April 30, 2004

Mr. Michael Kansler
President
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: PILGRIM NUCLEAR POWER STATION - FOURTH 10-YEAR INSERVICE TESTING (IST) PROGRAM AND REQUEST FOR APPROVAL OF IST RELIEF REQUESTS (TAC NOS. MB8771, MB8774, MB8775, MB8776, AND MC1261)

Dear Mr. Kansler:

By letter dated December 6, 2002, Entergy Nuclear Operations, Inc. (Entergy or the licensee) submitted the Pilgrim Nuclear Power Station (Pilgrim) IST Program in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50.55a(f)(4)(ii) for the fourth 10-year interval starting December 7, 2002. Included in the IST Program submittal, Entergy requested relief from several American Society of Mechanical Engineers Code for Operation and Maintenance of Nuclear Power Plants (ASME OM Code) requirements related to testing of pumps and valves.

Entergy supplemented its original relief requests in responses to the Nuclear Regulatory Commission's (NRC) requests for additional information by letters dated October 24, 2003, and February 10, 2004. The October 24, 2003, supplement revised several of the relief requests and withdrew Pump Relief Request PR-02 (MB8772) and Valve Relief Request VR-05 (MB8779). The February 10, 2004, supplement provided additional information related to Pump Relief Request PR-03. By letter dated October 29, 2003, Entergy submitted an additional relief request within the scope of the IST Program related to Standby Liquid Control System pump testing. Entergy also requested to use a portion of the ASME OM Code (1998 Edition through 2000 Addenda) in accordance with 10 CFR 50.55a(f)(4)(iv).

The NRC staff has reviewed the requests against the applicable ASME OM Code requirements. The staff determined that there are no limitations nor modifications in 10 CFR 50.55a(b) and that there are no other related requirements for the paragraphs in the ASME OM Code; therefore, use of a portion of the ASME OM Code (1998 Edition through 2000 Addenda) is authorized pursuant to 10 CFR 50.55a(f)(4)(iv) for the fourth 10-year IST interval.

For Pump Relief Request PR-01, the staff concludes that compliance with certain ASME OM Code requirements is impractical and the proposed alternative testing will adequately assess the pump's operational readiness. On this basis, relief is granted pursuant to 10 CFR 50.55a(f)(6)(i) for the fourth 10-year IST interval. The relief granted is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

The staff also concludes that the licensee's proposed alternatives to the ASME OM Code requirement, as specified in Pump Relief Request PR-04, and in Valve Relief Requests VR-01 and VR-02, are authorized pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that they provide an acceptable level of quality and safety. As requested, Pump Relief Request PR-04 is authorized until June 2004. Valve Relief Requests VR-01 and VR-02 are authorized for the fourth 10-year IST interval.

The staff concludes that the alternative proposed in Pump Relief Request PR-05 is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the fourth 10-year IST interval on the basis that compliance with the ASME OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The staff determined that the licensee's proposed alternative testing will provide reasonable assurance of operational readiness of the pumps.

The remaining relief requests included with the IST submittal, Pump Relief Request PR-03 (MB8773), and Valve Relief Requests VR-03 (MB8777), VR-04 (MB8778) and VR-06 (MB8780), are currently under consideration by the staff. The staff's review of these requests will be documented in a separate safety evaluation (SE).

The results the staff's review of the use of a portion of the ASME OM Code (1998 Edition through 2000 Addenda); Pump Relief Requests PR-01, PR-04 and PR-05; and Valve Relief Requests VR-01 and VR-02 are documented in the enclosed SE. If you have any questions, please contact Travis Tate at (301) 415-8474.

Sincerely,

/RA by VNerses for/

James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosure: Safety Evaluation

cc w/encl: See next page

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The staff also concludes that the licensee's proposed alternatives to the ASME OM Code requirement, as specified in Pump Relief Request PR-04, and in Valve Relief Requests VR-01 and VR-02, are authorized pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that they provide an acceptable level of quality and safety. As requested, Pump Relief Request PR-04 is authorized until June 2004. Valve Relief Requests VR-01 and VR-02 are authorized for the fourth 10-year IST interval.

The staff concludes that the alternative proposed in Pump Relief Request PR-05 is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the fourth 10-year IST interval on the basis that compliance with the ASME OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The staff determined that the licensee's proposed alternative testing will provide reasonable assurance of operational readiness of the pumps.

The remaining relief requests included with the IST submittal, Pump Relief Request PR-03 (MB8773), and Valve Relief Requests VR-03 (MB8777), VR-04 (MB8778) and VR-06 (MB8780), are currently under consideration by the staff. The staff's review of these requests will be documented in a separate safety evaluation (SE).

The results the staff's review of the use of a portion of the ASME OM Code (1998 Edition through 2000 Addenda); Pump Relief Requests PR-01, PR-04 and PR-05; and Valve Relief Requests VR-01 and VR-02 are documented in the enclosed SE. If you have any questions, please contact Travis Tate at (301) 415-8474.

Sincerely,
/RA by VNerses for/
James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
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Docket No. 50-293

Enclosure: Safety Evaluation

cc w/encl: See next page

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ADAMS Accession Number: **ML040780705**

*See SE input dated 1/28/04. No significant changes made **See previous concurrence

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DATE	4/29/04	4/29/04	SE dated 1/28/04	4/5/04	4/29/04

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOURTH 10-YEAR INSERVICE TESTING (IST) PROGRAM AND

REQUEST FOR APPROVAL OF IST RELIEF REQUESTS

ENTERGY NUCLEAR GENERATION COMPANY

ENTERGY NUCLEAR OPERATIONS, INC.

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

1.0 INTRODUCTION

By letter dated December 6, 2002, Entergy Nuclear Operations, Inc. (Entergy or the licensee) submitted the Pilgrim Nuclear Power Station (Pilgrim) IST Program in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50.55a(f)(4)(ii) for the fourth 10-year interval starting December 7, 2002. Included in the IST Program submittal, Entergy requested relief from several American Society of Mechanical Engineers Code for Operation and Maintenance of Nuclear Power Plants (ASME OM Code) requirements related to testing of pumps and valves.

Entergy supplemented its original relief requests in responses to the Nuclear Regulatory Commission's (NRC) requests for additional information by letters dated October 24, 2003, and February 10, 2004. The October 24, 2003, supplement revised Pump Relief Request PR-01; and Valve Relief Requests VR-01, VR-02, VR-03, VR-04, and VR-06. The licensee also withdrew Pump Relief Request PR-02 (MB8772) and Valve Relief Request VR-05 (MB8779). In this letter, the licensee also requested to use a portion of a later ASME OM Code (1998 Edition through 2000 Addenda) for its fourth 10-year interval IST program. The February 10, 2004, supplement provided additional information requested by the NRC staff to support the review of Pump Relief Request PR-03. By letter dated October 29, 2003, Entergy submitted Pump Relief Request PR-05, which is within the scope of the IST Program related to Standby Liquid Control (SLC) system pump testing.

This Safety Evaluation (SE) documents the NRC staff's review for the requested use of a portion of the ASME OM Code (1998 Edition through 2000 Addenda); the proposed relief requests, Pump Relief Requests PR-01, PR-04 and PR-05; and the Valve Relief Requests VR-01 and VR-02.

Enclosure

In Pump Relief Request PR-01, the licensee proposed an alternative pump test procedure for the reactor building closed cooling water (RBCCW) pumps in lieu of using the test procedure requirements as specified by paragraph ISTB 5.2 of the ASME OM Code.

In Pump Relief Request PR-04, the licensee proposed an alternative pump test criteria for the SLC system pumps in lieu of meeting the requirements as specified in paragraph ISTB 4.7.1(f) of the ASME OM Code. This alternative is only requested until new instrumentation is installed in June 2004.

In Pump Relief Request PR-05, the licensee proposed an alternative method to obtain a test measurement for the SLC system pumps in lieu of meeting the requirements as specified in paragraph ISTB-5.6.1 of the ASME OM Code.

In Valve Relief Request VR-01, the licensee proposed an alternative to the testing frequency for various excess flow check valves in lieu of the requirements as specified by paragraphs ISTC 4.5.2(c) and ISTC 4.5.2(f) of the ASME OM Code.

In Valve Relief Request VR-02, the licensee has proposed an alternative to the testing frequency for two instrumentation check valves in lieu of meeting the requirements as specified in paragraphs ISTC 4.5.2(c) and ISTC 4.5.2(f) of the ASME OM Code.

2.0 REGULATORY EVALUATION

Section 50.55a of 10 CFR requires that IST of certain ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with the ASME OM Code and applicable addenda, except where alternatives have been authorized or relief has been requested by the licensee and granted by the Commission pursuant to paragraphs (a)(3)(i), (a)(3)(ii),or (f)(6)(i) of 10 CFR 50.55a.

In accordance with 10 CFR 50.55a(f)(4)(ii), licensees are required to comply with the requirements of the latest edition and addenda of the ASME Code incorporated by reference in the regulations 12 months prior to the start of the subsequent 120-month IST program intervals. Accordingly, licensees whose subsequent 120-month (10-year) IST program interval began after November 22, 2000, are required to comply with the 1995 Edition with the 1996 Addenda of the ASME OM Code. Similarly, licensees whose 120-month (10-year) IST program interval began after October 28, 2003, are required to comply with the 1998 Edition through 2000 Addenda of the ASME OM Code. In accordance with 10 CFR 50.55a(f)(4)(iv), licensees may use portions of subsequent editions and addenda provided that all related requirements of the respective edition and addenda are met.

In proposing alternatives or requesting relief, the licensee must demonstrate that: (1) the proposed alternatives provide an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for the facility. Section 50.55a of 10 CFR authorizes the Commission to approve alternatives and to grant relief from ASME Code requirements upon making necessary findings. NRC guidance contained in Generic Letter (GL) 89-04, “Guidance on Developing Acceptable Inservice Testing Programs,” provides acceptable alternatives to ASME Code requirements. Further guidance is given in GL 89-04, Supplement 1, and NUREG-1482, “Guidance for Inservice Testing at Nuclear Power Plants.”

The fourth 10-year IST Interval for Pilgrim began on December 7, 2002, and extends through December 6, 2012. The effective ASME Code of record for this interval is the 1995 Edition including the 1996 Addenda of the ASME OM Code. Subsection ISTB provides the requirements for IST of pumps, and Subsection ISTC provides the requirements for IST of valves.

3.0 TECHNICAL EVALUATION

The staff has reviewed the regulatory and technical analysis in support of the licensee's request for relief from the ASME OM Code IST requirements which are described in, "Code Testing Exception Report," of the licensee's submittal. The staff's findings are discussed below.

3.1 Use of ASME OM Code 1998 Edition through 2000 Addenda

The licensee requested to use a portion of the ASME OM Code 1998 Edition through 2000 Addenda (ASME OMb Code - 2000) in lieu of 1995 Edition through 1996 Addenda for the Pilgrim fourth 10-year interval IST program. Specifically, the licensee requested to use the following paragraphs from the ASME OMb Code - 2000:

– Appendix I-1390, Test Frequency, Class 2 and Class 3 Pressure Relief Devices that are Used for Thermal Relief Application

– Appendix 1-4110(h) and Appendix 1-4130(g), Time Between Valve Openings

– Deletion of ISTA 2.1, Inspection

The Pilgrim fourth 10-year IST Interval began on December 7, 2002, and extends through December 6, 2012. The edition and addenda of the ASME Code incorporated by reference in the regulations 12 months prior to the start of Pilgrim's fourth 10-year IST interval (i.e., effective on December 7, 2001) is the 1995 Edition up to and including the 1996 Addenda. Therefore, the effective ASME Code of record for Pilgrim's fourth IST interval is the 1995 Edition through the 1996 Addenda of the ASME OM Code. The regulations state in 10 CFR 50.55a(f)(4)(iv) that inservice tests of pumps and valves may meet requirements set forth in subsequent editions and addenda that are incorporated by reference in paragraph (b) of 10 CFR 50.55a subject to the limitations and modifications listed in paragraph (b), and subject to Commission approval. It also states that portions of editions and addenda may be used provided that all related requirements of the respective edition and addenda are met. The ASME OMb Code - 2000 was incorporated by reference into 10 CFR 50.55a (67 FR 60520) and became effective on October 28, 2002. There are no limitations nor modifications in 10 CFR 50.55a(b) and no other related requirements for these paragraphs are in the ASME OMb Code - 2000. Therefore, the use of the above paragraphs in the ASME OMb Code - 2000 is approved pursuant to 10 CFR 50.55a(f)(4)(iv) for the Pilgrim fourth 10-year IST interval.

3.2 Pump Relief Request PR-01:

3.2.1 ASME Code Requirements for which Relief is Requested:

Paragraph ISTB 5.2.1, Group A Test, states that Group A tests shall be conducted with the pump operating at a specified reference point. The ASME Code further states that test

parameters shown in Table ISTB 4.1-1 shall be determined and recorded as required by this paragraph, and the test shall be conducted as follows:

ISTB 5.2.1(b): For centrifugal and vertical line shaft pumps, the resistance of the system shall be varied until the flow rate equals the reference point. The differential pressure shall then be determined and compared to its reference value. Alternatively, the flow rate shall be varied until the differential pressure equals the reference point and the flow rate determined and compared to the reference flow rate value.

3.2.2 System/Component(s) for which Relief is Requested:

The licensee requested relief from the ASME OM Code requirements for the test procedure as specified in paragraph ISTB 5.2.1 and Table ISTB 4.1.1 for its RBCCW pumps, P-202A, P-202B, P-202C, P-202D, P-202E and P-202F. These RBCCW pumps are Group A pumps as defined by the ASME Code.

3.2.3 Licensee's Basis for Relief:

> Reactor building closed-cooling water system instrumentation is not configured to measure individual pump flow rates during plant parallel pump operations in a single loop. Redesign of the system would be necessary to reconfigure the piping to allow the installation of permanent flow instrumentation or to utilize portable flow instrumentation.
>
> The RBCCW piping configuration does not permit installation of flow instrumentation (either portable or standard flow orifices) on the pump discharge piping that would be consistent with good instrument practices. A flow measurement instrument that compromises the recommended industry installation practices will not provide accurate reliable flow results on a consistent bases to meet the rigorous criteria for [ASME] Code pump testing. Each RBCCW loop has three pumps. The common suction header splits into three separate pump suction lines, which supply each RBCCW pump and then return into a common discharge header. Adequate distance downstream of each individual pump discharge elbow is not available where discharge piping joins the common header.
>
> Because the general area around the RBCCW pumps is very congested, the most cost effective fix requires a plant design change that will add a testing loop for both the 'A' loop and 'B' loop [of the] RBCCW systems. The modification would cut into each pump discharge header and run three test lines which connect into a common test loop that ties back into the 14" [inch] common pump discharge header. The estimated cost for this design and engineering, materials, installation, and testing to implement this modification is $600,000 per RBCCW Loop (Total System [modification] cost of 1.2 million dollars).
>
> A maintenance history study was performed on the RBCCW pumps to verify that they are not subject to frequent failures-especially where the degradation might not be detected by the proposed alternative testing. The study reviewed RBCCW pump historical data back to 1986 and confirmed that the RBCCW pumps (and motors) are not subject to frequent failures. The most common maintenance work activities have been periodic corrective measures to fix pump packing leakage and preventive

maintenance for motor oil changes and pump coupling lubrication. There was one functional failure of the motor for pump P-202E within the study time period. This was a recent event that resulted from motor winding degradation. The motor windings failed while the pump P-202E was in service. The follow-up investigation revealed that the 30 year old motor windings had degraded due to age. The P-202E motor winding failure was not detectable (due to its nature) through normal [ASME] Code pump testing, in that, all pump and motor bearing vibration parameters remained in their band and pump hydraulic capacity remained unchanged.

The reactor building closed-cooling water system is part of the ultimate heat sink for containment cooling functions and [r]eactor [v]essel shutdown cooling. Test loops do not exist for individual pump flow tests; therefore, disturbance of the system normal configuration during operation (and some cold shutdown conditions) will have negative impact on the plant's ability to maintain safe steady-state operation.

The reactor building closed-cooling water pump system flow rates depend on reactor power, service water injection temperature, outside ambient temperature, and plant equipment heat loads. When plant service water heat loads are high and/or salt service water inlet temperature is high (during summer months), parallel pump operation is necessary. These conditions normally occur during the months of July, August, and September. Because of these limitations, the RBCCW Group A pump testing will be performed using one of two methods. Scheduled testing during these conditions will be conducted in accordance with ISTB 5.3, Pumps in Regular Use. The Group A testing using parallel pumps will be performed using the same pump configurations (i.e., P-202A/B, P-202A/C, P-202D/E, or P-202D/F) at a known reference point of total flow. The use of parallel pumps allows monitoring both pumps' hydraulic and mechanical (vibration) parameters for degradation.

During periods when plant heat loads and climatic conditions allow the scheduled quarterly testing to be performed using single RBCCW pump operation, the Group A Test Method will be conducted using a single pump at a known flow reference point.

3.2.4 Licensee's Proposed Alternative:

The licensee proposed to perform normal quarterly Type A pump testing using single RBCCW pump operation. When heat loads and climate condition do not allow single pump quarterly testing to be scheduled in advance, the Type A test will be performed while parallel pumps are operating at the specified reference flow rate.

3.2.5 Evaluation:

The ASME OM Code requires that Group A tests be conducted by establishing a reference pump flow rate or differential pressure and determining other specified test parameters. As an alternative, the licensee proposes to perform normal quarterly Type A pump testing using single RBCCW pump operation. When heat loads and climate condition do not allow single pump quarterly testing to be scheduled in advance, the licensee proposes to perform Type A pump testing with pumps operating in parallel at the specified reference flow rate.

The staff has reviewed the licensee's justification and determined that Pilgrim's RBCCW system design does not allow measurement of individual pump flow rates during parallel pump operations in a single loop. Additionally, the system configuration does not permit installation of flow measurement instrumentation in a manner that would provide reliable flow measurement results to meet the ASME OM Code criteria. The staff's review of the licensee's justification also determined that, during certain environmental conditions that result in high heat loads, parallel pump operation is necessary to adequately cool components supplied by the RBCCW system. Operating with only one RBCCW pump per loop during these conditions could result in equipment damage and possibly cause a reactor trip.

In evaluating the licensee's proposed alternative pump testing, the staff considered the licensee's maintenance history study that revealed the pumps are not typically subject to failures. In addition, the licensee's investigation of a recent motor winding failure that occurred determined that the failure would not have been detectable through the required ASME OM Code pump testing. The licensee's proposed alternative does not modify the testing frequency required by the ASME OM Code. The staff determined that the licensee's proposed testing is a reasonable approach that provides a practical test for the pumps given the existing system design.

3.2.6 Conclusion

Based on the discussion above, the staff concludes that it is impractical and burdensome for the licensee to comply with the ASME OM Code requirements due to the major system redesign and modifications that would be necessary and the potential to cause equipment damage or a reactor trip when operating a single pump during high heat load conditions. Further, the staff concludes that the proposed testing will allow an adequate assessment of the pump operational readiness. Therefore, relief is granted pursuant to 10 CFR 50.55a(f)(6)(i) for the fourth 10-year IST interval. The relief granted is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

3.3 Pump Relief Request No. PR-04

3.3.1 ASME Code Requirements for which Relief is Requested:

Paragraph ISTB 4.7.1(f), "General Frequency Response Range," of the ASME OM Code requires that the frequency response range of the vibration measuring transducers and their readout system shall be from one-third minimum pump shaft rotational speed to at least 1000 (Hertz).

3.3.2 System/Component(s) for which Relief is Requested:

The licensee requested relief from the ASME OM Code requirements of paragraph ISTB 4.7.1(f) for the SLC pumps P-207A and P-207B.

3.3.3 Licensee's Basis for Relief:

The nominal shaft rotational speed of these pumps is 420 RPM [revolutions per minute] which is equivalent to approximately 7.0 Hz. Based on this frequency and ISTB 4.7.1(f), the required frequency response range of instruments used for measuring SLC pump vibration is from 2.3 Hz to 1000 Hz. Procurement and calibration of instruments to cover this range to the lower extreme (2.3 Hz) are impractical due to the limited number of vendors supplying such equipment and the level of sophistication and cost of the equipment.

These pumps are of a simplified, reciprocating (piston), positive displacement design with rolling element bearings, Model Number TD-60, manufactured by Union Pump Corporation. Union Pump Corp. has performed an evaluation of the pump design and has determined that there are no probable sub[-]synchronous failure modes associated with these pumps under normal operating conditions. Furthermore, there are no known failure mechanisms that would be revealed by vibration at frequencies below that related to shaft speed (7.0 Hz); thus, no useful information is obtained below this frequency nor will indication of pump degradation be masked by instrumentation unable to collect data below this frequency.

The requirement to measure vibration with instruments with response to one-third shaft speed stems from the need to detect oil whip or oil whirl associated with journal bearings. In the case of these pumps, there are no journal bearings to create these phenomena; thus, satisfying the frequency response range criteria would serve no significant purpose. The significant modes of vibration, with respect to equipment monitoring, are as follows:

> 1 - Times Crankshaft Speed - An increase in vibration at this frequency may be an indication of rubbing between a single crankshaft cheek and rod end, cavitation at a single valve, or coupling misalignment.
>
> 2 - Times Crankshaft Speed - An increase in vibration at this frequency may be an indication of looseness at a single rod bearing or crosshead pin, a loose valve seat in the fluid cylinder, a loose plunger/crosshead stub connection, or coupling misalignment.
>
> Other Multiples of Shaft Speed - An increase in vibration at other frequencies may be indications of cavitation at several valves, looseness at multiple locations, or bearing degradation.

The vibration sensing instruments utilized by PNPS [Pilgrim Nuclear Power Station] are accelerometers. The accelerometers have a frequency response range which is ideally suited for component operation but inherently have amplitude distortions at low frequencies. While other types of transducers may provide more accurate signals in a lower frequency response range, the advantages of accelerometers (light-weight, rugged, wide frequency response, good temperature resistance, moderate pricing, availability) would outweigh the advantages of having instrumentation that would meet the [ASME OM] Code requirements for SLC pumps. Additionally, as part of the PNPS

> Preventive Maintenance Program, the SBLC pumps are subject to periodic vibration analysis and also receive periodic oil analysis.
>
> Based on the foregoing discussion, it is clear that monitoring pump vibration within the frequency range of 7 to 1000 Hz will provide sufficient information for evaluating pump condition and ensuring continued pump reliability. Compliance with the [ASME OM] Code requirement would result in a significant hardship and cost without any compensating increase in pump performance.

3.3.4 Licensee's Proposed Alternative:

The licensee proposes to measure the vibration levels of the SLC pumps in accordance with the applicable portions of Subsection ISTB 4.7.1(f) to the ASME OM Code with the exceptions of the lower frequency response limit for the instrumentation. The lower frequency response limit of the vibration measuring equipment is 7 Hz or less. The licensee requested relief from the ASME OM Code requirement until June 2004 to allow sufficient time to procure the required instrumentation and to install and implement the necessary controls to meet the ASME OM Code requirements.

3.3.5 Evaluation:

In its application dated December 6, 2002, the licensee stated that the nominal shaft rotational speed of the SLC pumps is 420 RPM, which is approximately equivalent to 7 Hz. In order to comply with the ASME OM Code requirements, the required frequency response range capability of instruments used for measuring the SLC pump vibration is from 2.3 to 1000 Hz. The licensee proposes to use the existing instrumentation that provides a measurement capability of the SLC pump vibration over a range of 7 to 1000 Hz as an alternative to the ASME OM Code requirements.

The staff has reviewed the licensee's justification as presented above. In its October 24, 2003, response to the NRC staff's request for additional information, the licensee stated that a vendor has been located to provide accelerometers with the capability of obtaining measurements that comply with the applicable ASME OM Code requirements. Based on this, the licensee modified its request to obtain authorization for the proposed alternative only until June 2004. The licensee stated that the proposed extension to the schedule for implementing the ASME OM Code requirements would allow sufficient time to procure and install the required accelerometers and to implement the necessary controls for performing the required testing.

The licensee's request for relief until June 2004, in effect, extends the required implementing period by 6 months. The staff determined that the requested extension is reasonable due to the recent availability of the instrumentation and allows sufficient time for the licensee to procure and install the instrumentation and controls to meet the ASME OM Code requirements. The frequencies where high vibration would provide an indication of pump degradation with respect to equipment monitoring are one times (1X) pump running speed, (2X) pump running speed, and multiples of pump running speed. The types of pump problems associated with each of these frequencies are also known. Further, the frequency spectrum of the signals generated is characteristic of each pump and constitutes a unique pattern. Analysis of the spectrum pattern allows identification of vibration sources, and monitoring of change over time permits evaluation of the mechanical condition of the pump. Therefore, the staff also

determined that utilizing the existing instrumentation to measure the capability of the SLC pump vibration over a range of 7 to 1000 Hz for the requested period of relief provides an acceptable level of quality and safety for the requested extension period.

3.3.6 Conclusion:

Based on the discussion above, the staff concludes that the licensee's requested 6-month implementation extension of the ASME OM Code requirements, and the proposed alternative to utilize the existing instrumentation to measure SLC pump vibrations over a range of 7 to 1000 Hz provides an acceptable level of quality and safety. Therefore, the requested relief is authorized pursuant to 10 CFR 50.55a(a)(3)(i) until June 2004.

3.4 Pump Relief Request PR-05:

3.4.1 ASME Code Requirements for which Relief is Requested:

Paragraph ISTB 5.6, "Duration of Tests, ISTB 5.6.1 Group A Test," of the ASME OM Code requires that, after pump conditions are as stable as the system permits, each pump shall be run at least 2 minutes. At the end of this time, at least one measurement or determination of each of the quantities required by Table ISTB 4.1-1 shall be made and recorded.

3.4.2 System/Component(s) for which Relief is Requested:

The licensee requested relief from performing the ASME OM Code requirements of paragraph ISTB 5.6 for its SLC pumps, P-207A and P-207B.

3.4.3 Licensee's Basis for Relief:

> The SLC pumps are tested by pumping fluid from the SLC storage tank into a test tank. The test tank capacity does not allow for operation of the pump for more than [three] minutes. The [ASME OM] Code requires [a two minute] stabilization period before collecting accurate and repeatable flow rate data. If [two] minutes are allocated for [the] stabilization period, there is insufficient time for additional system operation to produce accurate and repeatable flow rate data. Thus[,] relief from the [two minute] stabilization period is required. The present surveillance procedure has provided consistent test results and produced good repeatability.
>
> During testing, the initial test conditions are established by starting the SLC pumps and adjusting the pump discharge test flow (throttle) valve to obtain the test reference discharge pressure. When the reference test pressure has been established[,] the pump is stopped and the initial test tank level is measured. The pump is then restarted and allowed to run for three minutes. The test tank final level is measured and the pump flow rate is calculated. Pump flow rate calculations meet the requirements of [T]able ISTB 4.7.1-1 for measured values.

3.4.4 Licensee's Proposed Alternative:

The licensee proposes to use a pump testing procedure that will establish the pump reference discharge pressure prior to conducting the 3 minute pump test run. When initial conditions for

reference discharge pressure are established, the SLC pump will be stopped. The SLC pump will then be operated for exactly 3 minutes. An accurate measurement of the initial test tank level and final test tank level will be used to determine the measured test flow rate.

3.4.5 Evaluation:

The ASME OM Code requires that pump flow rate be measured in order to determine the extent of any pump degradation. The 2-minute run time is required in order to achieve stable pump performance parameters before data are recorded during the test. The positive displacement SLC pumps, P-203A and P-203B, utilized at Pilgrim are designed to pump a constant flow rate regardless of system resistance. The SLC system was not designed with flow meter instrumentation in the flow loop and uses a test tank to determine flow rate by measuring the change in tank level over a period of time. Due to the physical limitations of the size of the tank, the pump run time is limited when using this test methodology. Design, fabrication, and installation changes would have to be made to comply with the ASME OM Code requirements.

As an alternative to the ASME OM Code requirements, the licensee is proposing to measure the flow rate by determining the change in tank level over a period of time and calculating an average flow rate into the tank. The change in flow resistance due to the rising tank level will be small in comparison with the pump discharge pressure, thereby having no significant effect on the test results. Provided the tank level at the beginning of each test is approximately the same, repeatable results can be achieved. In addition, the suction is a large source at a constant pressure, which will allow for pump performance parameters to stabilize quickly. This method is consistent with the methodology used during the previous IST interval and provides reasonable assurance of the pump's operational readiness when the test tank test level is measured in accordance with the accuracy requirements of Table ISTB 4.7.1-1. Implementing procedures include the calculational method and any test conditions required to achieve this accuracy.

As a result, the staff has determined that requiring the licensee to install a larger test tank to facilitate the pump testing in accordance with the ASME OM Code would impose a hardship without a compensating increase in the level of quality and safety.

3.4.6 Conclusion:

Based on the discussion above, the staff concludes that the proposed alternative to the requirements of the ASME OM Code, paragraphs ISTB 5.6.1, for flow rate measurement during testing of the SLC pumps, P-207A/B, using a tank-level calculational method provides reasonable assurance of operational readiness of the pumps. Therefore, the proposed relief is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) for the fourth 10-year IST interval.

3.5 Valve Relief Request No. VR-01:

3.5.1 ASME Code Requirements for which Relief is Requested:

Paragraph ISTC 4.5.1, Exercising Test Frequency, of the ASME OM Code requires that check valves be tested nominally every 3 months, except as specified by paragraph ISTC 4.5.2. The Pilgrim IST Program utilizes the exceptions in accordance with subparagraphs ISTC 4.5.2(c) and ISTC 4.5.2(f).

ISTC 4.5.2(c): If exercising is not practicable during plant operation and cold shutdowns, it shall be performed during refueling outages.

ISTC 4.5.2(f): All valve testing required to be performed during a refueling outage shall be completed before returning the plant to operation.

ISTC 4.3.3(a) Frequency: Tests shall be conducted at least once every 2 years.

3.5.2 System/Component(s) for which Relief is Requested:

The licensee requested relief from performing the ASME OM Code requirements of paragraph ISTB 4.5.1 and ISTC 4.3.3(a) for the following Excess Flow Check Valves (EFCVs) manufactured by Chemequip:

Table-1

Valve Number	System	OM Category	Safety Class
1-CK-17A/B/C/D	Main Steam	AC	1,2
1-CK-18A/B/C/D	Main Steam	AC	1,2
12-CK-360/361	Reactor Water Cleanup System	AC	1,2
1400-31A/B	Core Spray System	AC	1,2
1301-15A/B	Reactor Core Isolation Cooling	AC	1,2
2301-26	High pressure Coolant injection	AC	1,2
2301-220	High pressure Coolant injection	AC	1,2
261-19A/B	Nuclear Boiler Instrumentation	AC	1,2
261-20A/B	Nuclear Boiler Instrumentation	AC	1,2
261-21A/B	Nuclear Boiler Instrumentation	AC	1,2
261-22A/B	Nuclear Boiler Instrumentation	AC	1,2
261-67A/B/C/D/E/F/G/H	Nuclear Boiler Instrumentation	AC	1,2
261-110A/B	Nuclear Boiler Instrumentation	AC	1,2
262-25A/B	Recirculation Pump Instrumentation	AC	1,2
262-26A/B	Recirculation Pump Instrumentation	AC	1,2
263-38/44/45/51/53/55/57/59/61/ 69/71/73/75/77/79/81/83/90/92/ 225/227/233/237	Nuclear Boiler Instrumentation	AC	1,2
263-215A/B	Nuclear Boiler Instrumentation	AC	1,2

Valve Number	System	OM Category	Safety Class
263-217A/B	Nuclear Boiler Instrumentation	AC	1,2
263-219A/B	Nuclear Boiler Instrumentation	AC	1,2
263-220A/B	Nuclear Boiler Instrumentation	AC	1,2
263-223A/B	Nuclear Boiler Instrumentation	AC	1,2
263-231A/B	Nuclear Boiler Instrumentation	AC	1,2
263-242A/B	Nuclear Boiler Instrumentation	AC	1,2

3.5.3 Licensee's Basis for Relief:

[The General Electric Nuclear Energy (GE) Topical Report] NEDO-32977-A ["Excess Flow Check Valve Testing Relaxation," dated June 2000,] and the associated NRC Safety Evaluation, dated March 14, 2000, provide the basis for this relief. NEDO-32977-A justifies relaxing the EFCV testing frequency from the current testing of each valve once/cycle to an approximately 20% sample once/cycle such that each valve is tested within a 10-year interval.

NEDO-32977-A demonstrates, through operating experience, a high degree of reliability with EFCVs and the low consequences of an EFCV failure. Reliability data in the report (Tables 4-1 and 4-2) documents two EFCV failures (failure to close) at four participating plants (Monticello, Dresden, Vermont Yankee, and Oyster Creek) for Chemequip valves similar to those used at [Pilgrim]. These two failures were observed over a service time of 5426 operating years (4.75E+07 operating hours). This results in a "Best Estimate Failure Rate" of 4.21E-08 per hour of operating time and an "Upper Limit Failure Rate" of 1.33E-07 per hour of operating time. A review of historical test surveillance data and a test failure component history search at [Pilgrim] shows zero EFCV failures (failure to close or gross leakage test) have been observed based on data from 1983 through 2003 (RFO #14). In addition, there are no known EFCV failures that occurred earlier than 1983.

The instrument lines at [Pilgrim] have a flow-restricting orifice upstream of the EFCVs to limit [r]eactor water leakage in the event of rupture. Previous evaluations contained in [Pilgrim]'s Updated Final Safety Analysis Report ([U]FSAR) of such an instrument line rupture do not credit the EFCVs for isolating the rupture. Thus, a failure of an EFCV, though not expected as a result of this request, is bounded by the analysis. Based on NEDO-32977-A and the analysis contained in [Pilgrim]'s [U]FSAR, the proposed alternative to the required exercise testing frequency for EFCVs prescribed by [Subsection ISTC of the OM Code] provides a satisfactory level of quality and safety.

3.5.4 Licensee's Proposed Alternative:

The licensee proposes to reduce the number of EFCVs requiring to be tested every refueling outage from "each" to a "representative sample" every refueling outage (nominally once every 24 months) for EFCVs listed in Table 1. The representative sample is based on approximately 20 percent of the valves each 2-year cycle such that each valve is tested at least every 10 years (nominal).

The licensee proposes to exercise close test, a representative sample (~20 percent) of EFCVs every refueling outage, by full-stroking the valve to the position required to fulfill its function. During the exercise test, gross valve seat leakage (LX_{EFC}) will be measured. An exercise open test will be performed on each valve following the exercise close test and leak testing.

The licensee will evaluate and correct any EFCV failures in accordance with the Pilgrim Corrective Action Program (CAP). EFCV failures will be documented as surveillance test failures. The licensee will establish a program to trend EFCV test failures and determine whether additional testing is warranted. The program also will establish a minimum acceptance criteria for Chemequip EFCVs of less than or equal to one failure per year (two failures per 2 years) on a 2-year rolling average. This criteria ensures that EFCV performance remains consistent with the extended test interval. Upon exceeding the criteria, an evaluation will be performed which will:

- require a root cause evaluation to determine cause;
- determine the extent of condition;
- require an evaluation of the testing interval to ensure reliability of the EFCVs; and
- produce a risk analysis of the effects of the failure on cumulative and instantaneous plant safety.

Corrective actions and performance goals will be established based on the results of the root cause analysis.

3.5.5 Evaluation:

EFCVs are installed on boiling-water reactor (BWR) instrument lines to limit the release of fluid in the event of an instrument line break. Examples of EFCV installations include reactor pressure vessel level and pressure instrumentation, main steam line flow instrumentation, recirculation pump suction pressure, and reactor core isolation cooling steam line flow instrumentation. The Pilgrim safety analyses does not credit the EFCVs to close in response to a containment isolation signal or to operate under post loss-of-coolant accident (LOCA) conditions.

The proposed change by the licensee revises the surveillance frequency by allowing a "representative sample" of EFCVs to be tested every 24 months. The "representative sample" is based on approximately 20 percent of the EFCVs being tested each refueling outage such that each valve is tested at least once every 10 years (nominal).

Entergy's justification for the relief request is based on the GE Topical Report, NEDO-32977-A. The topical report provided: (1) an estimate of steam release frequency (into the reactor building) due to a break in an instrument line concurrent with an EFCV failure to close and

(2) an assessment of the radiological consequences of such a release. The staff reviewed the GE topical report and issued its SE on March 14, 2000. In its evaluation, the staff agreed that the test interval may be extended up to a maximum of 10 years. In conjunction with this finding, the staff noted that each licensee adopting the relaxed test interval program for EFCVs must have a failure feedback mechanism and CAP to ensure EFCV performance continues to be bounded by the topical report results. Also, each licensee should perform a plant-specific radiological dose assessment, an EFCV failure analysis, and a release frequency analysis to confirm that they are bounded by the generic analyses of the topical report.

In this SE, the staff reviewed Entergy's proposal for its applicability to GE Topical Report, NEDO-32977-A, and conformance with approved staff guidance regarding radiological dose assessment, EFCV failure rate and release frequency, and the proposed failure feedback mechanism and CAP. Based on its review, the staff determined that the radiological consequences of an EFCV failure are sufficiently low and acceptable, and that the alternative testing in conjunction with the corrective action plan provides a high degree of valve reliability and operability. Additionally, an orifice is installed upstream of the EFCVs to limit reactor water leakage in the event of rupture. The orifice limits leakage to a level where the integrity and functional performance of secondary containment and associated safety systems are maintained. Therefore, the staff finds that the licensee's proposed test alternative provides an acceptable level of quality and safety.

3.5.6 Conclusion:

Based on the above evaluation, the staff finds the proposed alternative which would allow a representative sample of EFCVs to be tested every 24 months with all EFCVs being tested at least once every 10 years (nominal) is acceptable. Therefore, the licensee's proposed alternative to the ASME OM Code requirements is authorized pursuant to 10 CFR 50.55a(a)(3)(i), for the fourth 10-year IST interval, based on the alternative providing an acceptable level of quality and safety.

3.6 Valve Relief Request No. VR-02

3.6.1 ASME Code Requirements for which Relief is Requested:

Paragraph ISTC 4.5.1, Exercising Test Frequency, of the ASME OM Code requires that check valves shall be exercised nominally every 3 months, except as provided by paragraph ISTC 4.5.2. The Pilgrim IST Program utilizes the exceptions in accordance with subparagraphs ISTC 4.5.2(c) and ISTC 4.5.2(f).

ISTC 4.5.2(c): If exercising is not practicable during plant operation and cold shutdowns, it shall be performed during refueling outages.

ISTC 4.5.2(f): All valve testing required to be performed during a refueling outage shall be completed before returning the plant to operation.

ISTC 4.3.3(a) Frequency: Tests shall be conducted at least once every 2 years.

3.6.2 System/Component(s) for which Relief is Requested:

The licensee requested relief from the ASME OM Code requirements for EFCVs 2-CK-125A and 2-CK-125B manufactured by Dragon.

3.6.3 Licensee's Basis for Relief:

> [The General Electric Nuclear Energy (GE) Topical Report] NEDO-32977-A ["Excess Flow Check Valve Testing Relaxation," dated June 2000,] and the associated NRC Safety Evaluation, dated March 14, 2000, provide the basis for this relief. NEDO-32977-A justifies relaxing the EFCV testing frequency from the current testing of each valve once/cycle to an approximately 20% sample once/cycle such that each valve is tested within a 10-year interval.
>
> NEDO-32977-A demonstrates, through operating experience, a high degree of reliability with EFCVs and the low consequences of an EFCV failure. Reliability data in the report (Tables 4-1 and 4-2) documents two EFCV failures (failure to close) at three participating plants (Clinton, Fermi, and WNP2 [Washington Nuclear Project]) for Dragon valves similar to those used at [Pilgrim]. These two failures were observed over a service time of 2494 operating years (2.18E+07 operating hours). This results in a "Best Estimate Failure Rate" of 9.2E-08 per hour of operating time and an "Upper Limit Failure Rate" of 2.89E-07 per hour of operating time. A review of historical test surveillance data and a test failure component history search at [Pilgrim] show zero EFCV failures (failure to close) have been observed from 1989 through RFO [Refueling Outage] 14 in 2003 (these valves were initially installed in 1987, but could not undergo meaningful plant testing until 1989 because design actuation flow rate was greater than available system test flow rate).
>
> The instrument lines at [Pilgrim] have a flow restricting orifice upstream of the EFCVs to limit [r]eactor water leakage in the event of rupture. Previous evaluations contained in [Pilgrim]'s Updated Final Safety Analysis Report ([U]FSAR) of such an instrument line rupture do not credit the EFCVs for isolating the rupture. Thus, a failure of an EFCV, though not expected as a result of this request, is bounded by the analysis. Based on NEDO-32977-A and the analysis contained in [Pilgrim]'s [U]FSAR, the proposed alternative to the required exercise testing frequency for EFCVs prescribed by [Subsection ISTC of the OM Code] provides a satisfactory level of quality and safety.

3.6.4 Licensee's Proposed Alternative:

The licensee proposes to reduce the number of EFCVs required to be tested every refueling outage from "each" to a "representative sample" every refuel outage (nominally once every 24 months) for EFCVs 2-CK-125A and 2-CK-125B. The representative sample is based on approximately 20 percent of the valves each 2-year cycle such that each valve is tested at least every 10 years (nominal). For the case of these EFCV's manufactured by Dragon, one valve will be tested each 2-year cycle.

The licensee proposes to exercise close test, at least one of the EFCV's every refueling outage, by full-stroking the valve to the position required to fulfill its function. During the exercise test, gross valve seat leakage (LX_{EFC}) will be measured. An exercise open test will be performed on each valve following the exercise close test and leak testing.

The licensee will evaluate and correct any EFCV failures in accordance with the Pilgrim CAP. EFCV failures will be documented as surveillance test failures. The licensee will establish a program to trend EFCV test failures and determine whether additional testing is warranted. The program also will establish a minimum acceptance criteria for Dragon EFCVs of less than or equal to ½ failure per year (one failure per 2 years) on a 2-year rolling average. This criteria ensures that EFCV performance remains consistent with the extended test interval. Upon exceeding the criteria, an evaluation will be performed which will:

- require a root cause evaluation to determine cause;
- determine the extent of condition;
- require an evaluation of the testing interval to ensure reliability of the EFCVs; and
- produce a risk analysis of the effects of the failure on cumulative and instantaneous plant safety.

Corrective actions and performance goals will be established based on the results of the root cause analysis.

3.6.5 Evaluation:

The EFCVs, 2-CK-125A and 2-CK-125B are installed on Nuclear Boiler Instrumentation lines. The Pilgrim safety analyses do not credit the EFCVs to close in response to a containment isolation signal or to operate under post LOCA conditions.

The proposed change by the licensee revises the surveillance frequency by allowing one of the two EFCVs to be tested every 24 months. This is based on approximately 20 percent of the EFCVs being tested each refueling outage such that each valve is tested at least once every 10 years (nominal).

Entergy's justification for the relief request is based on the GE Topical Report, NEDO-32977-A. The topical report provided: (1) an estimate of steam release frequency (into the reactor building) due to a break in an instrument line concurrent with an EFCV failure to close and (2) an assessment of the radiological consequences of such a release. The staff reviewed the GE topical report and issued its SE on March 14, 2000. In its evaluation, the staff agreed that the test interval may be extended up to a maximum of 10 years. In conjunction with this finding, the staff noted that each licensee adopting the relaxed test interval program for EFCVs must have a failure feedback mechanism and CAP to ensure EFCV performance continues to be bounded by the topical report results. Also, each licensee should perform a plant-specific radiological dose assessment, an EFCV failure analysis, and a release frequency analysis to confirm that they are bounded by the generic analyses of the topical report.

In this SE, the staff reviewed Entergy's proposal for its applicability to GE Topical Report, NEDO-32977-A, and conformance with approved staff guidance regarding radiological dose assessment, EFCV failure rate and release frequency, and the proposed failure feedback

mechanism and CAP. Based on its review, the staff determined that the radiological consequences of an EFCV failure are sufficiently low and acceptable, and that the alternative testing in conjunction with the corrective action plan provides a high degree of valve reliability and operability. Additionally, an orifice is installed upstream of the EFCVs to limit reactor water leakage in the event of rupture. The orifice limits leakage to a level where the integrity and functional performance of secondary containment and associated safety systems are maintained. Therefore, the staff finds that the licensee's proposed test alternative provides an acceptable level of quality and safety.

3.6.6 Conclusion:

Based on the above evaluation, the staff finds the proposed alternative which would allow one of the two EFCVs to be tested every 24 months to be acceptable. Therefore, the licensee's proposed alternative to the ASME OM Code testing requirements is authorized pursuant to 10 CFR 50.55a(a)(3)(i), for the fourth 10-year IST interval, based on the alternative providing an acceptable level of quality and safety.

4.0 CONCLUSION

Based on the information presented above, the staff concludes that the licensee's proposed use of a portion of the ASME OM Code 1998 Edition through the 2000 addenda in lieu of the 1995 Edition through 1996 Addenda is approved pursuant to 10 CFR 50.55a(f)(4)(iv) since there are no limitations nor modifications in 10 CFR 50.55a(b) and no other related requirements for these paragraphs are in the ASME OMb Code - 2000. Additionally, the staff concludes that the alternatives as specified in Pump Relief Request PR-04, and Valve Relief Requests VR-01 and VR-02 are authorized pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that they provide an acceptable level of quality and safety. Pump Relief Request PR-01 is granted pursuant to 10 CFR 50.55a(f)(6)(i) based on the impracticality of performing the IST in accordance with the ASME OM Code. The relief granted is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. The alternative proposed in Pump Relief Request PR-05 is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that compliance with the ASME OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee's proposed alternative testing will provide reasonable assurance of operational readiness of the pumps.

With the exception of Pump Relief Request PR-04, Pump Relief Requests PR-01 and PR-05, and Valve Relief Requests VR-01 and VR-02 are authorized for the fourth 10-year IST interval. Pump Relief Request PR-04 is authorized until June 2004.

5.0 REFERENCES

Title 10 of the *Code of Federal Regulations*, Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter I, Title 10, "Energy," Section 50.55a, Codes and standards.

U.S. Nuclear Regulatory Commission, "Guidance on Developing Acceptable Inservice Testing Program, "Generic Letter 89-04, through Supplement 1, April 4, 1995.

U.S. Nuclear Regulatory Commission, “Guidance for Inservice Testing at Nuclear Power Plants,” NUREG-1482, April 1995.

General Electric Nuclear Energy (GE) Topical Report NEDO-32977-A, "Excess Flow Check Valve Testing Relaxation" dated June 2000.

Letter, W. J. Riggs, Entergy to NRC, “Pilgrim Nuclear Power Station Fourth 10-Year Interval Inservice Testing (IST) Program and Request for Approval of IST Relief Requests for Pumps and Valves,” dated December 6, 2002.

Letter, W. J. Riggs, Entergy to NRC, “Pilgrim Nuclear Power Station Fourth 10-Year Interval Inservice Testing Program and Response to NRC Request for Additional Information,” dated October 24, 2003.

Letter, W. J. Riggs, Entergy to NRC, “Pilgrim Nuclear Power Station, Relief Request No. PR-05 related to Fourth 10-Year Interval Inservice Testing Program,” dated October 29, 2003.

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Date: April 30, 2004