



SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO EVALUATION OF RESPONSE TO NRC BULLETIN NO. 90-02

CONSUMERS POWER COMPANY

BIG ROCK POINT PLANT

DOCKET NO. 50-155

1.0 BACKGROUND

The licensee responded to NRC Bulletin 90-02, "Loss of Thermal Margin Caused by Channel Box Bow," in a letter dated August 3, 1990. This was followed by a response for additional information via a telephone conversation on October 12, 1990. The response described the number and disposition of these channel boxes in the core, (Figure 1, Ref. 1) and described the actions taken to assure compliance with the technical specification of thermal limits.

The Big Rock Point reactor has a small core rated at 240 MWT and contains 84 fuel assemblies. Approximately one quarter of the core at Big Rock Point is changed each refueling outage. The discharged assemblies have approximately 20-25 GWD/ST of exposure at the end of cycle. Those assemblies with 3 years of exposure together with the new fuel assemblies are placed around the outside area of the core, where they are expected to experience low power and exposure. Fuel assemblies with 1 and 2 cycles of exposure are located in the interior region of the core with the 2 cycle fuel residing in the very center. These fuel assemblies and channel boxes assemblies are not typical of other BWRs. The channel boxes are positioned and secured in place in the vessel with a grid system of hold down bars and remain in place when fuel shuffling is conducted during refueling. The fuel assemblies are moved about independently of the channel boxes, with the exposure of the channel boxes tracked separately from the fuel exposure. The licensee stated that it is Consumer Power Company/Big Rock Point policy, that individual channel box assemblies must be replaced when their exposure reaches approximately 35-40GWD/ST.

2.0 EVALUATION

Core configuration for the Big Rock Point Plant shows exposure and the number of operating cycles of individual channel box assemblies, currently slated for use in Cycle 25, (reference telephone conversation in support of submitted technical information clarification, October 12, 1990). The licensee pointed out that a number of the channel box assemblies were located in low power areas, consequently, they have received small exposure during each operating cycle.

Effect of channel box bow on the Minimum Critical Power Ratio

The licensee conducted an indepth engineering analysis to determine the change (if any) in the critical power ratio due to channel box bow. Calculations show that the Big Rock Point Plant fuel channel boxes bow only 1/5 the amount of the

modern BWR plants given the same exposure. This is due to the fact that the Big Rock Point Plant channel boxes are 1/2 the length of normal channels and are wider than the modern BWR plants channel boxes (Attachment 2, Ref.1). The NRC staff verified the 1/5 calculation independently.

Actual measured data reported in EPRI Report NP4225M, 1985, showed that channel box bow for channel boxes with up to 40GWD/ST exposure was less than 4.3mm (169 mils) at a 2 sigma confidence level for full length channels, (12 feet). Some of the channel boxes measured were of the same kind as those used by Big Rock Point (Cartech channels). The maximum bowing experienced by these Cartech channel boxes was found to be 2.4 mm (94 mils) with an average bow of 1.2 mm (48 mils). Bearing in mind the half size and wider channels boxes at Big Rock Point Plant, the licensee took the conservative approach and used the full size 12 foot maximum value of 4.3 mm (169 mils) for their half size 6 foot channel box calculation, i.e., Big Rock Point Plant maximum channel box bow is 1/5 of 4.3 mm or 0.9 mm (0.035 mils) for a typical channel box lifetime. This channel box bow of 0.035 mils translates into a maximum change in the minimum critical power ratio (MCPR) of 0.030 for a typical core loading. This maximum change is applied core wide, on all channel boxes and not just the limiting channel boxes.

The MCPR Operating Limit (Technical Specification) at Big Rock Point Plant is 1.763 including uncertainty. When the change in MCPR of 0.030 is added to the MCPR Operating Limit (OP), the new MCPR (OP) becomes 1.793. To insure compliance with the Technical Specification MCPR limit of 1.763, the licensee performs numerous physics calculations (prior to the start of every cycle), to identify those fuel assemblies having a MCPR less than or equal to 1.793. Those fuel assemblies which could have a MCPR of 1.793 or less, will be required to reside in new channel boxes, thus assuring that the operating limit is maintained.

In regard to the LHGR and the MAPLHGR the licensee conducted a LOCA analysis for fuel types G3/G4 and submitted to NRC. The local peaking factors (LPF) used for the analysis bound the current fuel design by an amount larger than the impact of channel box bow upon the LPF. The change in LPF between the current fuel design and G3/G4 is approximately 0.03, while the change in LPF due to channel box bowing was found to be less than or equal to 0.006 for the unrodded condition.

#### 1.0 CONCLUSION

Based on the above evaluation, the NRC staff concludes that the proposed utilization of reused channel boxes for the upcoming Cycle 25 is acceptable. Further, we conclude that the reuse of channel boxes in future reload cycles is acceptable for the Big Rock Point Reactor provided that the core design and channel box reuse is evaluated by the methods described in Reference 1 including the limitations which follow:

- (1) Individual channel box assemblies must be replaced before exceeding an exposure of 40 GWD/ST.
- (2) Limiting fuel assemblies will be identified during core design calculations for each cycle and will be required to reside in new channel boxes to assure that the MCPR operating limit is maintained.

- (3) Continued validity of the LHGR and MAPLHGR limits under the existing channel box bow conditions for each fuel cycle will be evaluated for each operating cycle.

Any deviations from the described methods to assure compliance of fuel assemblies with reused channel boxes to the technical specification thermal limits must be evaluated on a cycle specific basis, subject to NRC staff approval prior to restart of the future cycle.

#### 4.0 REFERENCES

1. Letter from J. Daniel Eddy, Consumers Power Company, to NRC, response update to NRC Bulletin 90-02, "Loss of Thermal Margin Caused by Channel Box Bow," August 3, 1990.