area are resolved and the stabilizer assembly maintains its intended functional requirements.

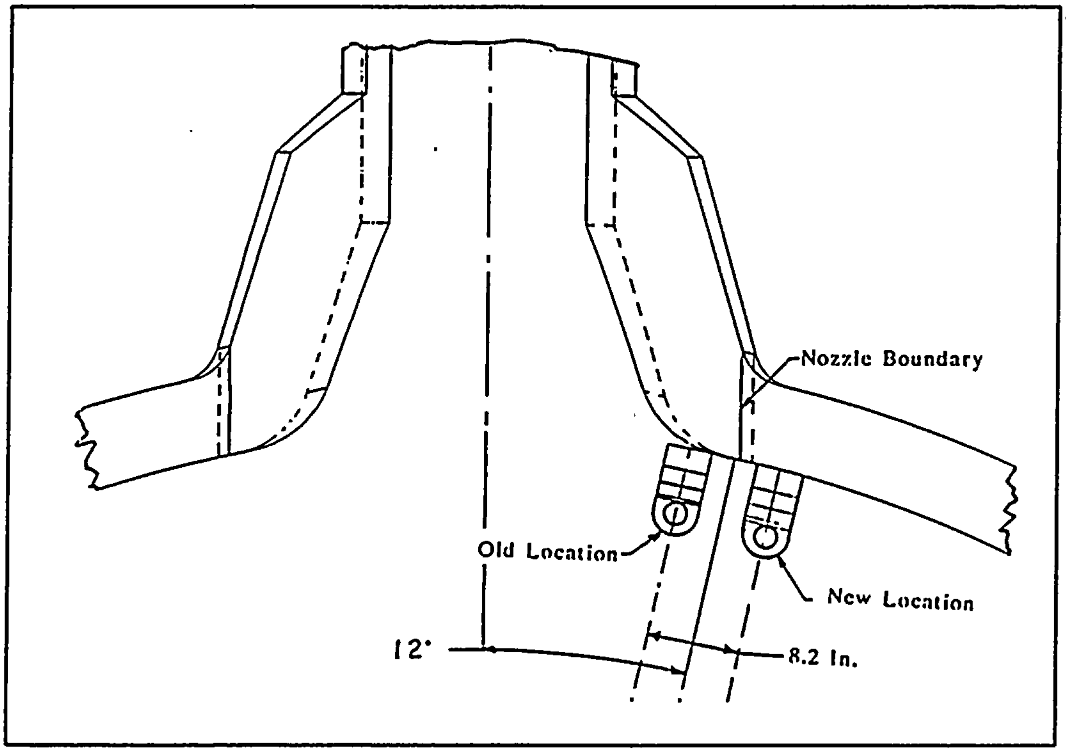

FIGURE 3.1

3.2. Description

Niagara Mohawk Power Corporation purchased a spare tie rod assembly and this assembly is intended to be modified to the alternate configuration. Applicable design and assembly drawings are revised to include the new parts and groups which define the alternate configuration. All additional parts and assemblies are designed and fabricated to the same design basis as the original shroud repair hardware. Moving the lower spring to the opposite side of the stabilizer assembly is accomplished by the steps listed below.

a. Remove the lower spring from the existing spare assembly and the lower contact from the existing lower spring. The staked locking pins will have to be removed to accomplish this. New locking pins will have to be installed in slightly different locations, but this will not affect the function of the part.

b. Modify the lower spring by adding counterbores to the opposite side of the bolt holes. Having counterbores on both sides does not affect the function of the part.

c. Modify the C-spring by extending the 1.125 diameter hole through the part.

d. Fabricate a new lower contact with the shroud sided surface tapered to fit on the opposite side of the stabilizer assembly. The new lower contact is also designed to extend beyond the H6A weld to avoid installation of the contact extension piece.

e. Re-assemble the tie rod assembly.

f. Since the lower wedge is at a new position, new annulus measurements are required and the new lower wedge machined to fit per the modification drawing.

g. All changes will be recorded on a modification drawing revision.

No changes are required for the upper support, the upper spring and the mid support.

3.3. Function

The lower spring is designed to restrict the core plate displacement during a seismic event. The stabilizer assembly is designed for a single lower spring to carry the entire horizontal seismic load at the core support. However, the direction of the load may be such that more than one spring shares the load. The limiting spring deflection and spring loads occur when only one of the lower springs reacts to the entire horizontal load. Relocating the spring has no affect on the maximum spring load or maximum spring deflection.

Relocating the lower spring does change the spacing between adjacent springs and the spacing does affect the net reaction when two springs share the lateral load. The lower spring contact with the RPV is changed by about 4° by moving it to the opposite side of the tie rod. The 4° change from the as-installed location results in a maximum 108° spacing between adjacent lower springs. The minimum spacing between adjacent lower springs is 76°.

When the four lower springs are 90° apart, the equivalent spring constant is the same for all directions of the applied load. The equivalent spring constant is the total load applied by the lower springs divided by the displacement in the direction of the applied load. Because of the non-uniform spring spacing, the variation in equivalent spring constant is

from +24% to -31%. An increase in the equivalent spring constant tends to increase the total reaction load and decrease the total displacement. Although the total reaction load increases, the load is shared by two springs and the load on either spring is bounded by the case where one spring carries the entire load. A decrease in equivalent spring constant results in a larger displacement in the direction of the load. Additional analysis in Attachments 8.1 and 8.2 show all loads and displacements remain acceptable for this modification.

4. H6A CONTACT EXTENSION

4.1. Background

The lower contacts do not extend above the H6A weld as was intended to satisfy the intended design requirements. The Reactor Modification Drawing, 107E5679 Revision 6, shows the as-installed position of the lower contacts and the H6A weld. The situation resulted from insufficient margin in the lower contact design to account for the uncertainties in the as-built geometry of the shroud support cone.

This above deviation from the intended design condition is described and evaluated in FDDR EA1-0031. The evaluation showed the core plate bolts are sufficient to maintain the core plate alignment without the lower contact extending above weld H6A. The evaluation considered the bolt clamping load and the elastic properties of the bolts to show allowable core plate displacement was not exceeded. Adding the extension piece provides additional design margin and assurance that the core plate alignment is maintained.

4.2 Description

The lower contacts at azimuths 90°, 166° and 350° are modified to extend beyond the H6A weld by adding a U shaped extension piece shown in Figure 4.1. The extension piece fits over the existing lower contact with the legs of the U extending around the sides of the existing lower contact. The steps at the ends of the legs fit under the lower contact to prevent axial movement. A tang at the top extension fits in the gap between the lower contact and the lower spring to restrict the horizontal movement. The added extension piece is captured in all directions on the existing lower contact. The legs of the extension provide a positive spring clamping force (40 lb to 50 lb) against the sides of the lower contact. This force is sufficient to prevent any free movement or vibrations. With this arrangement, the added extension piece is captured in all directions and is held secure by the spring loaded clamping force.

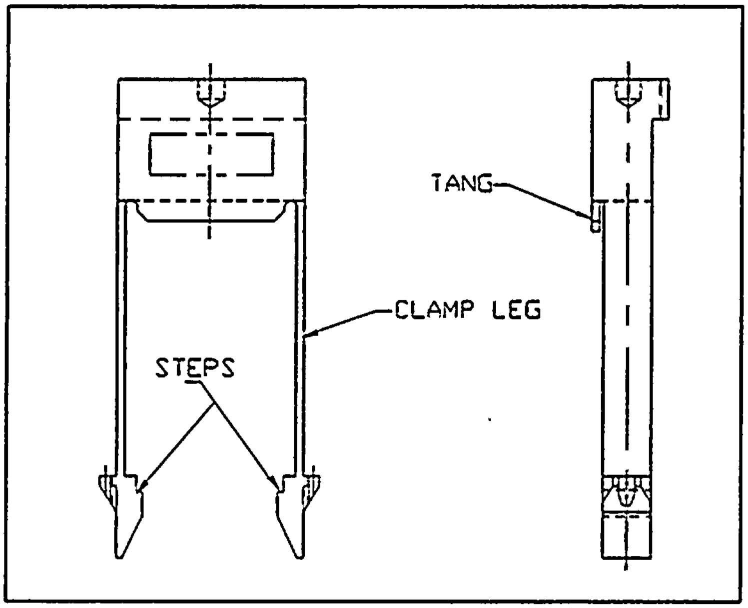

FIGURE 4.1

The added extension pieces are installed with a special tool for handling and to keep the legs sprung apart. When seated in place, the tool releases the legs allowing them to clamp around the lower contact. This method allows the piece to be installed without sliding or having to apply excessive force. The same tool can be used to remove the extension piece if required.

4.3 Function

The lower springs are designed to limit the core plate displacement during a seismic event. The lower spring bears against the shroud at the core support ledge and extends above the H6A weld and below the H6B weld. When the H6A weld remains in contact, whether its failed or otherwise, the joint is modeled as a hinge in the seismic model and is capable of carrying a shear load. During a steam line LOCA, the ΔP load on the shroud head is sufficient to open a 360° through wall crack at the H6A location. In this event, the joint is modeled as a roller in the seismic model and is not capable of carrying a shear load.

In the event of full separation at weld H6A the contact extension limits the possible shroud movement and, together with the core plate wedges, provide a redundant load path for the horizontal seismic loads. (The core support structure is also held in position

by the core support bolts and by the core support aligner pins.) Without taking credit for the core support bolts or aligner pins, the limiting lateral design load on the extension is the entire 63,800 lb maximum horizontal seismic load. The analysis in attachments 8.1 and 8.2 show all loads and displacements remain acceptable with the extension pieces installed.

5. DISPLACEMENT SUMMARY

Although all core support displacements remain acceptable, both modifications described in 3 and 4 above do affect the displacements and change the values reported in the original stress report, GE-NE-B13-01739-04, Rev. 0. The displacement values reported below supersede the displacement values reported in the original stress report.

The allowable permanent and transient displacements are summarized below. The shroud repair hardware design specification, 25A5583, provides the basis for the allowable displacements and safety factors.

Top Guide Permanent = 2.1/SF
Top Guide Transient = not specified

Core Support Permanent = 0.75/SF
Core Support Transient = 1.68/SF

Normal / Upset SF = 2.25
Emergency SF = 1.50
Faulted SF = 1.125

5.1 Top Guide

The Top Guide always remains in contact with the upper spring and there is no permanent displacement. The limiting condition for each event is the "all hinge" condition which has an equivalent displacement to the H1 roller case. Since there is only one seismic event, the displacement is the same for the Upset, Emergency and Faulted events. The calculated maximum transient design displacement is 0.904 inches for each event. Although the 0.904 inch is a transient displacement, it also satisfies the most restrictive allowable permanent displacement requirement for an Upset event of 0.93 inches.

5.2 Core Support

A faulted event with separation at weld H6A is the only condition where there may be permanent displacement at the core support. For all other events the displacement results from the spring compression which returns to the original position when the load stops. The "all hinge" case (equivalent to the "H1 roller" case) is applicable for Upset and Emergency and Faulted events.

5.2.1 Permanent Displacement

The maximum permanent displacement is the distance the shroud moves before contact with a spring member. The machined distance between the spring loaded shroud contact surface and the upper contact is 0.15 inches. The lower contact also bears against weld crown at H6B. The weld crown is estimated to be less than 0.13 high.

If the displacement is directed midway between the two contacts located 108° apart, the displacement is increased to 0.48 inches. (Attachment 8.2) The allowable permanent displacement is 0.67 inches.

5.2.2 Transient Displacement

The bounding transient displacement is a combination of the maximum permanent displacement and the maximum spring compression. For Upset, and Emergency conditions, there is no permanent displacement and the maximum transient displacement is 0.256 inches (Attachment 8.1, Table 1). The allowable Upset transient displacement is 0.75 inches.

Assuming the worst case scenario for load direction and spring characteristics for a Faulted event, the maximum spring compression is 0.368 inches (Attachment 8.1, Table 1). The maximum transient displacement becomes 0.85 inches when rounded to two places. The allowable Faulted transient displacement is 1.49 inches.

6. DESIGN BASIS

The hardware for both modifications is designed and fabricated to the same design basis as the original shroud repair hardware. The modified stabilizer assembly includes the same design features as the original hardware. All parts are locked in place or captured by mechanical devices. The fabrication requirements for the two proposed modifications will be in accordance with the previously approved fabrication requirements for the NMP-1 core shroud stabilizers. There is no welding required during fabrication or installation.

Relocating the lower spring to the opposite side of the stabilizer assembly is consistent with the core shroud repair design criteria and design basis. The additional counterbores and locking pin holes needed to utilize the existing parts have no affect on the stabilizer assembly function or stresses. The handling and installation tools are the same as used for the original installation.

7. SAFETY CONSIDERATIONS

This evaluation has investigated modifications to the shroud repair stabilizers at Nine Mile Point 1 which will restore them to their intended design function. The plant licensing bases have been reviewed. This review demonstrates that these modifications can be installed (1) without an increase in the probability or consequences of an accident or malfunction previously evaluated, (2) without creating the possibility of an accident or malfunction of a new or different kind from any previously evaluated, (3) and without reducing the margin of safety in the bases of a Technical Specification.

The GE Core Shroud Repair Design Safety Evaluation, GE-NE-B13-01739-05, Rev. 1 has been reviewed for possible adverse consequences of moving the lower spring to the opposite side of the stabilizer assembly. The core plate displacements reported in B.2.1 are updated to include the affects of the lower spring spacing. The 0.75 inch temporary displacement during a faulted event remains well the 1.49 inch allowable for this event. GE Safety Evaluation, GE-NE-B13-01739-5.1, Rev. 0, entitled, "Modification to GE Shroud Repair Design", was completed to evaluate the two proposed modifications in accordance with 10CFR50.59. The safety evaluation concluded that the proposed modifications do not involve any unreviewed safety questions.

8. ATTACHMENTS

8.1 GENE B13-01739-03, Supplement 1, Nine Mile Point 1 Seismic Analysis, Core Shroud Repair Modification

8.2 GENE B13-01739-04, Supplement 4, Nine Mile Point 1 Shroud Repair Hardware Stress Analysis

8.3 Drawing 107E5679 Rev. 7 and Parts List 107E5679 Rev. 5, Reactor Modification

8.4 Specification 25A5585 Rev. 4, Stabilizer Installation