ENCLOSURE

SAFETY EVALUATION REVISIONS TO GESTAR
(NEDE-24011-P) AMENDMENT 7

After the issuance of our SER on NEDE-24011-P Amendment 7 (Reference 1) GE requested clarifications to several statements and positions in the SER. Since these clarifications and positions are important to future use of Amendment 7 and the guidance of the SER, we are providing these requested clarifications. They refer to specific sections of the Amendment 7 SER and are in the form of page changes to our original SER.

ultimate tensile stress and the corresponding strain. The effective stress and stain are calculated using von Mises's criterion. The design ratio is limited to be less than or equal to unity for design purposes.

This design ratio is derived from ANSI/ANS-57.5-1981, which has some variations from the acceptable ASME Code Section III. For example, while ANSI/ANS-57.5-1981 uses a full ultimate tensile stress, the ASME Code Section III calls for only 70% of the same quantity.

GE has demonstrated, in response to our questions (Charnley, April 23, 1984) during the review of Amendment 7, that a conservative approach has been developed in calculating the design ratios. GE performs a Monte Carlo statistical analysis for either the stress or strain design ratio distributions. GE calcualtes the design ratio distribution for stress unless the stress reaches the plasticity state; then the design ratio distribution for strain is calculated. In order to satisfy the design criterion, GE requires that the upper 95 percentile of both distributions be less than unity.

We consider that the GE approach to this design criterion is an acceptable alternative to the ASME Section III approach specified in the SRP because appropriate conservatisms are incorporated into the analysis including the use of an upper 95% tolerance limit of the design ratio distributions and a bounding power history. Therefore, we conclude that the GE design ratio criterion is acceptable.

(2) Strain Fatigue

GE's design basis for strain fatigue is that the fuel assembly and the fuel rod cladding are evaluated to ensure that failure due to cyclic loadings will not exceed the fatigue capability. GE uses a fatigue design limit called fatigue usage, which is defined as a ratio of actual number of cycles at stress or strain to allowable cycles at stress or strain. This ratio must be less than unity.

We have previously (in our GESSAR II SER) approved the use of fatigue usage as a viable alternative to the SRP approach because the associated information, for example, Figure 2-11a in NEDE-24011-P-A-5, demonstrated that a level of conservatism existed approximately equivalent to that of O'Donnell and Langer whose method is cited in the Standard Review Plan. GE clarified that Figure 2-11b (which is the same as Figure 4-2 in Amendment 7) is a bounding curve of strain fatigue vs. number of cycles which bounds not only the O'Donnell and Langer data but also additional data and that Figure 4-2 is used as the basis for meeting this SAFDL. We, therefore, conclude that the GE fatigue usage design criterion is acceptable.

(3) Fretting Wear

Although the SRP does not provide numerical bounding-value acceptance criteria for fretting wear, it does stipulate that the allowable fretting wear, should be stated in the safety analysis and that the stress and fatigue limits should presume the existence of the wear. GE's design basis is that the fuel assembly is evaluated to ensure that the fuel will not fail due to fretting wear of the assembly components. Instead of providing a limit on fretting wear, GE considers the effect of fretting wear in design analysis based on testing and experience in reactor operations.

Since the SRP does not provide numerical acceptance criteria for fretting wear, and since fretting wear is addressed in the design analysis for each bundle design, the NRC staff concludes that the intent of the SRP has been adequately met.

(4) External Corrosion and Crud Buildup

With respect to external corrosion and crud buildup, GE's design basis is that the fuel rod is evaluated to ensure that the cladding temperature increase and cladding metal thinning due to cladding oxidation and the cladding temperature increase due to the buildup of corrosion products do not result in fuel rod failure due to reduced cladding strength. GE does not specify a maximum cladding external temperature to limit corrosion or an external corrosion or crud layer

would be given another settling friction test to obtain an exact friction-versus-position profile, the latter type of test is not mentioned by LRG-II or GESSAR-II. The position taken by the LRG-II and GESSAR-II applicants is that failure of the proposed settling time test would "prompt an investigation," which, if necessary, would lead to corrective action.

While we believe that a commitment to perform an exact settling friction profile test (or actual dimensional measurement) is preferable (because it would provide an estimate of the margin and physical state of the system in an unambiguous way), the LRG-II and General Electric Company in NEDE-21354-P have stated that the control rod drives will tolerate a relatively large increase in driveline friction while still remaining within Technical Specification limits. The screening-type test proposed would, thus, provide assurance of the scram function. Therefore, we have accepted (Rubenstein, August 19, 1982) the LRG-II position that the proposed actions will preclude excessive channel bowing in the LRG-II plants (i.e., River Bend and Perry), and by the same token, we accept GESSAR-II's endorsement of that position.

In a recent letter (Charnley, July 18, 1984), GE states that the recommendation in NEDE-21354-P and the GESSAR-II position will be implemented in GESTAR II. We, therefore, conclude that channel box deflection issue is resolved in GESTAR II.

Irradiation Axial Growth

GE relies on operational experience in determining the adequacy of expansion spring design. According to the GE results, the expansion spring experiences some minimal axial compression but is never fully compressed during irradiation. This suggests that fuel rod irradiation growth is small. Therefore, no interference between the fuel rods and the upper tieplate would be expected.

6.2 On-Line Fuel System Monitoring

The method of on-line fuel system monitoring is proposed by the applicant and is subject to approval by the staff. This topic is not addressed in GESTAR II.

6.3 Post-irradiation Surveillance

As indicated in the SRP, a routine fuel inspection program to provide information on irradiated and discharged fuel should be provided. In a letter dated November 23, 1983, from J. S. Charnley (GE) to C. H. Berlinger (NRC), GE proposed a generic fuel vendor surveillance program, which would satisfy the intent of SRP Section 4.2.II.D.3 that each applicant performs post-irradiation fuel surveillance on fuel irradiated in the applicant's reactor. The program proposed by GE would allow GE to assume the responsibility for post-irradiation fuel surveillance of GE designed and manufactured fuel. This program was approved by the staff in a letter dated June 27, 1984. Therefore, we conclude that post-irradiation surveillance is adequately addressed in GESTAR II as long as applicants referencing GESTAR II will endorse the GE fuel surveillance program or an acceptable alternative.

7.0 EVALUATION FINDINGS

The fuel system design in GESTAR II has been reviewed in accordance with SRP Section 4.2. The staff concludes that, although most of the objectives of the fuel system safety review have been met, several issues must be addressed by an applicant proposing to use this fuel design in GESTAR II.

These issues are:

1. The applicant must provide a plant-specific analysis

of combined seismic-and-LOCA loading using the approved method in NEDE-21175-3 or another acceptable method to demonstrate conformance to the structural acceptance requirements described in Appendix A to SRP 4.2. (SER Section 5.3(4))

2. The applicant must provide an acceptable post-irradiation surveillance program or endorse the approved GE fuel surveillance program. (SER Section 6.3)

With the above provisions, the staff concludes that the fuel designs covered in GESTAR II Amendment 7 have been designed such that (1) it will not be damaged as a result of normal operation and anticipated operational occurrences, (2) fuel damage during postulated accidents would not be severe enough to prevent control rod insertion when it is required, and (3) core coolability will always be maintained even after postulated accidents thereby meeting the related requirements of the following regulations: 10 CFR 50.46; GDC 10 and 27; and 10 CFR 50, Appendix K. This conclusion is based on two primary factors:

(1) General Electric has provided sufficient evidence that the design objectives will be met based on operating experience, prototype testing, and analytical predictions.

(2) General Electric has provided for testing and inspection of new fuel to ensure that it is within design tolerances at the time of core loading. The applicant will perform on-line fuel failure monitoring and post-irradiation surveillance to detect anomalies or confirm that the fuel has performed as expected.

The staff concludes that General Electric has described methods of adequately predicting fuel rod failures during postulated accidents so

REFERENCES:

1. Letter, C. O. Thomas, NRC, to J. S. Charnley (GE), "Acceptance for Referencing of Licensing Topical Report NEDE-24011-P Amendment 7 to Revision 6, General Electric Standard Application for Reactor Fuel", dated March 1, 1985.