Attachment I to JPN-94-060

Atrium-10A

Lead Fuel Assembly Licensing Evaluation Report

for

New York Power Authority

James A. FitzPatrick Nuclear Power Plant

Reload 11/Cycle 12

(Non-Proprietary Version)

James A. FitzPatrick Cycle 12 ATRIUM™-10A* Lead Fuel Assembly Licensing Evaluation

INTRODUCTION

The New York Power Authority (NYPA) will include four Siemens Power Corporation-Nuclear Division (SPC) ATRIUM-10A Lead Fuel Assemblies (LFAs) in the reload core for James A. FitzPatrick Cycle 12. The assemblies will be inserted in non-limiting core locations. SPC has evaluated the insertion of the four ATRIUM-10A LFAs in James A. FitzPatrick Cycle 12 and confirmed that the LFAs meet the acceptance criteria specified in Chapters 4 and 15 of the Standard Review Plan (SRP), Reference 1. Additionally, the ATRIUM-10A LFAs will not affect and are bounded by the safety analyses performed for the co-resident fuel. The evaluations performed by SPC include fuel mechanical design analysis, thermal-hydraulic design analysis, nuclear safety analysis, evaluation of Anticipated Operational Occurrences (AOO), and evaluation of postulated accidents.

LEAD FUEL ASSEMBLY PROGRAM OBJECTIVES

A normal and necessary function of lead fuel assemblies for any fuel design is to extend the fuel design performance data base. The James A. FitzPatrick lead assemblies will provide in-reactor data for demonstration of the performance of ATRIUM-10A fuel assemblies with SPC's advanced design fuel channel. This data will augment the data base that has already been established by SPC for the ATRIUM-10A fuel assembly design. The types of fuel performance data measurements which may potentially be obtained from the lead assemblies include:

MECHANICAL DESIGN ANALYSIS

SPC has demonstrated that the mechanical design of the James A. FitzPatrick ATRIUM-10A LFAs satisfies the acceptance criteria given in Section 4.2 of Reference 1. Analyses performed using SPC's NRC-approved mechanical analysis methodology show that the SPC ATRIUM-10A LFAs can be handled in the same manner as the co-resident fuel and operated in the James A. FitzPatrick Cycle 12 core while maintaining adequate margin to the applicable mechanical design limits. These mechanical design analyses are documented in Reference 2.

The mechanical design evaluation demonstrated that the LFAs will remain within the applicable design limits and meet the acceptance criteria for Fuel System Damage, Fuel Rod Failure, and

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Fuel Coolability under conservative projected reactor conditions and operating history. Acceptability of the LFAs under seismic/LOCA loading was demonstrated by

. The structural response of the LFAs to accident loadings will be nearly identical to that of the co-resident GE11 fuel assemblies.

THERMAL-HYDRAULIC DESIGN ANALYSIS

The ATRIUM-10A LFAs are designed to be hydraulically compatible with the co-resident GE11 fuel assemblies in the James A. FitzPatrick core. Discussion of the hydraulic compatibility design analysis is presented in Reference 3.

Analyses performed by SPC demonstrate that the ATRIUM-10A LFA steady-state MCPR performance is superior relative to the co-resident GE11 fuel assemblies

The SPC analyses, presented in Reference 3, show that for the same reactor operating conditions, and assuming both assemblies are at a MCPR of 1.00, the ATRIUM-10A LFA has a higher bundle critical power than the co-resident GE11 fuel design. The ATRIUM-10A LFAs will be monitored as GE11 fuel assemblies by the core monitoring system at FitzPatrick. Results of SPC analyses (Reference 4) show that the ATRIUM-10A LFAs can be operated to the same MCPR operating limit as the GE11 fuel assembly. Analyses performed by SPC show that monitoring the LFAs as GE11 fuel assemblies will result in the monitoring system

For bundle exposures ranging from

GWd/MTU, the limiting full power results shown in Table 3.1 of Reference 4 show that there is adequate margin

. For bundle exposures greater than

The ATRIUM-10A LFAs may therefore be monitored as GE11 fuel assemblies and have adequate MCPR margin.

Figure 4.1 of Reference 2 provides the steady state LHGR limit for the SPC ATRIUM-10A LFA. The SPC LHGR limit shown in Reference 2 is based on planar exposure. SPC has determined, through a conservative comparison using the "least limiting" MAPLHGR limit value for the co-resident GE11 fuel, that the ATRIUM-10A LHGR limit will not be exceeded if the LFAs are monitored to the GE11 planar MAPLHGR limit.

The impact of the four ATRIUM-10A LFAs on reactor stability is determined by the thermal hydraulic characteristics of the LFAs compared to the co-resident fuel since the dominant core neutronic characteristics are determined by the co-resident fuel. Single channel model evaluations of the ATRIUM-10A LFA and co-resident GE11 fuel under similar operating conditions resulted in insignificant differences in channel decay ratio. Results of this evaluation are presented in Reference 4. Operating restrictions implemented to protect stability margins for the GE11 core will remain adequate for a core containing the LFAs.

NUCLEAR SAFETY ANALYSIS

The enrichment distribution and gadolinia content of the ATRIUM-10A LFA were selected to match the hot operation neutronic performance of the co-resident fresh GE11 fuel assemblies in the Cycle 12 reload being replaced by the LFAs. The cold controlled, and cold and hot standby uncontrolled, reactivity of the ATRIUM-10A LFA is not significantly different from that of the co-resident GE11 fuel assemblies. Standby Liquid Control System, Cold Shutdown Margin, and Fuel

Storage Pool Criticality analyses performed for the co-resident fuel will remain adequate for the LFA.

SPC design criteria require an overall negative power coefficient for fuel designs in order to assure compatibility with reactor control systems. Reference 3 shows that the LFA design will provide a negative power coefficient at all operating conditions througnout the life of the fuel.

ANTICIPATED OPERATIONAL OCCURRENCES

Core-wide transients, including Over Pressurization, will not be significantly affected by the presence of four LFAs in the Cycle 12 core. SPC has performed analyses which demonstrate that the LFAs will meet applicable design limits during potential core wide transients if they are monitored as the co-resident GE11 fuel assemblies. The results of these evaluations are presented in Reference 4.

Localized AOOs evaluated by SPC are Control Rod Withdrawal Error, Fuel Assembly Mislocation Error, and Fuel Assembly Misorientation Error. Reference 4 shows that the comparable reactivity characteristics of the LFA and co-resident GE11 fuel result in comparable consequences for these AOOs. The LFAs, being in non-limiting core locations, will have more margin to limits than the co-resident GE11 fuel, and therefore the AOO analyses for the co-resident reload fuel are bounding for the LFAs.

POSTULATED ACCIDENTS

The LOCA performance of the SPC ATRIUM-10A LFA is comparable to that of the co-resident GE11 fuel. The larger number of rods in the LFA results in a lower initial temperature and in less stored energy than the co-resident GE11 fuel at the same planar power. Additional margin is provided because of the non-limiting core locations of the LFAs. As a result of these factors, the existing LOCA analysis will be bounding for the LFAs.

The deposited enthalpy resulting from a Control Rod Drop Accident is determined by the

In Reference 3, SPC showed that there is no significant difference for these parameters for the LFA and GE11 fuel assemblies in the Cycle 12 core. The LFA maintains a similar margin to the enthalpy limit as the co-resident GE11 fuel and the reload safety analysis is applicable to the LFAs.

SPC analysis discussed in Reference 4 indicates that the amount of radioactivity released to the environment from a fuel handling accident involving 10x10 fuel is essentially the same as that for 9x9 or 8x8 fuel assemblies. Therefore, the existing fuel handling accident analysis remains appropriate.

CONCLUSION

SPC has evaluated the insertion of the four ATRIUM-10A LFAs in James A. FitzPatrick Cycle 12. The evaluation confirmed that the LFAs meet the acceptance criteria specified in Chapters 4 and 15 of the Standard Review Plan (SRP) and that the LFAs will not affect and are bounded by the safety analyses performed for the co-resident reload fuel.

REFERENCES

1. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition," U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, July 1981.

2. EMF-94-128(P), Revision 1, "Mechanical Design Report for James A. Fitzpatrick ATRIUM™10A Lead Fuel Assemblies," Siemens Power Corporation-Nuclear Division, November 1994.

3. EMF-94-140(P), "Neutronic Design & Thermal-Hydraulic Compatibility Report for James A. Fitzpatrick ATRIUM™10A Lead Fuel Assemblies," Siemens Power Corporation-Nuclear Division, November 1994.

4. EMF-94-141(P), "Safety Analysis Report for James A. FitzPatrick ATRIUM™10A Lead Fuel Assembly," Siemens Power Corporation-Nuclear Division, November 1994.