

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

March 12, 2015

Mr. John A. Dent, Jr. Site Vice President Entergy Nuclear Operations, Inc. Pilgrim Nuclear Power Station 600 Rocky Hill Road Plymouth, MA 02360-5508

SUBJECT: PILGRIM NUCLEAR POWER STATION - ISSUANCE OF AMENDMENT REGARDING SAFETY LIMITS TO RESOLVE PRESSURE REGULATOR FAIL-OPEN TRANSIENT LICENSE AMENDMENT REQUEST (TAC NO. MF1382)

Dear Mr. Dent:

The U. S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 242 to Renewed Facility Operating License No. DPR-35 for the Pilgrim Nuclear Power Station. This amendment consists of changes to the Technical Specification (TS) in response to your application transmitted by letter dated April 5, 2013, as supplemented by letter dated March 20, 2014.

This amendment change reduces the reactor steam dome pressure from 785 pounds per square inch gauge (psig) to 685 psig in TS 2.1.1 and 2.1.2, "Safety Limits," to resolve the Pressure Regulator Failure-Open transient.

A copy of the related Safety Evaluation is enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

Nadiyah S. Morgan, Project Manager Plant Licensing Branch I-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosures:

- 1. Amendment No. 242 to License No. DPR-35
- 2. Safety Evaluation

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

ENTERGY NUCLEAR GENERATION COMPANY

AND ENTERGY NUCLEAR OPERATIONS, INC.

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 242 License No. DPR-35

- 1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment filed by Entergy Nuclear Operations, Inc. (the licensee) dated April 5, 2013, as supplemented by letter dated March 20, 2014, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

- 2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 3.B of Renewed Facility Operating License No. DPR-35 is hereby amended to read as follows:
 - B. <u>Technical Specifications</u>

The Technical Specifications contained in Appendix A, as revised through Amendment No. 242, are hereby incorporated in the renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of issuance and shall be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Bijan D. Beaslag

Benjamin G. Beasley, Chief Plant Licensing Branch I-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Attachment: Changes to the License and Technical Specifications

Date of Issuance: March 12, 2015

ATTACHMENT TO LICENSE AMENDMENT NO.242

RENEWED FACILITY OPERATING LICENSE NO. DPR-35

DOCKET NO. 50-293

Replace the following page of the Renewed Facility Operating License with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove	Insert
3	3

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
2-1	2-1

provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified below:

A. Maximum Power Level

ENO is authorized to operate the facility at steady state power levels not to exceed 2028 megawatts thermal.

B. <u>Technical Specifications</u>

The Technical Specifications contained in Appendix A, as revised through Amendment No. 242, are hereby incorporated in the renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. <u>Records</u>

ENO shall keep facility operating records in accordance with the requirements of the Technical Specifications.

- D. Equalizer Valve Restriction DELETED
- E. <u>Recirculation Loop Inoperable</u> DELETED
- F. Fire Protection

ENO shall implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report for the facility and as approved in the SER dated December 21, 1978 as supplemented subject to the following provision:

ENO may make changes to the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

G. Physical Protection

The licensee shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (50 FR27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans, which contain Safeguards Information protected under 10 CFR 73.21, is entitled: "Pilgrim Nuclear Power Station Physical Security, Training and Qualification, and Safeguards Contingency Plan, Revision 0" submitted by letter dated October 13, 2004, as supplemented by letter dated May 15, 2006.

The licensee shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The licensee's CSP was approved by License Amendment No. 236, as supplemented by changes approved by License Amendment Nos. 238 and 241.

2.1 Safety Limits

2.1.1 With the reactor steam dome pressure < 685 psig or core flow < 10% of rated core flow:

THERMAL POWER shall be < 25% of RATED THERMAL POWER.

2.1.2 With the reactor steam dome pressure ≥ 685 psig and core flow ≥ 10% of rated core flow:

MINIMUM CRITICAL POWER RATIO shall be \geq 1.08 for two recirculation loop operation or \geq 1.11 for single recirculation loop operation.

- 2.1.3 Whenever the reactor is in the cold shutdown condition with irradiated fuel in the reactor vessel, the water level shall not be less than 12 inches above the top of the normal active fuel zone.
- 2.1.4 Reactor steam dome pressure shall be \leq 1340 psig at any time when irradiated fuel is present in the reactor vessel.

2.2 Safety Limit Violation

With any Safety Limit not met within two hours the following actions shall be met:

- 2.2.1 Restore compliance with all Safety Limits, and
- 2.2.2 Insert all insertable control rods.



SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO.242

TO RENEWED FACILITY OPERATING LICENSE NO. DPR-35

ENTERGY NUCLEAR GENERATION COMPANY

AND ENTERGY NUCLEAR OPERATIONS, INC.

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

1.0 INTRODUCTION

By letter dated April 5, 2013 (Agencywide Document Access and Management System (ADAMS) Accession No. ML13108A217), as supplemented by letter dated March 20, 2014 (ADAMS Accession No. ML14087A128), Entergy Nuclear Operations, Inc., the licensee, submitted a request to the Nuclear Regulatory Commission (NRC) for changes to the Pilgrim Nuclear Power Station (Pilgrim) Technical Specification (TS). The supplement dated March 20, 2014, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on August 6, 2013 (78 FR 47788).

The proposed changes would revise the TS associated with the reactor steam dome pressure to resolve a Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21 condition concerning a potential violation of the reactor core safety limits during a Pressure Regulator Failure-Open (PRFO) transient.

2.0 BACKGROUND

In accordance with 10 CFR 21.21(d), on March 29, 2005, GE Nuclear Energy (GE) issued Safety Communication, SC 05-03, "Potential to Exceed Low Pressure Technical Specification Safety Limit" to Entergy (Reference 3). An unanalyzed condition was identified where a PRFO -Maximum Demand Abnormal Operation Occurrence (AOO) could result in a condition where the reactor steam dome pressure could potentially and momentarily decrease below the reactor core safety limit of 785 pounds per square inch gauge (psig), while reactor power is above 25 percent of rated thermal power. On July 18, 2006, the Technical Specifications Task Force (TSTF) and the Boiling Water Reactor Owners' Group (BWROG) submitted Revision 0 of TSTF-495, "Bases Change to Address GE Part 21 SC05-03" (Reference 4), proposing a modification to the "Applicable Safety Analysis" portion of the TS Bases 2.1.1. This change proposed to clarify that the safety limit was considered not to apply to momentary depressurization transients. In the NRC staff's safety evaluation (SE) input for TSTF-495, dated August 14, 2007 (Reference 5), it was stated that although the technical arguments presented in TSTF-495 had some merit, the NRC staff found the proposed change unacceptable because it would set a precedent which could lead to erosion of safety margins protected by safety limits. The NRC staff further stated in the SE that from a regulatory standpoint, the proposed change to the TS Bases was not acceptable. Consequently, the BWROG discontinued the effort to resolve the issue generically and recommended that plants lower their Low Pressure Safety Limit to meet the lower range of their critical power correlation on plant-specific basis.

Some advanced fuel designs have an NRC-approved critical power correlation with a lowerbound pressure significantly below the 785 psig reactor steam dome pressure, as specified in TS 2.1.1 and 2.1.2. The licensee proposed to utilize this fact and reduce the reactor steam dome pressure consistent with the approved lower-bound pressures for the critical power correlations for the GE14 and Global Nuclear Fuels 2 (GNF2) fuels comprising the core. The GE14 and GNF2 fuels utilize the General Electric Critical Quality (X) - Boiling Length (L) (GEXL) 14 and GEXL17 critical power correlations with approved pressure range from 700 per square inch absolute (psia) to 1400 psia.

3.0 REGULATORY EVALUATION

3.1 Description of System

The licensee stated that the "pressure regulator failure open event involves the failure of the pressure regulator in the open direction causing the turbine control valves to fully open, including the bypass valves. This causes the reactor to depressurize rapidly. When the Main Steam Line low pressure setpoint is reached, the Main Steam Isolation Valves (MSIVs) start to close and a reactor scram occurs. As the MSIVs approach full closure, reactor depressurization terminates and pressure commences to rise to the safety-relief valve setpoint."

The purpose of the safety limit is to ensure that specified acceptable fuel design limits (SAFDLs) are not exceeded during steady state operation and analyzed transients. The fuel cladding is one of the physical barriers that separate the radioactive materials from the environment. The integrity of this cladding barrier is related to its relative freedom from perforations or cracking. Fuel cladding perforations can result from thermal stresses, which can occur from reactor operation significantly above design conditions. Since the parameters that result in fuel damage are not directly observable during reactor operation, the thermal and hydraulic conditions that result in the onset of transition boiling (OTB) have been used to mark the beginning of the region in which fuel cladding damage could occur. The reactor core safety limits are set such that fuel cladding integrity is maintained and no significant fuel damage is calculated to occur due to OTB if the safety limits are not exceeded.

3.2 Proposed TS Change

The reactor steam dome pressure is reduced from 785 psig to 685 psig in TS 2.1.1 and 2.1.2, "Safety Limits."

The NRC is not required to review and approve changes to the TS bases pages. For information purposes only, the licensee provided the following TS bases changes:

- The current reactor steam dome pressure value of 785 psig is revised to 685 psig in the TS Bases Pages B2-1, 82-2, and B3/4.2-2.
- The Bases on B3/4.1-5 is revised to describe the role of the MSIV closure in preventing power operation with reactor pressure below 685 psig and core thermal power greater than 25% of rated thermal power.
- NEDC-33270P, Rev. 4, "GNF2 Advantage Generic Compliance with NEDE-2401 1-P-A (GESTAR II)", dated October 2011 is deleted and the following three references are added on TS Bases Page B2-4:
 - NEDC-32851P-A, Rev. 4, "GEXL14 Correlation for GE 14 Fuel," dated September 15, 2008
 - NEDC-33292P, Rev. 3, "GEXL17 Correlation for GNF2 Fuel," dated June 2009
 - NEDC-33270P, Rev. 4, "GNF2 Advantage Generic Compliance with NEDE-24011-PA (GESTAR II)," dated October 2011

3.3 Regulatory Requirements and Guidance

The construction permit for Pilgrim was issued by the Atomic Energy Commission (AEC) on August 26, 1968, a low-power license was issued on June 8, 1972, and a full-power license was issued on September 15, 1972. The plant design approval for the construction phase was based on the proposed General Design Criteria (GDC) published by the AEC in the *Federal Register* (32 FR 10213) on July 11, 1967. The AEC published the final rule that added Appendix A to 10 CFR Part 50, "General Design criteria for Nuclear Power Plants," in the *Federal Register* (36 FR 3255) on February 20, 1971.

Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TSs as part of the license application. The Commission's regulatory requirements related to the content of the TS are contained in 10 CFR 50.36(c). Section 50.36(c) of 10 CFR requires that the TSs include, among other things, items in the following categories: (1) safety limits, limiting safety systems settings, and limiting control settings; (2) limiting conditions for operation; (3) surveillance requirements; (4) design features; and (5) administrative controls.

The regulation at 10 CFR 50.36(c)(1)(i)(A) states, in part, that if any safety limit is exceeded, the reactor must be shut down.

Criterion 10, "Reactor Design," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 states, in part, that "the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that [SAFDLs] are not exceeded."

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," provides guidance on the acceptability of the reactivity control systems, the

reactor core, and fuel system design. Specifically, Section 4.2, "Fuel System Design," specifies all fuel damage criteria for evaluation and whether fuel designs meet the SAFDLs. Section 4.4, "Thermal Hydraulic Design," provides guidance on the review of thermal-hydraulic design in meeting the requirement of GDC-10 and the fuel design criteria established in Section 4.2.

4.0 TECHNICAL EVALUATION

During the PRFO described in GE's 10 CFR Part 21 notification, the critical power ratio (CPR) increases during depressurization, so GE concluded that the initial CPR is the limiting condition during the entire transient, the conditions that exceed the low pressure TS safety limit exist for only a few seconds, and fuel cladding integrity is not threatened. Nevertheless, GE considers the PRFO to be a known anticipated operational occurrence (AOO) that could contribute to the exceeding of a safety limit. While this condition had been determined to not involve an actual safety hazard, the potential for violation of a reactor core safety limit had been identified, and restoration to comply with the safety limit is required for the PRFO event.

At Pilgrim during the PRFO transient, both pressure regulators fail open and the turbine control valves open wider, which causes rapid depressurization. When reactor pressure reaches 810 psig, the low pressure isolation set point is reached and MSIVs begin to close. When MSIVs are approximately 10 percent closed (90 percent open), a position driven reactor scram occurs, which terminates the event. The proposed changes to lower the low pressure to 685 psig offer a greater range for pressure to reduce further while MSIVs are closing. The MSIVs close in 3 to 5 seconds, leading to the termination of pressure reduction. As a result, the licensee is revising the reactor steam dome pressure in TS 2.1.1 and 2.1.2, consistent with the NRC-approved pressure range of critical power correlations for the current fuel designs. Reducing the reactor steam dome pressure specification in this fashion provides margin to ensure that TS 2.1.1 and 2.1.2 are not violated and resolves the 10 CFR Part 21 issue involving a potential to violate the low pressure TS safety limit during a PRFO transient.

The current Pilgrim core has both GE14 and GNF2 fuel. The NRC staff notes that a SE (Reference 6) was issued approving the GEXL14 critical power correlation, which applies to GE14 fuel. As described in the associated licensing topical report and the NRC staff SE, the GEXL14 correlation is approved for the performance of critical power calculations with a pressure range of 700 psia to 1400 psia. The reactor steam dome pressure of 685 psig is established from the lower bound pressure (700.0 psia - 14.7 psia = 685.3 psig ~ 685 psig). As a result, the proposed change to TS 2.1.1 and 2.1.2 continues to ensure that a valid CPR calculation is performed for the AOOs described in the updated final safety analysis report, and that the proposed reactor steam dome pressure of 685 psig would not result in a violation of the TSs during a PRFO transient. In addition, the GEXL17 correlation for GNF2 fuel was approved for use per NEDE-24011-PA "General Electric Standard Application for Reactor Fuel (GESTAR II)." Since this approach is consistent with the methodology used to establish the reactor steam dome pressure and valid CPR calculations will continue to be performed, the NRC finds the GEXL17 correlation for GNF2 an acceptable method to address the 10 CFR Part 21 condition.

The NRC staff notes that the data used for development and verification of the GEXL critical power correlation for GE14 fuel and GNF2 fuels has an extended pressure range from 700 psia to 1400 psia using Stern Laboratory test data, as documented in References 7 and 8. The GEXL correlation also provides the validity of Minimum Critical Power Ratio (MCPR) calculations due to the fact that the PRFO event causes the MCPR to increase due to the

pressure reduction effect on the greater latent heat of vaporization, and the large voids causing negative reactivity and lower power as compared to the higher pressure condition. Therefore, the NRC staff has determined that as long as the core pressure and flow are within the range of validity of the specified CPR correlation (GEXL14 and GEXL17), the proposed reactor steam dome pressure change to TS 2.1.1 and 2.1.2 will continue to ensure that 99.9 percent of the fuel rods in the core are not expected to experience OTB. This satisfies the regulatory requirements regarding acceptable fuel design limits and continues to assure that the underlying criteria of the safety limit is met, and therefore, reducing the reactor steam dome pressure to 685 psig is acceptable. The NRC staff has also determined that reducing the reactor steam dome pressure from 785 psig to 685 psig resolves the reported 10 CFR Part 21 condition.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Massachusetts State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding published in the *Federal Register* on August 6, 2013 (78 FR 47788). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

8.0 <u>REFERENCES</u>

- Entergy Nuclear Operations, Inc., "Proposed License Amendment: Revision to Technical Specification (TS) 2.1, Safety Limits To Resolve Pressure Regulator Fail-Open (PRFO) Transient Reported by General Electric Nuclear in Accordance with 10 CFR 21.21(d)," Pilgrim Nuclear Power Station, Docket No. 50-293, License No. DPR-35 April 5, 2013, ADAMS Accession No. ML13108A217.
- 2. Entergy Nuclear Operations, Inc., "Entergy Response to NRC Request for Additional Information in Support of Proposed License Amendment: Revision to Technical

Specification (TS) 2.1, Safety Limits To Resolve Pressure Regulator Fail-Open (PRFO) Transient Reported by General Electric Nuclear in Accordance with 10 CFR 21.21(d)," Pilgrim Nuclear Power Station, Docket No. 50-293, License No. DPR-35 March 20, 2014, ADAMS Accession No. ML14087A128.

- 3. General Electric, GENE SC05-03, "Potential to Exceed Low Pressure Technical Specification Safety Limit," Reportable condition pursuant to 10 CFR 21, March 29, 2005.
- 4. Technical Specifications Task Force, (TSTF-06-20) transmitting TSTF-495, Revision 0, "Bases Change to Address GE Part 21 SC05-03," dated July 18, 2006, ADAMS Accession No. ML061990227.
- Kobetz, Timothy, NRC Technical Specification Branch memo to Gregory Cranston, U.S. Nuclear Regulatory Commission, "Safety Evaluation Input for TSTF-495, Revision 0, Bases Change to Address GE Part 21 SC05-03" August 14, 2007, ADAMS Accession No. ML072280007.
- Nieh, Ho K., U.S. Nuclear Regulatory Commission, letter to Andrew A. Lingenfelter, GNF Engineering, "Final Safety Evaluation for Global Nuclear Fuel (GNF) Topical Report (TR) NEDC-32851P, Revision 2, "GEXL14 Correlation for GE14 Fuel," August 3, 2007, ADAMS Accession No. ML072080365.
- Global Nuclear Fuel, "Acceptance Version of Global Nuclear Fuel (GNF) Topical Report NEDC-32851P, Revision 2, 'GEXL14 Correlation for GEXL Fuel 14," (Table 2, Page 6), September 14, 2007, ADAMS Accession Nos. ML072620193.
- Global Nuclear Fuel, "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33270P, Revision 2, June 2009 and GEXL Correlation for GNF2 Fuel, NEDC-33292P, Revison 3, June 2009 (MFN 09-436), ADAMS Accession Nos. ML091830614 and ML091830618, Table 3-1, Pg 3-4.

Principal Contributors: T. Huang C. Tilton

Date: March 12, 2015

Mr. John A. Dent, Jr. Site Vice President Entergy Nuclear Operations, Inc. Pilgrim Nuclear Power Station 600 Rocky Hill Road Plymouth, MA 02360-5508

SUBJECT: PILGRIM NUCLEAR POWER STATION - ISSUANCE OF AMENDMENT REGARDING SAFETY LIMITS TO RESOLVE PRESSURE REGULATOR FAIL-OPEN TRANSIENT LICENSE AMENDMENT REQUEST (TAC NO. MF1382)

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Sincerely,

/RA/

Nadiyah S. Morgan, Project Manager Plant Licensing Branch I-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-293

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- 1. Amendment No. 242 to License No. DPR-35
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ADAMS Accession No.: ML14272A070			*S	ee dated memo
OFFICE	LPLI-1/PM	LPLI-1/PM	LPLI-1/LA	DSS/SRXB/BC
NAME	DRender	NMorgan	KGoldstein	CJackson
DATE	2/05/2015	2/04/2015	1/21/2015	7/8/2014*
OFFICE	DSS/SNPB/BC	DSS/STSB/BC	OGC	LPLI-1/BC
NAME	JDean	RElliott	SUttal	BBeasley
DATE	2/11/2015	2/05/2015	2/23/2015	3/12/2015

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