ENCLOSURE 4

MFN 05-081

Revised Responses to AOO RAIs 2, 14, 16, 17, 25.b, and 26

These revised responses replace the response previously provided in GE Letter, MFN 04-026, dated 03/04/2004

Non-Proprietary Version

IMPORTANT NOTICE

This is a non-proprietary version of Enclosure 1 to MFN 05-081, which has the proprietary information removed. Portions of the enclosure that have been removed are indicated by an open and closed bracket as shown here [[ ]]

NRC RAI 2, TVAPS Effect for Brunswick

For the Brunswick EPU/MELLLA+ analyses, explain what method would be used to calculate TVAPS. According to the proposed Amendment 27 changes to Section 4.3.1.2.1 of GESTAR, the time varying axial power shape for GE 11 fuel and later products is calculated using ODYN. The staff has been informed that Progress Energy is using TRACG to perform the EPU/MELLLA+ reload analysis. As such, how does ODYN interface with TRACG? Based on the Brunswick EPU/MELLLA+ core, provide a description of how the TVAP effect on the CPR was accounted for and calculated. Provide plots of the results.

GE Response

The Brunswick-1 TRACG model includes a hot channel. Section 8.1 of NEDC-32906P-A, Revision 1, *TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analysis*, describes the channel grouping process. Since the hot channel is intricate to the TRACG 3D-Kinetic method, the hot channel includes all same boundary conditions that are used in the ODYN/TASC method (although the TRACG hot channel flow is driven from the plenum-to-plenum pressure drop). The TVAPS is obtained from the 3D prediction of the hot channel power. Figures AOO-2-1, AOO-2-4, AOO-2-5 and AOO-2-6 provides the same time histories as provided in Figure 8-3 through 8-6 in NEDC-32906P-A but for Bunswick-1 Cycle 15 at MELLLA+ conditions. Figures AOO-2-2 and AOO-2-3 provide additional results for key TVAPS phenomena.

Non-proprietary Version

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Figure AOO-2-1. TRACG M+ Power and Flow Response for TTNB Event

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Figure AOO-2-2. TRACG M+ TVAPS Response for TTNB Event

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Figure AOO-2-3. TRACG M+ Channel Inlet Mass Flow Rate for TTNB Event

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Figure AOO-2-4. TRACG M+ CPR Response for TTNB Event

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Figure AOO-2-5. TRACG M+ Pressure and Relief Valve Response for TTNB Event

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Figure AOO-2-6. TRACG M+ Vessel Inlet and Exit Flow for TTNB Event

NRC RAI 14, Rod Withdrawal Error

Demonstrate that the RWE for the EPU/MELLLA+ domain is less limiting than the non-MELLLA+ domain through out the cycle.

GE Response

The analysis procedure varies depending on the type of rod block monitoring (RBM) system. Plants crediting the flow biased RBM system utilize the Plant/Cycle Specific Analysis procedure described in GESTAR II Section S.2.2.1.5. [[

]] The results of the analysis are used as the plant/cycle specific limit.

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]] The plant/cycle analysis procedure for this type basis also requires a conservative initial rod pattern assumption. [[

]] The results of the analysis are compared to the generic statistical limit for each applicable setpoint. If the plant/cycle analysis results exceed the generic limit, the plant/cycle results are applied; otherwise, the generic limits are applied.

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]] The following are the results of this study:

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The following is a similar study for Brunswick-1 Cycle 15 at MELLLA+:

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[[ ]] A comparison of the RWE ΔCPR/ICPR response comparing rated core flow to the EPU/MELLLA+ domain will be provided in the plant-specific EPU/MELLLA+ application.

NRC RAI 16, Reload Analysis

Since the startup and intermediate rod pattern are developed by the licensees and subject to change during plant maneuvers, explain how is it ensured that the core and fuel assessment analyses performed during the reload is still applicable. For example, if the SLMCPR is performed at different burnup conditions during the cycle, how is it assured that the plant's operating history does not invalidate the reload assumptions. How are the correction or adjustments made to the plants core and fuel performance analyses to ensure the assumed parameters and conditions during the reload analyses remain applicable during the operation. The staff's concern stems from the additional challenges that EPU/MELLLA+ poses in terms of core and fuel performance.

GE Response:

The reload licensing analysis is based on a reference core loading which is documented in the Supplemental Reload Licensing Report (SRLR) for the plant and cycle being licensed. Deviations to this licensed reference core loading are allowed under the criteria defined in Section 3.4 of GESTAR II. Any variations in the core loading outside of these allowable deviations must undergo a re-examination as spelled out in that same section of GESTAR II. This re-examination can result in up to a complete relicense analysis if necessary.

The reload license analysis is also based on an assumed operational trajectory or set of design rod patterns. These design rod patterns represent a relatively detailed simulation of core operation at rated power using an operational philosophy that incorporates any utility instructions (regarding how they intend to operate), that optimizes core performance in regards to energy capability, thermal margins, operational simplicity and that meets all design and licensing requirements. The key nuclear reactivity assessments for reload licensing [strong-rod-out (SRO) *shutdown margin and standby liquid control system* (SLCS) *shutdown margin as* specified in Section 3.2 of GESTAR II] are analyzed both at beginning of cycle (BOC) and at selected exposure points through the cycle in enough detail to assure the maximum reactivity point during the cycle has been determined and that it meets the specified licensing criteria. To assure that the analysis will cover operational uncertainties in the previous cycle shutdown, these reactivity analyses are performed assuming a minimum energy accumulation scenario for the previous cycle. This previous cycle minimum energy requirement is also documented in the SRLR. Typically this previous cycle energy assumption has a stronger effect on the cold reactivity calculations (because it results in the carryover of additional reactivity on all of the exposed fuel) than variation in operational rod patterns. This is especially true for the SLCS analysis which is a core-wide reactivity event, not particularly sensitive to changes in local reactivity, and which most often exhibits minimum margin at BOC. For the SRO shutdown margin analysis a BOC demonstration is required of the plant and this demonstration is performed on the actual as-loaded core conditions.

The end of cycle (EOC) pressurization transients from which the core delta critical power ratio (ΔCPR) and ultimately the core minimum critical power ratio operating limit (OLMCPR) are derived based on [[

{3}]]

The statistical limit minimum critical power ratio (SLMCPR) analysis is performed under procedures and criteria approved by the NRC. In the SLMCPR analysis limiting rod patterns are established at multiple exposure points during the cycle so as to adequately characterize the core behavior. The limiting rod pattern criteria is constructed to achieve a core state at each of the exposure points that represents a limiting condition for establishing the SLMCPR. The object of the limiting rod pattern is to place a substantial fraction of the high power, interior bundles near the MCPR limit and then perform statistical analysis to determine the SLMCPR value at which 0.1% of the fuel rods would become susceptible to boiling transition. The object of achieving a relatively flat, near-limits core condition with the limiting rod pattern is to place a higher percentage of fuel bundles (and thus fuel rods) closer to this boiling transition threshold; enabling the 0.1% criteria to be reached at a higher SLMCPR. The statistical analysis for determining the SLMCPR is performed at all exposure points and the most limiting of these values is used to establish the SLMCPR for the plant/cycle.

NRC MELLLA+ AOO RAI #17, Thermal Limits Assessment

a. SLMCPR. It is possible that the impact on the critical heat flux (CHF) phenomena may be higher at the off rated or minimum core flow state points. Is the SLMCPR value provided in the SLMCPR amendment requests and reported in the TS based on the rated conditions? If so, justify why the SLMCPR is not calculated for state points other than the rated conditions. Quantitatively demonstrate that the SLMCPR calculated at the minimum 80 percent and 55 percent state points would be lower than the SLMCPR calculated at the rated conditions. Use power profiles and core designs that are representative of the EPU/MELLLA+ conditions. Discuss the assumptions made. Include the Brunswick EPU/MELLLA+ application in your sensitivity analyses.

b. SLMCPR at EPU/MELLLA+ Upper Boundary. The SLMCPR at the non rated conditions (EPU power/80 percent CF) could be potentially higher than the SLMCPR at rated conditions, explain how "state point-dependent" SLMCPR would be developed and implemented for operation at the EPU/MELLLA+ condition. Use the Brunswick EPU/MELLLA+ application to demonstrate the implementation of "state point-dependent" SLMCPR.

c. Exposure-Dependent SLMCPR. Discuss the development of the exposure-dependent SLMCPR calculation. State whether this is an NRC-approved method and refer to the applicable GESTAR II amendment request.

GE Response

Response to Part a

Q. It is possible that the impact on the critical heat flux (CHF) phenomena may be higher at the off rated or minimum core flow state points.

A. For GE BWR analysis, the SLMCPR is a particular critical power ratio (CPR). The phenomena for boiling transition due to a CPR value approaching 1.0 is film dryout that depends on integrated power. This phenomenon is different from the localized critical heat flux (CHF) phenomena for boiling transition that is relevant for PWRs. Therefore, this RAI is addressed in regards to the film dryout phenomena instead of the CHF phenomena.

Q. Is the SLMCPR value provided in the SLMCPR amendment requests and reported in the TS based on the rated conditions? If so, justify why the SLMCPR is not calculated for state points other than the rated conditions.

A. No, for current GE BWR SLMCPR amendment requests the SLMCPR value considers rated conditions and lowest licensed flow corresponding to the rated power conditions. See the following part (i) discussion for additional information concerning this.

Q. Quantitatively demonstrate that the SLMCPR calculated at the minimum 80 percent and 55 percent state points would be lower than the SLMCPR calculated at the rated conditions.

A. Table 17-3 in the part (iv) discussion that follows quantitatively demonstrates that the minimum 80 percent (Case 3) and 55 percent (Case 4) state points are lower than the rated conditions (Case 1).

Q. Use power profiles and core designs that are representative of the EPU/MELLLA+ conditions.

A. Calculations that are presented in response to this RAI are based on the Brunswick 1 Cycle 15 core, which is currently operating and was designed for EPU/MELLLA+ operation. Therefore, the SLMCPR results presented here are considered to represent realistic operating cores that were designed to accommodate EPU/MELLLA+ operation.

Q. Discuss the assumptions made.

A. The assumptions made are discussed in parts (iii) and (iv) of the discussion below.

Q: Include the Brunswick EPU/MELLLA+ application in your sensitivity analyses.

A. Utilizing the Brunswick EPU/MELLLA+ application power/flow map (see Figure 17-1 in the part (iii) discussion that follows) SLMCPR values were determined for three power / flow state points along the upper boundary of the map and for the rated power / lowest flow point being considered for generic MELLLA+ operation (100%P / 80%F), as defined in Table 17-1.

i) Additional Discussion

The calculated SLMCPR was previously based on the highest rated licensed power and flow conditions. This approach had been shown in NEDC-32601P-A to produce SLMCPR values that are slightly conservative compared to off-rated flow conditions (note in particular Figure II.4-1 on page B-5). However, recently it was determined that a rated power / reduced flow condition may result in a higher SLMCPR value due to changes in limiting control rod patterns to compensate for lower reactivity at reduced flow, as was discussed in MFN 04-108. All current SLMCPR evaluations account for this condition by determining the SLMCPR at both rated and lowest licensed flow corresponding to the rated power conditions, and then using the highest calculated SLMCPR value for the cycle specific licensing evaluation. The following discussion extends the evaluation to off-rated power / flow operating conditions, including the MELLLA+ region, and concludes that the cycle specific SLMCPR value calculated as discussed above is conservative to cover off-rated power / flow operating conditions. The two key phenomena at off-rated conditions that affect the SLMCPR are addressed here, first is the off-rated power distribution and second are the off-rated power and flow uncertainties. As discussed herein, the power distribution and, consequently, the CPR distribution tend to have a slightly less limiting effect at reduced power. Additionally, both the power and flow uncertainties are relatively constant at the higher power and flow range, and bounded by the values applied in the design analysis, and become larger at non-limiting low power and flow conditions.

ii) Off-Rated Power and CPR Distribution Effects

Whereas CPRs are sensitive to flow and CPR decreases as the flow decreases, the SLMCPR is sensitive to the relative distribution of the CPRs, not their absolute values. The relative distribution of CPRs in the core does not change appreciably with flow changes in the operating domains where the power is high enough for CPRs to be a concern. Rather, the SLMCPR is dominated by the uncertainty in CPRs as a result of the uncertainties in the two dominant inputs: power and flow.

Due to a slight flattening of the relationship between critical power and flow at the higher flows, the CPR distributions in the core tend to be slightly flatter at the higher flows so the calculated SLMCPR increases very slightly for the higher flows (as shown in Figure II.4-1 on page B-5 of NEDC-32601P-A).

The bundle designs and core loading configuration strongly influence the SLMCPR. Both of these are accounted for by performing cycle-specific analyses utilizing the actual bundle designs and the reference core loading. The bundles must be designed and the core loaded to support MELLLA+ operation. From the perspective of CPR performance this generally means that the bundles must have a very flat critical power response over a wide range of flows. MELLLA+ operations that use reduced flow to harden the neutron spectrum in order to build-in plutonium and extend cycle operation have two competing effects on bundle design. (1) Rod peaking factors must be maintained low enough that CPR performance can still be achieved at high powers and lower flows, e.g., the bundle designs need to be flattened. (2) Rod enrichments need to be high enough to achieve the desired cycle exposures and maintain sufficient reactivity to offset the negative impact of higher core voiding at the reduced flows, e.g., the bundle peakings are increased to accommodate more enrichment and the associated increases in gadolinium loaded to control the reactivity. All these effects are accounted for in the present cycle-specific SLMCPR methodology that evaluates the actual bundle designs to be loaded. Generally speaking, bundle designs for MELLLA+ operations tend to go in the same direction as for extended power uprates (EPU) and longer-exposure cycles, namely in the direction of being slightly more peaked which means that calculated SLMCPRs continue to trend downward.

Higher core power levels require lower radial peaking factors to maintain adequate margin to the operating limit MCPR (OLMCPR). Consequently, each bundle must be closer in power to the average bundle power so that either the average power per bundle can increase as is the case for EPU or the flow can be reduced for the same bundle power, as is the case for MELLLA+. Both scenarios result in a flatter MCPR distribution in the as-loaded core. If this were the only effect, one would expect that calculated SLMCPR values would be increasing whereas, in fact, they are not. This is because higher core powers also require higher fresh reload fuel batch fractions. These fresh fuel batches must consist of mixed streams of different bundle designs in order to control reactivity during the cycle and minimize enrichment costs. Thus, the number and distribution of MCPRs for the highest power bundles in the design that set the SLMCPR for the core remain approximately constant. The absolute power needed to drive the MCPR in these bundles down to the SLMCPR during a postulated AOO event remains unchanged since this power depends only on the critical power capability of the bundle. The fact that these limiting bundles may start at a lower MCPR because of reduced flow (or higher power) is relevant for the assessment of the OLMCPR, but is not relevant for the SLMCPR that depends only on the relative distributions of these bundle MCPRs.

Both the SLMCPR and the OLMCPRs for different scenarios are determined on a cycle-specific basis considering the actual bundle designs, the reference loading pattern and the use of CPR distribution limiting control blade patterns. Again the key point with respect to the SLMCPR is that these considerations are no different from those that are already considered as part of the cycle-specific SLMCPR evaluations.

iii) Bases and Assumptions

The Brunswick 1 Cycle 15 core design was selected to illustrate the effects of off-rated power and flow conditions on the SLMCPR calculation for EPU/MELLLA+ applications. The proposed MELLLA+ power / flow map for the Brunswick nuclear units is shown in Figure 17-1. SLMCPR values were determined for three power / flow state points along the upper boundary of the map and for the rated power / lowest flow point being considered for generic MELLLA+ operation (100%P / 80%F), as defined in Table 17-1.

Case (1) was the rated condition (state point "E" in Figure 17-1) SLMCPR evaluation that was used in the Reload Licensing Analysis for Brunswick 1 Cycle 15. Case (2) determined the SLMCPR for the rated power / lowest licensed flow condition (state point "N" in Figure 17-1). Case (3) determined the SLMCPR for rated power / lowest flow for the generic MELLLA+ application, for comparison purposes. Case (4) determined the SLMCPR for the highest off-rated power / lowest off-rated flow statepoint along the Brunswick 1 MELLLA+ upper boundary (point "M" in Figure 17-1).

Cases (1) and (2) addressed the Part 21 reportable condition (MFN 04-108) for the Brunswick 1 MELLLA+ extended operating domain. As discussed above, the SLMCPR for the cycle specific application is the most limiting of these two cases.

Cases (2) and (4) correspond to points N and M, respectively, on the MELLLA+ boundary, as seen in Figure 17-1. The SLMCPR calculations for these two cases used a fixed set of control rod patterns for a given exposure point calculation, as shown in Figure 17-2. This was done to illustrate the impact to SLMCPR when moving between state points M and N along or near the MELLLA+ boundary line without the effects of changing the limiting control rod configuration, which is typical of plant operation following control blade maneuvers which are performed at off-rated conditions.

The SLMCPR calculations for all cases (1) through (4) used uncertainties that have been previously reviewed and approved by the NRC as listed in Table 17-2 and described in NEDC-32601P-A, except for the R-factor uncertainty, which was slightly increased to conservatively account for effects of potential increased channel bow.

iv) Off-Rated Power and Flow Uncertainties Effects

It was determined that it is appropriate to use the feedwater and core flow uncertainties currently used for SLMCPR evaluation at rated conditions for the off-rated SLMCPR evaluations. Figure 17-3 provides the change in the feedwater and core flow uncertainties as the core flow decreases, as calculated for various BWR design types. Figure 17-4 provides the sensitivity of the calculated SLMCPR value to changes in the four most significant uncertainties. Figure 17-4 shows that the feedwater flow rate uncertainty has the strongest impact on SLMCPR, followed by the core flow uncertainty. In SLMCPR evaluations a feedwater flow uncertainty of [[ ]] is used for rated conditions, which Figure 17-3 shows is valid down to approximately [[ ]] rated feedwater core flow, covering all off-rated cases of interest. Similarly for core flow, an uncertainty of [[ ]] is used for rated conditions and is valid down to approximately [[ ]] rated core flow. This directly covers the off-rated conditions for cases (2) and (3). Case (4) uses only [[ ]] lower core flow (55% rated core flow), and Figure 17-3 shows that the core flow uncertainty for this case is approximately [[ ]]. Using the SLMCPR / core flow uncertainty relationship from Figure 17-4, the impact of the corresponding uncertainty increase from [[ ]] would be about +0.0012, a negligible effect compared to the inherent 1 sigma uncertainty (>0.005) of the Monte Carlo SLMCPR calculation methodology. Therefore, the rated condition uncertainties in Table 17-2 are appropriate to use for the SLMCPR calculations at off-rated conditions.

Tables 17-3 and 4 summarize the results of the SLMCPR evaluations for Brunswick 1 Cycle 15. For each case, three distinct cycle exposure points were analyzed: beginning-of-cycle (BOC, 181 MWd/ST), peak-hot-excess (PHE, 9072 MWd/ST), and near the end-of-cycle (EOC, 14440 to 14940 MWd/ST). The last column in Table 17-4 shows, for each case, the most limiting SLMCPR result for the entire cycle exposure range. Each column labeled BOC, PHE, EOC, and SLMCPR, is further divided into two sub-columns, the first displaying the SLMCPR results, and the second showing the difference between the two adjacent cases. The last row of Table 17-4 shows the total change in SLMCPR as we follow the path on the power-flow map from the rated point E to the lower MELLLA+ boundary point M (see Figure 17-1). For each exposure point, the total impact in SLMCPR as power and flow vary from the most limiting of the rated case (1) and the low flow case (2) to the lower MELLLA+ boundary case (4) is between -0.01 to -0.00.

A change in SLMCPR by more than 0.005 is considered a significant change. This threshold was chosen to correspond to the inherent variability in the Monte Carlo process for determining the safety limit. It is also consistent with the accepted practice of rounding and reporting SLMCPR values to two places past the decimal point. By definition, a change in a statepoint condition that goes into the evaluation of a SLMCPR is not significant unless it results in an increase in the calculated SLMCPR by +0.005. From the results shown in Tables 17-3 and 4, the changes in power and flow expected with EPU/MELLLA+ operation would not result in any significant changes compared to SLMCPR at the rated power condition.

Consequently, a SLMCPR evaluated for rated power MELLLA+ conditions is also valid for MELLLA+ off-rated power / flow conditions.

v) Summary

For the Brunswick 1 Cycle 15 SLMCPR calculations presented here, the rated power and rated flow case gives us the most limiting SLMCPR result. However, when reporting SLMCPR results to two decimal places, the rated power rated flow and 80% flow cases give a 1.11 SLMCPR. The rated power 85% flow, and the 77.6% power 55% flow cases give a 0.01 lower safety limit result.

The current SLMCPR process already analyzes rated power cases at both rated flow and the lowest flow conditions. Additionally, off-rated power safety limit calculations are unnecessary because they result in lower safety limits than full power cases.

Response to Part b

Q. The SLMCPR at the non rated conditions (EPU power/80 percent CF) could be potentially higher than the SLMCPR at rated conditions,

A. Concur, as stated in the (i) discussion above, recently it was determined that a rated power / reduced flow condition may result in a higher SLMCPR value due to changes in limiting control rod patterns to compensate for lower reactivity at reduced flow, as was discussed in MFN 04-108.

Q. explain how "state point-dependent" SLMCPR would be developed and implemented for operation at the EPU/MELLLA+ condition. Use the Brunswick EPU/MELLLA+ application to demonstrate the implementation of "state point-dependent" SLMCPR.

A. For clarity the definition of a "state point-dependent" SLMCPR is defined as having a SLMCPR that is a function of core power and core flow. It is not GE's intention and GE is not requesting to implement the SLMCPR as a "state-point-dependent" quantity. GE is utilizing the conservative approach of using a single limiting value, which is the maximum

SLMCPR value calculated by the analysis. Therefore, the SLMCPR directly utilized for the plant/cycle tend to be more conservative for most conditions other than the limiting condition.

For Brunswick, the use of the TRACG AOO methodology (NEDE-32906P-A) decouples the OLMCPR(s) from the SLMCPR. OLMCPR(s) are "state-point-dependent".

Response to Part c

Q. Discuss the development of the exposure-dependent SLMCPR calculation.

A. SLMCPR analyses are performed for multiple exposure points throughout the cycle. Exposure interval end points are then selected such as to be equal to an SLMCPR analysis exposure point. The maximum SLMCPR analysis value within that exposure interval (including end points) is selected to be the exposure dependent SLMCPR value for that exposure interval. The following tables present an arbitrary example where five SLMCPR analyses are performed to create two exposure dependent SLMCPR intervals (Note: In this example four unique exposure dependent SLMCPR intervals are possible, but they were collapsed into the use of only two exposure dependent SLMCPR intervals).

SLMCPR Analysis Results

Exposure (GWd/ST)	BOC	5.0	10.0	15.0	EOC
SLMCPR	1.11	1.10	1.09	1.08	1.10

Exposure dependent SLMCPR

Exposure Range (GWd/ST)	SLMCPR
BOC to 10.0	1.11
10.0 to EOC	1.10

Q. State whether this is an NRC-approved method and refer to the applicable GESTAR II amendment request.

A. NRC approval of GESTAR II Rev. 14 (NEDE-24011-P-A-14) specifically allows the SLMCPR values to be stipulated as a function of exposure. The exposure-dependent SLMCPR values were introduced in Amendment 25 to GESTAR II that was submitted for NRC review and approval in December 1996. The NRC SER approving this approach was issued March 11, 1999. This approval was reflected in section 1.1.5.B.vii of GESTAR II Rev. 14.

Non-proprietary Version

Table 17-1. Brunswick 1 Cycle 15 SLMCPR Evaluation Case Description

Evaluation Case Number	Case Description
Case (1)	100%P / 100%F – rated EPU case (state point E in Figure 17-1)
Case (2)	100%P / 85%F – upper BSEP MELLLA+ Power-Flow map case (NEDC-33063P) (state point N in Figure 17-1)
Case (3)	100%P / 80%F – upper generic MELLLA+ Power-Flow map case (NEDC-33006P)
Case (4)	77.6%P / 55%F – lower BSEP MELLLA+ Power-Flow map case (NEDC-33063P) (state point M in Figure 17-1)

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Table 17-2. Uncertainties Used for Brunswick 1 Cycle 15 SLMCPR Evaluation Cases

Description	Brunswick 1 Cycle 15
Standard Non-power Distribution Uncertainties	Revised NEDC-32601P-A
Core flow rate (derived from pressure drop)	2.5 (Two Loop)
Individual channel flow area	[[ ]]
Individual channel friction factor	5.0
Friction factor multiplier	[[ ]]
Reactor pressure	[[ ]]
Core inlet temperature	0.2
Feedwater temperature	[[ ]]
Feedwater flow rate	[[ ]]
Standard Power Distribution Uncertainties	Revised NEDC-32601P-A
GEXL R-factor	[[ ]]
Random effective TIP reading	1.2 (Two Loop)
Systematic effective TIP reading	[[ ]]
Integrated effective TIP reading	[[ ]]
Bundle power	[[ ]]
Effective total bundle power uncertainty	[[ ]]
Exceptions to the Standard Uncertainties	
GEXL R-factor	[[ ]]

Table 17-3. Summary of SLMCPR Results for Brunswick 1 Cycle 15

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Table 17-4. SLMCPR Sensitivity Results for Brunswick 1 Cycle 15

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Non-proprietary Version

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Figure 17-1. BSEP 1 and 2 MELLLA+ Operating Range Power-Flow Map (NEDC-33063P)

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Figure 17-2. Limiting Rod Patterns Used in Cases 100P/85F and 77.6P/55F

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Figure 17-3. Total Core Flow and Feedwater Flow Uncertainties for BWRs 4/5/6

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Figure 17-4. Four Dominant SLMCPR Sensitivities for a Factor Change in the Generic GETAB Uncertainty Value

NRC RAI 25, Large Break ECCS-LOCA

b. Reporting Limiting ECCS-LOCA Results. The MELLLA+ audit indicated that the rated ECCS-LOCA results are reported although it may not be for the most limiting results. For the EPU/MELLLA+ operation, the most limiting ECCS-LOCA result is at the MELLLA+ statepoint of 55 percent CF. Revise the MELLLA+ LTR to state that the ECCS-LOCA result at rated condition, minimum core flow at EPU power level and at the 55 percent CF statepoint will be reported. In addition, revise the applicable documents that specify the GENE licensing methods to state that the ECCS-LOCA result corresponding to the rated and the most limiting statepoint will be provided. Report in the supplemental reload licensing report (SRLR), the ECCS-LOCA results at the rated and the most limiting statepoints. Confirm that the steady-state initial conditions (e.g., operating limit maximum critical power ratio [OLMCPR]) assumed in the ECCS-LOCA analyses will be reported in the SRLR.

GE Response

Response to Part b

The MELLLA+ LTR will be revised to state that the MELLLA+ plant submittals will include calculations for the Appendix K and Nominal PCT at rated power/rated core flow, rated power/MELLLA+ boundary (point D of Figure 1-1), and the low flow point on the MELLLA+ boundary at which the off-rated flow dependent LHGR or MAPLHGR setdown begins to apply. This point will be at or above 55% core flow and between points D and E on Figure 1-1 (call point E').

The analyses at points D and E' will be initialized at the rated power LHGR and MAPLHGR limits. The initial MCPR at point E' will include application of the power dependent MCPR multiplier to the rated power assumed MCPR. Note that the MCPR assumption has no reliance on the safety limit MCPR since the hot channel is assumed to dry out at a MCPR of 1.0 in accident analyses.

When SAFER/GESTR methodology is applied, the hot bundle is initialized with a hot rod at the LHGR limit and the average rod at the MAPLHGR limit. The dryout times are determined with the TASC code assuming the hot bundle starts at the ECCS basis Initial MCPR. These initial conditions are designed to maximize the PCT. Further discussion on the impact of axial power shape on the PCT is contained in the response to RAI 28.

Since credit is taken for these off-rated limits, the plant will be required to apply these limits during core monitoring.

The Licensing Basis PCT, considering all calculated statepoint as described, will be reported in the plant-specific MELLLA+ Safety Analysis Report.

GE agrees to change future SAFER/GESTR analyses and SRLRs as follows:

1. The SAFER/GESTR report will provide the Licensing Basis PCT considering all calculated statepoints. The Licensing Basis PCT will be calculated either using the previous Licensing

Basis PCT plant variable uncertainty (e.g., NEDE-23875-1-PA, Section 3.1.3) or with a plant variable uncertainty specific to the calculated statepoint with the highest Appendix K PCT. Only one Licensing Basis PCT will be reported because it is the single PCT which considers all required licensing conservatism.

2. Only SRLRs, for both MELLLA+ plants and non-MELLLA+ plants, which report these future SAFER/GESTR analyses will report the Licensing Basis PCT considering all calculated statepoints as described above. No change will be made in SRLR reporting of previous SAFER/GESTR analyses.

3. Section 6 of NEDC-32950P will be revised to include determining the Licensing Basis PCT considering all calculated statepoints as described above. No other documents that specify the GENE licensing methods will be revised.

The Initial MCPR assumed in the ECCS/LOCA analyses is reported in the SRLR.

NRC RAI 26, Small Break ECCS-LOCA Response

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assuming high pressure coolant injection (HPCI) failure and automatic depressurization system depressurization. At the 55 percent CF statepoint (Point M), the hot bundle may be at a more limiting initial condition in terms of initial void content and the ADS would depressurize the reactor leading to core uncovery as well. Provide a sensitivity ECCS-LOCA analysis, using the bounding initial condition. Provide a small break LOCA analysis at point M (77.6 percent Power/55 percent CF), based on the bounding initial condition, worst case small break scenario and placing the hot bundle at the most limiting conditions (peaking factors). Use initial SLMCPR and OLMCPR condition that is bounding for operation at 80 percent CF or 55 percent CF statepoint.

GE Response

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]] If the small break PCT is at or near limiting, the MELLLA+ plant submittals will include calculations for the limiting small break at rated power/rated core flow and rated power/MELLLA+ boundary (point D of Figure 1-1). The following is a comparison of the small break PCT impact to the large (DBA) break (Appendix K assumptions) along the MELLLA+ boundary.

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]] Based on these result and the aforementioned expectations, near limiting is defined as within [[ ]] of the limiting Appendix K PCT.

ENCLOSURE 5

MFN 05-081

Affidavit

General Electric Company

AFFIDAVIT

I, **George B. Stramback,** state as follows:

(1) I am Manager, Regulatory Services, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosures 1 & 2 to GE letter MFN 05-081, George Stramback to NRC, *Revised Responses to MELLLA+ RAIs (TAC No. MB6157)*, dated August 16, 2005. The proprietary information in Enclosures 1 & 2 is delineated by a double underline inside double square brackets. Figures and large equation objects are identified with double square brackets before and after the object. In each case, the superscript notation$^{\{3\}}$ refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, <u>Critical Mass Energy Project v. Nuclear Regulatory Commission,</u> 975F2d871 (DC Cir. 1992), and <u>Public Citizen Health Research Group v. FDA,</u> 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, resulting in potential products to General Electric;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a., and (4)b, above.

(5) To address 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed results and conclusions from evaluations of the safety-significant changes necessary to demonstrate the regulatory acceptability for the expended power/flow range of MELLLA+ for a GE BWR, utilizing analytical models and methods, including computer codes, which GE has developed, obtained NRC approval of, and applied to perform evaluations of transient and accident events in the GE Boiling Water Reactor ("BWR"). The development and approval of these system, component, and thermal hydraulic models and computer codes was achieved at a significant cost to GE, on the order of several million dollars.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 16th day of August 2005.

George B. Stramback

George B. Stramback
General Electric Company

ENCLOSURE 1

MFN 05-081

Revised Responses to ATWS RAIs 2.1, 2.4, 3.1, and 6.4

These revised responses replace the response previously provided in GE Letter, MFN 04-027, dated 03/10/2004

GE Proprietary Information

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ENCLOSURE 2

MFN 05-081

Revised Responses to AOO RAIs 2, 14, 17, 25.b, and 26

These revised responses replace the response previously provided in GE Letter, MFN 04-026, dated 03/04/2004

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