November 3, 2003

Mr. James F. Klapproth, Manager
Engineering & Technology
GE Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION – GE NUCLEAR ENERGY LICENSING TOPICAL REPORT NEDC-33075P, REV. 2, "GENERAL ELECTRIC BOILING WATER REACTOR DETECT AND SUPPRESS SOLUTION - CONFIRMATION DENSITY" (TAC NO. MB5705)

Dear Mr. Klapproth:

By letter dated July 24, 2002, GE Nuclear Energy (GENE) requested the NRC staff's review and approval of licensing topical report (LTR) NEDC-33075P, Rev. 2, "General Electric Boiling Water Reactor Detect and Suppress Solution - Confirmation Density." The NRC staff has reviewed the LTR and has determined that additional information is needed to complete our review. A request for additional information is enclosed. This request was discussed with George Stramback of your staff and it was agreed that a response to the request for additional information would be provided to the NRC staff by December 1, 2003.

Sincerely,

/RA/

Alan B. Wang, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 710

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

LICENSING TOPICAL REPORT NEDC-33075P, REV. 2, "GENERAL ELECTRIC BOILING WATER REACTOR DETECT AND SUPPRESS SOLUTION - CONFIRMATION DENSITY"

GE NUCLEAR ENERGY

PROJECT NO. 710

The following questions were identified during the staff's review of the subject licensing topical report (LTR).

Generic Licensing Basis

1. The basic approach for the detect and suppress solution - confirmation density (DSS-CD) licensing basis is generic in nature. No specific reload confirmations are required. This generic confirmation of DSS-CD has been performed in NEDC-33075P, Rev. 2, with TRACG, which is not an NRC-approved code. While TRACG has been used for the generation of the DIVOM curve for other detect and suppress solutions, it is not typically used to demonstrate compliance with safety limits. Provide the rationale and justification for using a non-NRC approved code as the basis for the generic DSS-CD licensing.

2. The GEXL correlation is essentially a steady-state correlation based on channel-integral parameters. Provide the basis for using the GEXL correlation during power oscillation transients.

3. Provide a list of the decay ratio values at or around the moment of scram for the cases in the Confirmation Event Matrix (Section 4 of LTR). Based on these values, are these calculations reasonably limiting?

4. The DSS-CD methodology has only been demonstrated for GE fuels (GE 14 and earlier). Provide the analysis methodology for plant-specific calculations if the plant falls outside the licensed envelope (e.g., different vendor's fuel or future fuel design beyond GE 14) and demonstrate that Tables 6-1 and 6-2 are still applicable for fuel design other than GE fuel production line stated in Table 6-1. Specifically, address the following scenarios:

   a. A non-GE fuel plant that is going to reload GE fuel,
   b. A GE fuel plant that is going to reload non-GE fuel, and
   c. A non-GE fuel plant that requests a GE analysis for DSS-CD.

5. Provide in detail, the necessary software and hardware modifications required for the plant-specific application if one of the approved Boiling Water Reactor Owners Group long-term stability solution options is currently implemented.

6. According to the proposed DSS-CD technical specification (TS) changes, each plant would perform testing during the first startup, shutdown, and at intermediate times cycle.

The DSS-CD hardware would be bypassed during this testing. Please describe the testing that would be done and the success criteria that would be used.

7. Section 6 of the LTR states that "Non-fuel design related changes require a single reasonably limiting best-estimate TRACG case simulation performed according to the procedure of Table 6.2." Please provide the scope of expected changes (e.g., does this statement apply to a new reactor?). In addition, provide the expected scope of NRC staff review for plant-specific or generic applications when non-fuel design changes occur.

Confirmation Analysis Methodology

1. Please describe the detailed process of confirmation analysis performed with TRACG to calculate the reactor scram time and the final minimum critical power ratio (MCPR). Compare it with the physical signal processing steps and discuss the consistency between the numerical signal data process simulation and the physical process. In Table 4-3, it is stated that the hot channel neutron flux trace is used to identify the base period. Please provide the basis to justify that the scram time predicted based on the hot channel neutron flux is more conservative than using low power range monitors (LPRM)/operating power range monitors (OPRM) signals.

2. All the calculations in NEDC-33075P, Rev. 2, are noise-free. In real life, boiling water reactor (BWR) LPRMs have a ~3% noise level, which could interfere with the DSS-CD algorithm and produce spurious resets. What is the impact of ~3% noise on the time to scram? Provide the rationale for why the noise-free calculations are sufficient to simulate the performance of the DSS-CD scram and protection of specified acceptable fuel design limits (SAFDL).

3. What are the basis and numerical schemes for the harmonic mode power grouping used in the CLPS code? Please provide mathematical formulations and discussions. In addition, provide the mathematical formulation for the core wide mapping scheme.

4. Please provide information about how the PANACEA code calculates the harmonic power distribution.

Backup Stability Protection (BSP) Methodology

1. A simple extrapolation of the Region II "Controlled Entry" line of Figure 7-3 shows that this region would be very close to the maximum extended load line limit analysis plus (MELLLA+) upper boundary. The regions illustrated in Figure 7-3 are the base minimal regions; thus, the actual regions in MELLLA+ reactors cannot be smaller. What is the rationale for not calculating the stability of a new point (call it C') at the MELLLA+ upper boundary line and confirming that the MELLLA+ allowed operating domain is not inside the controlled entry region?

2. Table 7-1 describes the calculation procedure to determine the BSP. Please specify what is meant by "constant Xenon at rated conditions" for points A and B. Is it exactly

the same Xenon concentration in every 3-D node of the core, or is it the 3-D Xenon distribution at rated power, which is kept constant as the flow is reduced?

3. Table 7-1 – please, specify what is meant by "equilibrium Xenon" for point A'. Xenon transients take 24 to 48 hours to be significant. What is the probability of steady-state operation at point A' for more than 24 hours? The most likely scenario is either Xenon-free (a fast startup) or equilibrium Xe at rated conditions (a flow reduction.) Please, justify your choice and provide a rough estimate of the impact on the calculated regions if other Xenon distributions are assumed.

4. Table 7-1, Feedwater Temperature – what is the rationale for using rated-power feedwater temperature? The time constant for feedwater temperature transients is two to three minutes, at most five. Entry to Region II will require immediate operator action, which means within 15 minutes; thus, there is plenty of opportunity for the feedwater temperature to reach equilibrium before the operator maneuvers the reactor outside the region. Provide a rough estimate of the effect of your choice of feedwater temperature on the final region sizes.

5. NEDC-33075P, Rev. 2 does not specify the point in the cycle used for the BSP regions calculation. Will these calculations be performed for an end-of-cycle all-rods-out condition? Provide the rationale for your choice.

6. Please provide the proposed methodology to define the BSP boundary. Address the following issues:

   a. Calculation procedure, including reactivity coefficients, Xenon, feedwater temperature … (with a level of detail similar to Table 7-1 of NEDC-33075P, Rev. 2).

   b. Calculation methodology. Describe how the calculation will be performed. For example: (a) type of code (steady-state versus transient …), (b) what type of calculation is performed, (c) what results are we looking for, (d) how do you define success in the iterative method (any specific criteria?).

   c. Provide a link to the existing BSP methodology in the LTR. Specifically, what BSP regions (as defined in the LTR) are used in the new BSP boundary methodology.

   d. Results of the BSP boundary methodology – specifically, how will the BSP boundary be defined in the core operating limits report (COLR) (a straight line, a curved polynomial, …)

7. For the cases in Section 4 of NEDC-33075P, Rev. 2 , provide an illustration of the time when the scram would occur if automated BSP is active. Are SAFDLs satisfied by the automated BSP option for all cases by preventing the oscillation before it occurs?

8. Section 7.5 of NEDC-33075P, Rev. 2, contains a number of "may" statements. Are any of these statements a required option for licensees implementing automated BSP? If so, NEDC-33075P, Rev. 2 will need to be more specific.

9. Provide a more specific description of the proposed flow-biased scram region. NEDC-33075P, Rev. 2, only states that it will encompass Region I. Please be more specific on the implementation details.

10. Provide a short statement on the rationale for why the use of the non-safety grade drive flow signal is adequate for this application.

11. Provide the licensing basis for the automated BSP option. Explain how the automated BSP option will protect safety limits for reasonable events that initiate at rated power as well as startup events. Explain how the choice of criteria for region definition provides protection for intermediate power levels.

12. Provide a justification for why the BSP boundary is implemented as a straight line.

Request for Additional Data

1. Provide the FORTRAN codes that simulated the DSS-CD algorithm for the calculations in the Confirmation Event Matrix (e.g., PERIOD code). Please provide the associated documents describing the input/output, internal algorithm and sample input/output files. Also, provide a flow chart to describe their relationship for the calculation. Does the PERIOD code include a Butterworth filter algorithm to simulate the cutoff frequencies that are available in the PBDA hardware? If not, provide the filter algorithm code used by the PBDA. Demonstrate the capability of the PERIOD code to calculate the confirmation counts for a given oscillation signal.

2. Please provide the graphical interval size for the TRAC-G power oscillation signal passed into the "PERIOD" code. Also, provide input deck for final verification of the PERIOD code.

3. Can an LPRM signal be simulated using TRACG control system I/O variable? If it does, what is the unit of the I/O variable?

4. Please provide the BWR-4 regional oscillation case TRACG input decks and sample output files.

5. It was indicated that a written procedure has been in place to direct an analyst to perform manual mapping adjustment based on CLPS code output. Please provide this document and discuss the criteria used.

Technical Specifications

1. Provide the generic TSs required for a DSS-CD implementation.

2. Timing for TS Limiting Condition for Operation (LCO) 3.3.1.1, Action I.1 – please provide the basis for allowing 12 hours to initiate alternate method of detection (BSP). With the proposed TSs, if DSS-CD is declared inoperable, there is a gap of 12 hours until BSP protection is in place. For those 12 hours (regardless of the probability of an instability event) no protection is in place. Specifically, justify why the completion time for Action I.1 should not be "immediately."

3. Timing for TS LCO 3.3.1.1, Action I.2.2 – please provide the basis for allowing 14 days to initiate action to reduce operation to below the BSP boundary. Specifically, justify why the completion time for Action I.2.2 should not be "immediately."

4. Required channels per trip system – Table 3.3.1.1-1, Function 2-f, defines the number of OPRM upscale channels required per trip system as "3 APRMs [average power range monitors]." Please provide the rationale behind this requirement. Explain why the requirement should not be the number of OPRM channels that must be operable.

5. Evaluate if the safety limit MCPR and the operating limit MCPR applicability range given in Section 4.3, "Generic Applicability Envelope," should be included in the TS in accordance with 10 CFR 50.36 requirements.

6. TS 5.6.5, COLR – TS 5.6.5 shall list cycle-specific parameters relating to core operating limits. The proposed TS changes should follow the guidance specified in Generic Letter 88-16 and TS 5.6.5 shall list the NRC-approved topical reports to support the cycle-specific parameters listed in TS 5.6.5.

<u>Nine Mile Point 2 Event</u>

1. Provide a summary of the impact of the Nine Mile Point 2 event on the DSS-CD methodology. What is the expected performance of DSS-CD under the observed Nine Mile Point 2 event conditions?