MAR 11 1977

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Docket (50-296)
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Docket No. 50-296

Tennessee Valley Authority
ATTN: Mr. Godwin Williams, Jr.
Manager of Power
818 Power Building
Chattanooga, Tennessee 37201

Gentlemen:

RE: BROWNS FERRY PLANT, UNIT NO. 3

The enclosed Order of Modification pertains to Facility Operating License No. DPR-68 issued for Browns Ferry Nuclear Plant, Unit No. 3. The Order corrects errors and reflects changes in the methods of analysis in the ECCS performance evaluation submitted in accordance with 10 CFR §50.46.

The errors detected were of the nature of inputs to computer codes used in the analyses or were due to numerical errors in the calculations performed. The total impact of the errors and model changes is conservative and no reduction of plant operating limits is required to accommodate the presence of the errors.

This Order confirms the appropriateness of Tennessee Valley Authority voluntary action of agreeing to submit, on a timely basis, an ECCS re-evaluation using a General Electric ECCS evaluation model approved by the staff.

A copy of the Order is being filed with the Office of the Federal Register for publication.

Sincerely,

Original signed by

A. Schwencer, Chief
Operating Reactors Branch #1
Division of Operating Reactors

Enclosure:
Order for Modification
of License

cc w/enclosure:
See next page

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Form AEC-318 (Rev. 9-53) AECM 0240

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NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
Tennessee Valley Authority	)	Docket No. 50-296
	)	
Browns Ferry Nuclear Plant	)	
Unit No. 3	)	

ORDER FOR MODIFICATION OF LICENSE

I.

The Tennessee Valley Authority (the licensee), is the holder of Facility Operating License No. DPR-68 which authorizes the operation of the nuclear power reactor known as Browns Ferry Nuclear Plant, Unit No. 3 (the facility) at steady state reactor power levels not in excess of 3293 megawatts thermal (rated power). The facility consists of a boiling water reactor (BWR) located at the licensee's site in Limestone County, Alabama.

II.

In conformance with evaluations of the performance of the Emergency Core Cooling System (ECCS) of the facility submitted by the licensee in Amendments 59, 61, and 63 to the Browns Ferry Nuclear Plant FSAR, the Technical Specifications issued for the facility on July 2, 1976, limit the Average Planar Linear Heat Generation Rates to the values shown on Techical Specification 3.5.1.A and 3.5.1.B. The ECCS performance evaluation submitted by the licensee was based upon a previously approved ECCS evaluation model developed by General Electric Company (General Electric), the designer of the facility. This model has been found to conform to

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the requirements of the Commission's ECCS Acceptance Criteria, 10 CFR Part 50 s 50.46 and Appendix K. The evaluation indicated that with the average planar linear heat generation rate limited as set forth above, and with the other limits set forth in the facility's technical specifications, the ECCS cooling performance for the facility would conform with the criteria contained in 10 CFR s 50.46(b) which govern calculated peak clad temperature, maximum cladding oxidation, maximum hydrogen generation, coolable geometry and long term cooling.

Recently, the NRC staff was informed by General Electric that several errors had been discovered in the computer codes used to calculate peak clad temperature and the clad oxidation percentage in the General Electric evaluation model. These errors have been discovered by General Electric during a continuing internal Quality Assurance audit of their LOCA evaluation model codes. This audit is still under way and the errors reported reflect those found to date. The additional effort expended by the vendor to enhance the assurance of the quality of its evaluation model, the staff believes, was prudent and desirable. Identification of additional errors of a minor nature may still develop during the ongoing QA checks. Nonetheless, the staff believes it appropriate to order the correction of those uncovered thus far. While some of these errors discussed herein have either no significant effect or a conservative effect on the evaluation results, one or more of the errors included in the Browns Ferry Unit 3 ECCS evaluation leads to non-conservative values. Based on a preliminary assessment, including information and supportive calculations by General Electric, the NRC staff has determined that the

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combined effect of the following code errors would, when corrected, result in an ECCS evaluation requiring no reduction in operating limits for Browns Ferry Unit No. 3.

(1) Pressure Rule

The LAMB code is used to calculate system pressure during the LOCA. This calculated pressure is then used as an input to the REFLOOD code which calculates the water level vs time relationship in the core. General Electric used an approximation of the pressure response of the LAMB code that was thought, at the time of approval, to be an acceptable representation of the physical phenomena involved. Later application of this approximation to certain cases showed it to be non-conservative. General Electric proposes to correct this nonconservatism by utilizing a conservative approximation to the pressure rule for input into REFLOOD. This correction increases reflood time by 0 to 50 seconds and decreases MAPLHGR by 0 to 5%.

(2) Bundle Vaporization

General Electric has used incorrect coefficients in the calculation of the amount of vaporization occurring during core spray. The vapor formation in the bundle is a prime determinant of the amount of spray water that can get through the upper tie plate and reflood the core. The vapor formation was under-calculated by approximately 4% resulting in a 20-second increase in reflooding time and about a 2% decrease in the MAPLHGR.

(3) Discharge Break Modeling

General Electric proposes to take credit for an approved model for suction line friction (from the vessel nozzle to the discharge side of the

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recirculation pump) that improves reflooding time for the discharge break by approximately 15 seconds. This increases the MAPLHGR for discharge break limited plants by about 1.5%. This error does not apply to Browns Ferry Unit 3.

(4) Structural Absorption of Gamma Heat

General Electric has erroneously taken double credit for power generation in non-fuel structural material. Correction of this error results in approximately a 4% decrease in the MAPLHGR for certain plants. This error does not apply to Browns Ferry Unit 3.

(5) Increased Counter Current Flow Limiting (CCFL) Differential Pressure

Some experimental evidence exists that the differential pressure in a fuel assembly during periods of CCFL may be higher than previously assumed. This could cause a delay in reflood time. Correction of this error reduces the Browns Ferry Unit 3 MAPLHGR by 1 to 2%.

(6) Others

Several small changes of inputs to the evaluation codes were identified as being necessary to correct errors. They included:

(a) The use of actual plant specific break areas for the LOCA;

(b) A reduced core plate weight;

(c) An increase in the peripheral bypass area used in the counter current flooding calculations;

(d) The correction of a decimal point error in the assumed guide tube thickness; and

(e) Credit is no longer assumed for recirculation loop discharge valve closure during blowdown.

Due to the errors in the ECCS analysis currently approved by NRC for Browns Ferry Unit 3, the staff requested the licensee to submit an estimate of the impact of these errors on the peak clad temperature that would result from the worst break, if the errors were corrected. The revised ECCS calculations indicated that the MAPLHGR is conservative by approximately 1% considering the cumulative effect of these errors. Although GE model changes under review by the staff generically show that MAPLHGR limits even higher than those presently set forth in the Technical Specifications for Browns Ferry Unit No. 3 would still satisfy ECCS limits, no credit for such increase was considered by the NRC.

The staff expects that when final revised calculations for the facility are submitted using the revised and corrected model, they will demonstrate that operation with the linear heat generation rates set forth in this Order will conform to the Criteria of 10 CFR § 50.46(b). Such revised calculations fully conforming to the requirements of 10 CFR § 50.46 are to be provided for the facility as soon as possible.

As discussed herein, the present MAPLHGR limits for this facility are such that they assure that the ECCS will conform to the performance requirements of 10 CFR s 50.46. Accordingly, such limits provide reasonable assurance that the public health and safety will not be endangered.

Upon notification by the NRC staff on February 14, 1977, the licensee committed to submit a re-evaluation of the ECCS performance of Browns

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Ferry Unit 3 on a timely basis. The staff believes that the licensee's action, under the circumstances, is appropriate and that this action should be confirmed by NRC Order.

III.

Copies of the following documents are available for inspection at the Commission's Public Document Room at 1717 H Street, Washington, D. C. 20555 and are being placed in the Commission's local public document room at the Athens Public Library, South and Forrest, Athens, Alabama 35611:

(1) Letters from General Electric to NRC dated February 14, 1977, and January 26, 1977;

(2) Letters from Tennessee Valley Authority to the Director of Nuclear Reactor Regulation dated January 19, and February 18, 1977;

(3) Amendments 59, 61 and 63 to the Browns Ferry Nuclear Plant FSAR.

(4) This Order for Modification of License in the matter of Tennessee Valley Authority (Browns Ferry Nuclear Plant Unit No. 3).

Accordingly, pursuant to the Atomic Energy Act of 1954, as amended, and the Commission's Rules and Regulations in 10 CFR Parts 2 and 50, IT IS ORDERED THAT Facility Operating License No. DPR-68 is hereby amended by adding the following new provision:

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(1) As soon as possible, the licensee shall submit a re-evaluation of ECCS cooling performance calculated in accordance with General Electric Company's Evaluation Model approved by the NRC staff and corrected for the errors described herein and any other corrections in the Model of which the licensee is aware at the time the calculations are performed.

FOR THE NUCLEAR REGULATORY COMMISSION

Original signed by

Ben C. Rusche, Director
Office of Nuclear Reactor Regulation

Dated in Bethesda, Maryland
this MAR 11 1977

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