

Part 21 (PAR)

Event # 47630

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|--|------------------------------------|---|--|
| <b>Rep Org:</b> GE HITACHI NUCLEAR ENERGY  |                                    | <b>Notification Date / Time:</b> 02/01/2012 15:33 (EST) |  |
| <b>Supplier:</b> GE HITACHI NUCLEAR ENERGY |                                    | <b>Event Date / Time:</b> 02/01/2012 (EST)              |  |
| <b>Last Modification:</b> 02/01/2012       |                                    |   |  |
| <b>Region:</b> 1                           | <b>Docket #:</b>                   |   |  |
| <b>City:</b> WILMINGTON                    | <b>Agreement State:</b> Yes        |   |  |
| <b>County:</b>                             | <b>License #:</b>                  |   |  |
| <b>State:</b> NC                           |                                    |   |  |
| <b>NRC Notified by:</b> DALE PORTER        | <b>Notifications:</b> WILLIAM COOK | R1DO  |  |
| <b>HQ Ops Officer:</b> JOHN KNOKE          | JONATHAN BARTLEY                   | R2DO  |  |
| <b>Emergency Class:</b> NON EMERGENCY      | JAMNES CAMERON                     | R3DO  |  |
| <b>10 CFR Section:</b>                     | JEFF CLARK                         | R4DO  |  |
| 21.21                                      | UNSPECIFIED PARAGRAPH              | PART21 GROUP  |  |

PART 21 REPORT - FAILURE OF CRD COLLET RETAINER TUBE/OUTER TUBE WELD

The following information was received via facsimile:

"During a recent refurbishment of a Control Rod Drive (CRD) performed by GE Hitachi Nuclear Energy (GEH) for a domestic customer a 360 degree failure of the collet retainer tube fillet weld was identified. This weld is part of the CRD 919D258G003 Cylinder, Tube and Flange (CTF) assembly. The collet retainer tube fillet weld was performed in 1983 and subsequently assembled into a Group 003 part number 919D258G003 CTF. This G003 CTF assembly was assembled into a CRD in 1995 and placed into service in 1996. GEH continues to investigate the cause(s) of the failed fillet weld. Once the cause of the fillet weld failure is determined, GEH will review the extent of condition of this failure as well as the consequences to determine if a reportable condition exists.

"There were no adverse effects on the CRD's operation observed due to this failure.

"This 60-day interim notification, in accordance with 10CFR Part 21.21(a)(2), will be sent to all BWR/2-6 plants that utilize CRDs equipped with either 919D258G002 or 919D258G003 CTF assemblies."

The affected plants are: Nine Mile Point 1-2, Fermi 2, Columbia, Grand Gulf, River Bend, Fitzpatrick, Pilgrim, Vermont Yankee, Clinton, Dresden 2-3, LaSalle 1-2, Limerick 1-2, Oyster Creek, Peach Bottom 2-3, Quad Cities 1-2, Perry 1, Duane Arnold, Cooper, Susquehanna 1-2, Brunswick 1-2, Hope Creek, Hatch 1 - 2, Browns Ferry 1-3, Monticello, and Millstone.

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JEI9  
NR2

**HITACHI****GE Hitachi Nuclear Energy**

February 01, 2012  
MFN 12-006 R0

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

Dale E. Porter

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Safety Evaluation Program Manager

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**Subject: Part 21 60-Day Interim Report Notification:  
Failure of CRD Collet Retainer Tube/Outer Tube Weld**

This letter provides information concerning an evaluation being performed by GE Hitachi Nuclear Energy (GEH) regarding a failure of one Control Rod Drive (CRD) collet retainer tube fillet weld. There were no adverse effects on the CRD's operation observed due to this failure. As stated herein, GEH has not concluded that this is a reportable condition in accordance with the requirements of 10 CFR 21.21(d), and continued evaluation is required to determine if this weld failure is a reportable condition and the impact and extent of this condition.

The information required for a 60-Day Interim Report Notification per §21.21(a)(2) is provided in Attachment 3. The commitment for follow-on actions is provided in Attachment 3, item (vii).

If you have any questions, please call me at (910) 819-4491.

Sincerely,

Dale E. Porter  
Safety Evaluation Program Manager  
GE-Hitachi Nuclear Energy Americas LLC

Attachments:

1. Description of Evaluation
2. US Plants Potentially Affected
3. 60-Day Interim Report Notification Information per §21.21(a)(2)

MFN 12-006 R0

Page 2 of 2

cc: S. S. Philpott, USNRC  
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DRF Section No. 0000-0143-6385

MFN 12-006 RO

Attachment 1 – Description of Evaluation

Page 1 of 3

## Summary

During a recent refurbishment of a Control Rod Drive (CRD) performed by GE Hitachi Nuclear Energy (GEH) for a domestic customer a 360 degree failure of the collet retainer tube fillet weld was identified. This weld is part of the CRD 919D258G003 Cylinder, Tube and Flange (CTF) assembly. The collet retainer tube fillet weld was performed in 1983 and subsequently assembled into a Group 003 part number 919D258G003 CTF. This G003 CTF assembly was assembled into a CRD in 1995 and placed into service in 1996. GEH continues to investigate the cause(s) of the failed fillet weld. Once the cause of the fillet weld failure is determined, GEH will review the extent of condition of this failure as well as the consequences to determine if a reportable condition exists.

This 60-day interim notification, in accordance with 10CFR Part 21.21(a)(2), will be sent to all BWR/2-6 plants that utilize CRDs equipped with either 919D258G002 or 919D258G003 CTF assemblies.

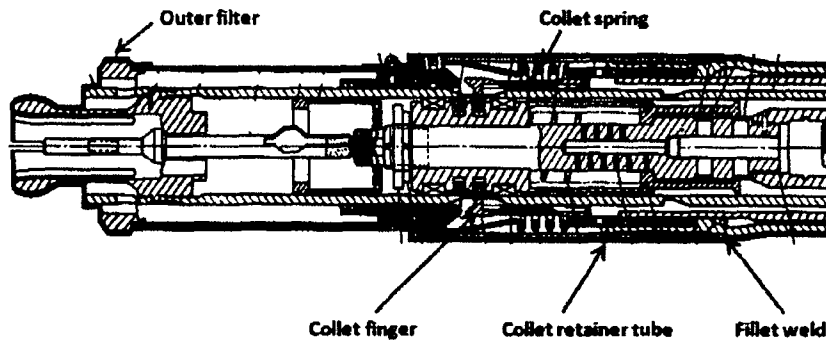
## Background

GE Hitachi Nuclear Energy (GEH) provides CRD CTF assemblies to operating GEH BWRs (BWR/2-6). The CTF inspection recommendations are specified in SIL 139 and applicable supplements. Inspections primarily consist of dye penetrant examinations of all collet retainer tubes of the CTFs during normal CRD maintenance. All CTFs that exhibit any relevant linear indication in the collet retainer tube identified at GEH are rejected and removed from service. Since GEH began refurbishing CRD assemblies for domestic customers, approximately 2100 (G002 and G003) CTF assemblies have been dye penetrant tested. Of these a total of 9 CTF assemblies were rejected for linear indications related to this fillet weld prior to this most recent identified failure. These indications did not result in a weld failure or compromise CRD functionality. These previous indications did not appear to be IGSCC related because the indications were typically in one area, uniformly oriented, and with point indications connected by lines. Also, there was no "branching" of the indications, which is typical of IGSCC, and the material is CF3 which is not susceptible to IGSCC.

The recent refurbishment of a CRD G003 CTF assembly revealed a 360 degree failure around the collet retainer tube weld which was also completely separated, with a 0.15" displacement of the collet housing from the outer tube. This is the first occurrence of this type failure on any CTF assembly observed by GEH. It is noted that the CRD continued to perform normally, including scram, while in service.

## Discussion

The fillet weld design in question is applicable to all 919D258G002 and G003 Cylinder, Tube and Flange assemblies since the collet retainer tube material, part configuration and fillet weld design are the same for both groups. This fillet weld is located on the Outer Tube Assembly and is part of the Cylinder, Tube and Flange (CTF) assembly of the CRD mechanism.



The G003 CTF containing the failed fillet weld was removed from service in 2011. The collet retainer tube displacement was observed to be 0.15 inches. In addition to this observed displacement, two other dimensions provide an upper bound to the potential movement of the collet retainer tube:

- Per drawing dimensions after separation the collet retainer tube could displace a nominal distance of ~1.3 inches, before the top of the CRD outer filter would stop against the bottom of the control rod guide tube base.
- After separation a displacement of ~1 inch would result in the collet spring, which is maintained in a compressed state per design requirements, returning to its free length state. The collet spring in its free length state would restrict the collet fingers from deflecting outward and clear of the index tube notches.

Testing is being performed to validate if weld shrinkage restricted the further displacement of the collet retainer tube from the outer tube after separation. CRD index tube movement would likely begin to be inhibited if the collet retainer tube separated and displaced an approximate distance of 1 inch. This degree of separation could potentially result in a stuck control rod (no insert, withdraw or scram motion).

Although not confirmed, preliminary indication suggests that the weld failure may be attributed to the lack of weld penetration and fusion to the base materials.

MFN 12-006 R0

Attachment 1 – Description of Evaluation

Page 3 of 3

Additional occurrences of this failure are deemed very low probability based on the following:

1. Since 1977, more than 5,000 G002 and G003 CTFs have been manufactured and many are approaching 30 years of service without observing a similar condition.
2. Approximately 2,100 G002 and G003 CTF assemblies have been dye penetrant inspected by GEH and this is the first identified failure of this type.
3. There were over 2,500 G002 and G003 CTF assemblies fabricated in the same period as this failed CTF and there have been no other 360 degree fillet weld failures identified.
4. An evaluation of a CTF representative of recent production and believed to be representative of all previous production runs, shows substantially more weld fusion than the failed CTF.

The failed collet retainer tube is currently being evaluated at the GEH Vallecitos facility. The evaluation is ongoing, however it appears the weld anomaly may be isolated. The probability of another weld failure appears to be extremely low. This is not considered a safety concern at this time.

#### **ABWR and ESBWR Design Certification Documentation Applicability**

The issue described above have been reviewed for applicability to documentation associated with 10 CFR 52 and it has been determined that there is no effect on the technical information contained in either the ABWR certified design or the ESBWR design in certification.

#### **Recommendation**

GEH recommends normal CRD surveillance testing in accordance with the plants' Technical Specification Surveillance Requirements. A failure of this fillet weld resulting in separation and full displacement of the collet retainer tube and affecting the operation of the CRD would be identified during the surveillance testing.

GEH recommends that all sites continue to perform scheduled maintenance on CRD assemblies and perform dye penetrant inspections of this weld area as previously described in GE SIL139 supplement 6.

#### **Corrective/Preventive Actions**

GEH will complete the ongoing evaluations by June 7, 2012.

Refer to Attachment 3, Item (vii) for corrective actions.

**Attachment 2**  
**US Plants Potentially Affected**

| <u>Utility</u>                             | <u>Plant</u>                   |
|--|--------------------------------|
| <u>X</u> Constellation Energy              | Nine Mile Point 1-2            |
| <u>X</u> Detroit Edison Co.                | Fermi 2                        |
| <u>X</u> Energy Northwest                  | Columbia                       |
| <u>X</u> Entergy                           | Grand Gulf                     |
| <u>X</u> Entergy                           | River Bend                     |
| <u>X</u> Entergy                           | FitzPatrick                    |
| <u>X</u> Entergy                           | Pilgrim                        |
| <u>X</u> Entergy                           | Vermont Yankee                 |
| <u>X</u> Exelon                            | Clinton                        |
| <u>X</u> Exelon                            | Dresden 2-3                    |
| <u>X</u> Exelon                            | LaSalle 1-2                    |
| <u>X</u> Exelon                            | Limerick 1-2                   |
| <u>X</u> Exelon                            | Oyster Creek                   |
| <u>X</u> Exelon                            | Peach Bottom 2-3               |
| <u>X</u> Exelon                            | Quad Cities 1-2                |
| <u>X</u> FirstEnergy Nuclear Operating Co. | Perry 1                        |
| <u>X</u> Florida Power & Light             | Duane Arnold                   |
| <u>X</u> Nebraska Public Power District    | Cooper                         |
| <u>X</u> PPL Susquehanna LLC               | Susquehanna 1-2                |
| <u>X</u> Progress Energy                   | Brunswick 1-2                  |
| <u>X</u> PSEG Services Corp.               | Hope Creek                     |
| <u>X</u> Southern Nuclear Operating Co.    | Hatch 1 - 2                    |
| <u>X</u> Southern Nuclear Operating Co.    | Pooled Equipment Inventory Co. |
| <u>X</u> Tennessee Valley Authority        | Browns Ferry 1-3               |
| <u>X</u> Xcel Energy                       | Monticello                     |
| <u>X</u> North East Utilities              | Millstone                      |

MFN 12-006 R0

Page 1 of 2

**Attachment 3 – 60-Day Interim Report Notification Information per §21.21(a)(2)**

- (i) Name and address of the individual or individuals informing the Commission.

Dale E. Porter  
GE Hitachi Nuclear Energy  
Safety Evaluation Program Manager  
3901 Castle Hayne Road, Wilmington, NC 28401

- (ii) Identification of the facility, the activity, or the basic component supplied for such facility which fails to comply or contains a defect.

See Attachment 2 for a list of potentially affected plants

- (iii) Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.

GE Hitachi Nuclear Energy

- (iv) Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

The collet retainer tube fillet weld completely failed 360 degrees around the weld and separated and displaced 0.15" from the outer tube. GEH is currently evaluating the cause and if this type of weld failure could credibly result in ~1 inch movement of the collet retainer tube and subsequent restriction of collet fingers and prevention of CRD operation.

- (v) The date on which the information of such defect or failure to comply was obtained.

A Potential Reportable Condition Evaluation in accordance with 10 CFR Part 21 was initiated on December 6, 2011.

- (vi) In the case of a basic component which contains a defect or fails to comply, the number and location of these components in use at, supplied for, being supplied for, or may be supplied for, manufactured, or being manufactured for one or more facilities or activities subject to the regulations in this part.

Cylinder, Tube and Flange (CTF) assemblies, drawing numbers 919D258G002 and G003, for CRD assemblies are installed and in use in all BWR 2-6 operating plants. Attachment 2 of this letter identifies all the sites that have these CTF assemblies supplied by GEH.



MFN 12-006 R0

Page 2 of 2

**Attachment 3 – 60-Day Interim Report Notification Information per §21.21(a)(2)**

- (vii) The corrective action, which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.

GEH Engineering is performing a Root Cause Analysis (RCA) and a detailed metallurgical analysis of the failed weld. Also GEH is performing extensive mockup testing to determine the potential maximum length of displacement of the collet retainer tube. Results of this analysis will be used to assess the potential functional consequence to determine if a reportable condition exists within the context of 10CFR Part 21.21(d).

Completion of the 10CFR Part 21 evaluation will be based upon the findings of this Root Cause Analysis and mockup testing. Completion of this evaluation is scheduled for June 7, 2012.

- (viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.

GEH recommends continuing performance of CRD surveillance testing in accordance with the surveillance testing specified in the plants' Technical Specifications.

GEH recommends all sites continue to perform their normal scheduled maintenance on CRD assemblies and perform PT inspection of this weld area as previously outlined in GE SIL139 supplement 6.

- (ix) In the case of an early site permit, the entities to whom an early site permit was transferred.

This is not an early site permit concern.