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

JAN 28 1975

Mr. Ivan F. Stuart, Manager
Safety and Licensing
Nuclear Energy Division
General Electric Company
175 Curtner Avenue
San Jose, California 95114

Dear Mr. Stuart:

ANTICIPATED TRANSIENTS WITHOUT SCRAM

In order that we may continue our evaluation of your analysis of your report, "Anticipated Transients Without Scram," NEDO 20626, additional information is required.

The information required is described in Attachment 1. The responses to these concerns must be provided by February 28, 1975.

Sincerely,

Victor Stello, Jr., Assistant Director
for Reactor Safety
Office of Nuclear Reactor Regulation

Enclosure:
Concerns on NEDO 20626

Enclosure 1

CONCERNS ON NEDO 20626

1. Section 7.1 of NEDO 20626 identifies the systems relied upon to mitigate the consequences of ATWS. Demonstrate the diversity of these systems and their initiating signals from the Reactor Scram System. Further discuss the reliability of these systems to perform their functions during an ATWS event.

2. NEDO 20626 uses NEDO 10349 results as bases for concluding that MSIV closure is the most limiting ATWS transient. Tables 3-1 and 3-2 of NEDO 20626 list the initial conditions and equipment performance characteristics. Provide similar tables used in the NEDO 10349 ATWS analysis. (Provide the value of the pool temperature in Table 3-1 of NEDO 20626). This list should also include the number and capacity of each relief/safety valve used in NEDO 10349 and NEDO 20626 analyses.

3. During an ATWS meeting on August 7, GE stated that a pool temperature limit of [illegible]°F will be used in their analysis (see memo from A. Thadani to T. Novak, USAEC, September 5, 1974). NEDO 20626 uses a pool temperature limit of 170°F. Explain the reasons for this change in the temperature limit and provide an analytical or experimental verification that damaging vibrations in the pool will not occur below 170°F.

4. NEDO 20626 does not adequately demonstrate the capability to bring the plant to a cold shutdown and maintain this condition following an ATWS. This capability can be demonstrated by meeting the following criteria.

   a. Ability to reduce vessel pressure

   b. Ability to maintain vessel level

   c. Ability to remove heat in the long term

   d. Ability to maintain containment pressure and temperature within limits

   Provide the analyses of the capability to bring the plant to a cold shutdown and maintain this condition for the following three cases.

   a. Reference case

b. One relief/safety valve fails to reclose

For these analyses, provide the following parameters as a function of time until after the systems designed for long term cooling (e.g. RHR or recirculation mode of ECCS) are placed in operation.

a. Reactor power

b. Vessel pressure and level

c. HPCI (HPCS) and RCIC flow rate

d. Containment pressure and temperature

e. RHR flow and temperature when RHR is used for suppression pool cooling and decay heat removal

f. Storage capacity of each source of water used to maintain level and remove energy from vessel

g. Operator actions including the time action taken

5. In an October 7, 1974 letter from I. F. Stuart to V. Stello, GE stated (responses to question 4) that the condensate storage tank would provide water for HPCI and RCIC for 24 minutes and that the suppression pool is not needed as a source of water for an ATWS event. If this is the case, explain how the plant can be brought to a cold shutdown condition.

6. Assuming that the selection and a complete withdrawal of an out-of-sequence rod is a single operator error, provide an analysis of this event with a failure to scram. Justify the rod worth used in the analysis. If GE considers this event not to be an anticipated transient, then demonstrate that the reliability of the available protective equipment is adequate to prevent such an occurrence. The discussion must include the following.

   a. Description of protective equipment used to prevent an occurrence of an out-of-sequence rod withdrawal transient

   b. List the protective equipment available in each plant

   c. Demonstrate that the probability of failure of this equipment is less than 10^{-3}/yr. The reliability study must include the time the protective equipment may be unavailable.

7. Analyses presented in NEDO 20626 assume automatic initiation of the Standby Liquid Control System (SLCS) within 7 seconds into the transient. Provide an analysis for a loss of normal on-site and off-site power and demonstrate that SLCS will be available when needed to mitigate consequences of this ATWS event.

8. Are the results stated in the report NEDO 20626 applicable to all current class B plants? List the set points of the recirculation pump trip upon high pressure or low water level for each plant.

9. A review of NEDO 10802 has been complete and our concerns documented, and in process of being forwarded to General Electric. A satisfactory response to those concerns must be obtained prior to a complete evaluation of the current document.

Provide nodal diagrams for fuel modeling, pressure modeling, and mass energy modeling of the BWR 4 plant analyzed. The significant features of the model used in the analysis are stated. The validation of the model features is not provided in the report. For the stated features of the model, provide the reports that validate the features. Also, for the BWR 4 plant analyzed, provide the input data used for the transient code and the validation for each input parameter.

A specific item on the validation of the model is the void reactivity feedback model. During an ATWS event resulting in pressurization, it is conservative to assume immediate bubble collapse with pressurization, thus resulting in immediate positive reactivity feedback. The reformation of bubbles and voids at higher surface heat flux levels is modeled as an instantaneous event, and is thus nonconservative as the feedback is negative reactivity. Bubble formation and bubble growth are time consuming events and thus it would appear logical to model the reactivity feedback in a manner reflecting the physical phenomenon. Provide justification for modeling negative reactivity feedback as an instantaneous result of bubble formation and an estimate of the bubble growth time constant. If this time constant is 0.03 seconds or greater, provide studies which show the sensitivity of pressure to this time constant.

10. What is the specific plant used in NEDO 20626 for which the initial conditions are stated? What is the variation in the void reactivity coefficient in each product line?

11. Section 4.2.2 indicates that "perforation is not precluded." Does perforation of the cladding due to deformation occur? If so, provide details.

12. The fuel damage limits used for ATWS by GE adopt those from Appendix K, 10 CFR 50. Although these criteria appear conservative since the LOCA is more severe, the direct applicability of these criteria to ATWS events should be explored for confirmation. The confirmation should consider the effects of previous operation of the fuel, in particular those processes which affect cladding stress or strain limits and those which may arise from fuel - cladding mechanical interaction.

A refined definition of the limits will facilitate post-ATWS event decisions relative to subsequent plant operations. Thus the confirmation among the failure (or fuel duty) mechanisms.

13. Provide any data available on the potential of occurrence for each of the transients listed in Section 5.1. Are there any other transients that should be included in the list?

14. The sequence of events for the MSIV Closure Transient states that some fuel experiences transition boiling at four seconds. Provide additional data, i.e., a curve presenting time duration in transition boiling, the percentage of pins in transition boiling, and a discussion of this event for the MSIV Closure Transient.

15. The sensitivity of peak pressure to recirculation pump trip set point is presented in Table 6-1 of NEDO 20626. For each product line, what is the accuracy of the pressure sensor? What is the variation in time delay?

16. The sensitivity of peak pressure to relief valve capacity is presented in Table 6-3 of NEDO 20626. For each product line, what is the minimum relief capacity? For the minimum relief capacity plants, what is the relief capacity of each valve? What is the probability that a relief valve will not open upon reaching the pressure set point? Identify B class plants with lower relief capacity than that used in NEDO 20626. Provide ATWS analyses using the plant with the least relief capacility as basis.

17. A more complete description of the Doppler and moderator void coefficients of reactivity used in the ATWS analyses is needed than the values simply listed in Table 3.1 of NEDO 20626. Therefore, provide for each BWR class the following:

    a. The bases and justification for the coefficients used as well as the functional variation of the coefficients throughout the course of an ATWS transient.

    b. A description of any Doppler and void statistical weighting factors that may be used.

    c. Values of design conservatism factors (DCF's) that may be used for each coefficient.

    d. Values of the effective delayed neutron fraction and prompt mode neutron generation time that are used.

18. Provide in the NEDO 20626 document, for each BWR class of plants, the effect of void and Doppler coefficient variation on the results.