

## ENCLOSURE 2

MFN 12-078

Response to NRC RAIs - NEDC-33075P, Revision 7

Non-Proprietary Information – Class I (Public)

### INFORMATION NOTICE

This is a non-proprietary version of Enclosure 1 to MFN 12-078, from which the proprietary information has been removed. Portions of the enclosure that have been removed are indicated by an open and closed bracket as shown here. [[            ]]

**RAI-01:**

The TRACG demonstration matrix relies on modeling the oscillation power range monitor (OPRM) response, which is obtained from the calculated local power range monitor (LPRM) time traces. Please provide a reference to how TRACG models the LPRM detectors and any available benchmarks.

**GEH Response:**

TRACG solves the three-dimensional (3-D) transient neutron diffusion equation using the same basic formulation and assumptions as in PANACEA (References 1-1 and 1-2). The core is described using i, j, k nomenclature, where i and j indices define the location of each flow channel and the k index provides the axial location. TRACG simulates the LPRM signal through the use of the control system input/output variables (Reference 1-1). The i, j, and k location of the LPRM detector is specified in the TRACG input. The LPRM signal is the TRACG calculated average nodal fission power of the 8 surrounding kinetics nodes to the specified i, j, and k location of the LPRM detector (4 above and 4 below the specified location).

Extensive comparisons of the LPRM, average power range monitor (APRM) and/or oscillation power range monitor (OPRM) plant data and validation of TRACG results were provided in Reference 1-3 for the Peach Bottom turbine trip tests, LaSalle instability event, Leibstadt stability tests, and the Nine Mile Point 2 instability event.

In addition, algorithm and LPRM/OPRM testing is documented in Tables 5-5 and 5-6 of the approved Detect and Suppress Solution – Confirmation Density (DSS-CD) licensing topical report (LTR, Reference 1-4). Testing of the application to OPRM cells was performed in support of the algorithm qualifications and is also summarized in Table 5-5 of Reference 1-4. These tests include Pilgrim stable startup data and KKL instability event data. Multiple LPRM signals from the KKL Cycle 7 regional instability test event and Columbia Cycle 8 core-wide instability event (see Table 5-6 in Reference 1-4) were examined and validated as documented in Section 5.3.2 of Reference 1-4. These results were reviewed and approved in Revision 6 of DSS-CD LTR (Reference 1-4) and apply to Revision 7 of the DSS-CD LTR as well (Reference 1-5).

**References:**

- 1-1. GE Hitachi Nuclear Energy, “TRACG Model Description,” NEDE-32176P, Revision 4, January 2008.
- 1-2. GE Nuclear Energy, “Steady-State Nuclear Methods,” NEDE-30130P-A, April 1985.
- 1-3. GE Hitachi Nuclear Energy, “TRACG Qualification,” NEDE-32177P, Revision 3, August 2007.

- 1-4. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P-A, Revision 6, January 2008.
- 1-5. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P, Revision 7, June 2011.

**RAI-02:**

Section 4.7.2 of NEDC-33075P states that [[

]]. The wording appears to be misleading because additional analyses are required if the applicability checklist is not satisfied. Please specify under which circumstances the full analysis matrix is required.

**GEH Response:**

Additional analyses are required each time the applicability checklists in Tables 4-1 and 4-6 of Reference 2-1 are not satisfied. The full analysis matrix of cases is required for a plant with [[

]] The full analysis matrix includes the following [[

]]

The statement in Section 4.7.2 of NEDC-33075P (Reference 2-1) refers only to the [[

]]

The reason for this approach is described in Section 4.7.2 of Reference 2-1; [[

]]

**References:**

- 2-1. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P, Revision 7, June 2011.
- 2-2. GE Hitachi Nuclear Energy, “General Electric Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P-A, Revision 6, January 2008.

**RAI-03:**

Please define the term “RS” and its units in the figure on page 4-27 labeled “OPRM Cell 121.”

**GEH Response:**

‘RS’ in the figure on page 4-27 (Reference 3-1) is a normalized signal without units. Figure 4-9 in Reference 3-1 depicts [[

]] Therefore, ‘Cn’ is the same as ‘RS’ in the figure on page 4-27, a normalized signal without units.

A short explanation about the meaning and units of RS will be added in the figure on page 4-27 from NEDC-33075P Revision 7 (Reference 3-1) when the accepted (-A) version is published.

**References:**

- 3-1. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P, Revision 7, June 2011.

**RAI-04:**

In the table on page 4-28, the fourth column is labeled [[

]] However, only one margin value is presented in the table, which appears to be the TLO margin. Please explain. Please [[  
]] in the third column of this table.

**GEH Response:**

In the table on page 4-28 of Reference 4-1, one [[  
]] margin value is provided, but depending on the scenario the margin is either related to the Two Loop Operation (TLO) Safety Limit Minimum Critical Power Ratio (SLMCPR) or the Single Loop Operation (SLO) SLMCPR. The first [[

]] Therefore, the table on page 4-28 is correct and consistent with the description provided in Step 4 on page 4-28 (Reference 4-1).

The [[

]]

**References:**

- 4-1. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P, Revision 7, June 2011.

**RAI-05:**

In the table on page 4-29, the fifth column is labeled [[ ]]. Since NEDC-33075P is the DSS-CD LTR, this statement is somewhat confusing. Does this mean [[ ]]? Would a restriction on initial MCPR/operating limit MCPR (IMCPR/OLMCPR) be imposed if the “Plant X” margins were lower than the “Matrix” margins?

**GEH Response:**

In the table on page 4-29 (Reference 5-1), the fifth column labeled [[ ]]

]]

No restriction would be imposed on Initial MCPR (IMCPR) / Operating Limit MCPR (OLMCPR) in the instance in which “Plant X” [[ ]] margins were lower than the “Matrix” [[ ]] margins provided in the Detect and Suppress Solution – Confirmation Density (DSS-CD) Licensing Topical Report (LTR, Reference 5-1). However, as specified in Step 5 on page 4-28 of Reference 5-1, the [[ ]]

]]

**References:**

- 5-1. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P, Revision 7, June 2011.

**RAI-06:**

Step 7 on page 4-29 is confusing. It refers to an “MCPR criterion.” However, Table 4-15 provides [[

]] It is not clear from the text in Step 7 how plant X satisfies this criterion. Do the criteria in Table 4-15 [[ ]]? Please explain Step 7 in more detail.

**GEH Response:**

Table 4-15 in Reference 6-1 provides [[

]]

The demonstration of how “Plant X” satisfies this criterion is actually described in Step 8 on pages 4-30 and 4-31 in Reference 6-1. In the example presented in Step 7 on pages 4-29 and 4-30 in Reference 6-1, the [[

]]

This is shown for Step 8 in the seventh row/third column in the table on page 4-31 (Reference 6-1). [[

]] and the result is shown in Step 8 in the eighth row/third column in the table on page 4-31 (Reference 6-1).

Therefore, the criteria in Table 4-15 [[

]]

**References:**

- 6-1. GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P, Revision 7, June 2011.

**RAI-07:**

In Table 3-4, the period based detection algorithm setpoint ( $S_p$ ) value in row 2, column 3 is marked as proprietary; however, on page 3-24, the same formula for  $S_p$  is not marked as proprietary. Please provide the correct proprietary marking. Additionally, for this  $S_p$  value in Table 3-4, the “max” function is missing the closing parenthesis.

**GEH Response:**

The formula for  $S_p$  on page 3-24 (Reference 7-1) is proprietary and needs to be marked as such, consistent with Table 3-4 proprietary markings. Therefore, this formula will be corrected and marked as proprietary on page 3-24 in NEDC-33075P Revision 7 (Reference 7-1) when the accepted (-A) version is published.

The  $S_p$  formula in row 2, column 3 of Table 3-4 (Reference 7-1) is missing the closing parenthesis. Therefore, this formula in row 2, column 3 of Table 3-4 will be corrected in NEDC-33075P Revision 7 (Reference 7-1) to include the closing parenthesis when the accepted (-A) version is published.

**References:**

- 7-1 GE Hitachi Nuclear Energy, “GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density (DSS-CD),” NEDC-33075P, Revision 7, June 2011.