MISSISSIPPI POWER & LIGHT COMPANY
*Helping Build Mississippi*
P. O. BOX 1640, JACKSON, MISSISSIPPI 39215-1640

March 31, 1986

O. D. KINGSLEY, JR.
VICE PRESIDENT - NUCLEAR OPERATIONS

U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
File: 0260/0840/L-860.0
Proposed Amendment to the Operating License (PCOL-86/05)
AECM-86/0092

In accordance with the provisions of 10 CFR 50.59 and 50.90, Mississippi Power & Light (MP&L) request an amendment to License NPF-29, for Grand Gulf Nuclear Station (GGNS) Unit 1.

The attached proposed amendment would incorporate two items into the license: 1) increased neutron flux noise surveillance, and 2) single loop operation. The changes related to flux noise surveillance are based on the core stability recommendations issued by General Electric in their Service Information Letter No. 380 (SIL-380), Revision 1. In SIL-380, GE identified a region of the operating map considered to be one of potential instability. The attached change defines this region for Grand Gulf and provides for the monitoring of core stability when operating in this region. The core stability changes proposed are consistent with the technical resolution of Generic Issue B-19, Thermal-Hydraulic Stability as identified in Generic Letter 86-02 which endorsed the detect and suppress provisions of SIL-380.

Also included in the attached change are provisions to permit operation with one recirculation loop out of service. Based on an extensive evaluation of the FSAR accidents and transients initiated from single loop operation conditions, revisions to appropriate technical specification limits and setpoints are proposed. The revised limits and setpoints, in conjunction with some operational requirements, ensure single loop operation can be performed safely at Grand Gulf.

The attached proposed change is submitted in advance of a proposed change to incorporate the Maximum Extended Operating Domain. MP&L's intent, however, is to implement both changes concurrently during fuel cycle 1. Further, MP&L intends to provide similar provisions for fuel cycle 2. Therefore, MP&L requests that your review be complete by July 14, 1986, in order to support cycle 1 operations and the reload licensing effort.



Add: NRR/DSRO RSIB ltr Encl
RGN 2/DRSS/EPRPB
RM/DDAMI/MIB

A001 w/check $150.00
3/40 # 03-0005

In accordance with the provisions of 10 CFR 50.30, three (3) signed originals and forty (40) copies of the requested amendment are enclosed. The attachment provides the complete technical justification and discussion to support the requested amendment. This amendment has been reviewed and accepted by the Plant Safety Review Committee (PSRC) and the Safety Review Committee (SRC).

Based on the guidelines presented in 10 CFR 50.92, it is the opinion of MP&L that this proposed amendment involves no significant hazards considerations.

In accordance with the requirements of 10 CFR 170.21, we have determined that the application fee is $150. A remittance of $150 is attached to this letter.

Yours truly,

ODK:dmm
Attachments: GGNS PCOL-86/05

cc: Mr. T. H. Cloninger (w/a)
Mr. R. B. McGehee (w/a)
Mr. N. S. Reynolds (w/a)
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State Board of Health
Box 1700
Jackson, Mississippi 39205

REMITTANCE ADVICE

CHECK DATE 03/04/86 VENDOR U S NUC REG COMM VENDOR NUMBER 929958 CHECK NO. 03-0005

| INVOICE DATE | PURCHASE ORDER NO. | INVOICE NUMBER / DESCRIPTION | VOUCHER NUMBER | GROSS AMOUNT | DISCOUNT | NET AMOUNT |
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AECM-86/0092

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Jackson, Mississippi 39205

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MIDDLE SOUTH ENERGY, INC.
P.O. BOX 1640 • JACKSON, MISSISSIPPI 39205
JOINT ACCOUNT

CHECK NO. 03-0005

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PAY

TO THE ORDER OF

U.S. NUCLEAR REGULATORY
COMMISSION
WASHINGTON, DC 20555

SIGNED BY

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BEFORE THE

UNITED STATES NUCLEAR REGULATORY COMMISSION

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LICENSE NO. NPF-29

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DOCKET NO. 50-416

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IN THE MATTER OF

MISSISSIPPI POWER & LIGHT COMPANY
and
MIDDLE SOUTH ENERGY, INC.
and
SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION

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## AFFIRMATION

I, O. D. Kingsley, Jr., being duly sworn, stated that I am Vice President, Nuclear Operations of Mississippi Power & Light Company; that on behalf of Mississippi Power & Light Company, Middle South Energy, Inc., and South Mississippi Electric Power Association I am authorized by Mississippi Power & Light Company to sign and file with the Nuclear Regulatory Commission, this application for amendment of the Operating License of the Grand Gulf Nuclear Station; that I signed this application as Vice President, Nuclear Operations of Mississippi Power & Light Company; and that the statements made and the matters set forth therein are true and correct to the best of my knowledge, information and belief.

O. D. Kingsley, Jr.

STATE OF MISSISSIPPI
COUNTY OF HINDS

SUBSCRIBED AND SWORN TO before me, a Notary Public, in and for the County and State above named, this 31st day of March, 1986.

(SEAL)

Notary Public

My commission expires:

October 27, 1987

SUBJECT: NLS-86/05

Technical Specifications Changes required for Stability Surveillance and Single Loop Operation (SLO) affect the following pages:

| | | |
|---|---|---|
| 1. | Index | Pages v, xiii |
| 2. | Specification 2.1.2 | page 2-1 |
| 3. | Table 2.2.1-1, Item 2.b.1) | page 2-4 |
| 4. | Bases 2.0 | page B 2-1 |
| 5. | Bases 2.1.2 | page B 2-2 |
| 6. | Table B 2.1.2-1 | page B 2-3 |
| 7. | Specification 3/4.2.1 | page 3/4 2-1 |
| 8. | Figure 3.2.1-1 | page 3/4 2-2 |
| 9. | Figure 3.2.1-2 (new) | page 3/4 2-2a |
| 10. | Specification 3.2.2 | page 3/4 2-3 |
| 11. | Table 3.3.6-2 Item 2.a | page 3/4 3-55 |
| 12. | Specification 3/4.3.10 (new) | page 3/4 3-111, 112 |
| 13. | Specification 3/4.4.1.1 | page 3/4 4-1 |
| 14. | Figure 3.4.1.1-1 (new) | page 3/4 4-1a |
| 15. | Surveillance Requirement 4.4.1.2.1 | page 3/4 4-2 |
| 16. | Specification 3.4.1.3 | page 3/4 4-3 |
| 17. | Bases 3/4.1.3 | page B 3/4 1-2 |
| 18. | Bases 3/4.2.1 | page B 3/4 2-1,2 |
| 19. | Bases 3/4.2.2 | page B 3/4 2-2 |
| 20. | Bases Table B 3.2.1-1 | page B 3/4 2-3 |
| 21. | Bases 3/4.2.3 | page B 3/4 2-4,6 |
| 22. | Bases 3/4.2 References | page B 3/4 2-7 |
| 23. | Bases 3/4.3.10 (new) | page B 3/4 3-7 |
| 24. | Bases 3/4.4.1 | page B 3/4 4-1 |

DESCRIPTION OF CHANGES: The Technical Specification changes to address GE's recommended increased core stability surveillance guidelines, and to allow Single Loop Operation (SLO), are described below.

1. Index: reflect addition of new specification and bases.

2. Specification 2.1.2: increase the MCPR Safety Limit by 0.01 for single loop operation, and in the ACTION statement change '1.06' to 'the applicable limits'. (Page 2-1)

3. Table 2.2.1-1, Item 2.b.1: Add new APRM setpoints for SLO. (Page 2-4)

4. Bases 2.0: replace the value for MCPR with the term 'Safety Limit'. (Page B 2-1)

5. Bases 2.1.2: provide reference for new uncertainties (Page B 2-2).

6. Table B 2.1.2-1: add footnotes to increase the Core Total Flow and TIP Reading uncertainties during single loop operation. (Page B 2-3)

7. Specification 3/4.2.1: designate Figure 3.2.1 for two loop operation, refer to Figure 3.2.1-2 for SLO, and replace the reference to Figure 3.2.1-1 with reference to the applicable limit in the ACTION statement and surveillance. (Page 3/4 2-1)

8. Figure 3.2.1-1: revise title to specify applicability to two loop operation (Page 3/4 2-2)

9. Figure 3.2.1-2: add MAPLHGR curve representative of SLO. (Page 3/4 2-2a)

10. Specification 3.2.2: Add new formulae to modify APRM setpoints for SLO. (Page 3/4 2-3)

11. Table 3.3.6-2: Add new formulae to modify APRM setpoints for SLO. (Page 3/4 3-55)

12. Specification 3/4.3.10: add a new Specification on Neutron Flux Monitoring Instrumentation. (Page 3/4 3-111, 3-112)

13. Specification 3/4.4.1.1: designates this specification is applicable to one and two loop operation, delete ACTION statement (a), and revise ACTION b to refer to new Figure rather than Fig B 3/4 2.3-1 and add ACTIONs and surveillance requirements to address the revised LCO. (Page 3.4 4-1)

14. Figure 3.4.1.1-1: add a new curve of the 80% Rod Line Core Thermal Power vs. Core Flow. (Page 3/4 4-1a)

15. Surveillance Requirement 4.4.1.2.1: revise requirements to reflect single loop operation. (Page 3/4 4-2)

16. Specification 3.4.1.3: add a clause that the specification applies to two loop operation; change the Action statement to refer to Specification 3.4.1.1 for single loop operation, and incorporate option to go to hot shutdown. (Page 3/4 4-3)

17. Bases 3/4.1.3: delete the value of 1.06, and replace with reference to the Safety Limit and correct typographical error. (Page B 3/4 1-2)

18. Bases 3/4.2.1: distinguish between one and two loop operation MAPLHGR limits, and add reference to analysis for SLO LOCA. (Page B 3/4 2-1,2)

19. Bases 3/4.2.2: delete '1.06' and replace with a reference to the 'Safety Limit'. (Page B 3/4 2-2)

20. Bases Table B 3.2.1-1: add a note to state that the single loop Appendix K analysis assumed rapid departure from nucleate boiling regardless of the initial MCPR. (Page 3/4 2-1)

21. Bases 3/4.2.3: replace the specific value of the MCPR with 'Safety Limit', add a reference for the transient analysis initial conditions for single loop operation, and add a statement that the operating limit MCPRs do not change. (Page B 3/4 2-4,6)

22. Bases 3/4.2 References: add reference to GE Final Report "GGNS Reactor Performance Improvement Program, Single Loop Operation", February, 1986, and to GE NEDO-20566-2, July, 1978. (Page B 3/4 2-7)

23. Bases 3/4.3.10: add a new Bases section for the new Specification 3/4.3.10 on Neutron Flux Monitoring Instrumentation. (Page B 3/4 3-7)

24. Bases 3/4.4.1: replace the first paragraph with criteria for single loop operation, clarify the applicability of recirculation loop flow mismatch limits in the second paragraph to two recirculation loop operation, provide basis for verifying jet pump operability in an inactive loop, and permission to operate in the single loop recirculation mode. (Page B 3/4 4-1)

DISCUSSION: The attached proposed changes will be utilized to implement GE recommendations of increased stability surveillance. These recommendations have been demonstrated to provide a suitable means of detecting and suppressing neutron flux oscillations prior to exceeding fuel design limits. Also included are changes to accommodate single recirculation loop operation. SLO is related to the stability changes in that SLO involves operation in that area of the power/flow operating map which is considered to be a region of potential core instability.

These proposed changes are submitted for NRC review in advance of proposed changes to accommodate GGNS operation in the Maximum Extended Operating Domain (MEOD). It is MP&L's intent, however, to implement both sets of changes concurrently. That is, upon NRC approval of both this core stability/single loop operation change request, and the forthcoming MEOD change request, MP&L will implement these proposed changes.

The objective of the GGNS plant and fuel design is to provide stable operation with margin over the normal operating domain. However, at the high power/low-flow corner of the operating domain, a small probability of limit cycle neutron flux oscillations exists depending on the combination of operating conditions (e.g., rod pattern, power shape). Neutron flux oscillations are characterized by the decay ratio which is a measure of system stability.

The decay ratio of an oscillatory response, such as neutron flux noise, is defined as the ratio of two consecutive peaks which are both on the same side (i.e., above or below) of the average value of the oscillatory parameter. For a decay ratio less than 1.0, the system is damped and the oscillatory response decays. For a decay ratio greater than 1.0, the system is undamped and the oscillations increase in magnitude. When the decay ratio is equal to 1.0, limit cycle response is achieved (i.e., the oscillations remain at a constant magnitude). A stable system, then, is one for which the decay ratio is less than or equal to one.

GE, using actual operating plant test data, has demonstrated that limit cycle oscillations can be observed using the neutron monitoring system. Based upon this data GE formulated recommendations regarding operation in the low-flow, high-power region of the power-flow operating map. The recommendations, issued in Service Information Letter (SIL)-380, Revision 1, dated February 10, 1984, defined a region where increased monitoring of potential oscillations is recommended. The region of increased surveillance is that above the 80% rod line with flow less than 45% of rated flow.

In the Safety Evaluation Report (SER) of GE's NEDE-24011, "General Electric Standard Application for Reactor Fuel", the NRC accepts GE's stability criteria for plants using GE fuels and implementing the intent of SIL-380 recommendations. Included in the Staff Position is the exemption of fuel reloads which meet these two criteria from the requirement of a cycle-specific stability calculation. The NRC acceptance of the GE stability criteria explicitly covers single loop operation mode.

Single loop operation capability provides increased operational flexibility. As noted above, the NRC acceptance of GE detect and suppress recommendations explicitly addressed the single loop operation (SLO) flow region. The attached proposed technical specifications also include the necessary revisions to permit single loop operation at GGNS. In support of these changes, GE has evaluated the FSAR accident and abnormal operational transient scenarios considering only one pump in operation. The GGNS Single Loop Operation Analysis is provided as an attachment to this request.

JUSTIFICATION: Thermal hydraulic stability over the entire range of the power-flow operating map has been demonstrated on a generic basis in GE Report NEDE-24011. Based on increased operator awareness of the flux oscillation behavior during various modes of operation and on the fact that the abnormal oscillations can be suppressed by operator action, criteria for compliance with 10CFR50 Appendix A, GDC 12 have been established. These criteria evolved from analysis work and operating plant test data which have shown that limit cycle flux oscillation can be suppressed without fuel design limits being exceeded.

GE has provided guidance in their SIL-380 to better assure increased operator awareness of abnormal flux oscillations and how to control them. The proposed increased surveillances represent additional requirements on plant operation. Implementation of these guidelines will assure that core stability is maintained during operation. This assurance of stable flux operation is assumed in the analyses of both single loop operation and two loop operation in the Maximum Extended Operating Domain (MEOD). Changes to reflect MEOD requirements will be submitted separately. In addition, implementation of these guidelines prepares GGNS for the utilization of approved generic stability acceptance criteria in addressing GDC 12 for future cycles.

In order to ensure fuel integrity in the event of operational transients, thermal performance operating limits have been established. The mechanisms which could lead to violation of fuel integrity are:

(a) severe overheating due to inadequate cooling, and

(b) stress due to pellet-cladding interaction.

These mechanisms are precluded by the Minimum Critical Power Ratio (MCPR) and the Maximum Average Planar Linear Heat Generation Rate (MAPLHGR). Analyses of single loop operation have revised the applicable limits in order to maintain the margin to safety. The revised limits are included in the attached proposed changes.

Additional justification of the changes to support single loop operation is provided by an analysis of the FSAR accident and transient scenarios attached to this submittal. A summary of the results of this analysis is provided below:

- The MCPR safety limit increases during SLO due to increased uncertainties but the MCPR operating limit does not change. The effects of transients initiated during single loop operation are less severe than those which occur during two loop operation. This is due primarily to the reduced initial power level assumed in the transient analyses. These analyses have demonstrated that even though the MCPR fuel cladding integrity safety limit is higher, there is sufficient MCPR margin in the existing operating limits to assure safe operation.

- Appendix K (LOCA) large break analyses of single loop operation result in a more severe peak clad temperature (PCT). The MAPLHGR limits have been reduced in order to maintain PCT below 10CFR50.46 limits. As noted in the attached GE analysis, the decreased MAPLHGR limits are equivalent to a 300°F - 500°F decrease in PCT. The SLO small break analysis resulted in an increase in PCT of about 50°F; the reduced MAPLHGR limits developed from the large break analysis overwhelmingly offset the small increase in PCT due to the small break.

- While the least stable operating condition occurs at high power and low flows, stability compliance criteria are still met during SLO.

- The containment analysis demonstrated that peak wetwell and drywell pressures, chugging loads, condensation oscillation and pool swell load are bounded by the rated power (two loop) analysis results.

- Operation with a single recirculation loop results in a maximum power output which is approximately 30% below that attainable during two loop operation. All FSAR transients have been reviewed for impact of SLO. Impacted transients have been reanalyzed. The consequences of single loop transients are bounded by the full-power (two loop) analysis results.

- ATWS and Fuel Mechanical Performance have been considered and the evaluations indicate SLO is bounded by results of two loop operation.

- Vessel internal vibration was also evaluated. Based on test data from GGNS, SLO vibration levels are within acceptable limits. Final GGNS test data was transmitted per Operating License Condition 2.C.(9), on February, 22, 1986 in letter AECM-86/0054. As noted in the attached analysis, an evaluation of other BWR/6 vibration test data support the GGNS-specific findings.

A detailed justification of each proposed change is provided below.

1. INDEX

An administrative change is made to reflect the addition of a new specification and its bases.

2. 2.0 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS SPECIFICATION 2.1.2, THERMAL POWER, HIGH PRESSURE AND HIGH FLOW

Except for the core total flow and the Traversing In-core Probe (TIP) reading, the uncertainties used in the statistical analysis to determine the MCPR fuel cladding integrity safety limit are not dependent on whether coolant flow is provided by one or two recirculation loops. The core flow uncertainty analysis results in an increased uncertainty, as does the uncertainty analysis for TIP readings, for single loop operation. These increased uncertainties result in an incremental increase of 0.01 in the MCPR fuel cladding integrity safety limit for single loop operation, as shown in section 15.C.2 in the attached G.E. analysis.

3. Table 2.2.1-1 REACTOR PROTECTION SYSTEM (RPS) INSTRUMENTATION SETPOINTS

2.b.1) Flow Biased Simulated Thermal Power - High Flow Biased

During normal two loop operation, total core flow varies characteristically with the total of the recirculation pump flows, particularly at high flow conditions. For this reason, the total pump flow is used in the APRM flow biased setpoint as a good estimate of total core flow. However, single loop operation at high flow rates results in backflow through the 12 jet pumps in the inoperable loop. Because of the backflow through the inactive loop jet pumps, the characteristic correlation between total core flow and single loop pump flow is altered.

A correction factor has been established for the equations for the RPS simulated thermal power flow biased trip setpoint and allowable value to account for the new relationship between core flow and pump flow, as described in the attached GE analysis on pages 15.C.3-8 and -9. The correction factor is a constant. This value was measured during the GGNS Startup Test Program and determined to be 12.3% of rated core flow. When applied in the equations, it conservatively lowers the trip setpoint and allowable value. The change adds new formulae which have incorporated the single loop operation correction factor for the setpoints.

This modification maintains the same scram versus power relationship with one loop in operation as with two loops in operation.

While the setpoints have been reduced for single loop operation the high flow clamp need not change. The clamp is utilized to maintain a constant margin over operation at 100% of RATED POWER. The clamp need not be reduced because 100% power is unattainable during single loop operation.

4. BASES 2.0 INTRODUCTION

The changes here generalize the discussion by referring to the Safety Limit in lieu of its specific value. This change does not affect the intent of the Bases.

5. BASES 2.1.2

The change adds a reference for the SLO analyses to complement the existing discussion.

6. BASES TABLE B 2.1.2-1

The core total flow uncertainty is increased in single loop operation because of larger uncertainties associated with core flow measurement when backflow occurs through 12 of the 24 jet pumps, as discussed in section 15.C.2.1 of the attached analysis. The footnote reference (a) indicates that the uncertainty for core total flow increases from 2.5% to 6.0% for single loop operation.

There is an additional increase in TIP reading uncertainty associated with single-loop operation due to an increase in random noise in the core as discussed in section 15.C.2.2 of the attached analysis. Footnote (b) identifies the increase from 6.3% to 6.8% for single-loop operation, as discussed in section 15.C.2.2 in the attached analysis.

The procedure for determining core flow uncertainty for single loop operation is similar to that utilized for the two loop uncertainty analysis. During SLO, however, there is an additional term for the inactive loop true flow. The methodology is described in Section 15.C.2.1.2 of the attached report.

The revised TIP noise uncertainty was derived based on a test performed at an operating BWR. The test was performed during single loop operation. The uncertainty evaluation is described in Section 15.C.2.2 of the attached report.

7. 3.2.1 POWER DISTRIBUTION LIMITS - APLHGR

This specification is revised to designate the existing Figure 3.2.1-1 is applicable to two-loop operation. A new figure reference, Figure 3.2.1-2, is added to reflect single loop operation limits. In the attached analysis of single loop operation, it was determined that the MAPLHGR limits should be reduced by a factor of 0.86 in order to maintain the margin to safety for single loop operation. The lower limits are provided in the new Figure.

The LOCA analysis which was performed to determine the original two loop operation MAPLHGR limits utilized an assumed recirculation pump trip coastdown time constant of 4 seconds. When test data obtained during startup indicated actual coastdown time constants of less than 4 seconds, a new analysis was performed (AECM-85/138). This new bounding analysis considered a coastdown time constant of 3 seconds and demonstrated the original limits are still applicable. This conclusion is also applicable to the single loop MAPLHGR values based on the conservative method used to establish the reduction factor.

The changes to the ACTION and SURVEILLANCE REQUIREMENTS are editorial in nature and will simplify future administration of the technical specifications should new MAPLHGR figures be needed.

8. FIGURE 3.2.1-1

The title of the figure is revised to reflect application of the curves to two loop operation in accordance with the bases by which they were established. This change distinguishes the curves from item 9 below.

9. FIGURE 3.2.1-2

A new figure is added to reflect the SLO LOCA analyses results. The similarities between the one and two loop analyses permit the use of a generic alternate procedure described in NEDO-20566-2 to calculate SLO MAPLHGR limits. A reduction factor of 0.86 was determined as described in section 15.C.5 of the attached analysis. These curves are 0.86 times the two loop MAPLHGR values.

10. 3.2.2 POWER DISTRIBUTION LIMITS - APRM SETPOINTS

As discussed in Section 15.C.3.2 of the attached analysis, the APRM rod block system provides alarms and rod blocks when power levels are grossly exceeded. Modification of the APRM rod block equation is required to maintain the two loop rod block versus power relationship when in one loop operation. This modification is accomplished in a manner consistent with the modification to the RPS instrumentation setpoints.

Since the APRM scram trip settings are flow biased in the same manner as the APRM rod block setting, they are subject to the same modification.

11. TABLE 3.3.6-2 CONTROL ROD BLOCK INSTRUMENTATION SETPOINTS

The indicated changes in the APRM flow biased neutron flux settings are consistent with the changes already discussed for the APRM rod block, APRM scram trip settings, and RPS instrumentation setpoints.

12. 3/4.3.10 (NEW SPECIFICATION)

A new specification is added to implement the guidance of SIL-380 to detect and suppress limit cycle power oscillations in the high power/low flow region of the power-flow map. The LCO, APPLICABILITY, ACTION, and surveillance requirements are consistent with the recommendations in SIL-380, revision 1. The region of potential instability is that region above the 80% rod line with core flow less than 45% of rated total core flow.

Section 15.C.4 in the attached analysis describes the GE stability analysis performed for GGNS single-loop operation. The results of this analysis and tests performed at operating plants indicate that the SLO stability characteristics are not significantly different from two-loop operation. Increased flow measurement uncertainties associated with single-loop operation and a tendency toward smaller stability margins at low flows result in a recommendation to also define the region of potential instability for SLO as above the 80% rod line with core flow less than 45% of rated total core flow.

LCO 3.3.10 implements the APRM and LPRM noise level criteria to be used for the detection of possible limit cycle oscillations. Reviews of operating plant data have shown that limit cycle oscillations typically are from 5 to 10 times noise levels in magnitude. The factor of 3 used in the LCO is a conservative value used to implement the SIL-380 recommendations and ensure that limit cycle oscillations will be detected and suppressed.

The applicable operational conditions are defined in the APPLICABILITY statement. For both one and two loop operation, the proposed surveillance region is defined as above the 80% rod line with core flows less than 45% of rated core flow but greater than 39% of rated core flow (Region I of Figure 3.4.1.1-1). This region has been identified in the SIL-380 as one of potential instability.

The ACTION statement indicates that if APRM/LPRM noise levels are exceeded then corrective action must be initiated within 15 minutes to restore noise levels to within limits within 2 hours. This corrective action may include increasing flow or reducing power to exit the region of potential instability. Two hours are permitted to bring the noise to within limits because operational changes made during this time will be in a more conservative direction. This period provides time to make a change in reactor state and allow the system to stabilize prior to making subsequent comparisons with the limits. If noise levels cannot be restored within 2 hours by power or flow changes within the region then THERMAL POWER must be reduced below the 80% rod line or flow increased to greater than 45% of rated core flow within the following 2 hours.

The ACTION statement includes a requirement that, in the event APRM/LPRM baseline data do not exist when the surveillance region is entered, action be immediately initiated to reduce THERMAL POWER or increase flow in order to exit the surveillance region. This effectively prohibits operation in the surveillance region if stability cannot be comparatively evaluated.

The asterisked note at the bottom of the page is provided to establish the recommended noise monitoring. In SIL-380, GE has recommended that LPRMs representing each octant of the core and the core center be monitored.

Surveillance 4.3.10.1 implements the APRM/LPRM monitoring requirements necessary for power operation in the surveillance regions defined in the APPLICABILITY statement. The surveillance is to be performed within 2 hours of entering the region. This initial surveillance is required shortly after entering the region to provide assurance that the stability condition is known. The length of the period is selected to provide adequate time to obtain the information. The surveillance must also be performed once every 8 hours while in the applicable operational condition and within 30 minutes after the completion of any THERMAL POWER increase of at least 5% of rated THERMAL POWER. The 8 hour time limit is chosen to correspond to nominally once per operating shift while in a relatively steady state condition. If no thermal hydraulic oscillations are detected during a given surveillance and the reactor state is not changed significantly, no significant changes in noise level would be expected; this requirement makes each shift aware of the noise levels. Surveillance 4.3.10.1.c is included in order to detect potential instabilities associated with a change of reactor state. The 5% increase in THERMAL POWER is selected as a reasonably small change of reactor state during operation in this region. The 30 minutes time limit is chosen in this case as a reasonable amount of time to perform the actual monitoring.

Surveillances 4.3.10.2 and 4.3.10.3 address the establishment of the baseline noise levels for two loop and single loop operation, respectively. This baseline is needed only to support operation in the applicable regions of potential instability. Thus the "interval" is prior to operation in the region since the last core alteration. As an alternate to establishing single loop noise baseline levels the operator is given the option of utilizing the two loop baseline data for comparison during single loop operation in the region. As discussed in Section 15.C.4.1 of the attached analysis, stability characteristics of single loop operation and two loop operation are not significantly different. At low core flows, single loop operation may be slightly less stable. At higher core flows, with substantial reverse flow through the inactive loop jet pumps, there will be higher system noise. Generally, then, for a given flow rate, the noise levels are higher during single loop operation than during two loop operation. The use of the two loop data, then, provides a conservative comparison.

13. 3.4.1.1 REACTOR COOLANT SYSTEM - RECIRCULATION SYSTEM, RECIRCULATION LOOPS

This Specification is modified to permit operation with either one or two loops operating. The LCO is expanded to address operation while one recirculation loop is out of service. This specification is based on and justified by the General Electric analysis of single loop operation provided as an attachment to this change request. In this analysis, the LOCA and limiting transients were evaluated based on the initial condition of one loop in operation. Based on these evaluations various changes to the two loop operation technical specification requirements were needed in order to maintain the margin of safety.

The proposed LCO clearly addresses itself to both one and two loop operation and refers to the following requirements which are to be varied depending on the recirculation system configuration:

a) MCPR Safety Limit - the GE analysis demonstrates that increased uncertainties in core flow and Traversing Incore Probe readings necessitate an increase in the Safety Limit during two loop operation.

b) APRM Flow-Biased Scram and Rod Block Setpoints - the dependence of these setpoints on flow in conjunction with a change in the relationship between loop flow and total core flow during single loop operation, dictate the setpoints be corrected for single loop operation. This correction factor has been addressed in the justification for each of the referenced specifications.

c) MAPLHGR Limits - the LOCA analysis results for one- and two-loop operation are similar and the accepted generic methodology to compute the reduction factor is based on maintaining the margin of safety. For GGNS the most-limiting SLO reduction factor is 0.86. This factor was utilized in the development of Figure 3.2.1-2; the curves of Figure 3.2.1-1 were reduced by the 0.86 factor and the results plotted on Figure 3.2.1-2.

The LCO also includes requirements to have the loop flow control in the manual mode during single loop operation. The flow control mode requirement restricts control system instabilities which could lead to excessive valve wear and also prevents inadvertent movement of the valve in the active loop into the cavitation region.

The LCO also restricts the volumetric loop flow rate during single loop operation. The selected limit was determined based on startup testing during high flow single loop operation. The test demonstrated reactor vessel internals vibration was acceptable in this flow regime. This limit is imposed to ensure vessel internal vibration remains within acceptable limits. This limit is further justified in Section 15.C.7.3 of the attached analysis.

The LCO also addresses a stability related concern. In accordance with the recommendations of GE SIL-380, operation above the 80% rod line and less than 39% core flow is prohibited. The stability characteristics for various power-flow relationships have been generically evaluated by GE based on analyses and operating plant test data. It has been determined, based on these evaluations, that a low flow limit of operation of 39% of rated core flow effectively avoids a region of near imminent instability.

For operation above the 80% rod line with flow between 39% and 45% of rated core flow, the increased surveillance proposed in Specification 3.3.10 permits suppression of any potential instabilities. The restricted region, then, is represented as Region IV of Figure 3.4.1.1-1.

The original ACTION statement 3.4.1.1.a has been deleted. Single loop operation has been analyzed as discussed in the attached report and found to be acceptable. The revised technical specification changes governing single loop operation are now included in the LCO. Therefore, an ACTION statement is not needed to address single loop operation.

The original ACTION statement 3.4.1.1.b is modified to provide reference to a figure which more clearly presents the limit. This is an editorial change performed to provide the operator with a clear representation of the 80% rod line. This rod line is not explicitly provided on the currently referenced figure. This ACTION statement addresses no loops in operation and is now ACTION 3.4.1.1.c.

The new ACTION statements 3.4.1.1.a and b are established to assure that vessel vibration remains within limits and the flow control is in the manual mode during single loop operation. These statements require quick action to correct operation outside the LCO.

The new ACTION 3.4.1.1.d is added to ensure that, if operating in a region where the cold water in the vessel bottom head is not being swept through the core, vessel thermal cycle limits are met. The differential temperature criteria are provided in the referenced SURVEILLANCE. The intent is to restrict power and flow increases which may cause the cold coolant to be circulated. This requirement will prevent thermal shock of the vessel nozzles and undue thermal stress on the vessel.

These limits are the same differential temperature criteria invoked by Technical Specification 3.4.1.4. The bases for 3.4.1.4 apply here also. An addition to the bases is made to note the applicability during single loop operation. During single loop operation, which is now permitted by the proposed changes, there may be insufficient circulation in the core at low active loop flows to meet the differential temperature criteria. Therefore, the restrictions are imposed to prevent undue thermal stress on the vessel and nozzles when power or flow increases force the cold bottom head coolant to circulate.

The new ACTION 3.4.1.1.f is added to address the LCO restriction regarding the limits and setpoints which are dependent on the recirculation system configuration. The action statement provides a 12 hour time period in which to adjust the affected setpoints and limits following an operational configuration change. If the change is not complete in 12 hours, the associated equipment is declared inoperable or the appropriate limits are declared "not satisfied". This declaration prompts entry into an ACTION statement of the appropriate referenced specification. For a change to single loop operation, the affected values are conservatively reduced. For the change to two loop operation, the restrictions may be relaxed to provide more operating flexibility within the original safety evaluations. The 12 hour time period is somewhat longer than the time allowed for APRM adjustments made per Specification 3.2.2. The additional time is needed because the required effort is much more complex - physically and administratively. The adjustment required in 3.2.2 is implemented by revising the gain settings. The adjustment required here, however, is an actual revision of the setpoint. This involves removing equipment from service and the completion of associated management approvals and documentation.

The new action 3.4.1.1.e is added to address the LCO restriction regarding operation in Region IV of Figure 3.4.1.1-1. In accordance with the GE recommendations of SIL-380, operation in this region should not be permitted. The region should be exited by either a power decrease or flow increase.

Surveillance requirements 4.4.1.1.1 and 4.4.1.1.2 are revised to accommodate operation with one loop out of service. Two new surveillances 4.4.1.1.3 and 4.4.1.1.4 are added to provide for regular verification of compliance with the new single loop operation LCO.

The new surveillance 4.4.1.1.5 is required in conjunction with ACTION 3.4.1.1.d to prevent thermal shock of the vessel. Based on GGNS startup test data, it was determined that the bottom head was swept during natural circulation conditions at power levels as low as 36% of rated. Similarly, test data demonstrate that the bottom head was swept by all single loop flow rates when the operating recirculation pump was on high speed operation. A conservatively broad condition, then, has been defined as less than 36% power and the recirculation pump not on high speed operation. Beyond these limits coolant circulation in the vessel will provide the assurance that the differential temperatures are maintained within acceptable limits.

The new surveillance 4.4.1.1.6 is provided to ensure the setpoints and limits are revised within a reasonable time, following a configuration change in the number of recirculation loops in operation. The time requirement is established consistent with surveillances 4.2.1.b and 4.2.2.b which require the verification of the limit within 12 hours following a power increase or during operation which may affect the limit. Further, the 12 hours is consistent with the previous ACTION statement for one loop out of service (i.e., 3.4.1.1.a). An operating change to single loop operation necessitates a reduction in the limits and setpoints. The surveillance ensures the changes are made to preserve the margin of safety provided by the APLHGR limits and to maintain the same APRM setpoints-to-power relationship. For an operating change to two loop operation, the surveillance addresses an operational concern: the limits and setpoints maybe increased to provide less restriction than was needed during single loop operation.

14. FIGURE 3.4.1.1-1 Thermal Power Limits

A new figure is provided to conveniently show the GGNS 80% rod line in order to clearly define the surveillance regions. This figure is also referenced in Specification 3/4.3.10.

15. 4.4.1.2.1 REACTOR COOLANT SYSTEM JET PUMPS

Jet pump operability is assumed in the LOCA analyses for both two loop and single loop operation. However, the criteria for demonstrating operability has been developed considering the drive flow provided by the recirculation pumps. During single loop operation at GGNS, startup testing has demonstrated that flow through the inoperable loop jet pumps is dependent upon the drive flow in the operating loop. When the operating loop flow is high, flow through inoperable loop jet pumps is in the reverse direction. At lower operating loop flow rates, however, natural circulation becomes the dominant influence on the inoperable loop jet pumps and the flow through these jet pumps reverts back to the normal forward flow. Based on this change in direction of flow through the inactive loop jet pumps there is a range over which the flow is nearly zero; this is indicative of a differential pressure across the pump of nearly zero. Because of this, the existing criteria for operability do not provide a reliable demonstration of the operability of the jet pumps in an inactive loop.

A review of the Nuclear Plant Reliability Data System (NPRDS) identified nine jet pump failures. Five of the nine failures occurred at Millstone 1 and are attributed to intergranular stress corrosion cracking (IGSCC). Three occurred at Dresden 3 and the other at Dresden 2; these are attributed to weld problems, possibly due to fatigue. General Electric has reviewed the impact of single loop operation on jet pump operability. The loads due to reverse flow are expected to be within design limits. Vibration during single loop operation, as demonstrated during start-up testing at GGNS, has been shown to be acceptable.

16. 3.4.1.3 RECIRCULATION LOOP FLOW

The LCO is changed to reflect that recirculation loop flow mismatch is only of concern when both recirculation loops are in operation. In the attached analysis, GE provides the results of their analysis of single loop operation justifying single loop operation is safe. Therefore, flow mismatch criteria which are not applicable with only one loop operating, are explicitly excluded during single loop operation.

This analysis evaluated the substantial reverse flow during SLO and its impact on APRM noise and core plate differential pressure. Within the limits identified in Specification 3.4.1.1, single loop operation was found to be acceptable. Loop flow mismatch is not applicable to single loop operation.

The ACTION statement is modified to require either the shutdown of a recirculation loop or shutdown of the plant, in the event loop flow mismatch cannot be corrected. The intent of specification 3.4.1.3 has not been changed. The option of being in HOT SHUTDOWN, which had been provided by the reference to the ACTION of 3.4.1.1, has been retained in the new ACTION 3.4.1.1.b. The option of single-loop operation allows greater operational flexibility in the event that recirculation loop flow mismatch cannot be readily corrected.

17. BASES 3/4.1.3

The specific value of 1.06 is changed to "the safety limit" since the value itself may change from cycle to cycle, but how the value is used will not change. This change will improve administration of the technical specification without affecting the intent. In addition an editorial change is made to correct the spelling of 'systematic'.

18 BASES 3/4.2.1

A statement referring to the single-loop LOCA-ECCS analysis is added, indicating the source of the MAPLHGR reduction factor required for single-loop MAPLHGR limits, as previously discussed. The specific reference is added as number 6 on page B 3/4 2-7. A discussion of the single loop APLHGR limits and reference to Bases Table B 3.2.1-2 is also added.

19. BASES 3/4.2-2

The value of 1.06 is replaced by "Safety Limit" again, as in Bases 3/4.1.3 above.

20. BASES Table B 3.2.1-1

The generic analysis of a LOCA initiated from single loop operation is described in the GE report NEDE-20566-2, dated July, 1978. The assumptions made in these analyses are similar to those made in the two loop analyses except with respect to the initial MCPR. For the single loop analyses it is assumed that departure from nucleate boiling occurs 0.1 seconds after the LOCA regardless of the initial MCPR. The change to the table incorporates this distinction and the information in the table is now representative of both the one and two loop analyses.

21. BASES 3/4.2.3

The specific values "of 1.06" are eliminated for editorial purposes only. The actual value may change from cycle to cycle, but the concept and use of the Safety Limit MCPR will not change. References to the single loop evaluation area added for completeness to justify SLO.

22. BASES 3/4.2 References

A reference (#5) is added to the attached GE single loop analysis. The actual reference appears on page B 3/4 2-7 as number 5. A reference (#6) is added to the GE Appendix K analysis for single loop operation.

23. BASES 3/4.3.10 - NEW

A basis for the new technical specification is added. The basis describes the background and justification for the limits and parameters used in the specification.

24. BASES 3/4.4.1

The existing bases discussion was revised to reflect single loop operation which is incorporated in the proposed technical specifications. The revision provides reference to the safety limit and setpoint changes which were needed in order to justify single loop operation.

SIGNIFICANT HAZARDS CONSIDERATION:

Implementation of the increased stability surveillances will assure that limit cycle oscillation is detected and suppressed.

The increased surveillance in the low-flow high power region of the operating map also provides assurance that single loop operation can be performed safely. In addition to the stability surveillance technical specification changes, evaluation of the accident and transients scenarios considering single loop operation have resulted in revisions to various setpoints and the MCPR safety limit. These changes are made to maintain the same margin of safety during single loop operation as during two loop operation.

The proposed changes to the operating license do not involve:

1) A significant increase in the probability or consequences of previously evaluated accidents.

   The added stability surveillance is an increase in technical specification requirements and has no impact on the consequences or probability of evaluated accidents.

   The changes made for single loop operation do not increase the probability of any evaluated accidents because plant equipment and systems operate within their design limits. In addition, evaluation of accident and performance analyses have been performed considering the single loop operation:

   - Appendix K (large break LOCA) analyses for single loop operation result in a more severe peak clad temperature (PCT). The MAPLHGR limits have been reduced in order to maintain PCT below 10CFR50.46 limits. As noted in the attached GE analyses the decreased MAPLHGR limits are equivalent to a 300°F - 500°F decrease in PCT. The SLO small break analyses resulted in an increase in PCT of about 50°F; the reduced MAPLHGR limits developed from the large break analysis overwhelmingly offset the small increse in PCT due to the small break.

- The Containment response for a Design Basis Accident with single loop operation is bounded by the rated power, two-loop operation analysis presented in FSAR Section 6.2. As presented in the GE analysis, the differential peak drywell and wetwell pressures of 19.8 psig and 6.3 psig, respectively are less than the 22 psig and 9.9 psig results noted in FSAR Section 6.2.

- All ATWS acceptance criteria are met during single loop operation. Because the initial power-flow condition is less during SLO than during rated power the transient response is less severe.

- A conservative evaluation of the incorrect startup of the idle loop recirculation pump is described in Section 15.4.4 of the FSAR.

- The APRM flow-biased scram and rod block setpoints are modified to account for reverse flow through the inactive loop jet pumps. The flow is in a reverse direction when the operating loop is producing high flow rates. The APRM equations, however, were conservatively modified considering reverse flow over the range of single loop flows. The modification maintains the drive flow versus power relationship during single loop operation as was provided during two loop operation.

- Fuel thermal and mechanical duty for transient events occurring during SLO is bounded by the fuel design bases. Reverse flow through the jet pumps in the inactive loop cause increased noise (APRM flux noise and core plate differential pressure noise). Both of these sources of noise, however, were analyzed and the results are within the fuel mechanical limits.

On the basis of these evaluations it is found that single loop operation does not increase the consequences of previously evaluated accidents.

2) The creation of a new or different accident from those evaluated in the FSAR.

   The increased surveillance requirements are intended to heighten operator awareness of stability and do not require any change to plant design or operation. The remedial actions to suppress thermal-hydraulic instability involve normal plant operating practices. Therefore, no new or different accident is created by these stability surveillance changes.

Single loop operation has been evaluated as described in the attached GE analysis. As noted above, the FSAR accident and transient analyses were evaluated with the initial condition of single loop operation. The idle recirculation pump start transient was analyzed in the FSAR. There is no change to the plant design required to accommodate single loop operation. No new or different accidents are created by single loop operation.

3) A significant reduction in the margin of safety.

The stability surveillance is an increase in requirements and increases the margin of safety by assuring thermal-hydraulic instabilities are detected and suppressed. These requirements are invoked when operating in regions of potential instability. They represent new requirements on two loop operation in the region and are also applied to single loop operation which is proposed in this request.

The changes in setpoints and safety limits to address single loop operation are derived from analyses of this operation. The revised values are established so as to maintain the margin of safety available during two loop operation in the single loop operating region. Therefore, there is no reduction in the margin of safety.

## LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS





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INSTRUMENTATION (Continued)





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