D860114

Honorable Nunzio J. Palladino
Chairman
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Palladino:

SUBJECT: ACRS REPORT RELATED TO THE FINAL DESIGN APPROVAL OF THE GESSAR II BWR/6 NUCLEAR ISLAND DESIGN APPLICABLE TO FUTURE PLANTS

During its 309th meeting, January 9-11, 1986, the Advisory Committee on Reactor Safeguards completed a review of the reference design described in the General Electric Standard Safety Analysis Report (GESSAR II) for a Final Design Approval (FDA). GESSAR II provides the safety information for a reference system consisting of a single BWR/6 Mark III nuclear steam supply system, with a design power level of 3730 MWt, and associated systems and structures, including the reactor building (the shield building and containment), fuel building, diesel generator buildings, control building, auxiliary building, and radwaste building. Subcommittee meetings were held with representatives of the General Electric Company (the Applicant) and the Nuclear Regulatory Commission (NRC) Staff on October 18-19, December 4-5, 1984, and February 14-15, 1985 in Los Angeles, Calif.; on March 27-29, 1985, in Albuquerque, New Mexico; and on August 7 and September 11, 1985 in Washington, D. C. The full Committee considered this matter during its 299th through 309th meetings held monthly from March 1985 through January 1986.

We believe that the GESSAR II design includes features that provide a significant improvement in safety over current BWR designs. If this were an application for a construction permit for one or more plants of this design, we would have no hesitation in recommending its approval. However, we are unable to agree with the Staff, for reasons discussed below, that the design satisfactorily or completely addresses all of the concerns described in the Commission's Severe Accident Policy.

While there is no doubt that, in the future, new plants should be consistent with the Severe Accident Policy, we see no harm in the approval of the GESSAR II design, provided that this approval is for a limited time (say five years), and provided that this procedure not be viewed in any way as a precedent for the handling of future applications. In particular, the information provided to us in connection with GESSAR II would not be sufficient to support an application for a one-step license.

Our concerns about the review and the review process are elaborated in the following paragraphs.

We believe that reviewing the GESSAR II design under the Severe Accident Policy was premature and incomplete. We do not see how the Severe Accident Policy can be implemented for an FDA while the policy on safety goals is still in the process of being developed. The NRC Staff's

severe accident review of the GESSAR II design was based on the acceptance of values of core-damage probability and the use of cost/benefit analyses that may turn out to be quite different from those adopted by the Commission for implementation of the safety goals. These and other concerns are discussed in the following items:

. In its policy statement on severe accidents, the Commission did not provide detailed guidance to the Staff concerning the safety philosophy the Commission desires for future plants. The requirement for completion of a PRA and of a Staff conclusion of safety acceptability leaves the matter of desired safety level undefined and something to be decided ad hoc for each future plant or standard plant design application.

. The Applicant and the Staff both evaluated the cost/benefit ratio of a large number of potential safety improvements. However, the approach used by the Staff is that which has been used in the past and may or may not be that which the Commission will adopt in its continuing consideration of its Safety Goal Policy.

. We believe that further evaluation is needed regarding the likelihood of loss of containment integrity, given an accident leading to melt-through of the reactor pressure vessel. Should this likelihood be large, as the Staff says it is, the acceptability of such a characteristic of containment behavior for a future plant should have the benefit of a deliberate evaluation, even if the failure is delayed.

. The Staff proposes to leave the question of seismic risk, including the fragility of equipment within the GESSAR II scope, to the construction permit stage. The Staff is confident that some, as yet unspecified, criteria for the seismic contribution to risk of severe accidents can be met at that stage without significant changes in the approved design. We do not share that confidence in the absence of a decision on a safety goal.

. The Staff consultants were provided only limited resources to review the internal flooding portion of the PRA. Because of the limited effort and the unavailability of design details vital to an evaluation of various flooding scenarios, the consultants were not able to estimate adequately the flooding contribution to core melt, which the Applicant calculates to be small. Thus, while some effort was made, the Staff's evaluation of the PRA was limited in this respect.

Our concerns about the FDA process include chiefly two areas: (1) the amount of detail and completeness required for approval of a "final design" and (2) the nature and definition of the interfaces between the nuclear island and the balance of plant, especially those that must be expressed in terms of reliability to meet the intent of the Severe Accident Policy. These concerns are generic to the standard plant concept and have arisen in our deeper examination of GESSAR II in terms of the Severe Accident Policy. Their resolution necessarily will be evolutionary; but, in our opinion they have not been adequately resolved in the GESSAR II application and review. Some of our concerns are described more fully in the following:

- The Applicant has committed to incorporate an ultimate plant protection system (UPPS) in the GESSAR II design, which could reduce the incidence of core melt accidents. However, the detailed design of this system has not been provided; it is to be provided at the time of a specific plant application. As a result, the Staff has not been able to evaluate this proposed system, nor have we.

- We are concerned that the scope of the FDA is not defined and documented with sufficient comprehensiveness and detail. We believe that this is necessary in order to make clear what changes in the design or in the plant can subsequently be required by the Staff without their being justified under the backfitting rule.

- The interface requirements are not sufficiently well specified in terms of minimum, quantitative performance requirements for systems and components of importance to an evaluation of core melt frequency and risk. Hence, there is no real assurance that a plant built in accordance with the GESSAR II design will meet or better the Staff's estimates of accident frequency and consequences. Also, there is no interface requirement aimed at limiting the number of challenges arising from the balance of plant to those assumed in the PRA.

Over and above the questions relating to the severe accident review and adequacy of the FSAR for an operating license stage document, the ACRS thinks that the following matters warrant consideration for the GESSAR II.

- We believe that the design of the scram discharge system has basic deficiencies in concept in the form of a preclosed dump volume. Consideration should be given to means, which may be relatively simple, to avoid continuing problems with this design.

- We believe that there should be requirements for a study of the effects of seismically induced failures of nonseismically designed components and structures on systems important to safety, for both GESSAR II and the balance of plant.

- General Electric maintains that with their choice of materials and proper attention to water quality, GESSAR II should be essentially free of stress corrosion cracking. We do not believe that this can be assumed in view of the long prior history of surprises in regard to stress corrosion cracking. We recommend that any FDA should include provisions for monitoring and for replacement of deficient material.

Our findings and recommendations are as follows:

- We believe that the GESSAR II design includes features that have the potential to provide a significant improvement in safety over current BWR designs.

- We are unable to agree with the Staff, for reasons discussed previously, that the design satisfactorily or completely addresses all of the concerns described in the Commission's Severe Accident Policy Statement.

. We see no harm in the approval of the GESSAR II design, provided that this approval is for a limited time (say five years), and provided that this procedure not be viewed in any way as a precedent for the handling of future applications. In particular, the information provided to us in connection with GESSAR II would not be sufficient to support an application for a one-step license.

Additional comments by ACRS members Max W. Carbon and Charles J. Wylie and by ACRS Member David Okrent are presented below.

Sincerely,

David A. Ward
Chairman

Additional Comments by ACRS Members Max W. Carbon and Charles J. Wylie

It is our belief that the GESSAR II design represents an improvement in safety over BWR designs approved in the past and that the Applicant has met all NRC requirements. Many items remain open to final resolution, but considerable additional review will be performed by both the Staff and the ACRS for either one- or two-step licensing. Therefore, we support the Staff's plan to issue an FDA applicable to one-step licensing.

Additional Comments by ACRS Member David Okrent

I agree with the ACRS that the GESSAR II design (and NRC Staff review) does not satisfactorily or completely address all of the concerns described in the Commission's Severe Accident Policy Statement. I also agree with those specific concerns about the review and review process described in the ACRS report.

I do not concur with the Staff that the design and review are adequate for issuance of an FDA that has met the Severe Accident Policy Statement, one which, according to the EDO recommended position, would be eligible for a five-year extension after a five-year initial award (and one for which the AIF proposes a ten-year approval period). I would have preferred rather that this be an interim report and that the entire matter, including the status of the GESSAR II review, be discussed by the ACRS with the Commissioners prior to further action on the GESSAR II FDA. In view of the multiple problems of inadequate design detail, incomplete Staff review, and potential conflicts with safety goal policy, among others, I do not think that GESSAR II should receive the "qualified" FDA recommended by the ACRS at this time.

I would like to elaborate on some of the concerns raised in the ACRS letter and introduce others that are not mentioned in the ACRS letter, as follows:

1. The seismic design and seismic PRA are inadequately defined. In

SSER No. 3, the Staff determined that the GESSAR II seismic risk study did not model well the risk likely to be contributed by seismic initiators for an actual GESSAR II plant at a typical site. The Staff now reports that the point estimate seismic-induced core melt frequency might be as high as one-in-a-thousand per year for "worst case" fragility values and unfavorable siting locations. The Staff gives a point estimate of about 4-5 x 10 per year as the seismic contribution to core melt frequency, perhaps half of which is attributed to seismically induced relay chatter. The Staff's estimate of the seismic contribution to core melt frequency is not a mean value, and it is not practical to ascertain a mean from their reported results.

I am currently not able to ascribe a numerical value to the seismic contribution to risk. However, I believe that the Staff estimate of about 4-5 x 10 is too large to be accepted for the contribution to core melt frequency from a single source or kind of accident initiator. I believe this value is too large an overall core melt frequency to be accepted for a future plant or FDA. I recommend that an overall total large-scale core melt frequency with a mean value of 10 per year be taken as the objective for future plants, and that about one-fifth of this objective should be a somewhat flexible objective for any principal contributor, such as an earthquake. Limitations on the contribution from individual sources will help reduce the impact of large uncertainties.

The Staff proposes to leave the question of seismic risk, including the fragility of components and equipment within the GESSAR II scope, to the construction permit stage. The Staff lists conditions to be met which could be interpreted as accepting a seismic core melt frequency such as the Staff estimates. The Staff further concludes that, if these conditions are not met, the utility applicant must demonstrate that this does not result in any significant increment in risk. But what is significant for a PRA? Is it a factor of two? A factor of ten? The Staff provides no basis for judging what might be acceptable in this regard. The Staff also states that the site hazard curve must be bounded by the GESSAR II hazard curve, without explaining how uncertainties are to enter into such a bounding exercise.

Although GESSAR II is well into the design stage, I believe that the merits of probabilistic seismic design bases should receive consideration in trying to achieve a smaller contribution to overall risk.

2. I believe that the FDA should not be approved with such incomplete and sketchy information available for the proposed ultimate plant protection system (UPPS).

3. For future plants, I believe that a dedicated, safety-grade, independent system for removal of decay heat from the core and containment should be included, in consequence of the matters entering into the resolution of USI A-45, Shutdown Decay Heat Removal, unless a case can be made that all of its merits have been

met in other ways. I favor hardening this system. This issue is discussed further in the next item.

4. In its review of GESSAR II, the Staff did not look beyond the current requirements for sabotage protection. In a letter to you dated July 17, 1985 concerning sabotage protection, the ACRS recommended that the Commission reconsider its design basis threat definition for sabotage protection and decide if the present definition should be reconfirmed or modified. The Committee also recommended that the Commission consider whether the NRC Staff, in the course of reviews of new designs, should take account of design options, and possible combinations of measures, which might have the effect of reducing or inhibiting sabotage or terrorist threats. This matter should be dealt with before issuance of future FDAs, rather than as a possible backfit item. Specifically, I recommend that the following be factored into the design of GESSAR II (and its balance of plant):

   . a protected, independent, safety-grade shutdown heat removal system

   . protection of the control room and other vital areas or functions against a vehicle bomb at the edge of the guarded site periphery by proper location, building strength, or other measures

   . geographical separation of redundant systems, including the ultimate heat removal system

   . special monitoring and access control of especially sensitive protection systems

   . roof design to limit helicopter landing access

In summary, I believe that neither the state of the design nor the Staff's review process is adequate for issuance of a forward-looking FDA which has taken Severe Accident and Safety Goal Policy properly into account. This is particularly so in view of the Commission's own test in applying backfitting policy.

References:

l. General Electric Company Standard Safety Analysis Report, "GESSAR II, BWR/6 Nuclear Island Design," with Amendments l through 20
2. U. S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the Final Design Approval of the GESSAR II BWR/6 Nuclear Island Design" NUREG-0979, dated April l983
3. Supplement l to the Safety Evaluation Report, dated July l983
4. Supplement 2 to the Safety Evaluation Report, dated November l984
5. Supplement 3 to the Safety Evaluation Report, dated January l985
6. Supplement 4 to the Safety Evaluation Report, dated July l985

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