Docket No. 50-259

Tennessee Valley Authority
ATTN: Mr. James E. Watson
        Manager of Power
818 Power Building
Chattanooga, Tennessee 37401

Change No. 2
License No. DPR-33

Gentlemen:

By letter dated August 14, 1973, you referenced Supplement No. 6 to
NEDM-10735, which was transmitted with General Electric Company's (GE)
letter dated August 11, 1973. Supplement No. 6 includes technical
specification changes related to postulated effects of fuel densification.
Your letter dated October 25, 1973 provided information concerning the
effect of the technical specification changes on the power level of
Browns Ferry Nuclear Plant, Unit 1. Additionally, in a letter dated
November 1, 1973, you concluded that the new gamma curves for maximum
Average Planar Linear Heat Generation submitted by GE's letter dated
October 25, 1973 (I. Stuart to V. Moore) are applicable to the Browns
Ferry fuel design. The proposed changes would add certain limiting
conditions for operation and surveillance requirements.

We have determined in the Regulatory staff's SER Supplement No. 5, dated
November 8, 1973, that the changes are acceptable and that they do
not involve a significant hazards consideration. Moreover, the
Regulatory staff has concluded that if these technical specification
limitations are met, there is reasonable assurance that operation of
the Browns Ferry Nuclear Plants will not result in undue risk to the
health and safety of the public.

Accordingly, pursuant to Section 50.59 of 10 CFR Part 50, the Technical
Specifications appended to Facility Operating License No. DPR-33, dated
June 26, 1973, are changed as shown in the enclosed Attachment A.

Sincerely,

Original signed by
Voss A. Moore

Voss A. Moore, Assistant Director
    for Boiling Water Reactors
Directorate of Licensing

Enclosure:
Attachment A - Change No. 2 to the
    Technical Specifications (Appendix A)

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DATE ►	11/28/73	11/29/73	11/30/73	11/30/73		

CHANGE NO. 2 TO THE TECHNICAL SPECIFICATIONS
(APPENDIX A)
TENNESSEE VALLEY AUTHORITY
DOCKET NO. 50-259

TABLE OF CONTENTS

LIMITING CONDITIONS FOR OPERATION

Section 3.5 add:

I. Average Planar LHGR

During steady state power operation, the average linear heat generation rate (LHGR) of all the rods in any fuel assembly, as a function of average planar exposure, at any axial location, shall not exceed the maximum average LHGR shown in Figure 3.5.1.

J. Local LHGR

During steady state power operation, the linear heat generation rate (LHGR) of any rod in any fuel assembly at any axial location shall not exceed the maximum allowable LHGR as calculated by the following equation:

$$LHGR_{max} \leq LHGR_d \ [1-(^{\Delta P}/_P) \ max \ (^L/_{LT})]$$

$LHGR_d$ = Design LHGR = 18.5 KW/ft

$(^{\Delta P}/_P)$ max = Maximum power spiking
penalty = 0.036

LT = Total core length = 12 ft

L = Axial position above bottom of core

SURVEILLANCE REQUIREMENTS

Section 4.5 add:

I. Average Planar LHGR

Daily during reactor power operation, the average planar LHGR shall be checked.

J. Local LHGR

Daily during reactor power operation, the local LHGR shall be checked.

3.5 BASES

Add the following pages:

149a - 149d (appended hereto)

3.5.I Average Planar LHGR

This specification assures that the peak cladding temperature following the postulated design basis loss-of-coolant accident will not exceed the 2300°F limit specified in the Interim Acceptance Criteria (IAC) issued in June 1971 considering the postulated effects of fuel pellet densification.

The peak cladding temperature following a postulated loss-of-coolant accident is primarily a function of the average heat generation rate of all the rods of a fuel assembly at any axial location and is only dependent secondarily on the rod to rod power distribution within an assembly. Since expected local variations in power distribution within a fuel assembly affect the calculated peak clad temperature by less than ±20°F relative to the peak temperature for a typical fuel design, the limit on the average linear heat generation rate is sufficient to assure that calculated temperatures are within the IAC limit.

The maximum average planar LHGR shown in Figure 3.5.1 is the same as that shown on the curve labeled "γ" (gamma) on Figures 1 & 2 forwarded by letter of October 25, 1973 from GE (I. Stuart) to AEC (V. Moore) replacing Figures 4-9F1 and 4-9F2 of GE topical "Fuel Densification Effects on General Electric Boiling Water Reactor Fuel," NEDM-10735, Supplement 6, August 1973 and is the result of the calculations presented in Section 4.3.4 of the same report. These calculations were made to determine the effect of densification on peak clad temperature and were performed in accordance with the AEC Fuel Densification Model for BWR's which is attached to NEDM-10735, Supplement 6 as

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Appendix B.

The possible effects of fuel pellet densification were: (1)
creep collapse of the cladding due to axial gap formation; (2)
increase in the LHGR because of pellet column shortening; (3) power
spikes due to axial gap formation; and (4) changes in stored energy
due to increased radial gap size. Calculations show that clad
collapse is conservatively predicted not to occur currently or
during the next power operation cycle. Therefore, clad collapse
is not considered in the analyses. Since axial thermal expansion
of the fuel pellets is greater than axial shrinkage due to densifi-
cation the analyses of peak clad temperature do not consider any
change in LHGR due to pellet column shortening. Although, the
formation of axial gaps might produce a local power spike at one
location on any one rod in a fuel assembly, the increase in local
power density would be on the order of only 2% at the axial mid-
plane. Since small local variations in power distribution have
a small effect on peak clad temperature, power spikes were not
considered in the analysis of loss-of-coolant accidents. Changes
in gap size affect the peak clad temperature by their effect on
pellet clad thermal conductance and fuel pellet stored energy. The
pellet-clad thermal conductance assumed for each rod is dependent
on the steady state operating linear heat generation rate and the
gap size. As specified in the AEC Fuel Densification Model for
BWR's, the gap size was calculated assuming that the pellet densified
from the measured pellet density to 96.5% of theoretical density.
For the most critical rod, the two standard deviation lower bound

on initial pellet density was assumed. For the other 48 rods in the bundle the two standard deviation lower bound on the initial mean "boat" pellet density was assumed.

The curves used to determine pellet-clad thermal conductance as a function of linear heat generation are based on experimental data and predict with a 95% confidence that 90% of the population exceed the predictions.

3.5.J   <u>Local LHGR</u>

This specification assures that the linear heat generation rate 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.

4.5.I & J   <u>Average and Local LHGR</u>

The LHGR shall be checked daily to determine if fuel burnup, or control rod movement has caused changes in power distribution. Since changes due to burnup are slow, and only a few control rods are moved daily, a daily check of power distribution is adequate.

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Figure 3.5.1 Maximum Allowable Planar LHGR

(Y-axis: MAXIMUM AVERAGE PLANAR LHGR (kW/ft), scale from 10 to 18)

(X-axis: AVERAGE PLANAR EXPOSURE (mWd/t), scale from 0 to 30,000)

Fuel Type II

Fuel Type III, I