Attachment 1

Technical Specification Bases Changes

LIST OF FIGURES

Bases

Operation at power with an inoperable control rod is permitted within the limits provided. These limits assure that an acceptable power distribution is maintained and that the potential effects of rod misalignment on associated accident analyses are minimized. For a rod declared inoperable due to misalignment, the rod with the greatest misalignment shall be evaluated first. Additionally, the position of the rod declared inoperable due to misalignment shall not be included in computing the average position of the group for determining the operability of rods with lesser misalignments. When a control rod is declared inoperable, boration may be initiated to achieve the existence of 1% $\Delta k/k$ hot shutdown margin.

The power-imbalance envelope obtained in accordance with the approved methodology is based on LOCA analyses which have defined the maximum linear heat rate (see Figures 3.5.2-16a and b ~~Figure 3.5.2-16~~) such that the maximum clad temperature will not exceed the Final Acceptance Criteria. Corrective measures will be taken immediately should the indicated quadrant tilt, rod position, or imbalance be outside their specified boundary. Operation in a situation that would cause the Final Acceptance Criteria to be approached should a LOCA occur is highly improbable because all of the power distribution parameters (quadrant tilt, rod position, and imbalance) must be at their limits while simultaneously all other engineering and uncertainty factors are also at their limits.** Conservatism is introduced by application of:

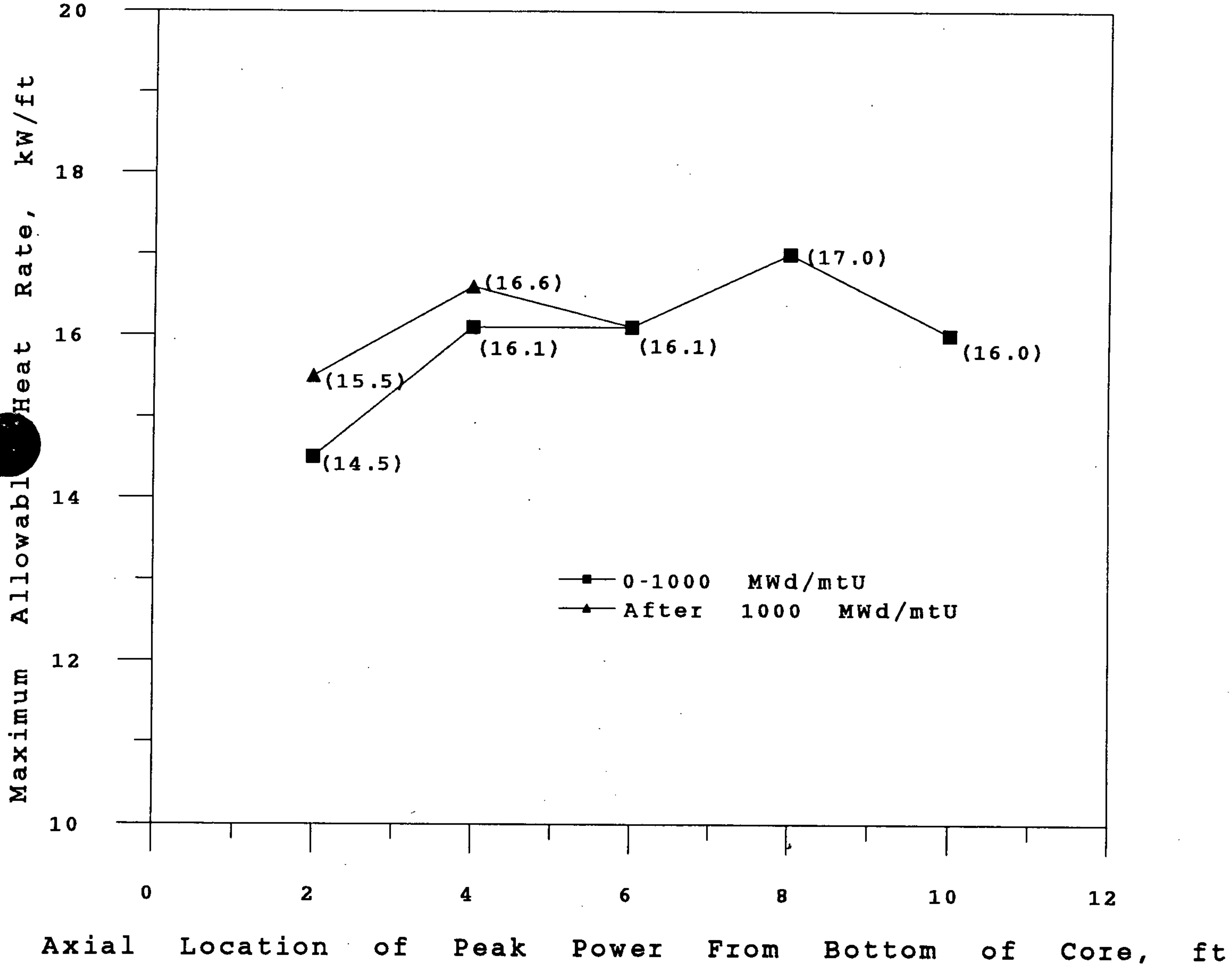
a. Nuclear uncertainty factors
b. Thermal calibration
c. Hot rod manufacturing tolerance factors

The 25% ± 5% overlap between successive control rod groups is allowed since the worth of a rod is lower at the upper and lower part of the stroke. Control rods are arranged in groups or banks defined as follows:

Group	Function
1	Safety
2	Safety
3	Safety
4	Safety
5	Regulating
6	Regulating
7	Xenon transient override
8	APSR (axial power shaping rod)

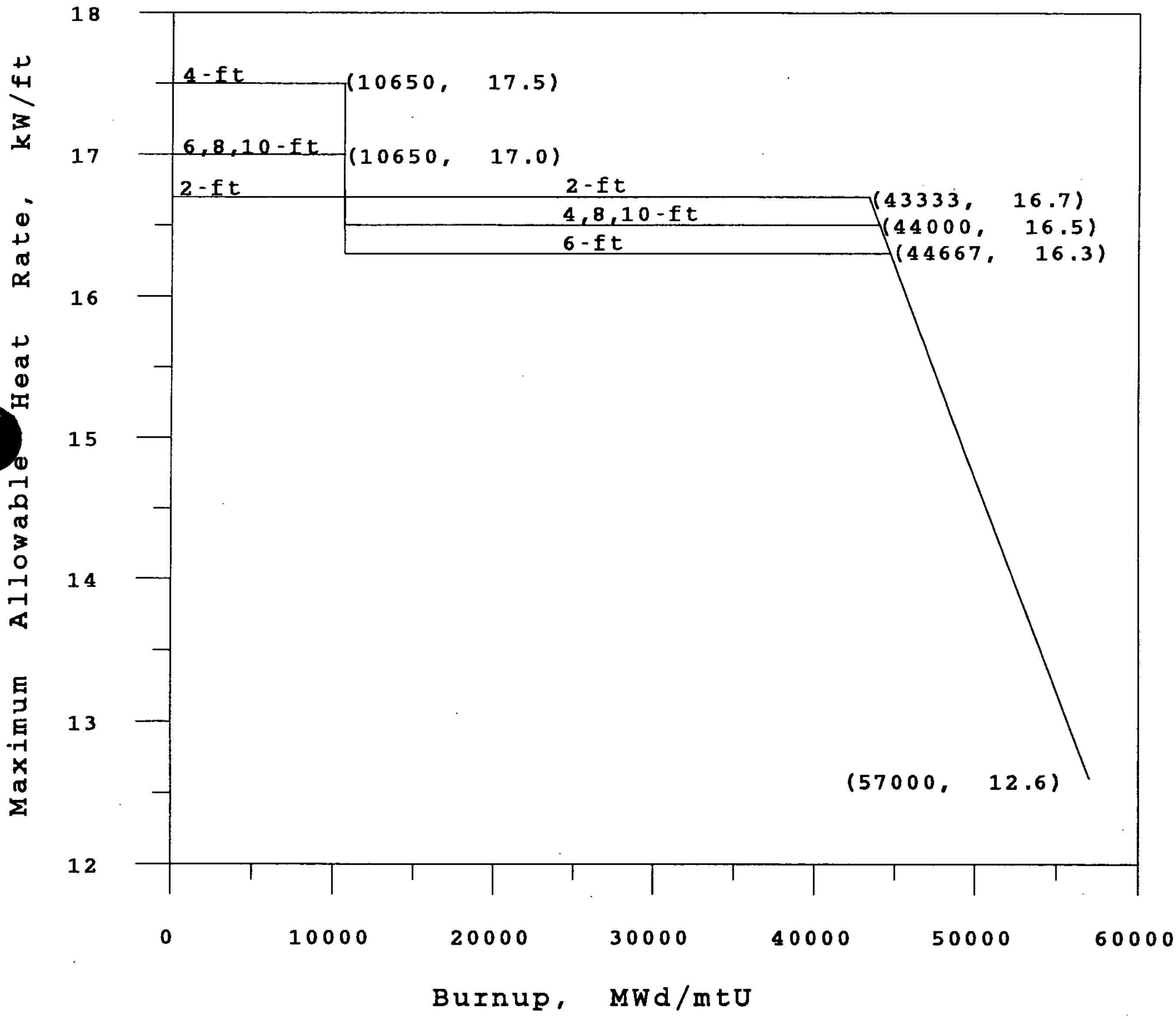
** Actual operating limits depend on whether or not incore or excore detectors are used and their respective instrument calibration errors. The method used to define the operating limits is defined in plant operating procedures.

LOCA-Limited Maximum Allowable Linear Heat Rate
For Mark B8 and Earlier Fuel Assembly Designs



Oconee Nuclear Station
Figure 3.5.2-16a

LOCA-Limited Maximum Allowable Linear Heat Rate For Mark B9 and Subsequent Fuel Assembly Designs



Oconee Nuclear Station
Figure 3.5.2-16b

Attachment 2

Technical Justification

Technical Justification

New LOCA linear heat rate limits have been calculated for the Mark B9 fuel assembly design. The beginning of cycle (BOC) LOCA limits have increased because of the lower initial fuel temperature, and hence stored energy, associated with the Mark B9 fuel assembly design. The fuel pellet diameter for the Mark B9 fuel assembly is slightly larger than the diameter for the Mark B8 and previous fuel assembly designs. Since the cladding dimensions remain the same between the Mark B8 and Mark B9 designs, the larger pellet diameter results in a smaller fuel pellet-cladding gap for the Mark B9 design. The smaller gap results in improved BOC heat transfer and a lower average fuel temperature.

In addition to the smaller fuel pellet-cladding gap, the new LOCA linear heat rate limits use initial fuel temperatures predicted by TACO3. As is described in Reference 1, TACO3 is a best estimate fuel performance code which predicts lower fuel temperatures than the TACO2 code. In the past, the TACO2 code has been used to determine the inital fuel temperatures for the LOCA analyses. Thus, the combined effect of the smaller gap size and TACO3 is that, for a given linear heat rate, the initial fuel temperature is significantly lower for the Mark B9 LOCA analyses than with the Mark B8 LOCA analyses.

Because of the above described differences in the fuel assembly design, Duke Power Company will use the LOCA limits in Technical Specification Bases Figure 3.5.2-16a for the Mark B8 fuel assembly design and its predecessors. The LOCA limits in Technical Specification Bases Figure 3.5.2-16b will be applied to the Mark B9 and subsequent fuel assembly designs. Operation of the fuel assemblies within their respective LOCA linear heat rate limits ensures compliance with the acceptance criteria of 10 CFR 50.46.

A description of the changes to the LOCA linear heat rate limits follows.

<u>Mark B8 LOCA Limits</u>

The LOCA linear heat rate limits provided in Figure 3.5.2-16a of the bases of the Oconee Technical Specifications are valid for the Mark B8 fuel assembly design and its predecessors. These limits have been revised to correct problems with the critical heat flux (CHF) correlations in the LOCA Evaluation Model (EM). References 2 and 3 summarize the impact of the CHF correlation problems on the generic LOCA limits for the 177 fuel assembly lowered loop plants. References 4 and 5 docket References 2 and 3 for Oconee Units 1, 2, and 3.

To some extent, Oconee deviates from the generic 177 fuel assembly lowered loop LOCA analyses. As a result, additional analyses were performed for the 4 and 6 foot elevations to accommodate Oconee specific assumptions. At the 6 foot core elevation the LOCA linear heat rate limit was lowered from 16.5 kW/ft (0-1000 MWd/mtU) and 18.0 kW/ft (after 1000 MWd/mtU) to 16.1 kW/ft for all burnups.

The 4 foot core elevation was reanalyzed using the TACO3 computer code as input to the LOCA EM. Assuming a linear heat rate of 16.1 kW/ft, use of the fuel temperature input from TACO3 resulted in a decrease in the peak cladding temperature from 2160°F to 1786°F. The lower peak cladding temperature associated with the use of TACO3 introduces enough margin to accomodate Oconee specific assumptions without requiring a reduction in the LOCA linear heat rate limit at the 4 foot elevation. The NRC was notified of these results in Reference 5.

The net effect of the EM CHF problems is that the LOCA linear heat rate limit for the 6 foot elevation is reduced to 16.1 kW/ft for all burnups.

Mark B9 LOCA Limits

Reference 1 is a report summarizing the LOCA linear heat rate analyses for the Mark B9 fuel assembly (attached). As was described earlier, the Mark B9 average fuel temperature is lower than the average fuel temperature for a Mark B8 fuel assembly because of a smaller diametral gap. Thus, for a given linear heat rate, the stored energy in a Mark B9 fuel rod is less than in a Mark B8 fuel rod. In addition, the TACO3 fuel performance code was used to specify average fuel temperature input for the LOCA EM. As is described in Reference 1, this fuel performance code predicts lower BOC fuel temperatures than the previously used fuel performance code, TACO2. The net effect of these changes is that the average fuel temperature is significantly lower in the Mark B9 fuel assembly than in the Mark B8 fuel assembly.

The lower BOC average fuel temperature associated with the Mark B9 fuel assembly introduces margin into the BOC LOCA linear heat rate limits. This margin is partially offset by changes in other EM input assumptions. In the past, the generic LOCA analyses have assumed nominal values for some of the ECCS input assumptions. For example, the nominal Technical Specification value of 600 psig was assumed for the core flood tank cover pressure. In an attempt to account for plant specific variations in some of these inputs, the B&W Owners Group (B&WOG) utilities developed a new set of bounding, generic assumptions for the 177 fuel assembly lowered loop plants. These new generic assumptions are described in Reference 1 and are used in the Mark B9 LOCA analyses. These assumptions tend to partially offset the gains associated with the lower fuel temperature of the Mark B9 fuel assembly. A detailed description of the analyses supporting the Mark B9 LOCA linear heat rate limits is provided in Reference 1 (attached).

References

1. B&W Document 86-1202153-00, MK-B9 Spectrum LOCA LHR Limit Analyses for 177-Fuel Assembly Lowered Loop Plants, June 27, 1991.

2. J. H. Taylor (B&W) to Dr. T. E. Murley (NRC) letter dated March 19, 1990 (JHT/90-43).

3. J. H. Taylor (B&W) to Dr. T. E. Murley (NRC), letter dated August 23, 1990 (JHT/90-126).

4. H. B. Tucker (Duke) to NRC Document Control Desk, letter dated July 18, 1990.

5. M. S. Tuckman (Duke) to NRC Document Control Desk, letter dated January 14, 1991.

Attachment 3

MK-B9 Spectrum LOCA LHR Limit Analyses for 177-Fuel Assembly Lowered Loop Plants

PROPRIETARY INFORMATION

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