



**Boston Edison**

Pilgrim Nuclear Power Station  
Rocky Hill Road  
Plymouth, Massachusetts 02360-5599

I&E Bulletin 80-13

**Nancy L. Desmond**  
Regulatory Relations Group Manager

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U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555

Docket No. 50-293  
License No. DPR-35

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON  
CRACKING OF CORE SPRAY INTERNAL PIPING (TAC M93398)

- Reference:
1. BECo Letter No. 97-038, "Supplementary Information on Inspection of Core Spray Piping Internals at Pilgrim," dated April 2, 1997.
  2. BECo Letter No. 97-033, "Inspection of Core Spray Piping Internals at Pilgrim", dated March 18, 1997.

The attachment to this letter provides our response to the NRC request for additional information transmitted to us on July 1, 1997, concerning core spray internal piping flaw evaluations. The inservice inspection results and flaw evaluations were reported to the NRC pursuant to NRC Bulletin 80-13 (References 1 and 2).

If you have any questions regarding the information contained in this letter, please contact Walter Lobo at (508) 830-7940.

Nancy L. Desmond

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Attachment: BECo Response to NRC Request for Additional Information including three enclosures.

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Boston Edison Company

cc: Mr. Alan B. Wang, Project Manager  
Project Directorate I-3  
Office of Nuclear Reactor Regulation  
Mail Stop: OWF14B2  
U. S. Nuclear Regulatory Commission  
1 White Flint North  
11555 Rockville Pike  
Rockville, MD 20852

U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

Senior Resident Inspector  
Pilgrim Nuclear Power Station

## ATTACHMENT

### BECO RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON CRACKING OF CORE SPRAY INTERNAL PIPING (TAC M93398)

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  2. BECo Letter No. 97-033, "Inspection of Core Spray Piping Internals at Pilgrim", dated March 18, 1997.
  3. Pilgrim Nuclear Power Station (PNPS) Chemistry Procedure 7.8.1, "Water Quality Limits" revision 16 (Enclosure 1).
  4. GENE Letter No. HSM-9721, "The Use of DLL Computer Program in Pilgrim Nuclear Station Core Spray Analysis", dated July 29, 1997 (Enclosure 2).
  5. NRC Letter B.W. Sheron Director Engineering NRR to J.T. Beckham Chairman BWRVIP, "Evaluation of BWR Shroud Cracking Generic Safety Assessment, Revision 1, 'GENE-523-A107P-0794, August 5, 1994 and 'BWR Core Shroud Inspection and Evaluation Guidelines', GENE-523-113-0894, September 2, 1994", dated December 28, 1994 (Enclosure 3).
  6. BWRV'P-18, "BWR Core Spray Internals Inspection and Evaluation Guidelines," dated July 1996.

#### NRC QUESTIONS:

On July 1, 1997, the NRC Project Manager for Pilgrim Station transmitted the following questions on core spray internal piping flaw evaluations. On July 10, 1997, NRC staff reviewer, Mr. William Koo, clarified the scope of the questions in light of our previous supplemental response (Reference 1). Our response to NRC questions are provided below. (References 1 and 2 were previously submitted to the NRC. References 3, 4 and 5 are enclosed with this attachment. Reference 6 was submitted to the NRC by BWR VIP.)

#### NRC QUESTION NO. 1

" In the licensee's flaw evaluation, a bounding crack growth rate of  $5 \times 10^{-5}$  inch/hr was used. The crack growth rate for IGSCC has been shown to depend on the reactor coolant water chemistry and several other factors. To ensure the bounding crack growth rate used in flaw evaluation is conservative, it is necessary to maintain a good water chemistry as measured by conductivity during normal operation. EPRI has published guidelines for maintaining a good water chemistry in the operation of BWRs."

" In operating the Pilgrim plant, is the licensee committed to EPRI's BWR Water Chemistry Guidelines, particularly regarding the action level 1? When the reactor water conductivity exceeds 0.3 microSiemens/cm, Action level 1 requires the licensee to take corrective action to reduce the conductivity to or below 0.3 microSiemen/cm within 96 hours. If yes, describe how

the referenced guidelines are being implemented during plant operation. Are there any water chemistry controls in the technical specification (TS) in term of conductivity limits? If yes, describe the controls in details."

RESPONSE

Pilgrim Nuclear Power Station (PNPS) has implemented EPRI's BWR Water Chemistry Guidelines in chemistry procedure 7.8.1, "Water Quality Limits", which includes response to an Action Level 1 condition for a reactor water conductivity of 0.3 microSiemens/cm ( $\mu\text{S}/\text{cm}$ ) (Reference 3). The PNPS-specific actions are explained in section 3.2.2.2 of procedure 7.8.1., which states:

" If the parameter has not been reduced below the Action Level 1 value within 96 hours, a technical evaluation (with formal review by management) should be performed to determine the cause of the problem and action plan(s) should be developed to correct the cause of the problem. Submit a Problem Report to the NWE [Nuclear Watch Engineer] (if not done already and if still in Action Level 1 for greater than 96 operating hours for the same parameter)."

These actions are implemented to promptly identify and correct the cause of the out-of-normal value without power reduction and to return the parameter to less than the Action Level 1 value. Furthermore, PNPS 7.8.1 requires that if reactor water conductivity exceeds 1.0  $\mu\text{S}/\text{cm}$  (EPRI Action Level 2) then an orderly unit shutdown will be initiated if conductivity is not less than 1.0  $\mu\text{S}/\text{cm}$  within 24 hours (unless an engineering evaluation determines that it is more prudent to continue operating to minimize the impact on affected components). The procedure also states that "less stringent control limits and actions are not permitted without the review and approval of the Senior Vice President, Nuclear" (Note No. 2 page 20 of 7.8.1).

In addition, PNPS Technical Specification 3.6.B.5 stipulates an orderly shutdown and achieving hot shutdown within 24 hours and cold shutdown within the next 8 hours if conductivity can not be maintained below 2  $\mu\text{S}/\text{cm}$  at steaming rates less than 100,000 lbs/hr or 10  $\mu\text{S}/\text{cm}$  at steaming rates greater than or equal to 100,000 lbs/hr (See table below).

PNPS TS 3.6.B Reactor Water Conductivity Limits

Plant Condition	Conductivity Limit	T.S. Action
TS 3.6.B.2: Steaming rates less than 100,000 lbs/hr.	2 $\mu\text{S}/\text{cm}$	TS 3.6.B.5: Orderly shutdown and reactor in hot shutdown within 24 hrs and cold shutdown within the next 8 hours
TS 3.6.B.3 and 4: Reactor Startup and for the first 24 hrs after start of power operation, and power operation at steaming rates greater than or equal to 100,000 lbs/hr.	10 $\mu\text{S}/\text{cm}$	TS 3.6.B.5: Orderly shutdown and reactor in hot shutdown within 24 hrs and cold shutdown within the next 8 hours

Although PNPS Technical Specifications do not have the equivalent of a 0.3  $\mu\text{S}/\text{cm}$  action level for conductivity, the 10  $\mu\text{S}/\text{cm}$  Technical Specification response is similar to an EPRI Action Level 2 response. Since PNPS has implemented the EPRI limits and controls, which are more restrictive than the Technical Specification limits for conductivity and aggressive anions, effectiveness of water chemistry to arrest IGSCC is maintained.

PNPS continuously monitors reactor water conductivity from both the reactor water cleanup inlet and the 'B' recirculation loop, which are considered to provide water chemistry conditions representative of reactor water in the vessel and reactor recirculation systems respectively.

#### NRC QUESTION NO. 2

"Had the DLL methodology and its computer program used in the licensee's structural evaluation been previously approved by the NRC or recommended in the BWR VIP guidelines? If yes, identify the supporting references and discuss any deviations."

#### RESPONSE

Boston Edison Company is a participant in the BWR Vessel and Internals Project (BWR VIP). The BWRVIP issued a report, BWRVIP-01 "BWR Core Shroud Inspection and Flaw Evaluation Guidelines", which provides a standardized methodology for performing core shroud inspections and for evaluating the consequences of any observed cracking. The BWRVIP sponsored and developed the BWR Core Shroud Distributed Ligament Length (DLL) methodology to facilitate the required calculations. The actual software program (or computer code) was also developed by the BWRVIP under EPRI supervision and was issued under EPRI report TR-107283, dated December 1996. Subsequently, the computer code was issued by the BWRVIP as BWRVIP-20 "BWR Core Shroud Distributed Ligament Length (DLL) Computer Program (Version 2.1)".

GE performed the flaw analyses of the Core Spray piping "multiple" circumferential flaws using version 2.1 of this program, with no deviations from BWRVIP-20. The results of the computer analyses were provided to the NRC in our submittal (Reference 2). The methodology is essentially based on the limit load methods of Appendix C of ASME Section XI, as stated in Reference 4. The NRC reviewed BWRVIP-01 "BWR Core Shroud Inspection and Flaw Evaluation Guidelines" and accepted this methodology (Reference 5). Reference 6, currently under review by the NRC, states that the methodology of BWRVIP-01 can be used to evaluate the core spray indications.

This program would have been used to evaluate the Pilgrim core shroud flaws, if "multiple" cracks were found in the girth welds. Since no flaws in the Pilgrim core shroud were found, the DLL methodology was not used.

NRC QUESTION NO. 3

"Please provide additional information for items identified below for each of the five welds (1P8b, 1P5, 2P8b, 3P8b and 3P5) that received better than 90% UT coverage.

- (a) How many inches of the pipe circumference were not UT inspected?
- (b) How many inches of the pipe circumference were neither UT inspected nor visually inspected?
- (c) Were the areas not UT inspected adjacent to a flaw and how far from the nearest flaw?
  - (c)(1) Perform a flaw evaluation to justify continued operation for a fuel cycle with the assumption that the areas not UT inspected were cracked through-wall.
  - (d) If acceptable results can not be obtained in item (c)(1), perform a plant-specific system assessment assuming complete failure of weld P9 considering the structural integrity of weld P8 is not assumed."

RESPONSE

The five welds (1P8b, 1P5, 2P8b, 3P8b and 3P5) received 100% UT examinations. Accordingly, the remaining questions do not apply as clarified by NRC staff reviewer Mr. William Koo on July 10, 1997.