



**BOSTON EDISON**

Pilgrim Nuclear Power Station  
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**Roy A. Anderson**

Senior Vice President — Nuclear

July 1, 1992

BECO 92-070


U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

License DPR-35  
Docket 50-293

Response to Generic Letter 92-01

The attachments to this letter provide Boston Edison Company's (BECO) response for Pilgrim Nuclear Power Station (PNPS) to NRC questions concerning reactor vessel structural integrity. The questions were contained in Generic Letter (GL) 92-01 and GL 92-01, Revision 1.

As the attachments indicate, Pilgrim's reactor vessel is the subject of an NRC approved inspection program governed by procedures and Technical Specifications.

  
R. A. Anderson

PMK/clc/6968

cc: See Page 2

Commonwealth of Massachusetts)  
County of Plymouth)

Then personally appeared before me, Roy A. Anderson, who being duly sworn, did state that he is Senior Vice President - Nuclear of Boston Edison Company and that he is duly authorized to execute and file the submittal contained herein in the name and on behalf of Boston Edison Company and that the statements in said submittal are true to the best of his knowledge and belief.

My commission expires:

October 5, 1995  
DATE

  
NOTARY PUBLIC

Ltr - Encl.

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P PDR

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ADD

BOSTON EDISON COMPANY

U.S. Nuclear Regulatory Commission

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Senior NRC Resident Inspector  
Pilgrim Nuclear Power Station

Attachment A to Generic Letter 92-01

Question #1

Certain addressees are requested to provide the following information regarding Appendix H to 10CFR Part 50:

Addressees who do not have a surveillance program meeting ASTM E 185-73, -79, or -82 and who do not have an integrated surveillance program approved by the NRC (see Enclosure 2), are requested to describe actions taken or to be taken to ensure compliance with Appendix H to 10CFR Part 50. Addressees who plan to revise the surveillance program to meet Appendix H to 10CFR Part 50 are requested to indicate when the revised program will be submitted to the NRC staff for review. If the surveillance program is not to be revised to meet Appendix H to 10CFR Part 50, addressees are requested to indicate when they plan to request an exemption from Appendix H to 10CFR Part 50 under 10CFR50.60(b).

Response to #1

The NRC reviewed and approved our integrated surveillance program in a NRC Safety Evaluation approving Amendment No. 82 to Pilgrim's Technical Specifications. Technical Specification Amendment No. 82 provided Pressure/Temperature limits and the surveillance capsule withdrawal schedule for Pilgrim.

The Safety Evaluation states, in reference to Appendix H to 10CFR50 as implemented at Pilgrim:

Appendix H of 10CFR50 requires that the surveillance capsule withdrawal schedule comply with ASTM E-185-82. The withdrawal schedule proposed by the licensee for the remaining two capsules meets the withdrawal schedule requirements of ASTM E-185-82. Hence, it satisfies Appendix H and may be incorporated into the Pilgrim Technical Specification.

Pilgrim Technical Specification Table 4.6.3 provides the surveillance program withdrawal schedule and is provided for your information as Attachment B.

Question #2.a

Certain addressees are requested to provide the following information regarding Appendix G to 10CFR Part 50:

Addressees of plants for which the Charpy upper shelf energy is predicted to be less than 50 foot-pounds at the end of their licenses using the guidance in Paragraphs C.1.2 or C.2.2 in Regulatory Guide 1.99, Revision 2, are requested to provide to the NRC the Charpy upper shelf energy predicted for December 16, 1991,

Attachment A to Generic Letter 92-01

and for the end of their current license for the limiting beltline weld and the plate or forging and are requested to describe the actions taken pursuant to Paragraphs IV.A.1 or V.C of Appendix G to 10CFR Part 50.

Response to #2.a

Pilgrim's Charpy upper shelf energy at end-of-life (EOL) was estimated to be 79 foot-pounds. Southwest Research Institute also provides this information in its report, "Pilgrim Nuclear Power Station Unit 1 Reactor Vessel Irradiation Surveillance Program," dated July, 1981. It is based on Regulatory Guide 1.99 guidance in effect in 1981. The Southwest Research Institute report was provided to the NRC as supplemental information to the 1991 Pilgrim Technical Specification Amendment request BECo submitted in response to GL 88-11.

Question #2.b.1

Addressees whose reactor vessels were constructed to an ASME Code earlier than the Summer 1972 Addenda of the 1971 Edition are requested to describe the consideration given to the following material properties in their evaluations performed pursuant to 10CFR50.61 and Paragraph III.A of 10CFR Part 50, Appendix G:

the results from all Charpy and drop weight tests for all unirradiated beltline materials, the unirradiated reference temperature for each beltline material, and the method of determining the unirradiated reference temperature from the Charpy and drop weight test;

Response #2.b.1

The requirements of 10CFR50.61 apply to Pressurized Water Reactors (PWRs) and therefore are not applicable to Pilgrim.

Pilgrim's reactor vessel was constructed earlier than the Summer 1972 Addenda of the 1971 Edition.

Battelle Columbus Laboratories conducted tests to determine the unirradiated Charpy impact and tensile properties of base metal, weld metal and heat affected zone (HAZ) metal for Pilgrim. The results are summarized in Battelle's "Final Report on Evaluation of Mechanical Properties of Unirradiated Specimens from Pilgrim Unit No. 1" dated October 25, 1979. The report describes the preirradiation baseline tensile and Charpy impact properties of the three materials being used in the surveillance capsule program. The Battelle Report was provided to the NRC as supplemental information to the 1991 Amendment request submitted in response to GL 88-11.

## Attachment A to Generic Letter 92-01

Data from that report are reproduced in Attachment C.

The reference temperature ( $RT_{NDT}$ ) was determined for the base and weld materials using nil-ductility transition temperatures ( $T_{NDT}$ ) of  $-10^{\circ}F$  and  $0^{\circ}F$ , respectively. The  $RT_{NDT}$  was established through testing triplicate Charpy specimens for each of the two materials at temperatures of  $T_{NDT} + 60^{\circ}F$ . Results of the two sets of tests showed the  $T_{NDT}$  to also be the  $RT_{NDT}$  for each of the materials.

### Question #2.b.2

The heat treatment received by all beltline and surveillance materials.

### Response to #2.b.2

Heat treatment was not explicitly considered in the Appendix G analysis, as there are no requirements or methods provided that relate to heat treatment. However, implicit in the Appendix G analysis is the assumption that the Charpy data used to develop the  $RT_{NDT}$  values is representative of the beltline materials, so heat treatment of the Charpy specimens should represent or bound that of the beltline materials.

After the beltline plates were quenched and tempered, specimen samples and the plate material used in the surveillance program were trimmed from the plates. The specimen samples and surveillance materials received a simulated post-weld heat treatment (PWHT) at  $1150^{\circ}F \pm 25^{\circ}F$  for 40 hours. The beltline materials received the same PWHT after welding, but only for one hour per inch of thickness or about six hours. The additional PWHT time for the specimens was intended to cover the possibility of future vessel repairs requiring subsequent PWHT. Since PWHT tends to reduce the fracture toughness of the material, the Charpy specimens and surveillance program materials provide a bounding representation of the vessel beltline materials.

### Question #2.b.3

The heat number for each beltline plate or forging and the heat number of wire and flux lot number used to fabricate each beltline weld.

### Response to #2.b.3

The heat numbers for vessel material and the beltline weld material is reproduced as Attachment D.

### Question #2.b.4

The heat number for each surveillance plate or forging and the heat number of wire and flux lot number used to fabricate the surveillance weld.

Attachment A to Generic Letter 92-01

Response to #2.b.4

The data on the surveillance weld indicates it is representative and provides us with information needed to meet the objective of Appendix H to monitor toughness changes due to irradiation. This information is provided in Amendment 17 to the original Pilgrim Final Safety Analysis Report.

Question #2.b.5

The chemical composition, in particular the weight in percent of copper, nickel, phosphorous, and sulfur for each beltline and surveillance material.

Response to #2.b.5

Chemical composition weight percent data for beltline materials are shown in Attachment D. In some cases for weld materials, upper bound assumptions of 0.35% copper and 1.0% nickel were used in the absence of actual chemistry data and were used with Regulatory Guide 1.99, Revision 2, to determine the limiting beltline material to address Generic Letter 88-11.

Generic Letter 88-11 resulted in Pilgrim proposing new Pressure/Temperature curves for operation to 32EFY and added Pressure/Temperature curves for the vessel bottom head. These proposed changes were approved by the NRC as Amendment No. 140 to the Pilgrim Technical Specifications and became effective January 29, 1992.

Question #2.b.6

The heat number of the wire used for determining the weld metal chemical composition if different than Item (3) above.

Response to #2.b.6

This does not apply as demonstrated in the above discussion.

Question #3.a

Addressees are requested to provide the following information regarding commitments made to respond to Generic Letter 88-11:



## Attachment A to Generic Letter 92-01

How the embrittlement effects of operating at an irradiation temperature (cold leg or recirculation suction temperature) below 525°F were considered. In particular licensees are requested to describe consideration given to determining the effect of lower irradiation temperature on the reference temperature and on the Charpy upper shelf energy.

### Response to #3.a

Pilgrim is a Boiling Water Reactor. Operation of Pilgrim's beltline region below 525°F was not considered in the Appendix G analysis because the steady-state operating temperature of the coolant in the beltline region is in excess of 525°F. Based on the temperature in the recirculation suction piping, which draws water directly from the beltline region, the steady-state temperature in the beltline is greater than 525°F.

Only during startup and operation without feedwater heating, which occurs when feedwater heaters are out of service or when the turbine is off line and the reactor steam is routed through the turbine bypass, does the beltline experience coolant less than 525°F when the core is critical. This is a short-term operational state and, therefore, is considered to have a minor effect on long term radiation embrittlement.

### Question #3.b

How their surveillance results on the predicted amount of embrittlement were considered.

### Response to #3.b

Surveillance results were factored into beltline embrittlement using Regulatory Guide 1.99, Revision 2, in support of the recent (1992) Pressure/Temperature Technical Specification curves reviewed and approved by the NRC as Amendment No. 140. The 1 sigma distribution of 28°F for welds and 17°F for base metal was used. The proposed curves were developed using Regulatory Guide 1.99, Revision 2, to address a commitment made in response to Generic Letter 88-11.

### Question #3.c

If a measure increase in reference temperature exceeds the mean-plus-two standard deviations predicted by Regulatory Guide 1.99, Rev. 2, or if a measured decrease in Charpy upper shelf energy exceeds the value predicted using the guidance in Paragraph C.1.2 in Regulatory Guide 1.99, Rev. 2, the licensee is requested to report the information and describe the effect of the surveillance results on the adjusted reference temperature and Charpy upper shelf energy for each beltline material as predicted for December 16, 1991, and for the end of its current license.

Attachment A to Generic Letter 92-01

Response to #3.c

In 1991, Pilgrim submitted changes to the Technical Specification Pressure/Temperature limits to address Generic Letter 88-11 concerns. We adjusted the reference temperature curves using Regulatory Guide 1.99, Revision 2. The NRC approved the proposed change as Amendment No. 140 on January 29, 1992. The NRC Safety Evaluation for Amendment No. 140 states, regarding reference temperature:

The licensee has removed one surveillance capsule from Pilgrim. The results from capsule 1 were published in Southwest Research Institute Report SWRI 02-5951. All surveillance capsules contained Charpy impact specimens and tensile specimens made from base metal, weld metal, and HAZ metal.

The licensee used the method in Regulatory Guide 1.99, Rev. 2, to calculate an ART of 91°F at 32EFY at 1/4T for the same limiting weld metal. The staff judges that the licensee's ART of 91°F is more conservative than the staff's ART of 90.9°F, and the staff verified that the proposed Pressure/Temperature limits for 32EFY for heatup, cooldown, and hydrotest meet the beltline material requirements in Appendix G of 10CFR Part 50. The staff also verified that Pressure/Temperature limits for 10, 11, 13, 15, and 20 EFYs meet the Appendix G requirements.



Attachment B to BECo

Response to Generic Letter 92-01