April 12, 2006

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

SUBJECT: PILGRIM NUCLEAR POWER STATION - ISSUANCE OF AMENDMENT RE: SINGLE RECIRCULATION LOOP OPERATION (TAC NO. MC4333)

Dear Mr. Kansler:

The Commission has issued the enclosed Amendment No. 219 to Facility Operating License No. DPR-35 for the Pilgrim Nuclear Power Station (Pilgrim). The amendment consists of changes to the facility operating license, technical specifications (TSs) and surveillance requirements in response to your application dated September 2, 2004, as supplemented by letters dated August 9, 2005, December 29, 2005 and March 22, 2006. This amendment allows continued plant operation with a single recirculation loop in-service at Pilgrim.

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

Sincerely,

/RA/

James J. Shea, 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. 219 to License No. DPR-35
2. Safety Evaluation

cc w/encls: See next page

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Package Number: ML
Amendment Number: ML060170119
TS Pages:

OFFICE	LPL1-1/PM	LPL1-1/LA	SBWB/BC	ITSB/BC	OGC	LPL1-1/BC
NAME	JShea	SLittle (DClarke for)	GCranston	TBoyce	SHamrick	RLaufer
DATE	1/26/06	1/26/06	02/14/06	3/29/06	4/07/06	4/12/06

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ENTERGY NUCLEAR GENERATION COMPANY

ENTERGY NUCLEAR OPERATIONS, INC.

DOCKET NO. 50-293

PILGRIM NUCLEAR POWER STATION

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 219
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 September 2, 2004, as supplemented by letters dated August 9, 2005, December 29, 2005 and March 22, 2006, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter1;

   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 Facility Operating License No. DPR-35 is hereby amended to read as follows:

   B. Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 219, are hereby incorporated in the 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 120 days.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Richard J. Laufer, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Facility Operating License
and Technical Specifications

Date of Issuance: April 12, 2006

ATTACHMENT TO LICENSE AMENDMENT NO. 219

FACILITY OPERATING LICENSE NO. DPR-35

DOCKET NO. 50-293

Replace the following page of the Facility Operating License with the attached revised page. The revised page is identified by amendment number and contains a marginal line indicating the area 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
ii	ii
2-1	2-1
3/4.1-4	3/4.1-4
3/4.6-2	3/4.6-2
3/4.6-7	3/4.6-7
3/4.6-8	3/4.6-8
3/4.11-1	3/4.11-1
3/4.11-2	3/4.11-2

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 219 TO FACILITY OPERATING LICENSE NO. DPR-35

ENTERGY NUCLEAR GENERATION COMPANY

ENTERGY NUCLEAR OPERATIONS, INC.

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

1.0 INTRODUCTION

By letter to the Nuclear Regulatory Commission (NRC or Commission) dated September 2, 2004 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML042640024) as supplemented by letters dated August 9, 2005 (ADAMS Accession No. ML052280246), December 29, 2005 (ADAMS Accession No. ML060090365) and March 22, 2006 (ADAMS Accession No. ML060900430), Entergy Nuclear Operations, Inc. (the licensee) submitted a request for changes to the Pilgrim Nuclear Power Station (Pilgrim) Facility Operating License, Technical Specifications (TSs), and Surveillance Requirements (SRs). The requested changes would allow continued plant operation with a single recirculation loop in service under certain specified conditions. The current Pilgrim Facility Operating License allows for 24 hours in single-loop operation (SLO). The proposed changes would provide enhanced plant operations flexibility and are consistent with the improved standard technical specifications (STS), NUREG-1433, "Standard Technical Specifications - General Electric Plants, BWR/4, Revision 3."

2.0 REGULATORY EVALUATION

The Commission's regulatory requirements related to the content of the TSs are set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36, "Technical specifications." This regulation requires that the TS include items in five specific categories. These categories include (1) safety limits, limiting safety system settings and limiting control settings, (2) limiting conditions for operation (LCOs), (3) SRs, (4) design features, and (5) administrative controls. Additionally, Criterion 2 of 10 CFR 50.36(c)(2)(ii) requires a limiting condition for operation to be established for a process variable, design feature, or operating restriction that is an initial condition of a design-basis accident (DBA) or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Appendix A, "General Design Criteria [GDC] for Nuclear Power Plants," to 10 CFR Part 50, Criterion 10, "Reactor Designs," requires that the reactor core and associated coolant, control, and protective systems be designed with appropriate margins to assure that specified acceptable fuel design limits (SAFDLs) are not exceeded during normal operation and anticipated operational occurrences.

Section 50.46, “Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power reactors,” establishes the acceptance criteria for the design-basis loss-of-coolant accident (LOCA). Specifically, paragraph (b)(1) requires the calculated maximum fuel element cladding temperature to not exceed 2200 EF.

NUREG-0800, “Standard Review Plan (SRP),” Section 4.2, “Fuel System Design,” defines the basis for the acceptance criteria for NRC staff reviews. These criteria include three parts: (1) design bases that describe SAFDLs as depicted in GDC 10 to 10 CFR Part 50 Appendix A, (2) design evaluation that demonstrates that the design bases are met, and (3) testing, inspection, and surveillance plans that show that there is adequate monitoring and surveillance of irradiated fuel. The design bases include (1) fuel system damage, (2) fuel rod failure, and (3) fuel coolability. The linear heat generation rate (LHGR) and average planar linear heat generation rate (APLHGR) limits are part of the SAFDLs.

3.0 TECHNICAL EVALUATION

Power generation with a single recirculation loop in service is a recognized mode of operation for boiling water reactors (BWRs). Reactor control and operation in single-loop is very similar to that in two-loop recirculation mode. The primary difference is that as the drive flow on the operating pump is increased, part of the total flow from the active jet pump loop will backflow through the inactive jet pumps. This effect reduces the net achievable core flow and limits the power level that can be achieved.

The NRC staff previously disallowed this mode of operation for most plants. Accordingly, in general, BWR TSs initially required shutdown within several hours if one of the reactor coolant loops became inoperable. The NRC staff primarily disallowed single recirculation loop operation because of jet pump vibration problems, and thermal-hydraulic stability concerns at certain high thermal power and low core flow operating conditions. Subsequently, the NRC staff issued Generic Letter (GL) 86-09, “Technical Resolution of Generic Issue No. B-59-(N–1) Loop Operation in BWRs and PWRs,” dated March 31, 1986, to inform licensees that SLO would be acceptable provided operating limitations are imposed for the detection and suppression of thermal hydraulic instabilities.

As part of the amendment submittal, the licensee included the General Electric (GE) Pilgrim SLO safety evaluation (GE-SE), GE Report GE-NE-0000-0027-5301, “Pilgrim Nuclear Power Station Single Loop Operation,” dated July 2004, that utilized NRC-approved methodologies and included operational restrictions on SLO at Pilgrim. The GE-SE report addressed specific Pilgrim jet pump vibration concerns, Pilgrim thermal-hydraulic stability concerns in addition to the SLO flow uncertainties and fuel thermal limits.

3.1 Existing and Proposed Pilgrim TS Requirements

The following changes are proposed as part of this license amendment request:

3.2 License Condition 3.E

The existing License Condition 3.E requires that the reactor not be operated for more than 24 hours if one recirculation loop is out of service.
The licensee has proposed to delete this license condition that limits single recirculation

loop operation at Pilgrim.

3.3 Safety Limit Minimum Critical Power Ratio (SLMCPR)

The existing TS 2.1.2 requires that SLMCPR be greater than or equal to 1.06 for two-loop operation (TLO) when reactor core flow is greater than or equal to 10 percent and steam dome pressure is greater than or equal to 785 pounds per square inch (psig) for the current fuel cycle.

With single recirculation loop operation, there are increased uncertainties in total core flow and traversing in-core probe (TIP) readings, therefore the licensee has proposed a conservative increase to the minimum critical power ratio (MCPR) for SLO. The licensee has proposed a MCPR increase of 0.02 for SLO. This would revise Pilgrim TS 2.1.2 SLMCPR to be greater than or equal to 1.08 for SLO in the current operating cycle (cycle-16) and would add a similar conservative value to subsequent fuel reload operating cycle SLMCPR values for Pilgrim SLO.

3.4 Thermal-Hydraulic Stability

The existing TS 3.6.A.6, “Thermal-Hydraulic Stability,” requires forced recirculation when core thermal power exceeds 25 percent.

The licensee has proposed that this requirement be removed and incorporated into the proposed revised TS 3/4.6.F, “Recirculation Loops Operating,” which would ensure forced recirculation during power operation with associated actions and SRs.

The proposed revision to TS 3/4.6.F will apply when the plant is operating in either the Run or Start-up Mode. The proposed TS revision would therefore ensure thermal-hydraulic stability with forced recirculation during power operation at Pilgrim. The proposed changes are consistent with STS 3.4.1 and are more restrictive than the existing requirements in TS 3/4.6.A, “Thermal and Pressurization Limitations.”

3.5 Jet Pumps

The existing TS 3/4.6.E, “Jet Pumps,” establishes the LCOs and SRs that ensure each jet pump remains operable whenever the reactor is in the Startup or Run Mode.

The licensee has proposed changes to the existing TS SR 3/4.6.E.1 based on the proposed removal of License Condition 3.E. The existing SR can not be performed when the plant is operating in extended SLO. The proposed surveillance revision would provide for three separate, loop specific options for verifying jet pump operability. The proposed SRs are consistent with STS SR 3.4.2.1.

3.6 Recirculation Loops Operating

The existing TS 3/4.6.F, “Jet Pump Flow Mismatch,” establishes the operating restrictions applicable to recirculation loop operation.

The licensee has proposed changes to these requirements based on the proposed removal of License Condition 3.E. The licensee would include additional recirculation loop operating

restrictions to address SLO conditions. The proposed changes would incorporate SLO restrictions, revise the TS title, and identify revised actions and action time limits if compliance is not achieved. The proposed TS changes are based on STS 3.4.1, "Recirculation Loops Operating."

3.7 TS 3/4.11 - Reactor Fuel Assembly

The existing TS 3/4.11, "Reactor Fuel Assembly," establishes operating restrictions applicable to fuel rod thermal limits.

The proposed revisions to TS 3/4.11.A, "Average Planar Linear Heat Generation Rate (APLHGR)," TS 3/4.11.B, "Linear Heat Generation Rate (LHGR)," and TS 3/4.11.C, "Minimal Critical Power Ratio (MCPR)," would clarify applicability for SLO and would be more consistent with STS 3.2.1, 3.2.2, and 3.2.3.

3.7.1 Average Planar Linear Heat Generation Rate (APLHGR)

The existing TS 3/4.11.A is applicable during operation with both recirculating pumps operating.

The licensee has proposed changes to these requirements based on the proposed removal of License Condition 3.E. TS LCO 3/4.11.A would require a change to delete the reference to "both recirculation pumps operating." Additionally, APLHGR restrictions only apply when the reactor is operating and rated thermal power is greater than or equal to 25 percent. The licensee proposed to change the LCO wording to include a statement that the TS applies when rated thermal power is greater than or equal to 25 percent. This would make the LCO consistent with STS 3.2.1.

The existing TS also requires a plant shutdown to cold shutdown conditions within 36 hours if it is determined that the APLHGR limit is exceeded. The proposed revised TS would require a thermal power reduction to less than 25 percent if the limiting value for APLHGR is exceeded, thermal power must be reduced to the point where the TS is not applicable within 4 hours in the proposed TS change. This proposed TS revision would also be consistent with STS 3.2.1.

3.7.2 Linear Heat Generation Rate (LHGR) and Minimum Critical Power Ratio (MCPR)

The existing TS 3/4.11.B and 3/4.11.C, are applicable during power operation that is not specified but is implied to be greater than or equal to 25 percent power because the SR requires a daily check of these limits when reactor thermal power is greater than or equal to 25 percent.

The licensee proposed to make TS 3/4.11.B and TS 3/4.11.C.1 consistent with STS 3.2.2 and STS 3.2.3 by incorporating the 25 percent thermal power applicability for these TS in the LCO.

The licensee also proposed an administrative change to update SR 4.11.C.1, "Minimum Critical Power Ratio (MCPR)," to identify that MCPR shall be determined daily during reactor operation at greater than or equal to 25 percent rated thermal power. The existing TS 4.11.C.1 inadvertently required the MCPR surveillance only to be performed at greater than 25 percent rated thermal power.

3.8 Table of Contents Administrative Changes

The Table of Contents would be updated to reflect the title revision to TS 3/4.6.F and to remove reference to two previously deleted TS sections, TS 3/4.6.H and TS 3/4.6.I. The TS reference to TS 3/4.6.H would also be deleted from TS page 3/4.6.8.

4.0 STAFF EVALUATION

The reactor coolant recirculation system provides forced coolant flow through the reactor core and, in combination with control rods, provides a means to control and change reactor power and power distribution over a broad range. The recirculation system consists of two recirculation pump loops and drive units, each with a separate variable speed motor generator (MG) set, recirculation pump, and piping loop. The individual recirculation pumps are located in the drywell and provide drive flow to the jet pumps, inside the reactor vessel, which in turn provide core recirculation flow.

During normal power operation both recirculation pumps are operated at near-matched speeds to provide forced recirculation flow. Recirculation pump speed and flow can be changed using the variable speed recirculation system MG set and, thus, be used to change core power. Chapter 4.3 of the Pilgrim Final Safety Analysis Report (FSAR) states that operation with a single recirculation loop is possible at reduced power. Power generation with a single recirculation loop in service is also a recognized mode of operation for BWRs and many BWRs have TSs that allow for SLO.

The most obvious benefit of adding an allowance for SLO is the ability to continue power operation in the event of the loss of a recirculation loop due to component malfunction. Several active components in the recirculation system are located in the reactor building and are readily accessible during power operation. These include the MG set drive motors, fluid couplers, generators, and associated oil coolers. Also accessible are the recirculation system controllers, logic relaying, and system electrical panels and breakers. Typically, most of these components can be repaired with the reactor in service with no impact on power operation other than the unavailability of the affected loop itself.

While the reactor recirculation system is a reliable system, temporary unavailability of a recirculating loop is occasionally experienced. Current Facility Operating License Condition 3.E restricts reactor operation with one recirculation loop out of service for a period up to 24 hours. It is not always possible to diagnose and repair the accessible recirculation system components within these time frames. The most recent unplanned recirculation system TS required shutdown at Pilgrim occurred in February 2002 due to an MG set generator field wiring failure. The repair could not be diagnosed, planned, and implemented within the LCO time frame currently allowed.

The primary difference between SLO and TLO concerning reactor control and operation is that the maximum achievable power level is reduced for SLO because of the reduction in total core flow. Drive flow on the operating pump is increased and part of the total flow from the active jet pump loop will backflow through the inactive jet pumps. This affects the normal relationship between drive flow and core flow as compared to TLO.

The primary analysis of the safety considerations in support of the proposed Pilgrim SLO TS is presented in the GE-SE report. This report was prepared for the purpose of evaluating the

effects of SLO on the plant transient and accident analyses. The basic conclusion of this report is that the plant can be operated safely in SLO mode for an unrestricted period of time provided that operation is controlled in accordance with specified operational restrictions and safety settings established for SLO operation at Pilgrim.

Although it is not a currently permitted mode of operation, SLO has been included as an operating flexibility option in the cycle-specific core reload analyses that are performed for each fuel cycle. These analyses are performed in accordance with the latest NRC-approved version of GE Licensing Topical Report, NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel."

4.1 Pilgrim Extended Single Loop Operation

4.1.1 Pilgrim and BWR Reactor Stability Considerations

The primary contributing factors to the stability performance with one recirculation loop not in service are the power-flow ratio and the recirculation loop characteristics. For low core flows occurring at minimum pump speed, the jet pumps for both recirculation loops will exhibit forward flow. At higher pump speeds, the core flow is increased in SLO and the inactive jet pump forward flow decreases with increasing core flow. The reduced flow in the inactive loop reduces the resistance that the recirculation loops impose on the reactor water flow perturbations, thereby adding a destabilizing effect. At the same time, the increased flow results in a lower power-flow ratio, which has a stabilizing effect. These countering effects result in a slightly decreased stability margin (higher decay ratio) initially as core flow is increased (from minimum) in SLO, and then an increase in stability margin (lower decay ratio) as the core flow is increased further and reverse flow in the inactive loop is established.

As core flow is increased beyond 40 percent of rated flow during SLO, reverse flow begins in the inactive loop. A cross flow is established in the annular downcomer region near the jet pump suction entrance caused by the reverse flow of the inactive recirculation loop. At higher flow, with substantial reverse flow in the inactive recirculation loop, the effect of cross flow results in an increase in system noise which increases the total core flow noise which tends to increase observed neutron flux noise.

GE has evaluated the SLO effects on stability, including increased noise, and determined that stability characteristics are not significantly different from TLO conditions. At low core flow, SLO may be slightly less stable than TLO, but as core flow increased and reverse flow is established, the stability performance of TLO and SLO is similar.

Because of generic stability concerns and the experience of some BWRs regarding the potential for power oscillations at low flow/high power operating map conditions, the NRC staff issued Bulletin No. 88-07, "Power Oscillations in Boiling Water Reactors," which was supplemented in December 1988. Bulletin 88-07, Supplement 1, requested licensees to adopt the BWR Owners Group (BWROG) stability monitoring guidelines similar to those originally issued by GE in Services Information Letter (SIL) 380, Revision 1, "BWR Thermal-Hydraulic Stability," dated February 1984. The NRC staff later requested licensees to address long-term solutions for thermal-hydraulic instabilities in GL 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in BWRs," dated July 11, 1994. In GL 94-02, the NRC staff requested licensees to update operating procedures and provide

operator training to address detection and suppression of power oscillations based on more recent operating experiences and revised BWROG guidelines.

In response to the above-referenced NRC staff operating guidance, the BWROG developed licensing strategies and methodologies to provide a long-term resolution for thermal-hydraulic instability. Initially, NEDO-31960-A and NEDO-31960-A, Supplement 1, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology," dated November 1995, were submitted to and approved by the NRC staff in 1993. The BWROG subsequently developed specific reports to address selected options for addressing thermal-hydraulic stability. NEDO-32339-A, "Reactor Stability Long Solution: Enhanced Option 1-A," and associated Supplements 1, 2, 3, and 4, dated April 1998, addresses Stability Option E1A, and NEDO-32465-A, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications (Options 1D and III)," dated August 1996, addresses Stability Option 1D. The NRC staff has specifically reviewed these reports and has approved the referenced stability monitoring and protection methodologies.

At the time the license amendment request was submitted, Pilgrim relied on administrative controls and plant hardware to enforce the protection methods described in Stability Option E1A. The licensee stated in its amendment request that it was pursuing a plant modification to adopt the protection features defined in Stability Option 1D.

The NRC staff understands that Pilgrim implemented Stability Option 1D during the refueling outage completed in May 2005. Since thermal-hydraulic stability protection is not predicated on the number of recirculation loops in service, either Stability Option E1A or 1D will provide adequate core protection from thermal-hydraulic instabilities when operating in the SLO operating mode.

Current Pilgrim TS 3.11.D - Power / Flow Relationship During Power Operation, requires that the Pilgrim power to flow relationship shall not exceed the limiting values specified in the COLR. Power and flow restrictions determined from the stability analysis are incorporated in the Pilgrim COLR power-flow map. This TS is not changing as part of this amendment.

4.1.2 Reactor Internal Vibration during SLO

In SLO mode, increases in average power range monitor (APRM) noise and core delta-p fluctuations have been observed in some plants while operating at high drive flows which may be associated with increased vibration of the active jet pumps. The impact of jet pump vibration during SLO was evaluated to ensure reactor internal vibration levels are maintained at acceptable levels.

The GE-SE report, Section 7, identifies that SLO operation will be restricted to operation below the 100 percent current licensed thermal power (CLTP) rod line with a maximum power limit of 65 percent of rated power (2028 MegaWatts thermal (MWt)) and a maximum core flow limit of 52 percent of rated flow (69 million pound mass per hr (Mlb/hr)) to ensure vibration is maintained at acceptable levels. These SLO operating limits will be identified in the COLR. TS 3.11.D addresses the power-flow map and ensures that the limiting values identified in the COLR are not exceeded. The SLO pump operating restrictions defined in the COLR will be reviewed for adequacy by the licensee for each subsequent reload cycle and these limits would be incorporated into appropriate operating procedures as required.

In addition to the GE evaluation, a separate evaluation of the effects of SLO on the structural integrity of the reactor vessel and associated internal components was performed and documented in Structural Integrity Associates (SIA) Inc., Report SIR-04-026, Rev. 2, "Evaluation of Single Loop Operation at Pilgrim Nuclear Power Station," dated June 2004. The SIA report addresses structural integrity via the evaluation of TLO and SLO vibration data. This data was obtained from the plant start-up program, 30 years of successful operation at 100 percent power, operating data obtained with the plant operating in SLO mode, and detailed jet pump inspections performed during recent refueling outages (RFOs). The report concludes that SLO operation is acceptable from a structural analysis standpoint since the vibration levels observed in the core for a single operating recirculation pump are enveloped by the vibration levels observed for TLO at 100 percent power.

The SIA report also identifies that the jet pumps are typically the component of most concern with respect to vibration because of high internal flow and RPV annulus downcomer flow rates, which can lead to significant vibratory response. The report documents that jet pump inspection history since RFO-11 (February 1996) has been extensive and has not detected the presence of any cracking in the jet pump welds. A detailed evaluation of the jet pump swing gate gaps was also performed and found to be structurally acceptable based on vibration frequency and harmonic analyses, which revealed that the jet pumps are nominally stressed to acceptable levels.

The evaluations of the Pilgrim vibration response provide reasonable assurance that SLO would not result in significant adverse vibration effects. Therefore, the NRC staff finds that continued plant operation with a single recirc loop in-service is acceptable.

4.1.3 Abnormal Operational Transients Analyzed for SLO

The reactor response to abnormal operational transients (AOOs) are generally independent of the source of the core flow. Therefore, the consequences of an event initiated while in SLO will be the same as the consequences of an event initiated from TLO. The highest allowable core flow, with one active pump is 52 percent and the maximum power is limited to 65 percent due to vessel internal vibration limitations. The core-wide transients potentially impacted by SLO were evaluated in Section 4 of the GE-SE report. The evaluation concludes that the consequences of the abnormal operating transients (pressurization, flow increase, cold water injection events) were less severe than the same events analyzed for two-loop mode, and thus were bounded by the two-loop analyses in the updated final safety analysis report (UFSAR).

The cycle-specific reload analyses performed by Global Nuclear Fuels Inc. (GNF) considers SLO an operating flexibility option that is evaluated in accordance with the methods described in NEDE-24011-P-A.

The operational limiting MCPR (OLMCPR) with an SLO MCPR adder, as specified in the COLR, was evaluated by the NRC staff and found to provide adequate protection for transients initiated during SLO.

4.1.4 Accident Evaluation for SLO

An evaluation of the SLO effects on applicable accident analyses is provided in GE-SE report. The LOCA and recirculation pump seizure events were evaluated since the remaining Chapter 14 UFSAR accidents are not significantly affected by recirculation mode or are bounded by two-loop accident analysis.

The postulated recirculation pump seizure accident is evaluated in GE-SE report, Section 4.1.5, and is characterized by a near instantaneous stoppage of the pump and the associated pump flow. With sudden stagnation of the drive flow, the active loop flow rapidly decreases, and the resultant core flow decreases causing the core void fraction to increase which in turn causes a rapid decrease in core power. The purpose of the analysis is to ensure that the radiological consequences of the event are acceptable. The analyses referenced in the GE report indicate that the MCPR will remain greater than the SLMCPR, and that the event will terminate with the reactor continuing to operate in natural circulation. A cycle independent OLMCPR was calculated for a recirculation pump seizure event when operating in SLO. This value was verified for Cycle 15 and will be reevaluated for each subsequent core reload in the cycle specific supplemental reload licensing report. Based on the analyses performed, recirculation pump seizure is not a limiting event and will not result in fuel entering boiling transition. Consequently, radiological release is avoided and there is no challenge to 10 CFR 100, “Reactor Site Criteria,” radiation release limits.

A summary of ECCS performance during a LOCA when operating in SLO is provided in Section 6 of the GE-SE report. This report references NEDC-31852 Revision 2, which describes the SAFER/GESTR-LOCA analysis performed for Pilgrim. The DBA-LOCA analysis for Pilgrim relied on SAFER/GESTR codes and methodology for performing LOCA analyses. With breaks smaller than the DBA, there is a longer period of nucleate and/or film boiling prior to fuel uncovery to remove the fuel's stored energy. This analysis report provides the results of LOCA analysis for SLO and concludes that the DBA (large breaks) are more severe than small break sequences and, therefore, the large break results are bounding for SLO. The analysis resulted in an SLO planar linear heat generation rate/maximum average planar heat generation rate (PLHGR/MAPLHGR) multiplier of 0.8 for both GE-11 and GE-14 fuel. The calculated Appendix K peak cladding temperatures (PCT’s) using these PLHGR/MAPLHGR multipliers are below the 10 CFR 50.46 limit of 2200 EF. Therefore, the calculated SLO PLHGR/MAPLHGR multipliers are conservative and assure that the SLO results satisfy the acceptance criteria of 10 CFR 50.46 and NRC safety evaluation report (SER) requirements for the SAFER/GESTR application methodology.

Following approval of the proposed SLO TS, the PLHGR/MAPLHGR SLO multiplier will be documented in the COLR report and the plant process computer will be programmed to apply the SLO PLHGR/MAPLHGR multiplier when calculating core thermal limits while in SLO mode to support the analysis assumptions.

Based on the discussion above, the NRC staff found that the DBA analysis for SLO at Pilgrim was bounding and that approved NRC methodologies were used to determine a conservative PLHGR/MAPLHGR multiplier that when coupled with the Appendix K assumptions yields PCT values below the 10 CFR 50.46 PCT limit of 2200 EF for Pilgrim SLO.

4.1.5 Rod Withdrawal Error Analysis for SLO

The rod withdrawal error (RWE) evaluations are independent of the source of core flow (i.e., one recirculation loop or two) and consequently, these evaluations are valid for both TLO and SLO. RWE is evaluated each fuel cycle as part of the cycle-specific reload analysis.

The NRC staff reviewed the Pilgrim RWE event for SLO and like the AOOs, this postulated event is bounded by the TLO RWE evaluations.

4.1.6 Flow-Biased APRM Scram and Rod Block Limits during SLO

Cycle-specific flow-biased APRM rod block and scram setpoints are calculated to define the scram trip and rod block limits. The cycle-specific APRM scram trip and rod block limits are defined on the power-flow map provided in the COLR. For SLO, the flow-biased APRM scram trip and rod block setpoints must be adjusted to account for the change in the relationship between drive flow and core flow due to reverse flow in the inactive loop jet pumps and lower core hydraulic resistance. GE-SE report, Section 4.1.6 identifies the equations used to correct the flow-biased APRM scram trip and rod block set-points for extended SLO at Pilgrim.

Pilgrim is currently in operating cycle 16. When the amendment is implemented the COLR will identify the revised SLO APRM setpoints. Pilgrim TS 3.11.D and the revised TS 3.6.F.2.c ensures that the plant will be operated in accordance with the power-flow map, which will be reset, in accordance with TS table 3.1.1. note 15, to reflect APRM setpoint revisions for SLO. In the plant, flow control trip reference (FCTR) cards will be updated to enforce SLO. After loss of a recirculation loop, operator action will be required to manipulate a FCTR card toggle switch within 24 hours to adjust or reset the APRM scram trip and rod block setpoint limits for SLO operation. The time period to make the SLO adjustments is consistent with STS 3.4.1.

The APRM setpoint revision process for SLO utilizes a verified 10 percent bounding drive flow value difference between SLO and TLO at the same core flow. The NRC staff considers this a conservative and appropriate means to determine SLO APRM flow-biased setpoints.

4.2 Pilgrim License Condition 3.E

The proposed license condition change would eliminate the 24-hour SLO restriction on Pilgrim plant operations. The NRC staff has previously determined that SLO is generically acceptable as described in GL 86-09 and is recognized as a standard mode of operation addressed in the STS.

Specifically, Pilgrim SLO was evaluated by GE in the GE-SE report which considered fuel cladding SLMCPR, plant transients, reactor stability, reactor internal vibrations, abnormal operational transients (AOOs), and accident analysis. These analyses applied conservative core flow and TIP reading uncertainties to determine applicable operational restrictions. The analysis methods employed were also based on NRC-approved methodologies. The results of these

evaluations justifies extended SLO for Pilgrim within the restrictions as outlined in the GE-SE report and the licensee's submittal. The NRC staff, therefore, finds this change to the Pilgrim Facility Operating License acceptable.

4.3 Safety Limit Minimum Critical Power Ratio

4.3.1 Pilgrim Safety Limit TS 2.1.2

The SLMCPR is established such that during abnormal operational reactor transients, no fuel damage will occur due to transition boiling if the SLMCPR limit is not violated. The SLMCPR limit is calculated using a statistical model that includes considerations for uncertainties. For SLO, as discussed in the GE-SE report, the SLMCPR would increase by 0.02 to provide additional margin due to uncertainties in the total core flow and TIP readings compared to TLO. Pilgrim states that except for these readings, the uncertainties used in the statistical analysis for SLMCPR are not dependent on whether core flow is provided by one or two recirculation pumps.

The net effect of the revised core flow and TIP uncertainties is an increase in SLMCPR of 0.02 for SLO operation. This is the value included in the proposed change to TS 2.1.2 for the current operating cycle (cycle -16). This SLO SLMCPR limit will be revised, should the proposed SLMCPR limit of 0.02 become non-conservative, based on the evaluations performed for each subsequent core reload.

The plant process computer will be updated with revised input data to allow for calculation of MCPR and fuel-specific MCPR operating limits applicable to SLO. Existing TS 3.11.C provides the requirements for monitoring MCPR and relies on the core operating limits report (COLR) to define the fuel OLMCPR limits. Pilgrim states that by maintaining MCPR greater than or equal to the OLMCPR, the SLMCPR specified in TS 2.1.2 will not be challenged in the event of the most limiting transient.

The NRC staff finds that an SLMCPR increase of 0.02 along with the fuel-specific changes to the OLMCPR limits is a conservative adjustment to account for the core flow and TIP reading uncertainties while in extended SLO. Therefore the proposed change to Pilgrim TS 2.1.2 SLMCPR to greater than or equal to 1.08 for SLO in the current operating cycle (cycle -16) is acceptable. Subsequent operating cycle evaluations will be done to ensure that the SLMCPR and SLO SLMCPR remains conservative.

4.4 Thermal-Hydraulic Stability TS 3.6.A.6

The licensee has proposed that the current requirement of forced circulation when rated thermal power is above 25 percent be deleted and incorporated into the revised TS 3.6.F. The current TS did not identify a required action or required surveillance if the LCO was not met. Revised TS 3.6.F includes the requirement for ensuring core flow during power operation as well as a required shutdown action and associated completion time limit. The revised Pilgrim TS 3.6.F is more restrictive because forced recirculation would be required at power operations, prior to reaching 25 percent power; this change is also consistent with the STS. The NRC staff, therefore, finds these changes to the Pilgrim stability TS acceptable.

4.5 Jet Pump Operability

4.5.1 Jet Pump SLO Considerations

The recirculation pump speed operating characteristics (pump flow and loop flow versus pump speed) are determined by the flow resistance from the loop suction through the jet pump nozzles. A change in the relationship indicates a plug, flow restriction, loss in pump hydraulic performance, leakage, or new flow path between the recirculation pump discharge and jet pump nozzle. For this criterion, the pump flow and loop flow versus pump speed relationship must be verified.

Individual jet pumps in a recirculation loop normally do not have the same flow. The unequal flow is due to the drive flow manifold, which does not distribute flow equally to all risers. The flow (or jet pump diffuser to lower plenum differential pressure) pattern or the relationship of one jet pump to the loop average is repeatable. An appreciable change in this relationship is an indication that increased (or reduced) resistance has occurred in one of the jet pumps. This may be indicated by an increase in the relative flow for a jet pump that has experienced beam cracks.

The deviations from normal are considered indicative of a potential problem in the recirculation drive flow or jet pump system. Normal flow ranges and established jet pump flow and differential pressure patterns are established by plotting historical data as discussed in GE SIL No. 330, “Jet Pump Beam Cracks,” dated June 9, 1980.

4.5.2 Jet Pump TS 4.6.E

The licensee has proposed a change to the Pilgrim jet pump TSs to ensure that jet pump SRs can be performed under either SLO or TLO operating conditions. With the proposed removal of License Condition 3.E, existing TS SR 4.6.E.1 can not be performed when the plant is operating in SLO. The proposed TS SR revision would provide three separate, loop-specific options to verify jet pump operability. The changes to TS SR 4.6.E.1 will provide adequate indications of jet pump operability and are consistent with STS. Therefore, the NRC staff finds these changes are acceptable for Pilgrim SLO.

4.5.3 Jet Pump TS 3.6.E

The licensee proposed to change the Pilgrim TS 3.6.E.1, LCO action time limit from “be in Cold Shutdown within 24 hours” to “be in Hot Shutdown in 12 hours.” The completion time of 12 hours is reasonable based on operating experience to complete shutdown actions in an orderly manner without challenging plant systems. These revisions are more restrictive and are consistent with STS 3.4.2 actions and required time limits. Therefore, the NRC staff finds these changes are acceptable.

An editorial change was also proposed that would capitalize “Startup and Run Modes” and “Operable” in TS 3.6.E.1. The NRC staff finds these minor editorial changes acceptable.

4.6 Recirculation Loop Operating Restrictions

4.6.1 TS 3/4.6.F - Jet Pump Flow Mismatch

These TSs contain the LCO and SR conditions applicable to the Pilgrim recirculation loops during power operation. Based on the proposed removal of License Condition 3.E, the licensee would modify TS 3/4.6.F to incorporate the SLO requirements identified in STS 3.4.1.

The titles of TS 3/4.6.F were changed to “Recirculation Loops Operating” and a mode switch restriction was also incorporated into revised TS 3.6.F, consistent with STS 3.4.1. The LCO applies when the reactor mode switch is in either Run or Startup, which are the operating modes where control of the recirculation pumps is required.

TS 3.6.F.1 will not be revised. This TS ensures that recirculation loop TLO operation is conforming to the accident analyses previously evaluated for LOCA and low pressure core injection (LPCI) loop select logic. Maintaining matched recirculation pump speeds (and drive flows) within limits is consistent with the restrictions defined in STS 3.4.1 for TLO operation.

New TS limits applicable to recirculation loop operating restrictions for SLO were determined based on the LCO limits defined in STS 3.4.1. These new SLO limits reference reactor fuel LCO limits established for APLHGR (TS 3/4.11.A) and MCPR (TS 3/4.11.C), and the APRM high flux trip setting (as defined in TS Table 3.1.1). In accordance with the proposed TS, calculated values for SLO will be located in the COLR.

The revised TS 3.6.F.3 identifies the required actions for restoration of compliance to TS 3.6.F.1 and TS 3.6.F.2. A 24-hour completion time limit to restore compliance is proposed. If compliance cannot be achieved or no recirculation pumps are operating, action to be in hot shutdown within 12 hours is required. The required action and completion times are consistent with STS 3.4.1. The 24-hour limit to achieve compliance is justified based on engineering judgment of the likelihood of a transient or DBA occurring, while providing time for deliberate controlled operator action. The 12-hour shutdown requirement is acceptable based on operating experience related to actions necessary to shutdown the plant in an orderly manner without challenging plant systems.

The NRC staff finds the revised Pilgrim recirculation loop operability requirements are less restrictive than the current TSs, with regards to allowed out of service time. However, the revision puts specific restrictions on SLO consistent with the GE-SE report and the STS, therefore the NRC staff finds these changes to TS Section 3/4.6.F acceptable.

4.7 Reactor Fuel Assembly

4.7.1 Pilgrim TS 3/4.11

The licensee has proposed revisions to TS 3.11.A, TS 3.11.B, and TS 3.11.C to clarify TS LCO applicability and to provide for consistency with STS 3.2.1, 3.2.2, and 3.2.3. TS 4.11.C was revised to make an editorial correction to the specified power level.

4.7.2 Pilgrim TS 3/4.11 Applicability

The proposed revisions would explicitly state that when the reactor is operated below 25 percent rated thermal power, compliance with the reactor fuel limit LCOs are not required. APLHGR, MCPR and LHGR limits are derived from fuel design evaluations and LOCA and transient analyses that are assumed to occur at high power levels. Design calculations and operating experience have shown that when power is reduced, the margin to the required fuel limits increases. When below 25-percent rated thermal power, the reactor is operating with substantial margin and as a result, the LCO is not required. This LCO applicability restriction is consistent with the STS.

4.7.3 Pilgrim TS 3/4.11 Action Requirements

The proposed revisions would also specify prompt action if the reactor fuel limits are not in compliance with TSs. The 2-hour requirement to restore fuel limits to prescribed TS limits is sufficient. If compliance can not be achieved, a 4-hour action to bring the plant to a safe condition, less than 25 percent power, would be required. The LCO is not applicable when power is less than 25 percent. These time limitations are more restrictive than the current TS required shutdown in 36 hours if thermal limits cannot be restored. The time to take the action is acceptable due to the reduced likelihood of a transient or DBA occurring within these imposed time constraints.

The proposed revisions to Pilgrim's reactor fuel assembly themal limit TSs are more restrictive and the applicable plant thermal limits for SLO were based on NRC-approved methodologies and the GE-SE report. The GE-SE report describes the process for determining the conservative correction factors used to calculate the thermal limits for SLO, these would be included in the Pilgrim COLR for the current cycle (cycle -16) and subsequent fuel cycles. These changes are consistent with the STS and therefore, the NRC staff finds the revisions to Pilgrim TS 3.11.A, B, C and 4.11.C acceptable.

4.8 Editorial TS Changes

A revision to the Table of Contents was proposed to remove reference to two previously deleted TS sections, TS 3/4.6.H and TS 3/4.6.I. These TS sections were deleted and the TS section number is not required to maintain the TS 3/4.6 number sequence. Reference to TS 3/4.6.H was also deleted from TS page 3/4.6.8.

4.9 NRC Staff Evaluation Summary

The NRC staff has reviewed the reports submitted by Pilgrim for SLO operation and concludes that appropriate material was submitted and that the fuel design, the nuclear design, the thermal-hydraulic design, and the transient and accident analyses are acceptable. Further, the NRC staff reviewed the licensee's submittal and determined the licensee's analyses were based on NRC-approved methodologies.

Based on the above discussion, the NRC staff concludes that the proposed SLO operation with the proposed operating limits are adequate to detect and suppress thermal-hydraulic instabilities. Therefore, the NRC staff finds the licensee's proposed TS changes acceptable.

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 and SRs. 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 (69 FR 76490; December 21, 2004). 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 NRC staff concludes, 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) 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.

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