James A. FitzPatrick
Nuclear Power Plant
PO Box 41
Lycoming, New York 13093
315 342 3840

New York Power Authority

NUCLEAR SAFETY EVALUATION

NO. JAF-SE-90-024 REV. 0

QA CAT. 1

____ MOD ____ TEST

____ EXPERIMENT X OTHER

____ NUMBER

Change of RHR Pump Rated Flow to 8910 GPM in LPCI Mode

TITLE: Decrease of RHR Pump Rated Flow by 10% in LPCI Mode

The proposed modification, test, or experiment:

1. ( ) Does (X) Does Not - Increase the probability of occurrence or consequences of an accident or malfunction of structures, systems, or components important to safety previously evaluated in the FSAR.

2. ( ) Does (X) Does Not - Create the possibility of an accident or malfunction of a different type than any evaluated previously in the FSAR.

3. ( ) Does (X) Does Not - Reduce the margin of safety as defined in the basis for any Technical Specification.

4. ( ) Does (X) Does Not - Involve an unreviewed safety question based on 1, 2, and 3 above.

5. (X) Does ( ) Does Not - Involve a change in the Technical Specifications (Section(s) 4.5.A.3).

6. ( ) Does (X) Does Not - Require pre-implementation review by the NRC.

7. ( ) Does (X) Does Not - Degrade the Security Plan, Quality Assurance Program, or the Fire Protection System.

8. ( ) Does (X) Does Not - Affect the environmental impact of the plant or involve an unreviewed environmental question.

Preparer: C. H. Stoll (General Electric Co.) / 2/5/90
Engineer Date

Reviewer: W. A. Warbis (General Electric Co.) / 2/5/90
Engineer Date

Approved: V. M. Walz Victor M. Walz / 2/6/90
Technical Services Supt. Date

Reviewed: 90-011 / 2/6/90
PORC Meeting No. Date

Distribution
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D. Burch, WPO

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NEW YORK POWER AUTHORITY
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
NUCLEAR SAFETY EVALUATION

A. SCOPE OF EVALUATION

This evaluation demonstrates that the Residual Heat Removal System (RHR) (including the Low Pressure Coolant Injection (LPCI) mode of operation) for the James A. FitzPatrick Nuclear Power Plant (JAFNPP) is capable of performing its intended function and that there is no impact on the JAFNPP Emergency Core Cooling System (ECCS) licensing basis for the following condition:

> The rated flow for RHR pump(s) operating in the LPCI mode decreased from 9900 GPM to 8910 GPM (a 10% reduction in rated LPCI flowrate) which results in a smaller (if any) reduction in the other modes of RHR operation.

The functions of the RHR system that could potentially be affected are:

a. To provide core cooling in the event of a Loss-of-Coolant Accident (LOCA) via the LPCI mode of operation,

b. To provide inventory makeup in the LPCI mode during postulated events in compliance with 10CFR50 Appendix R,

c. To provide torus water (suppression pool) cooling when operating in the pool-cooling mode of operation,

d. To remove decay heat from the reactor vessel at low reactor vessel pressures in order to achieve and maintain cold shutdown of the reactor, and

e. To remove heat from the drywell and wetwell in situations where it is beneficial to do so.

Each function is assessed, herein, assuming RHR pump rated flow of 8910 gpm in the LPCI mode and a rated flow consistent with this same pump performance when operating in the other modes of RHR operation. The assessment of the LPCI system performance during LOCAs also determines the impact of this change on the JAFNPP ECCS licensing basis.

B. REASON FOR EVALUATION

The results of recent surveillance tests conducted by NYPA indicate that the performance of RHR pumps A and C are near the current technical specification limit which is based on required LPCI flowrate. The current technical specification requirements for the LPCI flowrate are based on calculated results from older licensing evaluation models which are overly conservative. The current LOCA licensing basis for JAFNPP utilizes the SAFER/GESTR ECCS-LOCA methodology (Reference 1) and requirements such as LPCI flowrate may be relaxed without having a significant impact on plant safety or ECCS limits. Therefore, the LPCI technical

specification flowrate requirements are more stringent than necessary when utilizing the newer technology.

Sensitivity analyses performed for JAFNPP with the SAFER/GESTR model (Reference 2) indicate a maximum increase in the limiting licensing fuel peak cladding temperature (PCT) of 88°F for a 10% reduction in rated LPCI flow rate. The current limiting licensing PCT is more than 600°F below the 2200°F allowable limit. Therefore, JAFNPP would still meet all requirements of 10CFR50.46 and Appendix K of 10CFR50 with significant margin even with a 10% lower LPCI flow rate.

An evaluation of a decrease in the LPCI system rated flow, which substantiates that no significant safety hazard would result, could reduce the potential for forced shutdowns during the operating cycle if indicated LPCI flow should decrease.

The purpose of this safety evaluation is to justify JAFNPP continued power operation until the next refueling outage (currently scheduled for March 31, 1990) with reduced LPCI flow (as low as 8910 gpm from one RHR pump in the LPCI mode).

C. SAFETY EVALUATION

C.1 LPCI System Performance During LOCAs

The RHR pumps are aligned to the LPCI system and are dedicated to supplying emergency inventory makeup flow to the reactor vessel upon occurrence of a LOCA signal.

The LPCI system is an integral part of the ECCS that replenishes reactor vessel inventory during LOCAs that rapidly depressurize the vessel. A sensitivity study (Reference 2) was performed that varied LPCI system and other ECCS system performance requirements for the JAFNPP. The sensitivity study demonstrated that a 10% reduction in LPCI system rated flow would result in a maximum increase in the licensing peak cladding temperature (PCT) of 88°F and an insignificant increase in metal water reaction for the limiting large break accidents with no change in fuel MAPLHGR limits. For small break accidents, the requirements for the LPCI flow rate are less stringent than for large breaks because the loss of coolant inventory is less significant and the fuel cladding heat transfer is higher throughout the transient due to steam cooling.

Therefore, a decrease of the LPCI system rated flow from 9900 gpm to 8910 gpm has no impact on the JAFNPP licensing basis (the fuel MAPLHGR limits are unchanged) and the LPCI remains capable of performing its intended function during postulated LOCAs.

C.2 LPCI System Performance During Appendix R Events

The LPCI system is also relied upon to supply reactor inventory makeup during postulated Appendix R events. These are not pipe break events but postulated fire events that can threaten the ability of the plant to maintain reactor vessel inventory depleted by decay heat and sensible heat boiloff.

Reference 5 documents an analysis of a worst case Appendix R event which assumes an RHR pump is utilized in the LPCI mode to replenish inventory. The calculated fuel peak cladding temperature (PCT) during this event was 1013°F. The Appendix R requirement is to prevent fuel cladding damage which is not expected to occur for PCT below 1500°F.

The PCT for this event (based on the Reference 5 analysis results) is estimated to increase less than 60°F assuming a 10% reduction in LPCI flowrate which maintains a large margin to 1500°F. Therefore, the ability of the LPCI system to perform this function in compliance with Appendix R is not compromised by a 10% reduction in rated LPCI flow.

C.3 RHR Pool Cooling Performance During LOCA Events

Another important function of the RHR system is to remove heat from the suppression pool. For this mode of operation the RHR pumps are aligned to circulate pool water through a heat exchanger and back to the suppression pool. The most stringent requirements for heat removal from the pool occur during postulated LOCA events. A flowrate of 8000 gpm was assumed for this mode of operation in pool temperature analyses (Reference 4). Since the design of the RHR pump is based on the higher flowrate requirements of LPCI, the pump flowrate is normally throttled in the pool cooling mode to prevent excessive flow. In the pool cooling mode of operation, there is no difference in elevation head and pressure head between the system suction and discharge, unlike the situation in the LPCI mode. Therefore, the ability to perform this function is not compromised by a 10% reduction in rated LPCI flow.

C.4 RHR Shutdown Cooling Performance

The RHR pumps may also be aligned to circulate reactor water through a heat exchanger for decay heat removal. The design flowrate in this mode of operation is 7700 gpm. In this mode of operation the system is capable of cooling down the reactor vessel to cold shutdown conditions (212°F) within approximately 20 hours and to 125°F within approximately 20 hours additional time with a flowrate of 7700 gpm. Therefore, the ability to perform this function is unaffected by a 10% reduction in rated LPCI flow (from 9900 gpm to 8910 gpm per pump).

C.5 Containment Spray Performance

Since the design of the RHR pump is based on the higher flowrate requirements of LPCI, the pump flowrate in the containment drywell and wetwell spray mode is less than in the LPCI mode.

The design basis LOCA containment response analyses for JAFNPP which consider the containment (drywell or wetwell) spray systems are the analysis to determine the allowable bypass leakage between the drywell and wetwell airspace described in paragraph 5.2.4.4 of the FSAR and the design basis accident analysis described in paragraph 14.6.1.3 of the FSAR. The analyses of containment bypass leakage are performed to show that the containment response for design basis loss-of-coolant accidents remains within containment pressure design limits considering wetwell sprays. These bypass leakage analyses are primarily dependent on the time delay for operator initiation of the sprays and are not strongly sensitive to the wetwell spray flowrate.

The design basis accident containment response analysis in paragragh 14.6.1.3 has cases with and without containment sprays. Case D without containment sprays gives the highest (limiting) values for long term drywell temperature and containment pressure. It is judged that a 10% reduction in spray flow rate would not result in the cases which consider sprays to become more limiting than Case D.

Therefore, based on engineering judgement, a 10% reduction in the containment spray flow rate should have no impact on the Fitzpatrick containment response analysis including the bypass leakage analysis (paragragh 5.2.4.4) or the design basis accident analysis (paragragh 14.6.1.3.3).

Some plants have considered use of drywell sprays to obtain a reduction in long term drywell temperature envelope for equipment qualification (EQ). Also, the Emergency Operating Procedures (EOPs) based on BWROG Emergency Procedure Guidelines (Revision 4) call for the operator to use drywell or wetwell sprays to control the containment pressure or temperature if these parameters approach design limits. The drywell and wetwell spray systems typically have significantly more flow capability than that required for controlling the containment pressure or temperature so that EQ envelopes which consider containment sprays and operator actions to mitigate pressure or temperature per EOPs would be expected to be unaffected by a 10% reduction in spray flowrate.

C.6 Evaluation of the Effect on the FSAR

C.6.1 Residual Heat Removal System (FSAR Chapter 4.8)

As described in section C.1, the LPCI system is capable of

performing its intended ECCS function with a rated flow decrease from 9900 gpm to 8910 gpm. The LPCI rated flow is addressed in Table 4.8-1 of Chapter 4.8 of the JAFNPP FSAR Update. If the rated flow of a RHR pump were to decrease from 9900 gpm to 8910 gpm, the flowrate would be below the amount specified in this table. As described in sections C.2, C.3, C.4, and C.5 the functions of inventory makeup during Appendix R events, pool cooling and shutdown cooling with RHR, and the containment spray cooling with RHR are all unaffected with an RHR pump flowrate of 8910 gpm. Therefore, the rest of this Chapter of the FSAR is unaffected by this condition.

C.6.2 ECCS (FSAR Section 6)

This section of the FSAR discusses the intended function of LPCI but references the SAFER/GESTR-LOCA report for calculated performance results. As described in section C.1, the LPCI system is capable of performing its intended ECCS function with a rated flow decrease from 9900 gpm to 8910 gpm. Therefore section 6 of the FSAR is unaffected by this condition.

C.7 Impact on Plant Technical Specifications

The LPCI system rated flow is referenced in the JAFNPP Technical Specifications section 4.5.A.3. Section C.1 above demonstrated that the ECCS licensing basis is unaffected by a 10% rated flow decrease (i.e., over 500°F margin to the 2200°F regulatory limit remains). The fuel MAPLHGR limits in the JAFNPP Technical Specifications section 3.5.H are not restricted by LOCA analysis but by fuel design limits (14.4 kW/ft) and remain unchanged. Therefore the margin to thermal limits delineated within the JAFNPP Technical Specifications would not be affected.

If the LPCI flowrate were to decrease to 8910 gpm per pump, it would be below the LPCI flowrate specified in 4.5.A.3. However, this evaluation substantiates the fact that no safety hazard or significant degradation of safety margins would occur.

C.8 Impact on Reload Evaluation

The reload licensing document (Reference 6) provides the thermal limits for the respective cycle based on the licensed performance of JAFNPP systems and equipment. The ECCS thermal limits reported in the reload analysis are those determined from the limiting LOCA events. The sensitivity studies performed in Reference 2 demonstrate that the thermal limits during limiting LOCA events (i.e., fuel MAPLHGR limits) are unaffected by a 10% decrease in the LPCI rated flowrate. Therefore, this condition would have no impact on the current and future reload licensing analyses.

C.9 Summary of Safety Evaluation

This safety evaluation was performed to support continued power operation of JAFNPP with a 10% reduction of RHR pump flowrates until the next refueling outage (currently scheduled for March 31, 1990). This postulated condition has been demonstrated to have no impact on the capability of the RHR system to perform its intended functions. Additionally, it was demonstrated that this condition would have no impact on the JAFNPP licensing basis documented in References 1 and 7 (i.e., no change in fuel MAPLHGR limits). There is no effect on RHR system and component safety bases as defined in the FSAR. A review of plant Technical Specifications to assess the effects on applicable Limiting Conditions of Operation, Limiting Safety System Settings, Safety Limits, and reactor thermal parameters concludes that a 10% decrease in rated flowrate does not significantly reduce the margin of safety as defined in the bases for the Technical Specifications.

C.10 Evaluation Summary

Based on the above evaluation, it is determined that a decrease of 10% in RHR system rated flowrate does not constitute a significant hazard as defined in 10CFR50.92 for the following reasons:

a. It does not increase the probability of occurrence or the consequences of an accident evaluated previously in the safety analysis report. A decrease in the rated flowrate is a performance condition that is in response to accident conditions. Therefore, this change has no impact on the conditions that would initiate an accident. An LPCI system flow reduction was shown to have no significant impact on the JAFNPP ECCS licensing basis and therefore does not increase the consequences of any accident analyzed in the safety analysis report.

b. It does not create a possibility for an accident of a different type than any evaluated previously in the safety analysis report. This is because the condition would be a change in performance for the response of the LPCI system to abnormal or accident conditions within the JAFNPP. Consequently, the conditions leading to such events are unaffected.

c. The margin of safety as defined in the basis for the Technical Specifications would not be significantly reduced. The fuel MAPLHGR limits in JAFNPP Technical Specifications section 3.5.H would remain unchanged. The margin of safety is reflected in the operating limits and Limiting Safety System Settings of the Technical Specifications. The postulated LPCI

system rated flow decrease would not change any of these limits. The consequences of transients or accident events have been assessed and the appropriate safety limits or regulatory requirements would not be affected.

D. REFERENCES

1. "JAFNPP SAFER/GESTR - LOCA Analysis", General Electric Company, NEDC-31317P, October 1986.

2. "Sensitivity of the JAFNPP Safety Systems Performance to Fundamental System Parameters", General Electric Company, MDE-83-0786, July 1986.

4. "JAFNPP Suppression Pool Temperature Response", General Electric Company, NEDC-24361-P, August 1981.

5. "Analysis to Extend Operator Action Time For Alternate Shutdown Panels In Support Of Fitzpatrick Compliance To Appendix R", General Electric Nuclear Energy, MDE-137-0585, November 1985.

6. "Supplemental Reload Licensing Report for JAFNPP Reload 8 (Cycle 9)", General Electric Nuclear Energy, 23A5898, June 1988.