BWR OWNERS' GROUP

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<u>Proprietary Notice</u>
This letter transmits GEH proprietary information in accordance with 10 CFR 2.390. Upon removal of Enclosure 1, the balance of the letter may be considered non-proprietary.

Project 691

BWROG-11047
August 23, 2011

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Attention: Chief, Information Management Branch
Division of Program Management
J. Golla, NRC

Subject: Draft Presentation Materials for the August 31, 2011 Meeting Between the NRC and the BWR Owners' Group

Reference: 1) REQUEST FOR ADDITIONAL INFORMATION RE: BOILING WATER REACTOR OWNERS' GROUP TOPICAL REPORT NEDC-33608P, REVISION 2, BOILING WATER REACTOR EMERGENCY CORE COOLING SUCTION STRAINER IN-VESSEL DOWNSTREAM EFFECTS (TAC NO. ME5345)

The Boiling Water Reactors Owners' Group (BWROG) is providing the attached draft presentation materials to support the August 31, 2011, meeting between the Nuclear Regulatory Commission (NRC) and the BWROG. The purpose of this meeting is to discuss forthcoming responses to Requests for Additional Information (RAIs) contained in Reference 1. These responses will contain information proprietary to GE-Hitachi Nuclear Energy Americas LLC (GEH).

Because the presentation materials contain proprietary information, we are also providing a non-proprietary (public) version. The nature of the proprietary information reflects GEH Loss of Coolant Accident (LOCA) analysis information. In the August 31 meeting, we will discuss specific results of LOCA analysis in the context of the GEH's proprietary Engineering Computer Code used for Emergency Core Cooling System (ECCS) LOCA analysis ("SAFER").

Please note that these presentation materials are still in final review and may change in advance of the meeting and are considered unverified information. They are provided to the

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NRR

NRC at this time only for the purpose of identification of GEH proprietary information to support meeting closure.

If you have any questions concerning this letter, please contact me or Robert Whelan, the BWROG Project Manager (910-200-1006). Thank you.

Sincerely,

Frederick P. "Ted" Schiffley, II
Chairman
BWR Owners' Group

cc: M. H. Crowthers, BWROG Vice Chairman
S. L. Scammon, BWROG ECCS SS Committee Chairman
C.J. Nichols, BWROG Program Manager
R. W. Whelan, BWROG ECCS SS Committee Project Manager
BWROG Primary Representatives

Commitments: None.

Enclosures:

1. DRAFT Proposed Responses to Analysis-Related RAIs – GEH Proprietary Information – Class III (Confidential)
2. DRAFT Proposed Responses to Analysis-Related RAIs – Non-Proprietary Information – Class I (Public)
3. GEH Affidavit

ENCLOSURE 2

BWROG-11047

DRAFT Proposed Responses to Analysis-Related RAIs

Non-Proprietary Information – Class I (Public)

IMPORTANT NOTICE

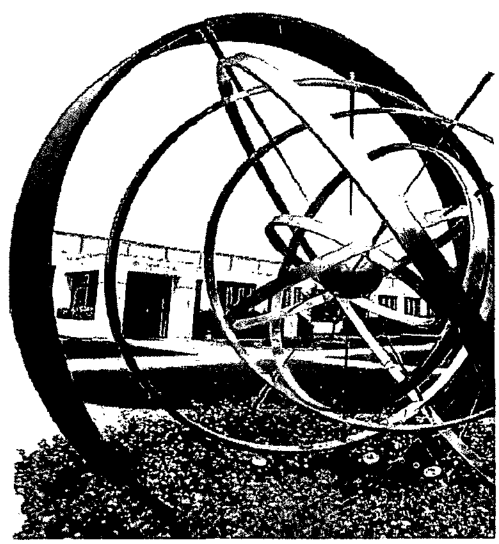
Enclosure 2 is a non-proprietary version of the presentation from Enclosure 1, which has the proprietary information removed. Portions that have been removed are indicated by open and closed double brackets as shown here [[ ]].

Proposed Responses to Analysis-Related RAIs

Dan Fouts, Vice Chairman
ECCS Suction Strainers
DSE-F Subcommittee

NRC/BWROG RAI Meeting

August 31, 2011
Bethesda, MD



Topics

Requests for Additional Information (RAIs) and responses

Further SAFER scenarios (to be added)

RAI 1

Please provide adequate technical basis for concluding that the analysis of a single accident scenario (a recirculation suction line break) for a reference BWR/3 plant can be considered bounding for all relevant in-vessel blockage impacts of post-LOCA (loss-of coolant accident) debris for all boiling-water reactors (BWRs) to which the topical report is intended to apply. Please consider the following specific items in the response:

a. The recirculation suction line break scenario analyzed in the topical report appears to have been selected based on its potential to be limiting with respect to peak cladding temperature in the absence of post-LOCA debris. Adequate justification was not presented to conclude that this scenario is necessarily limiting once the impacts of post-LOCA debris have been included, particularly with regard to long-term cooling over the duration of the system mission time.

RAI 1 (cont.)

b. According to the topical report methodology, the impacts of post-LOCA debris blockage are to be shown to be acceptable on an individual basis for four separate cases considered independently (i.e., lower plenum refill, core reflood, core inlet blockage, and core outlet blockage). The topical report presumes that the recirculation suction line break scenario results in the limiting impacts from post-LOCA debris for all of the cases. Adequate justification has not been provided to conclude that the limiting accident scenario (e.g., break location, available emergency core cooling equipment) need not be determined and analyzed for each of the four cases on an individual basis.

RAI 1 (cont.)

c. LOCA scenarios in which core sprays are unavailable exist for most operating BWR designs. Therefore, if debris blockage at fuel assembly inlets and support grids could impede the operation of the low-pressure coolant injection (LPCI) system, an accident scenario with core sprays unavailable could potentially be more limiting than the analyzed scenario, particularly with respect to ensuring adequate long-term core cooling.

d. Adequate justification has not been provided for the topical report's position that blockage of the entire core or some number of adjacent fuel assemblies could not result in a more limiting condition than the case of a single blocked fuel assembly that was analyzed in the topical report.

RAI 1 (cont.)

e. Although the BWR/3 reference analysis in the topical report appears broadly representative of post-LOCA behavior for the majority of operating BWR plants with jet pumps, adequate basis was not presented to support the BWR Owners' Group (BWROG) conclusion that it can be considered bounding with respect to all operating BWRs to which the topical report is to be applied.

f. Different pipe breaks can generate different debris loadings, with different debris constituents. It is not clear that the most limiting break can be determined generically without regard for plant-specific differences in debris loading.

RAI 1 Response (a)

a. The reference Loss of Coolant Accident (LOCA) calculation is regarded as being the most limiting not only from a Peak Clad Temperature (PCT) consideration but also from an oxidation consideration because it imposes the most challenging cooling requirements. The objective of the tests is to validate a specific blockage history (e.g., blockage magnitude as function of post low pressure Emergency Core Cooling System (ECCS) injection) that has been shown to produce acceptable LOCA results for the Design Basis Accident (DBA).

RAI 1 Response (b)

b. BWROG will provide the following LOCA cases to demonstrate application of proposed blockage history to non-limiting cases:
(i) Small Break Recirculation Pipe Break,
(ii) DBA for Inside Shroud Low Pressure Coolant Injection (LPCI) BWR/5, 6 plants,
(iii) Core Spray (CS) Line Break and CS injection failure, and
(iv) DBA for Non-Jet Pump plant.

RAI 1 Response (c-f)

c. The no CS scenario will be demonstrated by specific calculation as not being of concern (see part b). The core spray pipe break is located above the core elevation, therefore the level both inside and outside the shroud will correspond to that of the break. Flow from the lower plenum through the bypass flow paths will maintain coolant level above the fuel channels to be available for cooling if it is postulated that fuel inlet grids become fully blocked (after extended cooling via natural circulation).

d. Less coolant is available for the blocked hot fuel channel when the average fuel channel is not blocked.

e. The cases discussed in part (b) should demonstrate applicability of reference LOCA case.

f. The debris loading that produces the most limiting blockage in terms of magnitude and time should be used in tests.

RAI 2

Please confirm whether the topical report methodology is applicable to BWR/2s. It is unclear to the staff that the limiting scenarios, analytical results, test descriptions, and test acceptance criteria included in the topical report adequately consider unique aspects of the BWR/2 design that are fundamentally different from later BWRs with jet pumps and enhanced ECCS designs. Therefore, if applicable to BWR/2s, please provide, or else clarify why the topical report does not need to provide, separate analysis, test descriptions, and test acceptance criteria that are tailored to BWR/2 reactors.

RAI 2 Response

The Non-Jet Pump BWR/2 case is a sub-set of the long term Jet Pump BWR scenario being cooled by core spray alone. Note that the upper tie plate grid is approximately [[ ]] below the top of the channel, and thus only excessive debris accumulation (beyond the criteria) would decrease core spray flow.

RAI 3

Please provide the following additional information regarding Tables 4-1, 4-2, and 4-3:

a. Confirmation that the information in these tables has been validated against plants' current licensing bases as documented in the current versions of their Final Safety Analysis Reports (FSARs). Based on a sampling review conducted by the staff, apparent inconsistencies were identified between Tables 4-2 and 4-3 and plant FSARs. If corrections are necessary, please provide the revised information and update the topical report.

RAI 3 (cont.)

b. Clarification as to how the most limiting ECCS configurations were determined in Table 4-3, and whether the effects of post-LOCA debris were accounted for in the determination. For example, depending upon the assumed single failure, a LOCA on the HPCS system piping of a BWR/6 could presumably lead to a scenario with two LPCI pumps available or the scenario with one core spray pump and one LPCI pump designated in Table 4-3 as representing the minimum ECCS available." In light of the as-yet-undetermined impacts of post-LOCA debris, it is not clear to the staff that definitive conclusions can be reached regarding which single failure would result in the most limiting condition.

RAI 3 Response

a. Individual utilities will verify their licensing ECCS configuration listed in the Tables.

b. The full complement of ECCS is considered in the determination of the debris laden flow applied in the tests. Therefore a conservative result is assured by using the minimum cooling in the LOCA analysis and maximum ECCS flows in the tests.

RAI 7

The topical report presumes that core heatup would not occur after the completion of reflooding based on an expectation that future testing of fuel assemblies with debris-laden coolant would not result in significant debris accumulation. However, the ultimate outcome of these future tests is not certain, and it is possible that this expectation may not materialize. Furthermore, even if the test acceptance criteria are satisfied, analytical Sensitivity Case 4 results in two additional cladding temperature increase cycles, each with an amplitude of approximately [[ ]] F, when significant debris lockage is postulated to occur in the process of quenching the fuel.

RAI 7 (cont.)

a. Please discuss the extent to which testing for degradation mechanisms associated with significantly reheating and quenching previously quenched or partially quenched fuel rods demonstrates that the ductility and strength of the cladding remains sufficient to satisfy the criteria in 10 CFR 50.46.

b. Please clarify whether it is necessary to establish acceptance criteria (e.g., reheatup limits for cladding temperature and oxidation) to ensure that additional heatup and quenching cycles and/or steady-state heatup due to the accumulation of post-LOCA debris would not result in noncompliance with the criteria in 10 CFR 50.46.

RAI 7 Response

a. The reheating temperature magnitude exhibited in Figure 3-19 for the reference LOCA case with blockage is considered insignificant compared against the standard long term reheating given in the original GEH LOCA Licensing Topical Report (LTR) NEDE-20566P-A Volume 3 page III-30 Figure 7 that yields acceptable oxidation.

b. It is correct that postulated full inlet blockage may lead to a few longer term quenching/reheating cycles when unsteady Counter Current Flow Limiting (CCFL) coolant enters to top of the channel as illustrated in the LOCA calculation.

[[

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RAI 8 / RAI 8 Response

RAI 8: With the exception of the modifications described in Section 3.3.5, please confirm that the application of SAFER/GESTR-LOCA used to generate the analysis documented in the topical report was performed in a manner that is consistent with the method accepted in the NRC staff's safety evaluation, including conditions and limitations specified therein, or else identify and justify areas where deviations exist.

Response: It is correct that only the changes for applying the blockage were made to the licensing SAFER model. The calculation uses the nominal calculation basis for all the presented results.

RAI 10 / RAI 10 Response

RAI 10: Please define the variable X as used in the last equation on Page 11 and clarify the intent of the final steps of the derivation.

Response: The 'X' represents the flow area multiplier modification, where the applied parameter 'C' in the pressure loss calculation becomes the original parameter 'Co' divided by the square of the flow area multiplier 'X.'

RAI 12 / RAI 12 Response

RAI 12: Please specify the elevations of the top and bottom of the active fuel and the peak cladding temperature for the reference analysis.

Response: The reference LOCA analysis uses a BWR/3 [[ ]] vessel geometry whose corresponding fuel elevations are [[ ]] inches for the bottom of active fuel and [[ ]] inches for the top of active fuel, elevations referenced to vessel zero. However, the top of the fuel channel is approximately [[ ]] inches above the top of the active fuel. The calculated PCT is generally at the top [[ ]] fuel elevation, but the calculation will track the highest temperature as it changes due to the axial cooling effectiveness history of the specific event.

RAI 15

Based on a sampling of peak clad temperatures reported in licensing basis documents for several plants with GNF- and GE-supplied fuel that demonstrate higher temperatures than those analyzed in the topical report, it is not clear why the topical report's analysis is characterized as bounding. Although its intent is not transparent, the topical report itself seems to acknowledge this circumstance in Section 3.4.1, where it states that, for some jet-pump plants, the core reflood time could be closer to [[ ]] seconds rather than the [[ ]] seconds used in the reference analysis. The time at which core heatup ceases for BWR/2s is not provided, but the topical report implies it is in excess of [[ ]] seconds.

RAI 15 (cont.)

Therefore, please provide acceptable guidance and criteria to clarify the applicability limits of the topical report analysis; or else, please provide additional analytical cases addressing fuel heatup conditions that are bounding for all operating BWRs. Alternately, please provide adequate justification that results derived from the topical report reference analysis can be generally applied, even in plant-specific cases where heatup durations and peak cladding temperatures are significantly greater.

RAI 15 Response

The reference LOCA calculation results in a nominal PCT of approximately [[ ]], with a corresponding Appendix K PCT of approximately [[ ]]. Therefore, it is concluded that this reference LOCA calculation is representative of worst case plant specific LOCA.

RAI 18

Please provide further clarification concerning the following items associated with Tests 1 and 2:

a. For Test 1, the topical report indicates on Page 33 that the typical flow rate presented in Figure 3.1-4 for the early refill period will be used. Please clarify whether the intended reference is Figure 3-4 or a different figure.

b. Please clarify whether the use of the hot bundle flow rate for Test 1 as opposed to an average bundle flow rate would be conservative or prototypical.

RAI 18 (cont.)

c. Please clarify whether LPCI flow is intentionally neglected (e.g., as a conservatism) or is otherwise accounted for in the scaling of Test 1 in determining the heatup impacts of a delay in lower plenum refill associated with post-LOCA debris blockage.

d. The flow rate is specified for Test 2 on Page 33 through reference to the typical flow rate in Figure 3-3 for the reflood period. However, this specification does not appear sufficient to determine the flow split between the upward and downward branches of the test setup. Please clarify.

RAI 18 Response

a. It is correct that the intended Figure should be 3-4.

b. The Test 1 flow discussion is intended to capture the actual range of bypass refill flows from the reference LOCA calculation and adjust them upwardly for more ECCS conditions as discussed in RAI 20.

c. The PCT history in the reference LOCA calculation is regarded as representative for BWRs with GEH fuel at high power conditions, the Low Pressure Coolant Injection (LPCI) flow is credited in as far as determining the resulting reflood time in mitigating the fuel heatup.

d. It is correct that the flow in Figure 3-3 may not be the best indicator of flow to achieve the reflood rates identified in Table 5-1 for Test 2, please see RAI 20 for more complete description of Test 2 criteria basis.

RAI 20

Please provide adequate basis for the criterion in the topical report that the measured flow rate in Tests 1 and 3 shall not exceed 200% of the maximum predicted flow (as well as the equivalent criterion for Test 2 that the rate of water level rise shall not exceed 200%). Although some variation is expected, it is not clear to the staff that the proposed limit of 200% is sufficiently restrictive. One explanation for increases in flow rate and rate of water level rise relative to analytically calculated values is that the code results are overly conservative; in some cases, the absence of boiling in the test setup may also contribute.

RAI 20 (cont.)

Alternatively, the discrepancy could imply that clearances in the test setup and mock fuel assembly are non-conservatively large (and thus less capable of capturing debris) relative to the prototypical plant condition, that the introduction of low is not prototypical (and thus may tend to carry debris through the assembly more readily), that the scaling of the lower plenum in the test setup was not correct, etc. Please discuss the extent to which the analytical model should be expected to underpredict conservatively the flow rate and rate of water level rise, referencing previous experiments, if available, that demonstrate prototypical behavior (e.g., test data used to benchmark code predictions)

RAI 20 Response

The Test 1 maximum bypass flow of 200% is based on doubling the core spray capacity to two systems compared to a single system in the reference LOCA analysis. This maximum will be increased to a value comparable to those plants that inject the LPCI inside the shroud, being approximately 500% (5 systems).

However, this is unrealistic as the actual flow is dependent on the developing bypass driving head (as coolant is injected) and the refill will be completed (as well as the test duration) prior to developing sufficient head to drain the injected capacity.

RAI 34

Please provide adequate basis to support the topical report's position that the flow rate used in Test 4 should be based on the analytically calculated rates of liquid downflow in Figures 3-15 and 3-16 considering the following items:

a. Please clarify whether the liquid downflow shown in these figures is predominately due to core spray or whether it also consists of substantive quantities of spillover from the LPCI system that would not be present if the fuel assembly inlets across the entire core were blocked.

RAI 34 (cont.)

b. Data for Figures 3-15 and 3-16 is only provided to 2500 seconds, whereas Test 4 should consider debris blockage impacts over the entire system mission time. Important phenomena influencing downflow through the fuel assemblies during the period considered in the reference analysis, such as pooling of liquid in the upper plenum, are dependent on the decay heat loading and may be of reduced influence at later stages of the system mission time that were not analyzed.

c. The proposed range of flow rates for Test 4 is 1 to 10 gpm. This is a large range, and in particular, 10 gpm appears somewhat higher than typically expected steady-state values over the system mission time. Use of excessive flow rates may lead to non-prototypical washout of debris from the fuel assembly, particularly in a room temperature test environment.

RAI 34 (cont.)

d. It is not clear that acceptance criteria determined from a generic calculation should serve as test parameter inputs in place of limiting core spray flow rate values from operating BWRs' licensing bases.

RAI 34 Response (a-b)

a. The liquid downflow in Figures 3-15 and 3-16 is the result of fully blocking the bundle inlet flow paths and is the result of coolant in the upper plenum provided by core spray injection (please also consider the discussion in RAI 44 with respect to LPCI flow).

b. It is correct that Figures 3-15 and 3-16 represent only the early portion of the long term reference LOCA calculation. However, these figures along with the PCT Figures 3-13 and 3-17 indicate that fuel will remain quenched at later times and therefore the blockage criteria are appropriate.

RAI 34 Response (c)

c. It is correct that the flow into the fuel channel top can vary greatly, from very low values for fully inlet blocked channels at low decay heat conditions ([[ ]]), to intermediate values for fully inlet blocked channels at high decay heat conditions, as illustrated in Figures 3-15 and 3-16, and corresponding to minimum core spray distribution as well ([[ ]]), to maximum values for core spray distribution ([[ ]]).

RAI 34 Response (d)

d. The limiting core spray values per channel for all BWRs are covered in the given range as discusses in (c) above. Specifically, depending on BWR type, the minimum design core spray flow can be as low as [[ ]] and as high as [[ ]], with an average of approximately [[ ]] and a maximum value of approximately [[ ]]. These flows are used to determine blockage magnitude, not flow magnitude, the reference LOCA calculation and related supporting sensitivities demonstrate that the blockage criteria is acceptable.

RAI 39

Provided the reference calculation is shown to be limiting for all operating BWRs, the staff would largely agree with the options for addressing deviations from test acceptance criteria specified on Page 55 in Appendix A of the topical report. However, Sections 6 and 7 of the topical report also contain a non-specific allowance that, if acceptance criteria are not satisfied, "the justification for equivalent cooling to achieve the overall equivalency as in the reference bounding LOCA case will be given." Section 5 includes a similar provision that plants may justify that a deviation from the test acceptance criteria is inconsequential to cooling requirements. Please clarify whether the cited phrases from Sections 5, 6, and 7 refer to plant-specific actions and methods that are beyond the scope of the topical report, or else provide the methodology that would be used for these demonstrations if different than specified in Appendix A.

RAI 39 Response

The intent of the discussion in Section 5 is to support the specific details in Appendix A. The intent of the discussion in Section 6 and 7 is to clarify that the blockage history, in Tests 3 and 4 respectively, may not conform to the conservative intermediate blockage targets but the effect on the cooling effectiveness may be acceptable on the basis of the total test blockage history.

For example, Test 4 allows up to 50% blockage long term, though reference LOCA analysis applies the blockage at [[ ]] minutes after injection, then even a blockage of 60% at one hour may be acceptable provided that it is much smaller at [[ ]] minutes.

RAI 42

The topical report does not consider the average core power as a significant parameter, apparently based in part on the assumption that a bounding evaluation can be performed by considering blockage of only the hot fuel assembly. However, it is not clear to the staff that blockage of the hot assembly is bounding, particularly with regard to evaluating long-term cooling. Should the entire core experience blockage at the inlet and/or outlet of the fuel assemblies, average core power may influence the resulting heatup. Therefore, please provide adequate technical basis for not including cases in the reference analysis where postulated blockage from post-LOCA debris is considered over the entire reactor core rather than only the hot assembly.

RAI 42 Response

The adequacy of cooling is based on the premise that sufficient coolant is available under the selected limiting blockage histories. The BWR parallel channel configuration allows more flow to be available for a limiting channel when the average channel blockage is assumed.

Because the BWR ECCS always injects in the upper plenum (except for core spray pipe break in conjunction with second spray failure addressed in RAI 1), full core blockage would only increase the coolant available above the full core as it would be prevented from leaking out to the lower plenum and recirculation break.

RAI 44

Please clarify two statements on Page 41 of the topical report:

a. In the discussion of the recirculation line break, the topical report states that after several hours, the upper section of fuel can become uncovered, and thus limited debris blockage on the upper grid could occur. Please clarify that this statement is consistent with the reference analysis baseline case, where it is assumed that LPCI is shut off after [[ ]] seconds. Specifically, is it correct that, from approximately [[ ]] after the LOCA, core spray downflow through the bypass region that subsequently leaks into the active fuel region provides sufficient core cooling? Please further clarify whether the discussion is applicable for all assemblies in the core or only the hot channel and/or other high-powered channels.

RAI 44 (cont.)

b. The topical report indicates that debris cannot accumulate on the upper tie plate via spray flow in the refill or reflood phase of a recirculation line or steam line break. Please clarify whether this statement applies only to the hot channel and/or other high-powered channels, or whether essentially all of the core spray across the entire core is diverted to the bypass region or pools in the upper plenum during the refill and reflood phases.

RAI 44 Response (a)

Once the core is reflooded and the two phase elevation inside the shroud equalizes to the single elevation in the vessel annulus jet pump the LPCI ceases to drive flow into the core inlet orifice (see Figure 3-3) and merely overflows into the vessel annulus and pipe break. The core spray will continue to inject into the two phase upper plenum mixture and LPCI becomes irrelevant as spray capacity is more than sufficient to maintain coolant level and makeup for decay heat.

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RAI 44 Response (b)

Some limited Core Spray flow is able to enter low power peripheral bundles, though these are less than 15% of total fuel bundles for most BWRs. Thus a temporary pool forms above the core region from core spray until it becomes subcooled and [[
]] in peripheral channels as well as bypass region.

RAI 46 / RAI 46 Response

RAI 46: Please confirm that minimum ECCS flows for BWRs with jet pumps are sufficient to preclude long-term uncovery [*sic*] to less than two-thirds core height for a break on the reactor water cleanup system vessel drain line. If this is not the case, please provide a more detailed technical basis demonstrating generically that this break location could not be limiting with respect to post-LOCA debris accumulation in the core.

Response: The presence of debris in ECCS flow and potential fuel blockage in post-LOCA conditions does not affect long term fuel coolant level adversely. Sufficient core spray is always available for both decay heat and postulated drain flow.

RAI 47

Please clarify the following items concerning the length of time necessary to refill and reflood the reactor core:

a. On Page 56 of Appendix A, the topical report indicates that the lower plenum refill time can be approximately 5 minutes. However, in the reference analysis the lower plenum refill time appears to be slightly longer than [[ ]]. Please clarify the circumstances under which the lower plenum refill time could be approximately 5 minutes and justify not considering such a scenario in the reference analysis that is considered bounding relative to operating BWRs.

RAI 47 (cont.)

b. Similarly, the reflood phase duration in the reference analysis is [[ ]], whereas Appendix A indicates on Page 59 that times can range up to 2 minutes. Appendix A further notes on Page 61 that the total length of Test 2 (including both refill of the simulated lower plenum and refill of the test fuel assembly) is expected to be less than 2 minutes. Please clarify why the reference analysis and Test 2 duration adequately represent limiting conditions for operating BWRs.

RAI 47 Response

a. The 5 minute Test 1 discussion is not intended to reflect the criteria requirement but rather test operation. The Test 1 duration criteria is based on applying a wide range of driving head that reflect the BWR fleet characteristics as given in Table 5-1.

b. The 2 minute Test 2 discussion is not intended to reflect the criteria requirement but rather to generally describe the LOCA scenario. Indeed the actual refill rate is much shorter than 2 minutes, however, if one considers the time of Test 1 lower plenum refill and small breaks, 2 minutes can be used for discussion.

RAI 48 / RAI 48 Response

RAI 48: The topical report appears to indicate in Section 3.6.2 that Test 2 will not be terminated until the water level reaches the 12 ft elevation. Please clarify if this is correct. If Test 2 will be terminated at two-thirds core height, as permitted in Appendix A of the topical report, then please provide adequate justification. The elevation of the limiting peak clad temperature location can be above two-thirds height; furthermore, as demonstrated in the reference analysis, coolant recovers to the top of the core for the first several hours of the event. Subsequently, after decay heat subsides, the water level decreases to two thirds core height.

Response: This is an oversight; Test 2 description has been revised to run test through top of channel and confirm total refill rate is not significantly affected.

RAI 49

Please provide additional technical justification to demonstrate that BWRs with LPCI injection into the bypass region through the core shroud are bounded by the reference analysis and test plan scenarios that are based on LPCI injection into the recirculation system, accounting for the potential effects of post-LOCA debris blockage. For example, in Test 1, the time for refill could be extended if both core spray and LPCI flows must drain through the bypass region into the lower plenum in the presence of debris.

RAI 49 Response

Test 1 will validate that flows up to those corresponding to BWRs that totally inject into the bypass region are acceptable (see RAI 32a response). After core refill, the required bypass flow for adequate core cooling becomes approximately equal to decay heat makeup and thus bypass flow may be obstructed to a significant degree (in fact leading to beneficial in-shroud coolant accumulation) without consequences. Therefore additional Test 1 time is not required.

ENCLOSURE 3

BWROG-11047

AFFIDAVIT

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Edward D. Schrull, state as follows:

(1) I am the Vice President, Regulatory Affairs, Services Licensing, GE-Hitachi Nuclear Energy Americas LLC (GEH) 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 Enclosure 1 of the letter BWROG-11047, Frederick. P. Schiffley, II, BWR Owners' Group Chairman, to the U.S. Nuclear Regulatory Commission, Document Control Desk (DCD), "Draft Presentation Materials for the August 31, 2011 Meeting Between the NRC and the BWR Owners' Group," dated August 23, 2011. GEH proprietary information in Enclosure 1, is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]]. Figures containing GEH proprietary information 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 or licensee, GEH 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 qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F2d 871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F2d 1280 (DC Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that 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 GEH's competitors without license from GEH constitutes a competitive economic advantage over GEH and/or other companies.

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

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, that may include potential products of GEH.

d. Information that discloses trade secret and/or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to the NRC in confidence. The information is of a sort customarily held in confidence by GEH, 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 GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary and/or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited to 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 for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH 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 and/or confidentiality agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed methods, results, and conclusions regarding supporting evaluations of the effects on nuclear fuel performance of containment debris that bypasses the ECCS Suction Strainers for a GEH Boiling Water Reactor (BWR). The analysis utilized analytical models and methods, including computer codes, which GEH has developed, obtained NRC approval of, and applied to perform evaluations of containment debris effects on the nuclear fuel for a GEH BWR. 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 GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH'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 GEH. 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. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH 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 GEH 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 GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining 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 10th day of August 2011.

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