



ENCLOSURE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

STAFF EVALUATION REPORT

on Licensing Topical Reports by General Electric Company
"BWR/6 Fuel Assembly Evaluation of Combined Safe Shutdown
Earthquake (SSE) and Loss-of-Coolant Accident (LOCA) Loadings"

NEDE-21175-P & NEDO-21175, November 1976

Amendment No. 1, April 1977

Amendment No. 2, September 1977

Core Performance Branch

April 1979

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1.0 INTRODUCTION

The General Electric Company has presented a licensing topical report (Ref. 1) and two amendments (Refs. 2 and 3) that describe (a) seismic and blowdown loadings, (b) analytical methods used to determine fuel assembly structural response to the loads and (c) design limits used to determine the adequacy of BWR/6 fuel assemblies.

We find the analytical methods in the GE topical report to be acceptable. However, generic fuel assembly design limits were not accepted because we have not yet completed developing general acceptance criteria for the design limits. Furthermore, the seismic and blowdown loads were not reviewed at present and must be considered on a plant-by-plant basis.

The report also discusses the analysis of potential fuel bundle liftoff from the core plate for a postulated steam line break. This subject will be evaluated separately and a report will be issued later.

2.0 REPORT DESCRIPTION AND EVALUATION

The GE reports describe the loads on the fuel assembly caused by an earthquake, a steam line break, and a recirculation line break.

The analytical procedure used by GE on the fuel assembly components is a linear-static approach. Unlike in a PWR, the blowdown load due to a pipe rupture in a BWR is expected to be small. Consequently, the analysis revealed no lateral impacting between the fuel assemblies. This makes the fuel assembly response independent of gap size between the assemblies and permits a relatively simple linear analysis. Stiffness and damping of the assemblies were also assumed to be linear.

The static seismic loading was taken as a maximum acceleration envelope generated from a dynamic analysis by an overall system finite element model. The LOCA loading was generated by a blowdown analysis computer code. No asymmetric loading was considered other than the lateral seismic excitation. The different pressures were applied statically to the various fuel assembly components and combined with earthquake loads to obtain final stresses. Detailed analyses are performed for each major fuel assembly component including the upper tieplate, fuel rods, water rods, spacer grids, channel boxes, and lower tieplate. In general, an overall conservative static analysis is performed on the fuel assembly in both the lateral and vertical directions.

Because the analysis is linear and because conservative assumptions are used, no detailed staff evaluation was necessary; linear structural dynamic analyses as well as static stress calculations are well established engineering methods. To prevent any unforeseen error in the models or calculations, however, an independent audit calculation was performed (Ref. 4) and confirmed the adequacy of the GE methods.

3.0 CONCLUSION

We conclude that the analytical methods described in the subject reports are acceptable. The reports can be referenced in plant applications as a description of acceptable analytical methods for fuel assembly structural response to seismic and LOCA loads. Design limits and earthquake and blowdown loads will be reviewed on a case-by-case bases. If the plant-specific loadings are larger than the ones described in the subject reports, and if the combined loadings cause fuel assemblies to impact, then a new fuel assembly response model must be submitted for staff review since the present model is not suitable for impact evaluation.

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REFERENCES

1. "BWR/6 Fuel Assembly Evaluation of Combined SSE and LOCA Loadings," General Electric Proprietary Report NEDE-21175-P, November 1976 (Non-Proprietary Report NEDE-21175).
2. "BWR/6 Fuel Assembly Evaluation of Combined SSE and LOCA Loadings (Amendment No. 1)," General Electric Proprietary Report NEDE-21175-1-P, April 1977 (Non-Proprietary Report NEDE-21175-1).
3. "BWR/6 Fuel Assembly Evaluation of Combined SSE and LOCA Loadings (Amendment No. 2)," General Electric Proprietary Report NEDE-21175-2-P, September 1977 (Non-Proprietary Report NEDE-21175-2).
4. R. L. Grubb, "General Electric BWR/6 Fuel Assembly Mechanical Response Analysis Review," INEL Proprietary Report RE-A-77-152, February 1978.

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Central Files - Topical Reports

MAY 17 1979

Dr. G. G. Sherwood
Manager - Safety and Licensing
General Electric Company
175 Curtner Avenue
San Jose, California 95114

Dear Dr. Sherwood:

SUBJECT: STAFF EVALUATION OF TOPICAL REPORT NEDE-21175-P AND NEDO-21175

We have completed our review, through Amendment 2, of General Electric topical report NEDE-21175-P (proprietary) and NEDO-21175 (non-proprietary version), "BWR/6 Fuel Assembly Evaluation of Combined SSE and LOCA Loadings." This report describes: (1) seismic and blowdown loadings, (2) analytical methods used to determine fuel assembly structural response to the loads, and (3) design limits used to determine the adequacy of BWR/6 fuel assemblies.

Based on our review, we conclude that the analytical methods described in this report are acceptable for reference in license applications as discussed in the enclosed staff evaluation. We have not reviewed the generic fuel assembly design limits since we have not yet completed developing general acceptance criteria for the design limits. The seismic and blowdown loads were not reviewed and must be considered on a plant-by-plant basis. In addition, the analysis of the potential fuel bundle liftoff from the core plate for a postulated steam line break will be evaluated separately and a report will be issued on the subject at a later time.

The staff does not intend to repeat its review of this report when it is referenced in specific license applications, except to assure that the report is applicable to the specific plant involved. When the proprietary report is used as a reference, both the proprietary and the non-proprietary version of the report must be referenced.

In accordance with established procedure, it is requested that General Electric issue a revised version of this report to include; Amendments 1 and 2, any supplementary information provided for our review of this report, this acceptance letter, and the staff evaluation (Enclosure).

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Dr. G. G. Sherwood

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Should regulatory criteria or regulations change such that our conclusions concerning NEDE-21175-P and NEDO-21175 are invalidated, you will be notified and will be given the opportunity to revise and resubmit your report for review, should you so desire.

Sincerely,

Alan D. Parr
Alan D. Parr, Chief
Light Water Reactors Branch No. 3
Division of Project Management

Enclosure:
Topical Report Evaluation

cc w/enclosure:

Mr. L. Gifford
General Electric Company
4720 Montgomery Lane
Bethesda, Maryland 20014

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