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

MAR 22 1986

MFN-029-086

Ms. J. S. Charnley
Fuel Licensing Manager
General Electric Company
175 Curtner Avenue
San Jose, CA 95125

Dear Ms. Charnley:

SUBJECT: ACCEPTANCE FOR REFERENCING OF LICENSING TOPICAL REPORT NEDE-24011-P-A, "GE GENERIC LICENSING RELOAD REPORT," SUPPLEMENT TO AMENDMENT 11

We have completed our review of the subject topical report submitted by General Electric Company by letter dated October 9, 1985.

We find the report to be acceptable for referencing in license applications to the extent specified and under the limitations delineated in the report and the associated NRC evaluation, which is enclosed. The evaluation defines the basis for acceptance of the report.

We do not intend to repeat our review of the matters described in the report and found acceptable when the report appears as a reference in license applications, except to assure that the material presented is applicable to the specific plant involved. Our acceptance applies only to the matters described in the report.

In accordance with procedures established in NUREG-0390, it is requested that GE publish accepted versions of this report, proprietary and non-proprietary, within three months of receipt of this letter. The accepted versions shall incorporate this letter and the enclosed evaluation between the title page and the abstract. The accepted versions shall include an -A (designating accepted) following the report identification symbol.

Should our criteria or regulations change such that our conclusions as to the acceptability of the report are invalidated, GE and/or the applicants referencing the topical report will be expected to revise and resubmit their respective documentation, or submit justification for the continued effective applicability of the topical report without revision of their respective documentation.

Sincerely,

Gus C. Lainas, Assistant Director
for BWR
Division of BWR Licensing
Office of Nuclear Reactor Regulation

Enclosure:
As stated

# SAFETY EVALUATION REPORT FOR AMENDMENT 11

# TO NEDE-24011

By letter from Cecil O. Thomas (NRC) to Ms. J. S. Charnley (GE) dated November 5, 1985, the Nuclear Regulatory Commission found Amendment 11 to NEDE-24011 acceptable for referencing in license applications with qualifications. In particular, the evaluation noted:

> Amendment 11 also revised the manner in which code uncertainties are handled in obtaining the Option A and Option B MCPR operating limits. However insufficient justification has been provided for this change and we conclude that the currently used treatment of uncertainties must continue to be used. This has been discussed with GE and they concur in this condition to the staff approval of this amendment.

General Electric provided supplementary information which supports the proposed method of treating unertainties in letter JSC-065-85 from J. S. Charnley to C. O. Thomas dated October 9, 1985. The October 9 letter was revised in JSC-005-86 from J. S. Charnley to H. N. Berkow dated January 16, 1986. The new application methodology is for the GEMINI/ODYN transient analysis methodology. The proposed approach is similar to the previously approved GENESIS/ODYN methodology. The revised amendment 11 describes the derivation of statistical adjustment factors to be applied to GEMINI/ODYN results to determine plant operating limits for BWR/4 and BWR/5 plants operating without recirculation pump trip. Factors for other types of plants will be provided in future reports.

Background (GENESIS/ODYN Application)

The current licensing basis approved with the GENESIS/ODYN models for calculating the ΔCPR for pressurization events is performed in accordance with either or both of two methods known as Option A and Option B. These currently used options are summarized below:

Option A

This approach is comprised of the two-step calculation which follows:

1. The pressurization transient is analyzed using the GENESIS/ODYN models to obtain the change in the critical power ratio (ΔCPR) for the core. The initial CPR ($ICPR_c$) is then determined such that $ICPR_c$ minus ΔCPR equals the MCPR Fuel Cladding Integrity Safety Limit. Conservative input parameters are used in the analysis, e.g. the scram speed is per technical specifications, and a conservative Haling power shape, as well as other maximum equipment specifications, is used.

2. The licensing basis ICPR is given as:

$$ICPR_{\text{Licensing Basis}} = 1.044\ ICPR_c$$

where $ICPR_c$ = value of ICPR calculated using GENESIS/ODYN models, i.e. ICPR = ΔCPR + MCPR Safety Limit

Option B

This procedure provides for a statistical determination of the pressurization transient ΔCPR/ICPR such that there is a 95% probability with 95% confidence (95/95) that the event will not cause the critical power ratio to fall below the MCPR Fuel Cladding Integrity Safety Limit. This approach can be satisfied in one of two ways:

1. A plant-specific statistical analysis can be performed per the approved statistical methodology procedures to determine the 95/95 ΔCPR/ICPR; or
2. Generic ΔCPR/ICPR statistical adjustment factors (SAF) for groupings of similar type plants can be applied to plant-specific calculations to derive the 95/95 ΔCPR/ICPR value. This procedure is characterized by the following expression:

$$\left(\frac{\Delta CPR}{ICPR}\right)_{95/95} = \left(\frac{\Delta CPR}{ICPR}\right)_{C} + SAF$$

where $\left(\frac{\Delta CPR}{ICPR}\right)_{C}$ = ΔCPR/ICPR calculated for the pressurization event per the assumptions of Step 1 in Option A

By substituting into the above expression the relationship:

$$\Delta CPR_{95/95} = ICPR_{95/95} - \text{MCPR Safety Limit},$$

it follows that the $(ICPR)_{95/95}$ is determined from the following expression:

$$ICPR_{95/95} = \frac{\text{MCPR Safety Limit}}{1 - \left[\left(\frac{\Delta CPR}{ICPR}\right)_{C} + SAF\right]}$$

This statistical Option B uses a GENESIS/ODYN model uncertainty of 37% of ΔCPR/ICPR at the 2σ level to determine the 95/95 ICPR. This uncertainty was determined by the staff when the GENESIS/ODYN model predictions were compared to the full scale turbine trip qualification data.

Utilities using Option B must demonstrate that their plant's scram speed distribution is consistent with that used in the statistical analysis. This is accomplished through an approved technical specification which consists of testing at the 5% significance level and allows adjustment of the operating limit MCPR if the scram speed is outside the assumed distribution.

GEMINI/ODYN Application

The GEMINI/ODYN set of methods has been compared against actual test data. The results of the comparison indicate an improvement in prediction accuracy with GEMINI/ODYN. The true 95/95 ΔCPR/ICPR will be determined using the same fundamental approach established for the current GENESIS/ODYN Option B and accounting for the improvement in prediction accuracy. The resulting procedure, which will be used with the GEMINI/ODYN models, simplifies the current two option approach (Option A and Option B) into one. The GEMINI/ODYN licensing bases are discussed in the following sections.

Licensing Analysis

Licensing analyses accomplised with the GEMINI/ODYN models will permit plants to operate under a single set of MCPR limits if scram speed

compliance procedures identical to those in current plant Technical Specifications are followed. If scram speed compliance is not demonstrated, more conservative MCPR operating limits must be met. The licensing analysis with the GEMINI/ODYN models will be calculated in a similar manner as with the GENESIS/ODYN models. The statistical determination of the transient ΔCPR/ICPR adjustment factor for the pressurization event will continue to assure a 95% probability with 95% confidence that the critical power will not fall below the MCPR Fuel Cladding Integrity Safety Limit. The ODYN model uncertainty used in statistical analysis will be revised from the 37% ΔCPR/ICPR used for the GENESIS/ODYN methods to a value to reflect the improved accuracy of the GEMINI/ODYN set of methods demonstrated by comparison to data.

GEMINI/ODYN Technical Specification Limits

The technical specification limit will be determined from the following general equation:

$$OLMCPR_{Tech\ Spec} = OLPMCPR_{95/95} + \frac{\tau_{ave} - \tau_{B}}{\tau_{A} - \tau_{B}} (\Delta OLMCPR)$$

where ΔOLMCPR = factors derived by the new methodology and

and $OLMCPR_{95/95} = \Delta CPR_{95/95}$ + MCPR Safety Limit.

The definitions of $\tau_A$, $\tau_B$ and $\tau_{ave}$ remain the same as those currently appearing in Technical Specifications. For plants that demonstrate scram speed compliance (i.e. $\tau_{ave} \leq \tau_B$)