Comment Resolution Table for Appendix K – Safety Evaluation of NEDC-33173P, Supplement 3, "Applicability of GE Methods to Expanded Operating Domains – Supplement for GNF2 Fuel."

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1	Section 1.0, Pg K-2, and Section 3.2.2.5.3, Pg K-19 note: GEH identified the section number in error. Sections 3.2.2.5.1, 3.2.2.5.2, and 3.2.2.6 require similarly updated verbiage. No changes made in Section 3.2.2.5.3.	<u>Section 1.0</u>: … However, this exposure limit is established to address open items and technical concerns regarding the continued applicability of the GSTRM T-M analysis methodology to the advanced GNF2 fuel design. The NRC staff has previously imposed Limitation 12 on the IMLTR through its approving SE, which requires, in part, that future EPU and MELLLA+ licensing analyses be performed using updated, approved T-M methods. Currently, the NRC staff is reviewing the PRIME T-M methodology (References 10, 11, and 12). Consistent with Limitation 12 and IMLTR Supplement 4 (Reference 13), it is the understanding of the NRC staff that if PRIME is approved, then future licensing evaluations for GNF2 in EPU and MELLLA+ cores will be performed using the updated PRIME T-M methods.	The verbiage regarding the status of the PRIME review should be updated to reflect the current approved status. The highlighted portions deserve reconsideration.	Comment accepted. <u>Highlighted portion of Section 1.0 revised to read</u>: … The NRC staff reviewed the PRIME T-M methodology and documented its approval in its SE dated January 22, 2010. (Reference 10). Consistent with IMLTR Limitation 12 and IMLTR Supplement 4 (Reference 11), it is the understanding of the NRC staff that since PRIME has been approved, future licensing evaluations for GNF2 in EPU and MELLLA+ cores will be performed using the updated PRIME T-M methods. GNF documented its agreement with this understanding in a letter to the NRC dated May 27, 2010 (Reference 12). Noting this expectation, but given that the PRIME T-M methodology was still under NRC review when the GNF2 methods applicability supplement to the IMLTR (Reference 4) was submitted, the NRC staff

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		Noting this expectation, the NRC staff understands that the GNF2 methods applicability supplement to the IMLTR (Reference 4) must address the interim GESTAR II Amendment 32 approach as well as an approach that accounts for the use of updated T-M methods if PRIME is approved by the NRC staff. <u>Section 3.2.2.5.1</u>: ... However, Supplement 3 provides that, if the NRC staff approves PRIME, future T-M calculations will be performed using the PRIME T-M methodology. … The NRC staff has approved this magnitude for the monitoring uncertainty for use in GSTRM calculations and on the same basis finds that it is acceptable for PRIME calculations if the PRIME T-M methodology is approved by the NRC staff.		understands that this IMLTR supplement needed to address the interim GESTAR II Amendment 32 approach as well as an approach that accounts for the use of updated T-M methods now that PRIME has been approved by the NRC staff. <u>Section 3.2.2.5.1 revised to read</u>: … However, Supplement 3 provides that, since the NRC staff has approved PRIME, future T-M calculations will be performed using the PRIME T-M methodology. … The NRC staff has approved this magnitude for the monitoring uncertainty for use in GSTRM calculations and on the same basis finds that it is acceptable for PRIME calculations.

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		<u>Section 3.2.2.5.2</u>: … Noting that, in accordance with Limitation 12 and Supplement 3, GEH intends to use PRIME T-M methods for future applications once those methods are approved by the NRC staff, the NRC staff reviewed the operating history parameters assumed in the analysis according to the PRIME Application Methodology LTR (Reference 12). Section 3.3.2 of the PRIME Application Methodology LTR states that the PRIME analyses are conservatively performed assuming that the peak power node of the fuel rod operates on the limiting power-exposure envelope throughout the fuel rod lifetime. This sweeping of the axial profile is consistent with the "operating history" conservatism in GSTRM. Further, the NRC staff review of PRIME will address the adequacy of its predictions of rod internal pressure. Therefore, the NRC staff finds that the potential migration to the PRIME T-M method, once		<u>Section 3.2.2.5.2 revised to read</u>: Noting that, in accordance with IMLTR Limitation 12 and Supplement 3, GEH intends to use PRIME T-M methods for future applications, the NRC staff reviewed the operating history parameters assumed in the analysis according to the PRIME Application Methodology LTR (Reference 10). Section 3.3.2 of the PRIME Application Methodology LTR states that the PRIME analyses are conservatively performed assuming that the peak power node of the fuel rod operates on the limiting power-exposure envelope throughout the fuel rod lifetime. This sweeping of the axial profile is consistent with the "operating history" conservatism in GSTRM. Further, the NRC staff review of PRIME (Reference 10) addressed the adequacy of its predictions of rod internal pressure. Therefore, the NRC staff finds that the planned migration to the PRIME T-M method does not invalidate the basis for the

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		approved, does not invalidate the basis for the acceptance of the T-M method for extension to application to EPU or MELLLA+ conditions. <u>Section 3.2.2.6</u>: Limitation 12 from the NRC staff SE approving the IMLTR requires that future licensing evaluations be performed using updated T-M methods (Reference 2). PRIME is currently under review by the NRC staff to replace the GSTRM T-M methodology (References 10, 11, and 12). IMLTR, Supplement 4 (Reference 13) provides the implementation plan to update the methods for compatibility with PRIME if PRIME is approved by the NRC. Therefore, the NRC staff expects that the exposure limit will be revised for GNF2 fuel. Supplement 3 provides for this possible outcome and discusses revising the peak pellet exposure limit if PRIME is approved. The NRC staff reviewed the proposed alternative limit for use with the PRIME methodology. In RAI-3, the NRC staff requested that the Supplement 3 language be revised to reflect the status of the		acceptance of the T-M method for extension to application to EPU or MELLLA+ conditions. <u>Section 3.2.2.6 revised to read</u>: The fuel rod exposure limit was established for GNF2 according to GESTAR II, Amendment 32 (Reference 8). This was an interim exposure limit to address methodology concerns regarding the applicability of the GSTRM T-M methods to GNF2. The exposure limit documented in Amendment 32 to GESTAR II was reviewed and approved by the NRC staff (Reference 9). This peak pellet exposure limit [ ] than the GE14 peak pellet exposure limit of 70 GWD/MTU. In addition, Limitation 12 from the NRC staff SE approving the IMLTR requires that future licensing evaluations be performed using updated T-M methods (Reference 2). GNF submitted the PRIME T-M methodology for NRC staff review to replace the GSTRM T-M methodology. The NRC staff reviewed and approved the PRIME

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		PRIME review. The response to RAI-3 provides a revision to Supplement 3 that removes the specific exposure limit (Reference 14). The exposure limit for GNF2 is expected to be revised, but must be revised consistent with the NRC staff's approval of the T-M methods. Specifying the exposure limit presumes the outcome of the NRC staff's ongoing review of PRIME and is not necessary to describe the process by which this limit would be revised with the approval of a T-M method. The revised Supplement 3 is consistent with this process and the status of the NRC staff's review of PRIME. The NRC staff finds that Supplement 3 is consistent with GESTAR II, Amendment 32 and provides an acceptable peak pellet exposure limit when GSTRM T-M operating limits are utilized. The nature of this exposure limit is such that additional consideration of potential non-conservatism in the predicted rod internal pressure is not required to assure adequate safety. Supplement 3 states that once PRIME is approved, the new		T-M methodology in its SE dated January 22, 2010. (Reference 10). IMLTR, Supplement 4 (Reference 11) provides the implementation plan to update GEH's methods for compatibility with PRIME. Since PRIME was still under NRC staff review when Supplement 3 was submitted, Supplement 3 needed to address the interim GESTAR II Amendment 32 approach, but also provided for the anticipated approval of PRIME and discussed revising the peak pellet exposure limit if PRIME were to be approved. Following the NRC staff approval of PRIME, GNF submitted GESTAR II Amendment 33 to incorporate the use of PRIME into the GESTAR II process and address these limitations related to GNF2 and the use of GSTRM. In its SE approving GESTAR II Amendment 33, the NRC staff approved the removal of the Amendment 32 exposure limit for GNF2 fuel. The NRC staff imposed a condition on the use of GSTRM to calculate T-M operating limits in Appendix F of its SE for the IMLTR. This condition requires that the critical pressure limit be adjusted by 350 psi to address potential non-

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		method will be adopted and the exposure limit will be revised through the GESTAR II licensing process. The NRC staff requested additional information in RAI-3 to ensure this limit is consistent with the NRC staff's approval of the T-M methods. On these bases, that NRC staff finds that the exposure limit for GNF2 is acceptable.		conservatism in the method in terms of predicting the rod internal pressure. Supplement 3 states that this penalty does not apply to GNF2. The NRC staff agrees with this assessment on the basis that the rod internal pressure limits are not challenged until high bundle exposures have been reached, much later than the exposure limit imposed in GESTAR II, Amendment 32. Therefore, the NRC staff finds that the GSTRM T-M operating limits remain acceptable up to the exposure limit of [ ] peak pellet exposure. Since the NRC staff did not evaluate the effectiveness of GSTRM for predicting the rod internal pressure for GNF2 beyond [ ] peak pellet exposure, the use of GSTRM to calculate T-M operating limits for GNF2 fuel beyond the peak pellet exposure limit of [ ] would require that the 350 psi critical pressure adjustment described in Appendix F of the SE for the IMLTR be applied. However, consistent with IMLTR Limitation 12 and Supplement 4 to the IMLTR (Reference 11), it is the understanding of the NRC staff that since PRIME has been approved,

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				future licensing evaluations for GNF2 in EPU and MELLLA+ cores will be performed using the updated PRIME T-M methods. GNF documented its agreement with and commitment to this understanding in a letter to the NRC dated May 27, 2010 (Reference 12). The 350 psi critical pressure adjustment does not apply if the PRIME T-M methods are used. The NRC staff finds that Supplement 3 is consistent with GESTAR II, Amendment 32 and provides an acceptable peak pellet exposure limit when GSTRM T-M operating limits are utilized. The nature of this exposure limit is such that additional consideration of potential non-conservatism in the predicted rod internal pressure is not required to assure adequate safety. Now that PRIME has been approved, Supplement 3 states that the new method will be adopted and the exposure limit will be revised through the GESTAR II licensing process. This was accomplished through the review and approval of GESTAR II Amendment 33. On these bases, that NRC staff finds that the

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		<u>Footnote 4 in Section 4.0</u>: The T-M review considered the GNF2 specific exposure limit provided by GESTAR II, Amendment 32. This exposure limit does not necessitate the critical pressure penalty imposed on GSTRM calculations for GE14. The NRC staff anticipates that this exposure limit will be revised with the approval of the advanced PRIME T-M methodology.		exposure limit for GNF2, as revised by the review and approval of GESTAR II Amendment 33, is acceptable. <u>Footnote 4 in Section 4.0 revised to read</u>: The T-M review considered the GNF2-specific exposure limit provided by GESTAR II, Amendment 32. This exposure limit does not necessitate the critical pressure penalty imposed on GSTRM calculations for GE14. Now that the advanced PRIME T-M methodology and GESTAR II, Amendment 33 have been approved by the NRC staff, this specific exposure limit has been revised and the critical pressure penalty imposed on GSTRM does not apply to GNF2 when the PRIME methodology is used.

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2	Section 3.2.2.4 Pg K-14	Therefore, the ECCS [emergency core cooling system]-LOCA analysis…	Generic Editorial. Use of square brackets vs. parentheses, e.g., ...ECCS [emergency core cooling system]....	Comment rejected. NRC convention is as follows: When an acronym contained within a quoted citation has not been previously defined in the current document, the acronym definition is inserted into the citation text set off by square brackets.
3	Section 3.2.2.8 Pg K-20	The prediction of soluble boron worth is confirmed by the comparison of TGBLA with MCNP code results. The accuracy of lattice physics data generated at different boron conditions will factor into the calculation of the SLCS SDM. However, in this review the NRC staff did not perform code-to-code comparisons to assess TGBLA generated boron libraries.	Suggest adding 06 to the acronym for TGBLA in the last paragraph.	Comment accepted. Sentences revised as: The prediction of soluble boron worth is confirmed by the comparison of TGBLA06 with MCNP code results. The accuracy of lattice physics data generated at different boron conditions will factor into the calculation of the SLCS SDM. However, in this review the NRC staff did not perform code-to-code comparisons to assess TGBLA06-generated boron libraries.
4	Section 3.4.3 Pg K-27		Correct spelling of homogenous to homogeneous.	Comment accepted. Spelling changed.

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5	Sections 3.5.3, 3.5.4, and 3.5.5 Pg K-35	In response to RAI-4 (Reference 14), GEH confirmed that the bypass void fraction will be limited to five percent based on cycle-specific analyses. (repeated in each section)	Suggest adding clarifying expression "at steady state conditions" as noted in the markup.	Comment accepted. Sentence revised in each of the three sections to read: In response to RAI-4 (Reference 14), GEH confirmed that the bypass void fraction at steady state conditions will be limited to five percent based on cycle-specific analyses.
6	Section 3.5.5 Pg K-36	The BSP determines an exclusion region in the power-to-flow map similar to Option I-D and EIA.	Last Paragraph. Suggest corrections regarding the BSP as follows and as included in the markup. Current: The BSP determines an exclusion region in the power-to-flow map similar to Option ID and EIA. Proposed: The BSP determines a scram region in the power-to-flow map similar to the exclusion region in Option I-D and EIA.	Comment accepted. Sentence revised to read: The BSP determines a scram region in the power-to-flow map similar to the exclusion region in Options I-D and EIA.
7	Section 3.5.6 Pg K-36	The DSS-CD LTS is an evolutionary solution based on the Option III detect and suppress strategy with modifications. The first is the use of the PBDA without a specific oscillation magnitude specified for reactor suppression. That is, the PBDA in	The first and second paragraphs seek to explain the design of the DSS-CD in general terms by comparing it to Option III. It may be better to describe the DSS-CD design directly. We suggest replacing the first and second paragraph with something like	Comment accepted. Section revised to read: The Confirmation Density Algorithm (CDA) is the licensing basis protection function of the DSS-CD. The CDA is designed to recognize a developing coherent

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		DSS-CD calls for reactor SCRAM on any detected coherent power oscillations of any magnitude. The implementation of the PBDA in DSS-CD may be considered similar to the Option III implementation of the PBDA with a very conservative setpoint. To prevent spurious SCRAMs, the DSS-CD solution uses the confirmation density algorithm (CDA). The CDA has only one setpoint, which is the fraction of active OPRM cells that must confirm unstable oscillations before a SCRAM is initiated (Reference 27). The second primary difference is the BSP. BSP is provided for instances where the DSS-CD is declared inoperable, such that automatic suppression will occur under conditions adverse to stability. This feature is necessary for MELLLA+ operation where a dual recirculation pump trip (2RPT) event may result in rapidly growing power oscillations.	the following. The Confirmation Density Algorithm (CDA) is the licensing basis protection function of the DSS-CD. The CDA is designed to recognize a developing coherent instability and initiate control rod insertion before the power oscillations increase much above the noise level. The CDA capability of early detection and suppression of instability events is achieved by relying on the successive confirmation period element of Period Based Detection (PBDA). The CDA employs an amplitude OPRM signal discriminator to minimize unnecessary spurious reactor scrams from neutron flux oscillations at or close to the Oscillation Power Range Monitor (OPRM) signal noise level. The CDA identifies a confirmation density (CD), which is the fraction of operable OPRM cells in an OPRM channel that reach a target successive oscillation period confirmation count. When the CD exceeds a preset number of OPRM cells, and any of the confirming OPRM cell signals reaches or exceeds the	instability and initiate control rod insertion before the power oscillations increase much above the noise level. The CDA capability of early detection and suppression of instability events is achieved by relying on the successive confirmation period element of PBDA. The CDA employs an amplitude OPRM signal discriminator to minimize unnecessary spurious reactor scrams from neutron flux oscillations at or close to the OPRM signal noise level. The CDA identifies a confirmation density (CD), which is the fraction of operable OPRM cells in an OPRM channel that reach a target successive oscillation period confirmation count. When the CD exceeds a preset number of OPRM cells, and any of the confirming OPRM cell signals reaches or exceeds the amplitude discriminator setpoint, an OPRM channel trip signal is generated. The amplitude discriminator setpoint is generically provided in the DSS-CD LTR or can be established as a plant-specific parameter that is set to bound the inherent plant-specific noise.

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			amplitude discriminator setpoint, an OPRM channel trip signal is generated. The amplitude discriminator setpoint is generically provided in the DSS-CD Licensing Topical Report or can be established as a plant-specific parameter that is set to bound the inherent plant-specific noise. The DSS-CD Backup Stability Protection (BSP) methodology describes two BSP options that are based on selected elements from three distinct constituents: (a) manual; (b) automated; and (c) BSP boundary. The two BSP options are: Option 1: Consists of the BSP Manual Regions, BSP Boundary and associated operator actions. Option 2: Consists of the Automated BSP (ABSP) Scram Region, as implemented by the APRM flow-biased scram setpoint and associated rod-block setpoints, and associated operator actions. For BSP Option 1, the reactor power is reduced below the BSP	The DSS-CD BSP methodology describes two BSP options that are based on selected elements from three distinct constituents: (a) manual; (b) automated; and (c) BSP boundary. The two BSP options are: Option 1: consists of the BSP Manual Regions, BSP Boundary and associated operator actions. Option 2: consists of the Automated BSP (ABSP) Scram Region, as implemented by the APRM flow-biased scram setpoint and associated rod-block setpoints, and associated operator actions. For BSP Option 1, the reactor power is reduced below the BSP Boundary so that two-recirculation pump trip (2RPT) does not result in operation inside the Exclusion Region. For BSP Option 2, a scram is automatically generated if the reactor enters the Exclusion Region. Both BSP options rely on calculations to demonstrate that instabilities outside the Exclusion Region are not likely. The sample

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			Boundary so that two-recirculation pump trip does not result in operation inside the Exclusion Region. For BSP Option 2, a scram is automatically generated if the reactor enters the Exclusion Region. Both BSP Options rely on calculations to demonstrate that instabilities outside the Exclusion Region are not likely. The sample Technical Specifications (TS) in the DSS-CD LTR delineate specific implementation requirements for both BSP Options when the OPRM system is declared inoperable.	Technical Specifications (TS) in the DSS-CD LTR delineate specific implementation requirements for both BSP options when the OPRM system is declared inoperable. Given the similarities between the features of DSS-CD and other stability solutions (namely Options I-D, EIA, and III), the technical basis for the staff's conclusions documented in the preceding sections is applicable to DSS-CD.
8	Section 5 Pg K-45		The date for Reference 2 should be the date of the final SE which is July 21, 2009. The ML number may need to be changed as well.	Comment Accepted. Reference information updated.
9	Section 5 Pg K-45		Reference 9 appears to be an internal draft of the Amendment 32 SE. It should be changed to the final SE which is dated July 30, 2009. The ML number may need to be changed as well.	Comment Accepted. Reference information updated.