



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

October 31, 1994

The Honorable John F. Kerry  
United States Senator  
One Bowdoin Square  
Tenth Floor  
Boston, MA 02114

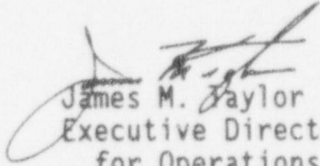
Dear Senator Kerry:

I am responding to your letter of October 3, 1994, in which you asked the U.S. Nuclear Regulatory Commission to respond to concerns raised by Ms. Ott and Dr. Muirhead regarding the reactor core shroud at Pilgrim Nuclear Power Station.

I am enclosing a copy of our response to Ms. Ott and Dr. Muirhead. This reply to you and the reply to Ms. Ott and Dr. Muirhead will not be publicly distributed, because we are treating the information supplied by Ms. Ott and Dr. Muirhead concerning two sources knowing of cracks in the Pilgrim core shroud as an allegation. Our process purposefully limits distribution of related correspondence to reduce the possibility of revealing the identity of individuals bringing allegations to our attention.

I hope this is responsive to your concerns.

Sincerely,

  
James M. Taylor  
Executive Director  
for Operations

Enclosure: Letter to Ms. Ott and Dr. Muirhead

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NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

October 26, 1994

Dr. Donald M. Muirhead, Jr.  
Ms. Mary C. Ott  
Citizens Urging Responsible Energy  
Post Office Box 2621  
Duxbury, MA 02331

Dear Dr. Muirhead and Ms. Ott:

I am responding to your September 16, 1994, letter regarding core shroud cracking at the Pilgrim Nuclear Power Station (PNPS). As you stated, the U.S. Nuclear Regulatory Commission (NRC) is concerned about core shroud cracking and is acting to ensure safe operation of the affected plants.

On October 4, 1994, the Boston Edison Company (BECo) management made a presentation to NRC management and staff in a public meeting in Rockville, Maryland. During the meeting BECo presented information to support its belief that the condition of Pilgrim's shroud is acceptable. BECo also provided evidence to support its contention that the risk associated with allowing PNPS to operate until the scheduled refueling outage in April 1995, without performing a core shroud inspection or repair, is acceptable. During that refueling outage, BECo has committed to install a General Electric designed modification which will replace the structural integrity currently provided by the core shroud welds. I am enclosing (Enclosure 1) a copy of the slide presentation from the October 4, 1994, public meeting. The NRC staff asked BECo to submit a sensitivity analysis that would provide the margin to unacceptable performance of the core shroud during a postulated large break loss-of-coolant accident. BECo submitted the analysis on October 13, 1994, and the staff is currently reviewing it. A decision on whether it is acceptable to wait until the April 1995 outage to perform repairs to the core shroud will be made after that review. We will inform you of our decision.

On September 27, 1994, the NRC staff informed you in a telephone conversation that we are also concerned about the information supplied to you by anonymous sources regarding the core shroud at PNPS. As the staff told you, BECo informed us that the core shroud has not been inspected in a manner that would allow BECo to determine if the shroud is cracked. Without additional information, NRC has no basis on which to substantiate the statements of the anonymous sources. As the staff requested, if you are contacted again, please ask the sources to contact us directly. If they are reticent to do so, but could supply additional information to substantiate their assertions, we will revisit the issue.

As requested, I am also enclosing (Enclosure 2) a copy of the slide presentation from the August 4, 1994, public meeting with BECo to discuss the reactor vessel inspection and a proposed intergranular stress-corrosion cracking (IGSCC) inspection relief request. The slide presentation was included in the meeting summary of August 9, 1994, during which time BECo proposed changing the frequency of inspection of 11 category D recirculation

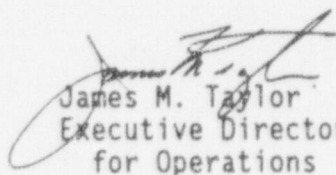
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Donald M. Muirhead and Mary C. Ott -2-

safe-end welds. This proposal is highlighted on the fourth slide of the presentation. NRC informed BECo that relief is not required if they implement hydrogen water chemistry as stated in Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping." They do, however, need to submit a written description of their program for evaluation and approval by the NRC staff.

I hope this reply addresses your concerns, and I will await any additional information you may be able to supply regarding the PNPS core shroud.

Sincerely,

  
James M. Taylor  
Executive Director  
for Operations

- Enclosures:
1. Core Shroud Presentation  
(October 4, 1994)
  2. Proposed IGSCC Inspection Relief  
Request (August 4, 1994)



# Pilgrim Nuclear Power Station

Commitment to Safety



## **Core Shroud Presentation**

- **E.T. Boulette - Senior Vice President Nuclear**
- **H.V. Oheim - Nuclear Engineering Services  
Department Manager**
- **R.V. Fairbank - Regulatory Affairs and  
Emergency Preparedness  
Department Manager**
- **J. P. Gerety - Fluid Systems and  
Mechanical Components  
Division Manager**

# Meeting Objectives

- Assure the NRC Staff that Pilgrim places safety as the foremost consideration in resolving the core shroud cracking issue
- Update the NRC Staff on status of Pilgrim's efforts to resolve this issue
- Apprise the staff of the dynamic and complex nature of this issue
- Obtain feedback from the NRC Staff regarding Pilgrim's response to the Generic Letter
- Maintain open communications allowing for frequent status reports from Pilgrim and feedback from NRC Staff

## **Safety is Pilgrim's foremost consideration in responding to shroud cracking issue**

- **Our early recognition of significance and applicability dictated our sense of urgency**
- **Pilgrim plant-specific safety assessment provides interim safety assurance**
- **Industry experience continuously factored into planning**
- **Pilgrim is committed to permanent resolution as soon as practicable**
- **Pilgrim will provide frequent progress reports to the NRC Staff as our efforts continue**



**Our early recognition of significance and applicability dictated our sense of urgency**

- **Pilgrim took a leadership role in industry response**
- **Preemptive repair eliminates risk**
- **Optimum repair completion is RFO #10**

## **Pilgrim took a leadership role in industry's response to shroud cracking**

- **BWRVIP Executive Oversight Committee Member**
- **Assessment Subcommittee Representative**
- **Inspection Subcommittee Representative**
- **Mitigation Subcommittee Chairman**
- **Mitigation Subcommittee Representative**
- **Repair Subcommittee Representative**
- **Repair design and hardware fabrication are in progress to support RFO #10**

# Preemptive repair eliminates risk

- Inspection uncertainties continue
- Repair restores structural margin
- Pilgrim likely to need eventual repair
- Do it right the first time



## **Optimum repair completion is RFO #10**

- **Safest implementation during planned RFO**
  - High Confidence in Interim Safety
  - Provides necessary design and hardware lead times
- **Pilgrim is presently in an outage**
- **Implementation during current outage scope is uncertain and adds unnecessary risk**

## **Safest implementation during planned RFO**

- **Vessel open for refueling**
- **Fuel movement planned**
- **Operators trained and prepared**
- **Equipment tested and prepared**

## **Pilgrim is presently in an outage**

- **Plant trip 8/29/94 due to generator failure**
- **MCO commenced 26 days early 9/4/94**
- **MCO to complete 10/7/94**
- **Generator repair dictates restart**
- **Restart target early December**
- **No plan to open vessel**
- **Generator repair progress**
- **'B' Battery Cell replacement**



## **Implementation during current outage is uncertain and adds unnecessary risk**

- **Repair design uncertainties**
- **Inspection plan uncertainties**
- **Battery cell replacement**
- **Refuel floor and operator readiness**
- **Open the vessel**
- **Move fuel**
- **RFO planning impacted**
- **Repair impacts vessel inspection**

## **Core Shroud repair design uncertainties must be resolved prior to implementation**

- **Lead plant success**
- **Seismic loads**
  - PNPS loads > lead plant loads
  - lead plant design may not be adequate for PNPS
- **Pre-installation inspection uncertainties**
  - Gusset welds
  - Vertical welds
  - Ring Segment
  - Others
- **As-built configuration uncertainty**
- **Core support plate wedges**
- **LOCA Loads - RLB**
- **Code Classification**

## **Core shroud repair implementation concerns must be resolved**

- **Availability of hardware and people**
- **Refuel floor readiness**
- **Operator readiness**
- **125 vdc Battery cell replacement**
- **Potential regulatory support**
  - 125 vdc battery crosstie tech spec waiver
  - approval of SGTS/CRHEAF tech spec submittal
  - agreement outage does not meet tech spec definition of “Refueling Outage”



## **Pilgrim's plant specific safety assessment provides interim safety assurance**

- **Structural margin exists assuming conservative crack size estimates**
- **Plant safety functions assured assuming hypothetical complete shroud failure**
  - Normal Operation
  - Anticipated Operational Events
  - Design Basis Accident
- **Probabilistic risk assessment confirms acceptability of operation**

## **Structural margin exists assuming conservative crack size estimates**

- **GE PLEDGE model based on conservative assumptions**
  - highest fleet conductivity
  - initial flaw size and shroud material condition
  - potential IASCC contribution included
  - typical residual stress considered
- **Analysis indicates high flaw tolerance**
  - 64% of shroud circumference
  - 95% through wall
- **Crack growth rate slowed**
  - low conductivity
  - hydrogen water chemistry
  - crack growth to RFO #10 < 1%
- **Estimated crack size is acceptable**

## **Plant safety functions assured assuming hypothetical complete shroud failure**

- **Normal Operation**
  - detectable
  - proper core geometry maintained
- **Anticipated Operational Events**
  - assume preexisting undetected 360° through wall crack
  - proper core geometry maintained
  - no additional reactor components affected
- **Design Basis Accident**
  - MSLB and RLB
  - Shroud lift less than top guide depth
  - Ability to SCRAM maintained
- **Confirms Safe Operation**



## **Probabilistic risk assessment confirms acceptability of operation**

- **Probability of undetected 360° through-wall crack**
- **Probability of MSLB or RLB**
- **Probability of shroud failure causing loss of mitigating systems and recovery actions:**
  - Control Rods
  - SBLC
  - Core Spray
- **Change in CDF < 10%**

## **Industry experience is continuously factored into shroud project planning**

- **Inspection results enveloped by predictive model**
- **Inspection difficulties**
- **Repair difficulties**
- **Public interest**

## **Safety is Pilgrim's foremost consideration in responding to shroud cracking issue**

- **Our early recognition of significance and applicability dictated our sense of urgency**
- **Pilgrim plant-specific safety assessment provides interim safety assurance**
- **Industry experience continuously factored into planning**
- **Pilgrim is committed to permanent resolution as soon as practicable**
- **Pilgrim will provide frequent progress reports to the NRC Staff as our efforts continue**



## **PROPOSED IGSCC INSPECTION RELIEF REQUEST**

- 1. BECO Response To NRC GL 88-01**
- 2. IGSCC Inspection Program Scope**
- 3. IGSCC Inspection Results**
- 4. IGSCC Relief Request Scope**
- 5. Conclusion**

## BECO RESPONSE TO NRC GL 88-01

- **GL Identified 13 NRC Positions for Conformance**
- **BECO Responded to the NRC GL by Aug. 4, 1988 letter**
  - Provided Response to the Staff Positions.
  - Provided a List of IGSCC Welds.
- 1. **RFO # 6 (12/83-12/84) Pipe Replacement Project:**
  - Entire Recirc. System Piping Replaced with 316NG Material**
  - Portions of RHR, CS and RWCU Piping Replaced**
  - No unrepaired Cracked Welds remained in service at PNPS**
- 2. **IGSCC Mitigation Effort:**
  - Hydrogen Water Chemistry**

**TABLE 1: IGSCC Related Welds**

IGSCC Category	Description	Number of Safety Related Welds Excluding RWCU	Number of Safety Related RWCU	Number of Non-Safety Related Welds (RWCU)
A	Resistant Material	121	43	19
B	Non-resistant material, SI within 2 years of operation	0	0	0
C	Non-resistant material, SI after 2 years of operation	0	2	1
D	Non-resistant materials, no SI	35	12	3
E	Cracked, reinforced by weld overlay or mitigated by SI	1	0	0
F	Cracked, inadequate or no repair	0	0	0
G	Non-resistant materials not inspected	4	4	45
<b>TOTALS</b>		<b>161</b>	<b>61</b>	<b>68</b>

Total IGSCC susceptible safety-related welds: 222  
 Total IGSCC susceptible non-safety related welds: 68  
 Total IGSCC susceptible welds are: 290



TABLE 2. PROPOSED GL 88-01 SCHEDULE FOR RECIRCULATION WELDS

Materials/Mitigation Process	IGSCC Category	Inspection Extent & Proposed Schedule	Number of Welds	Proposed Changes
Resistant material	A	25% every 10 years (at least 12% in 6 years)	61	N/C
Non-resistant materials (stress improvement [SI] within 2 years of operation)	B	25% every 10 years (at least 12% in 6 years)	0	N/C
Non-resistant materials SI after 2 years of operation	C	50% every 10 years (at least 25% in 6 years)	0	N/C
Non-resistant materials with no SI	D	All every 4 refueling cycles	11	Frequency change by a factor of 2
Cracked reinforced by weld overlay or mitigated SI	E	All every 4 Refueling cycles	0	N/C
Cracked inadequate or no repair	F	All every refueling outage	0	N/C
Non-resistant not inspected	G	All next refueling outage	0	N/C

2R-N2A-1	2R-N2F-1	2R-N1B-1
2R-N2B-1	2R-N2G-1	
2R-N2C-1	2R-N2H-1	
2R-N2D-1	2R-N2J-1	
2R-N2E-1	2R-N2K-1	

## IGSCC INSPECTION PROGRAM RESULTS

- **Inspection Program Conformed to:**

  - NRC GL 84-11

  - Upgraded to conform to GL 88-01

- **88 IGSCC Weld Examinations since GL 88-01 were performed**
- **24 Examinations since HWC Injection were performed**
- **One S-R and 3 N S-R Cracks Discovered in RWCU piping prior to continuous H Injection in Sept. 91; piping replaced during RFO # 9**
- **NO Cracks after continuous Hydrogen Injection**
- **Safety-Related Portion of RWCU piping undergoing Replacement during RFO # 10**
- **Non-Safety Related RWCU Piping Fall under the Scope of NRC GL 88-01 Suppl. #1**
- **NO CRACKS IN ANY PIPING SINCE CONTINUOUS USE OF HWC**

## CONCLUSION

- Relief Request Based on NRC Approval of Generic BWROG Topical Report
- Proposed Inspection Frequency Change by a Factor of 2 to Category D Recirc. Safe-End welds
- Proposed Relief Request to be Implemented Beginning RFO # 10 (4/ 1995) or 11
- Implementation of Relief Saves per Refueling Outage:
  - ~ 3.66 man-rem Exposure and
  - ~ \$300K Expenditures
- Relief Request to be Submitted after NRC approval of BWROG Report.