

## ATTACHMENT

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## POWER DISTRIBUTION SYSTEMS

### BASES

#### 3/4.2.2 DELETED

#### 3/4.2.3 MINIMUM CRITICAL POWER RATIO

The required operating limit MCPRs at steady state operating conditions as specified in Specification 3.2.3 are derived from the established fuel cladding integrity Safety Limit MCPR, and an analysis of abnormal operational transients. For any abnormal operating transient analysis evaluation with the initial condition of the reactor being at the steady-state operating limit, it is required that the resulting MCPR does not decrease below the Safety Limit MCPR at any time during the transient assuming instrument trip setting given in Specification 2.2.

To assure that the fuel cladding integrity Safety Limit is not exceeded during any anticipated abnormal operational transient, the most limiting transients have been analyzed to determine which result in the largest reduction in CRITICAL POWER RATIO (CPR). The type of transients evaluated were loss of flow, increase in pressure and power, positive reactivity insertion, and coolant temperature decrease. The limiting transient yields the largest delta MCPR. When added to the Safety Limit MCPR, the required minimum operating limit MCPR of Specification 3.2.3 is obtained and presented in the CORE OPERATING LIMITS REPORT.

Analyses have been performed to determine the effects on CRITICAL POWER RATIO (CPR) during a transient assuming that certain equipment is out of service. A detailed description of the analyses is provided in Reference 5. The analyses performed assumed a single failure only and established the licensing bases to allow continuous plant operation with the analyzed equipment out of service. The following single equipment failures are included as part of the transient analyses input assumptions:

- 1) main turbine bypass system out of service,
- 2) recirculation pump trip system out of service,

*Insert Paragraph A*

## **PARAGRAPH A**

References to current equipment out-of-service analyses, as well as descriptions of those equipment out-of-service options which require an adjustment to the operating limit MCPR, are provided in the CORE OPERATING LIMITS REPORT.

## POWER DISTRIBUTION SYSTEMS

### BASES

#### MINIMUM CRITICAL POWER RATIO (Continued)

- 3) safety/relief valve (S/RV) out of service, and
- 4) feedwater heater out of service (corresponding to a 100 degree F reduction in feedwater temperature).

For the main turbine bypass and recirculation pump trip systems, specific cycle-independent MINIMUM CRITICAL POWER RATIO (MCPR) Limiting Condition for Operation (LCO) values are established to allow continuous plant operation with these systems out of service. A bounding end-of-cycle exposure condition was used to develop nuclear input to the transient analysis model. The bounding exposure condition assumes a more top-peaked axial power distribution than the nominal power shape, thus yielding a bounding scram response with reasonable conservatism for the MCPR LCO values in future cycles. The MCPR LCO values shown in the CORE OPERATING LIMITS REPORT for the main turbine bypass and recirculation pump trip systems out of service are valid provided that these limits bound the cycle specific results.

The analysis for main turbine bypass and recirculation pump trip systems inoperable allows operation with either system inoperable, but not both at the same time.

For operation with the feedwater heater out of service, a cycle specific analysis will be performed. With reduced feedwater temperature, the Load Reject Without Bypass event will be less severe because of the reduced core steaming rate and lower initial void fraction. Consequently, no further analysis is needed for that event. However, the feedwater controller failure event becomes more severe with a feedwater heater out of service and could become the limiting transient for a specific cycle. Consequently, the cycle specific analysis for the feedwater controller failure event will be performed with a 100 degree F feedwater temperature reduction. The calculated change in CPR for that event will then be used in determining the cycle specific MCPR LCO value.

In the case of a single S/RV out of service, transient analysis results showed that there is no impact on the calculated MCPR LCO value. The change in CPR for this operating condition will be bounded by reload licensing calculations, and no further analyses are required. The analysis for a single S/RV out of service is valid in conjunction with dual and single recirculation loop operation.

The evaluation of a given transient begins with the system initial parameters shown in FSAR Table 15.0-1 that are input to a GE-core dynamic behavior transient computer program. The codes used to evaluate events are described in

# POWER DISTRIBUTION SYSTEMS

## BASES

### 3/4.2.4 LINEAR HEAT GENERATION RATE

The specification assures that the LINEAR HEAT GENERATION RATE (LHGR) in any rod is less than the design linear heat generation even if fuel pellet densification is postulated. The power spike penalty specified is based on the analysis presented in Section 3.2.1 of the GE topical report NEDM-10735 Supplement 6, and assumes a linearly increasing variation in axial gaps between core bottom and top and assures with a 95% confidence that no more than one fuel rod exceeds the design LINEAR HEAT GENERATION RATE due to power spiking.

#### References:

1. General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10 CFR 50, Appendix K, NEDO-20566A, September 1986.
2. "Qualification of the One-Dimensional Core Transient Model for Boiling Water Reactors," General Electric Company Licensing Topical Report NEDO 24154 Vols. I and II and NEDE-24154 Vol. III as supplemented by letter dated September 5, 1980, from R. H. Buchholz (GE) to P. S. Check (NRC).
3. "LaSalle County Station Units 1 and 2 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," General Electric Company Report NEDC-32258P, October 1993.
4. "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A (latest approved revision).
5. "Extended Operating Domain and Equipment Out-of-Service for LaSalle County Nuclear Station Units 1 and 2," NEDC-31455, November 1987.
5. "ARTS Improvement Program Analysis for LaSalle County Units 1 and 2," General Electric Company Report NEDC-31531P, December 1993.

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## POWER DISTRIBUTION SYSTEMS

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#### 3/4.2.2 DELETED

#### 3/4.2.3 MINIMUM CRITICAL POWER RATIO

The required operating limit MCPRs at steady-state operating conditions as specified in Specification 3.2.3 are derived from the established fuel cladding integrity Safety Limit MCPR and an analysis of abnormal operational transients. For any abnormal operating transient analysis evaluation with the initial condition of the reactor being at the steady-state operating limit, it is required that the resulting MCPR does not decrease below the Safety Limit MCPR at any time during the transient assuming instrument trip setting given in Specification 2.2.

To assure that the fuel cladding integrity Safety Limit is not exceeded during any anticipated abnormal operational transient, the most limiting transients have been analyzed to determine which result in the largest reduction in CRITICAL POWER RATIO (CPR). The type of transients evaluated were loss of flow, increase in pressure and power, positive reactivity insertion, and coolant temperature decrease. The limiting transient yields the largest delta MCPR. When added to the Safety Limit MCPR, the required minimum operating limit MCPR of Specification 3.2.3 is obtained and presented in the CORE OPERATING LIMITS REPORT.

Analyses have been performed to determine the effects on CRITICAL POWER RATIO (CPR) during a transient assuming that certain equipment is out of service. A detailed description of the analyses is provided in Reference 5. The analyses performed assumed a single failure only and established the licensing bases to allow continuous plant operation with the analyzed equipment out of service. The following single equipment failures are included are part of the transient analyses input assumptions:

1. main turbine bypass system out of service,
2. recirculation pump trip system out of service,

*Insert Paragraph B*



## **PARAGRAPH B**

References to current equipment out-of-service analyses, as well as descriptions of those equipment out-of-service options which require an adjustment to the operating limit MCPR, are provided in the CORE OPERATING LIMITS REPORT.

## POWER DISTRIBUTION SYSTEMS

### BASES

#### MINIMUM CRITICAL POWER RATIO (Continued)

3. safety/relief valve (S/RV) out of service, and
4. feedwater heater out of service (corresponding to a 100 degree F reduction in feedwater temperature).

For the main turbine bypass and recirculation pump trip systems specific cycle-independent MINIMUM CRITICAL POWER RATIO (MCPR) Limiting Condition for Operation (LCO) values are established to allow continuous plant operation with these systems out of service. A bounding end-of-cycle exposure condition was used to develop nuclear input to the transient analysis model. The bounding exposure condition assumes a more top-peaked axial power distribution than the nominal power shape, thus yielding a bounding scram response with reasonable conservatism for the MCPR LCO values in future cycles. The MCPR LCO values shown in the CORE OPERATING LIMITS REPORT for the main turbine bypass and recirculation pump trip systems out of service are valid provided that these limits bound the cycle specific results.

The analysis for main turbine bypass and recirculation pump trip systems inoperable allows operation with either system inoperable, but not both at the same time.

For operation with the feedwater heater out of service, a cycle specific analysis will be performed. With reduced feedwater temperature, the Load Reject Without Bypass event will be less severe because of the reduced core steaming rate and lower initial void fraction. Consequently, no further analysis is needed for that event. However, the feedwater controller failure event becomes more severe with a feedwater heater out of service and could become the limiting transient for a specific cycle. Consequently, the cycle specific analysis for the feedwater controller failure event will be performed with a 100 degree F feedwater temperature reduction. The calculated change in CPR for that event will then be used in determining the cycle specific MCPR LCO value.

In the case of a single S/RV Out of service, transient analysis results showed that there is no impact on the calculated MCPR LCO value. The change in CPR for this operating condition will be bounded by reload licensing calculations and no further analyses are required. The analysis for a single S/RV out of service is valid in conjunction with dual and single recirculation loop operation.

The evaluation of a given transient begins with the system initial parameters shown in FSAR Table 15.0-1 that are input to a GE-core dynamic behavior transient computer program. The codes used to evaluate events are described

## POWER DISTRIBUTION SYSTEMS

### BASES

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#### 3/4.2.4 LINEAR HEAT GENERATION RATE

The specification assures that the LINEAR HEAT GENERATION RATE (LHGR) in any rod is less than the design linear heat generation even if fuel pellet densification is postulated. The power spike penalty specified is based on the analysis presented in Section 3.2.1 of the GE topical report NEDM-10735 Supplement 6, and assumes a linearly increasing variation in axial gaps between core bottom and top and assures with a 95% confidence that no more than one fuel rod exceeds the design LINEAR HEAT GENERATION RATE due to power spiking.

#### References:

1. General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10 CFR 50, Appendix K, NEDO-20566A, September 1986.
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3/4.2.2 DELETED

3/4.2.3 MINIMUM CRITICAL POWER RATIO

The required operating limit MCPRs at steady state operating conditions as specified in Specification 3.2.3 are derived from the established fuel cladding integrity Safety Limit MCPR, and an analysis of abnormal operational transients. For any abnormal operating transient analysis evaluation with the initial condition of the reactor being at the steady-state operating limit, it is required that the resulting MCPR does not decrease below the Safety Limit MCPR at any time during the transient assuming instrument trip setting given in Specification 2.2.

To assure that the fuel cladding integrity Safety Limit is not exceeded during any anticipated abnormal operational transient, the most limiting transients have been analyzed to determine which result in the largest reduction in CRITICAL POWER RATIO (CPR). The type of transients evaluated were loss of flow, increase in pressure and power, positive reactivity insertion, and coolant temperature decrease. The limiting transient yields the largest delta MCPR. When added to the Safety Limit MCPR, the required minimum operating limit MCPR of Specification 3.2.3 is obtained and presented in the CORE OPERATING LIMITS REPORT.

Analyses have been performed to determine the effects on CRITICAL POWER RATIO (CPR) during a transient assuming that certain equipment is out of service.

References to current equipment out-of-service analyses, as well as descriptions of those equipment out-of-service options which require an adjustment to the operating limit MCPR, are provided in the CORE OPERATING LIMITS REPORT.

The evaluation of a given transient begins with the system initial parameters shown in FSAR Table 15.0-1 that are input to a GE-core dynamic behavior transient computer program. The codes used to evaluate events are described in

## POWER DISTRIBUTION SYSTEMS

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#### 3/4.2.4 LINEAR HEAT GENERATION RATE

The specification assures that the LINEAR HEAT GENERATION RATE (LHGR) in any rod is less than the design linear heat generation even if fuel pellet densification is postulated. The power spike penalty specified is based on the analysis presented in Section 3.2.1 of the GE topical report NEDM-10735 Supplement 6, and assumes a linearly increasing variation in axial gaps between core bottom and top and assures with a 95% confidence that no more than one fuel rod exceeds the design LINEAR HEAT GENERATION RATE due to power spiking.

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