Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
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September 2, 2004

Michael A. Balduzzi
Site Vice President

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

SUBJECT: Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket No. 50-283
License Number. DPR-35

License Amendment Request
Technical Specification Changes for Single Recirculation Loop Operation

LETTER NUMBER: 2.04.074

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Nuclear Operations, Inc. (Entergy) requests approval of the enclosed changes to the Pilgrim Nuclear Station (PNPS) Operating License and Technical Specifications to allow continued plant operation with a single recirculation loop in service.

The proposed changes have been evaluated in accordance with 10 CFR 50.91(a)(1) using criteria in 10 CFR 50.92(c) and it has been determined that these changes involve no significant hazard considerations. The bases for these determinations are provided in the enclosure.

ENO requests NRC approval by May 10, 2005.

Attachment 2, GE Report GE-NE-0000-0027-5301, is proprietary and an affidavit signed by an authorized representative of GE is provided pursuant to 10 CFR 2.790. It is requested that this proprietary information be withheld from public disclosure. Attachment 3 provides a non-proprietary version of the report.

Commitments made by the Licensee in this letter are listed in Attachment 4.

If you have any questions or require additional information, please contact Bryan Ford at (508) 830-8403.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 2nd day of SEPTEMBER, 2004.

Sincerely,

Michael A. Balduzzi
Michael A. Balduzzi
Site Vice President

Enclosure: Evaluation of Proposed Changes, (14 pages)

Attachments:
1. License and Technical Specification Mark-ups with Bases (16 pages)
2. General Electric Report GE-NE-0000-0027-5301 (proprietary)
3. General Electric Report GE-NE-0000-0027-5301 (non-proprietary)
4. List of Regulatory Commitments

A001

204074

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ENCLOSURE to Letter 2.04.074

Evaluation of Proposed Changes

Subject: License Amendment to allow Single Loop Operation

Application for License Amendment to Allow Single Loop Operation

1. Description

This letter is a request to amend Operating License DPR-35 and applicable Technical Specifications (TS) for Pilgrim Nuclear Power Station (PNPS). The proposed license amendment requests changes to include provisions for continued reactor operation in single recirculation loop operation (SLO) mode under certain specified conditions. The current PNPS Operating License (OL) allows for only 24 hours of SLO.

The proposed changes are based on NUREG 1433, Rev. 3 (Reference 1), Standard Technical Specifications (STS) for General Electric Boiling Water Reactors (BWR/4), which includes provisions for SLO.

Attachment 1 provides a mark-up of the proposed changes to the existing OL and associated TS. Mark-ups of the associated technical specification bases are also enclosed for the purpose of adding clarity and completeness to the submittal. Attachment 2 and 3 are proprietary and non-proprietary copies of General Electric Report GE-NE-0000-0027-5301, "Pilgrim Nuclear Power Station Single Loop Operation." This report identifies the operational restrictions that must be implemented in order to justify single loop operation without undue risk to public health and safety. Attachment 4 is a list of the regulatory commitments applicable to this license amendment request.

SLO is a recognized operating practice for Boiling Water Reactor (BWR) operation and many BWRs have TS that allow indefinite operation with a single recirculation pump in service. The ability to operate in single-loop mode provides operational flexibility and allows continued power operation in the event of an inoperable recirculation loop.

2. Proposed Changes

The following changes are proposed as part of the OL and TS amendment.

A. License Condition 3.E.

This license condition requires that the reactor not be operated for more than 24 hours if one recirculation loop is out of service. This change deletes the license condition.

B. Safety Limit for MINIMUM CRITICAL POWER RATIO (SLMCPR)

TS 2.1.2 identifies that the SLMCPR for two-loop operation (TLO) is ≥ 1.06. Based on increased uncertainties in total core flow and Traversing In-core Probe (TIP) readings, the TLO Safety Limit MCPR must be increased by 0.02 for SLO. TS 2.1.2 is revised to identify a SLMCPR limit of ≥1.08 for SLO.

C. Jet Pumps

Existing TS 3/4.6.E – Jet Pumps, established the LCO and surveillance requirements that ensure each jet pump remains operable whenever the reactor is in the Startup or Run Mode. Based on removal of license condition 3E, existing surveillance requirement TS 4.6.E.1 cannot be performed when the plant is operating in SLO. The proposed surveillance revision provides for three

F. Table of Contents

The Table of Contents is 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. Reference to TS 3/4.6.H was also deleted from page 3/4.6.8.

3. Background

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 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 two separate jet pump headers inside the reactor vessel, which in turn provide core recirculation flow. For a detailed discussion of the system components and operating characteristics, refer to the description in Chapter 4.3 in the Updated Final Safety Analysis Report (UFSAR).

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 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 Boiling Water Reactors (BWRs) and many BWRs have TS 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 very reliable system, temporary unavailability of a recirculating loop is occasionally experienced. Currently, Operating License, Section 3.E restricts reactor operation with one recirculation loop out of service to a period of less than 24 hours. As might be expected, it is not always possible to diagnose and effect repairs to the system within these time frames. PNPS most recently had a recirculation system TS required shutdown in February 2002 due to a MG set generator field wiring failure because the repair could not be diagnosed, planned, and implemented within the LCO time frame currently allowed.

Many BWRs (Hatch, Peach Bottom, Vermont Yankee, Fitzpatrick, Cooper, Duane Arnold, and Grand Gulf) have previously provided justification for SLO and have obtained TS changes allowing operation in single-loop. Thus, there is ample industry experience demonstrating the viability of operating in single-loop and precedent in analyzing the safety considerations of SLO.

The NRC has previously determined SLO is generically acceptable as set forth in Generic Letter 86-09, "Technical Resolution of Generic Issue B-59 (N-1) Loop Operation in BWRs and PWRs," (Reference 3). SLO is also recognized as a standard mode of operation addressed in NUREG-1433, BWR/4 ISTS.

In this submittal, Entergy is providing the technical analyses that form the basis for changing the license and associated technical specifications to allow indefinite SLO operation. This license change and associated TS changes would allow continued operation in the event of loss of a single recirculation loop. As noted above, it is expected that, in most cases, a malfunctioning loop could be repaired with the reactor in service, and normal operations resumed. Thus, for these circumstances, approval of these TS changes would have a positive economic impact in allowing continued power generation in SLO. Similarly, the avoidance of shutdowns due to recirculation system failures would eliminate risk factors associated with unnecessary reactor shutdowns and restarts.

4. Technical Analysis

With two recirculation loops in service, the reactor recirculation system, in combination with the control rods, is designed to support the full range of power operations. Power operation with a single recirculation loop in service is also a viable mode of operation although with a single loop in service, full core flow and, hence, full core power cannot be achieved.

Reactor control and operation in single-loop is very similar to two-loop recirculation operation. The primary difference is that the maximum achievable power level is reduced 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 two-loop operation.

The primary analysis of the safety considerations in support of PNPS proposed SLO TS is presented in Attachment 2, General Electric Report GE-NE-0000-0027-5301, "Pilgrim Nuclear Power Station Single Loop Operation," July 2004. 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 in SLO mode safely for an unrestricted period of time provided that operation is controlled in accordance with the identified safety settings established for SLO operation.

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 approved version of GE Licensing Topical Report NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (Reference 4).

Safety Limit Minimum Critical Power Ratio (SLMCPR)

The SLMCPR is established such that no fuel damage is calculated to occur if the limit is not violated during reactor transients. The limit is calculated using a statistical model that includes considerations for uncertainties. For SLO as discussed in GE-NE-0000-0027-5301, the SLMCPR increases by 0.02 due to increased uncertainties in the total core flow and Traversing In-Core Probe (TIP) readings compared to two-loop operation. 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. The SLO SLMCPR limit will be revised if necessary 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 (OLMCPR) 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 OLMCPR limits. By maintaining MCPR ≥ OLMCPR, the SLMCPR specified in TS 2.1.2 will not be challenged in the event of the most limiting transient.

Core Operating Transients

Core wide transients potentially impacted by single loop operation were evaluated in Section 4 to GE-NE-0000-0027-5301. 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 bounded by the two-loop UFSAR analyses.

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, "General Electric Standard Application for Reactor Fuel." The OLMCPR with an SLO MCPR adder, as specified in the COLR, was evaluated and provides adequate protection for transients initiated during 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 two-loop operation and single loop operation. RWE is evaluated each fuel cycle as part of the cycle-specific reload analysis. 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 single loop operation, the flow-biased APRM scram trip and rod block set points 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 resistance. GE-NE-0000-0027-5301, Section 4.1.6 identifies the equations used to correct the flow biased APRM scram trip and rod block set points for long-term SLO operation.

PNPS is currently in operating Cycle 15. The Operating Cycle-16 COLR will identify the revised TLO and SLO APRM setpoints and existing TS 3.11.D ensures that the plant will be operated in accordance with the power-flow map, which will be updated to reflect APRM setpoint revisions. In the plant, flow control trip reference (FCTR) cards will be updated to enforce TLO and SLO APRM scram trip and rod block setpoint limits. After loss of a recirculation loop, operator action will be required to manipulate a FCTR card toggle switch within 24 hours to adjust for SLO operation. The time period to make the SLO adjustments is consistent with standard TS 3.4.1.

Accident Evaluation

An evaluation of the effects of SLO on applicable accident analyses is provided in GE-NE-0000-0027-5301. 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 Recirculation Pump Seizure accident is evaluated in GE-NE-0000-0027-5301, 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 radiation release limits.

A summary of Emergency Core Cooling System (ECCS) performance during a Loss of Coolant Accident (LOCA) when operating in SLO is provided in Section 6 of GE-NE-0000-0027-5301. This report references NEDC-31852 Rev 2, which describes the SAFER/GESTR-LOCA analysis performed for Pilgrim Station. The DBA-LOCA analysis that was performed for PNPS 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 concluded that the design basis accident (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 PLHGR/MAPLHGR multiplier of 0.8 for both GE-11 and GE-14 fuel. The calculated Appendix K PCT's using these PLHGR/MAPLHGR multipliers are below the 10 CFR 50.46 limit of 2200°F. 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 when in single loop operating mode to support the analysis assumptions.

Stability Requirements

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% of rated during SLO, substantial reverse flow is established 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 BWR reactors regarding the potential for power oscillations at low flow/high power operating map conditions, the NRC issued Bulletin No. 88-07 which was supplemented in December 1988. Bulletin 88-07, Supplement 1 (Reference 5), requested Licensees to adopt the Boiling Water Reactor Owners Group (BWROG) stability monitoring guidelines similar to those originally issued by GE in Services Information Letter (SIL) 380 Revision 1 (Reference 6). The NRC later requested licensees to address long-term solutions for thermal-hydraulic instabilities in Generic Letter (GL) 94-02 dated July 11, 1994 (Reference 7). In the GL, the NRC requested utilities 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 operating guidance, the BWROG developed licensing strategies and methodology to provide a long-term resolution for thermal-hydraulic instability. Initially, NEDO-31960 and NEDO-31960, Supplement 1 were submitted to and approved by the NRC in 1993 (Reference 8). The BWROG subsequently developed specific reports to address selected options for addressing thermal-hydraulic stability. NEDO- 32339-A (Reference 9) addresses Stability Option E1A, and NEDO-32465-A (Reference 10) addresses Stability Option 1D. The NRC has specifically reviewed these reports and has approved the referenced stability monitoring and protection methodologies.

PNPS currently relies on administrative controls and plant hardware to enforce the protection methods described in Stability Option E1A. However, PNPS is pursuing a plant modification to adopt the protection features defined in Stability Option 1D. 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.

Reactor Internal Vibration

In single-loop recirculation mode, increases in 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.

GE Report GE-NE-0000-0027-5301, Section 7, identifies that SLO operation will be restricted to operation below the 100% Current Licensed Thermal Power (CLTP) rod line with a maximum power limit of 65% of rated power (2028 Mwt) and a maximum core flow limit of 52% of rated flow (69 Mlb/hr) to ensure vibration levels are 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 for each subsequent reload cycle. SLO pump operating limits will be incorporated into operating procedures after approval of the amendment request.

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," 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, thirty (30) years of successful operation at 100% 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% 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. 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.

Recirculation Loop Operating Restrictions

TS 3/4.6.F – Jet Pump Flow Mismatch and TS 3.6.A.6 – Thermal-Hydraulic Stability contain the LCO conditions applicable to controlling recirculation loops during power operation. Review of the NRC approved STS revealed that STS 3.4.1 – Recirculation Loops Operation, identifies the necessary LCO requirements for controlling TLO, SLO and no recirculation loop operation. Based on the removal of License Condition 3.E, TS 3/4.6.F was modified to incorporate the STS recirculation loop operating requirements identified in STS 3.4.1.

The title of TS 3/4.6.F was changed to Recirculation Loops Operating and a mode switch applicability restriction was also incorporated 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 3/4.6.F.1 was not revised. This TS ensures that recirculation loop TLO operation is conforming to the accident analyses previously evaluated for LOCA and 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 SLO operation were identified 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 identified in the COLR.

TS 3/4.6.F.3 identifies the required actions and time limits for restoration of compliance to TS 3/4.6.F.1 and TS 3/4.6.F.2. A 24-hour completion time limit to restore compliance is identified. 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 simultaneously with the limits out of specification while providing sufficient 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.

TS 3.6.A.6 – Thermal-Hydraulic Stability included the requirement to ensure forced recirculation when core thermal power is ≥ 25%. This TS did not identify a required action or required surveillance. Revised TS 3/4.6.F includes the requirement for ensuring core flow during power operation as well as a required shutdown action and associated completion time limit. As previously discussed above, a 12-hour shutdown action and associated completion time is justified based on operating experience related to completing shutdown activities.

<u>Jet Pump Operability</u>

A revision to TS 3/4.6.E – Jet Pumps is identified to ensure that jet pump surveillance requirements can be performed under either SLO or TLO operating conditions. The revisions also ensure consistency with STS 3.4.2 requirements.

Based on the removal of License Condition 3.E, existing surveillance requirement TS 4.6.E.1 cannot be performed when the plant is operating in SLO. The proposed surveillance revision provides for three separate, loop-specific options to verify jet pump Operability.

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, June 9, 1980 (Reference 2).

The required TS 3.6.E.1 LCO action and the associated action time limit was also revised 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 consistent with STS 3.4.2 actions and required time limits.

An editorial change was also implemented to capitalize Startup and Run Modes and Operable in TS 3.6.E.1.

<u>TS 3/4.11- Reactor Fuel Assembly Revisions</u>

Revisions to TS 3/4.11.A, TS 3/4.11.B, and TS 3/4.11.C are identified to clarify TS LCO applicability and to improve 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 specified power level.

The revised specifications identify that when the reactor is operated below 25% rated thermal power, compliance with the reactor fuel limit LCOs is 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. Below 25% 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 STS and their associated bases.

The revised specifications identify that if the reactor fuel limits cannot be restored, prompt action is required. The two (2) hour limit to restore compliance is sufficient to perform the necessary actions and is acceptable due to the reduced likelihood of a transient or DBA occurring simultaneously with the limits out of specification. If compliance can not be achieved, a four (4) hour action to bring the plant to a safe configuration where power levels are reduced, fuel margins are improved, and the LCO does not apply. These LCO actions and time limits are consistent with STS and their associated bases.

<u>Editorial TS Changes</u>

A revision to the Table of Contents was identified 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 page 3/4.6.8.

5. Regulatory Safety Analysis

5.1 No Significant Hazards Consideration

Entergy Nuclear Operations, Inc. (Entergy) is proposing to modify the Pilgrim Station Technical Specifications to allow plant operation with only one recirculation in service. Entergy has evaluated whether or not a significant hazards consideration is involved with the proposed amendment(s) by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

i) Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed license and technical specification changes will allow the plant to be operated with one recirculation pump for longer than 24 hours provided that appropriate limits are instituted. Extended single recirculation loop operation has been evaluated and methodologies have been established for determining appropriate operating limits. Implementation of the single recirculation loop operating limits ensures that system operation is in conformance with the conditions established to minimize the probability of accidents and the associated consequences. Required completion times for implementing the system operating limits and restoring out of specification limits minimize the probability that an accident occurs when out of specification conditions exist while allowing for deliberate operator action.

Therefore, this proposed amendment does not involve a significant increase in the probability of occurrence or consequences of an accident previously evaluated.

ii) Does the proposed change create the possibility of a new or different kind of accident from any previously evaluated?

Response: No.

The proposed license and technical specification changes will allow plant operation with a single recirculation loop for longer than 24 hours. The proposed changes introduce an additional recirculation system-operating mode, however, existing system component operating equipment or operating characteristics will not change. The Pilgrim Station Single Loop Analysis Report identifies required operating limits that apply when the system will be operated in the single loop operation mode. Implementation of these operating limits will ensure that the system is operated in accordance with design. Additionally, revised jet pump surveillance ensures that loop specific surveillance is performed as required to validate the bounding assumptions of existing accident analyses. As such, no new failure mechanisms are created and existing design evaluations bound system operation.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident.

iii) Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

The proposed license and technical specification changes identify the operating limits that apply to single recirculation loop operation. These proposed recirculation system limits were identified to ensure that system operation would be in conformance to the conditions evaluated in applicable accident and transient analyses. Implementation of the proposed limits for single recirculation loop operation ensures that safety margins are maintained. Required completion times for implementing the system operating limits minimizes the possibility that an accident occurs when out of specification conditions exist.

Therefore, the proposed changes do not involve a significant reduction in the margin of safety.

Based on the above, Entergy concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Environmental Consideration

The proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental assessment needs to be prepared in connection with the proposed amendment.

6. <u>Coordination With Other Pending TS Changes</u>

There are no other pending TS changes that would be affected by this proposed license amendment.

7. <u>Precedents</u>

This proposed license amendment request is similar those submitted the by Tennessee Valley Authority on June 2, 1997 and approved December 23, 1998 (TAC Nos. M98885, M98886, and M8887). This proposed license amendment request is not identical to those requests due to differences in the Technical Specifications between the plants and the exact approach each licensee took to amend their Technical Specifications, however, the overall intent of all the requests are believed to be the same with very similar justifications.

8. <u>References</u>

1. NUREG 1433, Standard Technical Specifications for General Electric Plants, BWR/4, Revision 3, June 2004.
2. GE Services Information Letter (SIL) No. 330, "Jet Pump Beam Cracks, "June 9, 1980
3. NRC Generic Letter 86-09, "Technical Resolution of Generic Issue B-59 (N-1) Loop Operation in BWRs and PWRs," March 1986.

4. General Electric Licensing Topical Report NEDE-24011-P-A, June 2000; and the US Supplement, NEDE-24011-P-A-14-US, "General Electric Standard Application for Reactor Fuel," June 2000.
5. NRC Bulletin No. 88-07 and Bulletin 88-07, Supplement 1, "Power Oscillations in Boiling Water Reactors," December 1988.
6. GE Services Information Letter (SIL) 380 and SIL 380, Rev. 1, " BWR Thermal-Hydraulic Stability," February 1984.
7. NRC Generic Letter (GL) 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling Water Reactors," July 1994.
8. NEDO-31960-A, and NEDO-31960-A, Supplement 1, November 1995, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology," November 1995.
9. NEDO-32339-A, "Reactor Stability Long-Term Solution: Enhanced Option 1-A," and associated Supplements 1, 2, 3 and 4, April 1998.
10. NEDO-32465-A, " Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications (Options 1D and III)," August 1996.
11. GE Services Information Letter (SIL) No. 517, "Single Loop Operation- GE BWR/ 3, 4, 5 and 6 Plants," July 1990.

Attachment 1 to 2.04.074

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Plant

Proposed Amendment to the Technical Specifications

Mark-Up of License and Technical Specifications (with Bases)
(16 total pages)

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 205, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. Records

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

D. Equalizer Valve Restriction - DELETED

E. Recirculation Loop Inoperable – DELETED

The reactor shall not be operated with one recirculation loop out of service for more than 24 hours. With the reactor operating, if one recirculation loop is out of service, the plant shall be placed in a hot shutdown condition within 24 hours unless the loop is sooner returned to service.

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, guard training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10CFR73.55 (51FR27817 and 27822) and to the authority of 10CFR50.90 and 10CFR50.54(p). The plans, which contain Safeguards Information protected under 10CFR73.21, are entitled: "Pilgrim Nuclear Power Station Physical Security Plan," with revisions submitted through September 18, 1987; "Pilgrim Nuclear Power Station Guard Training and Qualification Plan," with revisions submitted through September 24, 1984; and "Pilgrim Nuclear Power Station Safeguards Contingency Plan," with revisions submitted through February 15, 1984. Changes made in accordance with 10CFR73.55 shall be implemented in accordance with the schedule set forth therein.

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2.0 SAFETY LIMITS

2.1 Safety Limits

2.1.1 With the reactor steam dome pressure < 785 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 ≥ 785 psig and core flow ≥ 10% of rated core flow:

MINIMUM CRITICAL POWER RATIO shall be ≥ 1.06 for two recirculation loop operation or ≥ 1.08 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 ≤ 1325 psig at any time when irradiated fuel is present in the reactor vessel.

2.2 Safety Limit Violation

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

2.2.1 Within one hour notify the NRC Operations Center in accordance with 10CFR50.72.

2.2.2 Within two hours:

A. Restore compliance with all Safety Limits, and

B. Insert all insertable control rods.

2.2.3 The Station Director and Senior Vice President - Nuclear and the Nuclear Safety Review and Audit Committee (NSRAC) shall be notified within 24 hours.

2.2.4 A Licensee Event Report shall be prepared pursuant to 10CFR50.73. The Licensee Event Report shall be submitted to the Commission, the Operations Review Committee (ORC), the NSRAC and the Station Director and Senior Vice President - Nuclear within 30 days of the violation.

2.2.5 Critical operation of the unit shall not be resumed until authorized by the Commission.

3.1 REACTOR PROTECTION SYSTEM (Cont)

could exceed the safety limit. The 15% APRM scram remains active until the mode switch is placed in the RUN position.

The analysis to support operation at various power and flow relationships has considered ~~operation with~~ two recirculation ~~pumps~~ loop operation and single recirculation loop operation.

Intermediate Range Monitor (IRM)

The IRM system consists of 8 chambers, 4 in each of the reactor protection system logic channels. The IRM is a 5-decade instrument which covers the range of power level between that covered by the SRM and the APRM. The 5 decades are covered by the IRM by means of a range switch and the 5 decades are broken down into 10 ranges, each being one-half of a decade in size.

The IRM scram setting of 120/125 of full scale is active in each range of the IRM. For example, if the instrument were on Range 1, the scram setting would be a 120/125 of full scale for that range; likewise, if the instrument were on Range 5, the scram would be 120/125 of full scale on that range. Thus, as the IRM is ranged up to accommodate the increase in power level, the scram setting is also ranged up. The most significant sources of reactivity change during the power increase are due to control rod withdrawal. For in-sequence control rod withdrawal, the rate of change of power is slow enough due to the physical limitation of withdrawing control rods that heat flux is in equilibrium with the neutron flux, and an IRM scram would result in a reactor shutdown well before any safety limit is exceeded.

In order to ensure that the IRM provided adequate protection against the single rod withdrawal error, a range of rod withdrawal accidents was analyzed. This analysis included starting the accident at various power levels. The most severe case involves an initial condition in which the reactor is just subcritical and the IRM system is not yet on scale. This condition exists at quarter rod density. Additional conservatism was taken in this analysis by assuming that the IRM channel closest to the withdrawn rod is bypassed. The results of this analysis show that the reactor is scrammed and peak core power limited to one percent of rated power, thus maintaining MCPR above the safety limit MCPR. Based on the above analysis, the IRM provides protection against local control rod withdrawal errors and continuous withdrawal of control rods in sequence and provides backup protection for the APRM.

Reactor Low Water Level

The setpoint for low level scram is above the bottom of the separator skirt. This level has been used in transient analyses dealing with coolant inventory decrease. The results show that scram at this level properly protects the fuel and the pressure barrier, because MCPR remains well above the safety limit MCPR in all cases, and system pressure does not reach the safety valve settings. The scram setting is approximately 15 inches below the normal operating range and is thus sufficient to avoid spurious scrams.

LIMITING CONDITION FOR OPERATION

3.6 PRIMARY SYSTEM BOUNDARY (Cont)

A. Thermal and Pressurization Limitations (Cont)

In the event this requirement is not met, achieve stable reactor conditions with reactor vessel temperature above that defined by the appropriate curve and obtain an engineering evaluation to determine the appropriate course of action to take.

3. The reactor vessel head bolting studs shall not be under tension unless the temperature of the vessel head flange and the head is greater than 55°F.

4. The pump in an idle recirculation loop shall not be started unless the temperatures of the coolant within the idle and operating recirculation loops are within 50°F of each other.

5. The reactor recirculation pumps shall not be started unless the coolant temperatures between the dome and the bottom head drain are within 145°F.

6. ~~Thermal-Hydraulic Stability~~

~~Core thermal power shall not exceed 25% of rated thermal power without forced recirculation.~~

SURVEILLANCE REQUIREMENTS

4.6 PRIMARY SYSTEM BOUNDARY (Cont)

A. Thermal and Pressurization Limitations (Cont)

Test specimens of the reactor vessel base, weld and heat affected zone metal subjected to the highest fluence of greater than 1 Mev neutrons shall be installed in the reactor vessel adjacent to the vessel wall at the core midplane level. The specimens and sample program shall conform to the requirements of ASTM E 185-66. Selected neutron flux specimens shall be removed at the frequency required by Table 4.6-3 and tested to experimentally verify adjustments to Figures 3.6-1, 3.6-2, and 3.6-3 for predicted NDT temperature irradiation shifts.

3. When the reactor vessel head bolting studs are tensioned and the reactor is in a Cold Condition, the reactor vessel shell temperature immediately below the head flange shall be permanently recorded.

4. Prior to and during startup of an idle recirculation loop, the temperature of the reactor coolant in the operating and idle loops shall be permanently logged.

5. Prior to starting a recirculation pump, the reactor coolant temperatures in the dome and in the bottom head drain shall be compared and permanently logged.

3.6 PRIMARY SYSTEM BOUNDARY (Cont)

D. Safety Relief Valves (Con't)

4. Any safety relief valve whose discharge pipe temperature exceeds 212°F for 24 hours or more shall be removed at the next cold shutdown of 72 hours or more, tested in the as-found condition, and recalibrated as necessary prior to reinstallation. Power operation shall not continue beyond 90 days from the initial discovery of discharge pipe temperatures in excess of 212°F for more than 24 hours without prior NRC approval of the engineering evaluation delineated in 3.6.D.3.

5. The limiting conditions of operation for the instrumentation that monitors tail pipe temperature are given in Table 3.2-F.

E. Jet Pumps

1. Whenever the reactor is in the startup or run modes, all jet pumps shall be operable. If it is determined that a jet pump is inoperable, ~~an orderly shutdown shall be initiated and the reactor shall be in a Cold Shutdown Condition within 24 hours.~~

The reactor shall be in Hot Shutdown within 12 hours.

4.6 PRIMARY SYSTEM BOUNDARY (Cont)

E. Jet Pumps

NOTES

1. Not required to be performed until 4 hours after the associated recirculation loop is in operation.

2. Not required to be performed until 24 hours after >25% Rated Thermal Power.

See Insert →

~~Whenever there is recirculation flow with the reactor in the startup or run modes, jet pump operability shall be checked daily by verifying that no two of the following conditions occur simultaneously.~~

~~1. The two recirculation loops have a flow imbalance of 10% or more when the pumps are operated at the same speed.~~

~~2. The indicated value of core flow rate varies from the value derived from loop flow measurements by more than 10%.~~

~~3. The diffuser to lower plenum differential pressure reading on an individual jet pump varies from established jet pump delta P characteristics by more than 10%.~~

Insert for SR 4.6.E – Jet Pumps

Whenever there is recirculation flow with the reactor in the Startup or Run Modes, jet pump operability shall be checked daily by verifying at least one of the following criteria (1, 2, or 3) is satisfied for each operating recirculation loop:

1. Recirculation pump flow to speed ratio differs by ≤ 5% from established patterns, and jet pump loop flow to recirculation pump speed ratio differs by ≤ 5% from established patterns.
2. Each jet pump diffuser to lower plenum differential pressure differs by ≤ 20% from established patterns.
3. Each jet pump flow differs by ≤ 10% from established patterns.

LIMITING CONDITIONS FOR OPERATION

3.6 PRIMARY SYSTEM BOUNDARY (Cont)

F. ~~Jet Pump Flow Mismatch~~

~~1. Whenever both recirculation pumps are in operation, pump speeds shall be maintained within 10% of each other when power level is greater than 80% and within 15% of each other when power level is less than or equal to 80%.~~

~~2. If Specification 3.6.F.1 is exceeded immediate corrective action shall be taken. If recirculation pump speed mismatch is not corrected within 30 minutes, an orderly shutdown shall be initiated and the reactor shall be in the Cold Shutdown condition within 24 hours unless the recirculation pump speed mismatch is brought within limits sooner.~~

See insert

G. Structural Integrity

1. The structural integrity of the primary system boundary shall be maintained at the level required by the ASME Boiler and Pressure Vessel Code, Section XI "Rules for Inservice Inspection of Nuclear Power Plant Components," Articles IWA, IWB, IWC, IWD and IWF and mandatory appendices as required by 10CFR50.55a(g), except where specific relief has been granted by the NRC pursuant to 10CFR50.55a(g)(6)(i).

~~H. Deleted~~

SURVEILLANCE REQUIREMENTS

4.6 PRIMARY SYSTEM BOUNDARY (Cont)

F. ~~Jet Pump Flow Mismatch~~ Recirculation Loops Operating

Recirculation pump speeds shall be checked and logged at least once per day.

G. Structural Integrity

Inservice inspection of components shall be performed in accordance with the PNPS Inservice Inspection Program. The results obtained from compliance with this program will be evaluated at the completion of each ten year interval. The conclusions of this evaluation will be reviewed with the NRC.

Insert for TS 3.6.F – Recirculation Loops Operating

F. <u>Recirculation Loops Operating</u>

During operation in the Run and Startup Modes, at least one recirculation pump shall be operating.

1. Whenever both recirculation pumps are in operation, pump speeds shall be maintained within 10% of each other when power level is greater than 80% and within 15% of each other when power level is less than or equal to 80%.

2. Whenever a single recirculation loop is operating, the following limits are applied when the associated LCO is applicable:
   a) LCO 3.11.A, "Average Planar Linear Heat Generation Rate (APLHGR)," single loop operation limits specified in the COLR,
   b) LCO 3.11.C, "Minimum Critical Power Ratio (MCPR)," single loop operation limits specified in the COLR, and
   c) LCO 3.1, "Reactor Protection System," Average Power Range Monitor High Flux function, trip level setting is reset for single loop operation per Table 3.1.1.

3. If the requirements of Specification 3.6.F.1 or 3.6.F.2 are not met, restore compliance within 24 hours. If compliance is not restored or with no recirculation pumps in operation the reactor shall be in Hot Shutdown within 12 hours.

See insert

E. Jet Pumps

~~Failure of a~~ jet pump nozzle assembly hold down mechanism, nozzle assembly and/or riser, would increase the cross-sectional flow area for blowdown following the design basis double-ended recirculation line break. Therefore, if a failure occurred, repairs must be made.

A nozzle riser failure could cause the coincident failure of a jet pump body; however, because of the lack of any substantial stress in the jet pump body, the converse is not possible. Therefore, failure of a jet pump body cannot occur without the failure of the nozzle riser.

The following factors form the basis for the surveillance requirements:

A break in a jet pump decreases the flow resistance characteristic of the external piping loop causing the recirculation pump to operate at a higher flow condition when compared to previous operation.

The change in flow rate of the failed jet pump produces a change in the indicated flow rate of that pump relative to the other jet pumps in that loop. Comparison of the data with a normal relationship or pattern provides the indication necessary to detect a failed jet pump.

The jet pump flow deviation pattern derived from the diffuser to lower plenum differential pressure readings will also be used to evaluate jet pump operability.

The surveillance is modified by two Notes. Note 1 allows the surveillance not to be performed until 4 hours after the associated recirculation loop is in operation, since these checks can only be performed during the jet pump operation. The 4 hours is an acceptable time to establish conditions appropriate for data collection and evaluation. Note 2 allows the surveillance not to be performed when thermal power is ≤ 25% of Rated Thermal Power. During low flow conditions, jet pump noise approaches the threshold response of the associated flow instrumentation and precludes the collection of repeatable and meaningful data. The 24-hour frequency has been shown by operating experience to be timely for detecting jet pump degradation and is consistent with the surveillance frequency for recirculation loop operability verification.

The surveillance requires verification of jet pump operability on a daily basis by verifying two of three of the following conditions do not occur simultaneously: 1) the recirculation loops have a flow imbalance of less than 10% when the pumps are operated at the same speed, 2) the variation in the indicated core flow rate and the loop flow rate is less than 10%, and 3) the diffuser to lower plenum differential pressure reading on an individual jet pump is less than 10%.

The jet pump operability detection technique is as follows. With the two recirculation pumps balanced in speed to within ± 5%, the flow rates in both recirculation loops will be verified by Control Room monitoring instruments. If the two flow rate values do not differ by more than 10%, riser and nozzle assembly integrity has been verified. If they do differ by 10% or more after correction for the difference in pump speeds, the diffuser to lower plenum differential pressure of all jet pumps will be compared to established jet pump ΔP characteristics. In the event of a failed jet pump nozzle (or riser), the affected jet pump diffuser differential pressure signal would be reduced because the backflow would be less than the normal forward flow. If the jet pump ΔP indications are within 10% of established jet pump ΔP characteristics, jet pump nozzle and riser integrity have been established. If the indicated jet pump ΔP varies from the established jet pump characteristics by more than 10%, indicated core flow will be compared to the core flow derived from loop flow measurements. If the difference between measured and

See insert

E. Jet Pumps (Cont)

derived core flow rate is 10% or more, a failed jet pump nozzle (or riser) is indicated and the plant shall be shut down for repairs. If the potential blowdown flow area is increased, the system resistance to the recirculation pump is also reduced; hence, the affected drive pump will "run out" to a substantially higher flow rate (approximately 115% to 120% for a single nozzle failure). If the two loops are balanced in flow at the same pump speed, the resistance characteristics cannot have changed.

Any imbalance between drive loop flow rates would be indicated by the plant process instrumentation. In addition, the affected jet pump would provide a leakage path past the core thus reducing the core flow rate. The reverse flow through the inactive jet pump would still be indicated by a positive differential pressure but the net effect would be a slight decrease (3% to 6%) in the total core flow measured. This decrease, together with the loop flow increase, would result in a lack of correlation between measured and derived core flow rate.

F. ~~Jet Pump Flow Mismatch~~ Recirculation Loops Operating

The LPCI loop selection logic has been previously described in the Pilgrim Nuclear Power Station FSAR. For some limited low probability accidents with the recirculation loop operating with large speed differences, it is possible for the logic to select the wrong loop for injection. For these limited conditions the core spray itself is adequate to prevent fuel temperatures from exceeding allowable limits. However, to limit the probability even further, a procedural limitation has been placed on the allowable variation in speed between the recirculation pumps.

The licensee's analyses indicate that above 80% power the loop select logic could not be expected to function at a speed differential of 15%. At or below 80% power the loop select logic would not be expected to function at a speed differential of 20%. This specification provides a margin of 5% in pump speed differential before a problem could arise. If the reactor is operating on one pump, the loop select logic trips that pump before making the loop selection.

The flow mismatch restriction also derives from the "Core Flow Coastdown" concern. This concern postulates that if the recirculation loop with the higher flow is broken, the "effective core flow" is determined by the loop with the lower flow. Compared to a matched flow condition, this would start pump coastdown from a lower flow/speed with the reactor power effectively above the rated rod line. Therefore, boiling transition may occur earlier during a postulated LOCA event, which could result in higher calculated peak cladding temperatures (PCTs). Therefore, the purpose of the "Core Flow Coastdown" flow mismatch restriction is to maintain Pilgrim within its analyzed conditions.

Specification 3.6.F allows 30 minutes to correct a mismatch in recirculation pump speeds in order to take manual control of the recirculation pump MG set scoop tube positioner in the event that its control system should fail.

see insert

Insert for TS Bases Section B3/4.6.E – Jet Pumps

The jet pumps are part of the Reactor Coolant Recirculation System and are designed to provide forced circulation through the core to remove heat from the fuel. Jet pump OPERABILITY is an explicit assumption in the design basis loss of coolant accident (LOCA) analysis. The structural failure of any of the jet pumps could cause significant degradation in the ability of the jet pumps to allow reflooding to two-thirds core height during a LOCA. OPERABILITY of all jet pumps is required to ensure that operation of the Reactor Coolant Recirculation System will be consistent with the assumptions used in the licensing basis analysis.

The jet pumps are required to be OPERABLE when the reactor is operating in the Run or Startup Modes since there is a large amount of energy in the reactor core and since the limiting DBAs are assumed to occur in these MODES. This is consistent with the requirements for operation of the Reactor Coolant Recirculation System.

An inoperable jet pump can increase the blowdown area and reduce the capability of reflooding during a design basis LOCA. If one or more of the jet pumps are inoperable, the plant must be brought to a Mode in which the LCO does not apply. To achieve this status, the plant must be brought to Hot Shutdown within 12 hours. The Completion Time of 12 hours is reasonable, based on operating experience, to reach Hot Shutdown from full power conditions in an orderly manner and without challenging plant systems.

The surveillance is designed to detect significant degradation in jet pump performance that precedes jet pump failure. The surveillance is required to be performed only when the loop has forced recirculation flow since surveillance checks and measurements can only be performed during jet pump operation. The jet pump failure of concern is a complete mixer displacement due to jet pump beam failure. Jet pump plugging is also of concern since it adds flow resistance to the recirculation loop. Significant degradation is indicated if the specified criteria confirm unacceptable deviations from established patterns or relationships. The allowable deviations from the established patterns have been developed based on the variations experienced at plants during normal operation and with jet pump assembly failures. Each recirculation loop must satisfy one of the performance criteria provided. Since refueling activities (fuel assembly replacement or shuffle, as well as any modifications to fuel support orifice size or core plate bypass flow) can affect the relationship between core flow, jet pump flow, and recirculation loop flow, these relationships may need to be re-established each cycle. Similarly, initial entry into extended single loop operation, off-normal operating conditions, and changes in monitoring equipment may also require establishment of these relationships. During the initial weeks of operation under such conditions, while base-lining new "established patterns", engineering judgment of the daily surveillance results is used to detect significant abnormalities which could indicate a jet pump failure.

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 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, June 9, 1980.

The 24 hour frequency has been shown by operating experience to be timely for detecting jet pump degradation and is consistent with the Surveillance Frequency for recirculation loop OPERABILITY verification.

The surveillance is modified by two Notes. Note 1 allows this Surveillance not to be performed until 4 hours after the associated recirculation loop is in operation, since these checks can only be performed during jet pump operation. The 4 hours is an acceptable time to establish conditions appropriate for data collection and evaluation. Note 2 allows the surveillance not to be performed when THERMAL POWER is ≤ 25% of RTP. During low flow conditions, jet pump noise approaches the threshold response of the associated flow instrumentation and precludes the collection of repeatable and meaningful data.

Insert for TS Bases Section B3/4.6. F – Recirculation Loops Operating

A plant specific LOCA analysis has been performed assuming only one operating recirculating loop. This analysis has demonstrated that, in the event of a LOCA caused by pipe break in the operating recirculation loop, the Emergency Core Cooling System response will provide adequate core cooling, provided the APLHGR requirements are modified accordingly.

The transient analyses of Chapter 14 of the FSAR have also been performed for single loop operation and demonstrate sufficient flow coastdown characteristics to maintain fuel thermal margins during the abnormal operational transients analyzed provided the MCPR requirements are modified. During single loop operation modification of the Reactor Protection System (RPS) average power range monitor (APRM) instrument setpoints is also required to account for the different relationships between recirculation drive flow and the reactor core flow. The APLHGR, MCPR, and APRM High Flux limits for single loop operation are specified in the COLR.

LIMITING CONDITIONS FOR OPERATION

3.11 REACTOR FUEL ASSEMBLY

Applicability:

The Limiting Conditions for Operation associated with fuel rods apply to those parameters which monitor the fuel rod operating conditions.

Objective:

The Objective of Limiting Conditions for Operation is to assure the performance of the fuel rods.

Specifications:

A. Average Planar Linear Heat Generation Rate (APLHGR)

During ~~power~~ operation [at ≥ 25% rated thermal power,] ~~with both recirculation pumps operating,~~ the APLHGR for each type of fuel as a function of average planar exposure shall not exceed the applicable limiting value specified in the CORE OPERATING LIMITS REPORT.

If at any time during operation [at ≥ 25% rated thermal power] ~~it is determined by normal surveillance that~~ the limiting value for APLHGR is being exceeded, action shall be initiated within 15 minutes to restore operation to within the prescribed limits. If the APLHGR is not returned to within the prescribed limits within two (2) hours, [reduce thermal power to <25% within four (4) hours.] ~~the reactor shall be brought to the Cold Shutdown condition within 36 hours. Surveillance and corresponding action shall continue until reactor operation is within the prescribed limits.~~ -8

SURVEILLANCE REQUIREMENTS

4.11 REACTOR FUEL ASSEMBLY

Applicability:

The surveillance requirements apply to the parameters which monitor the fuel rod operating conditions.

Objective:

The Objective of the Surveillance Requirements is to specify the type and frequency of surveillance to be applied to the fuel rods.

Specifications:

A. Average Planar Linear Heat Generation Rate (APLHGR)

The APLHGR for each type of fuel as a function of average planar exposure shall be determined daily during reactor operation at ≥ 25% rated thermal power.

at ≥ 25% rated thermal power,

LIMITING CONDITIONS FOR OPERATION

3.11 REACTOR FUEL ASSEMBLY (Cont)

B. Linear Heat Generation Rate (LHGR)

During ~~reactor power~~ operation, the LHGR shall not exceed the limits specified in the CORE OPERATING LIMITS REPORT.

If at any time during operation ~~it is determined by normal surveillance that~~ the limiting value for LHGR is being exceeded, action shall be initiated within 15 minutes to restore operation to within the prescribed limits. If the LHGR is not returned to within the prescribed limits within two (2) hours, ~~the reactor shall be brought to the Cold Shutdown condition within 36 hours. Surveillance and corresponding action shall continue until reactor operation is within the prescribed limits.~~

C. Minimum Critical Power Ratio (MCPR)

1. During ~~power~~ operation, MCPR shall be ≥ the MCPR operating limit specified in the Core Operating Limits Report. If at any time during operation ~~it is determined by normal surveillance that~~ the limiting value for MCPR is being exceeded, action shall be initiated within 15 minutes to restore operation to within the prescribed limits. If the steady state MCPR is not returned to within the prescribed limits within two (2) hours, ~~the reactor shall be brought to the Cold Shutdown condition within 36 hours. Surveillance and corresponding action shall continue until reactor operation is within the prescribed limits.~~

reduce thermal power to < 25% within four (4) hours.

SURVEILLANCE REQUIREMENTS

4.11 REACTOR FUEL ASSEMBLY (Cont)

B. Linear Heat Generation Rate (LHGR)

The LHGR as a function of core height shall be checked daily during reactor operation at ≥25% rated thermal power.

at ≥ 25% rated thermal power

reduce thermal power to < 25% within four (4) hours.

at ≥ 25% rated thermal power,

C. Minimum Critical Power Ratio (MCPR)

1. MCPR shall be determined daily during reactor power operation at ≥ 25% rated thermal power and following any change in power level or distribution that would cause operation with a limiting control rod pattern as specified ~~in Table 3.2.C.1 Note 5.~~

at ≥ 25% rated thermal power

2. The value of τ in Specification 3.11.C.2. shall be equal to 1.0 unless determined from the result of surveillance testing of Specification 4.3.C as follows:-

a) τ is defined as

$$\tau = \frac{\tau_{ave} - \tau_B}{1.252 - \tau_B}$$