July 24, 2003

Mr. Gordon Bischoff, Manager
Owners Group Program Management Office
Westinghouse Electric Company
P.O. Box 355
Pittsburgh, PA 15230-0355

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING WCAP-15831-P, "WOG RISK-INFORMED ATWS ASSESSMENT AND LICENSING IMPLEMENTATION PROCESS" (TAC NO. MB5751)

Dear Mr. Bischoff:

By letter dated July 23, 2002, the Westinghouse Owners Group (WOG) requested that the NRC staff review and approve the above subject topical report (TR). The staff has completed its initial evaluation of WCAP-15831-P and has determined that there are aspects of the approach described in the TR that should be further developed, while other aspects need to be significantly revised or eliminated. In coming to this conclusion, the staff has considered lessons learned from the recently completed staff review of a risk-informed licensing basis change request for the Byron and Braidwood Stations on essentially the same topic (i.e., risk-informed anticipated transient without scram (ATWS) and use of an ATWS significant equipment configuration management approach). In particular, in Section 7 of WCAP-15831-P, the WOG proposes two approaches to managing the risks due to ATWS events. The staff believes that the WOG's proposed Approach 1, which involves the development of an ATWS significant equipment configuration management program, is an appropriate direction for addressing the staff's concerns regarding defense-in-depth, though additional details need to be provided regarding such a program and its implementation. For this approach to be acceptable, it would also need to include a proactive response strategy that would effectively limit the time a plant could operate in an ATWS unfavorable condition. The WOG's proposed Approach 2, which utilizes the plant's configuration risk management program risk evaluations to determine the impact and acceptability of ATWS mitigation equipment unavailability, is a risk-based approach that has previously been rejected by the staff and is still not acceptable to the staff since it does not address defense-in-depth.

The staff will continue its review of a revised version of WCAP-15831-P that addresses the issues identified in the enclosed request for additional information.

As an alternative to developing management approaches for controlling the plant's unfavorable exposure time (UET), the WOG could propose other means to address ATWS concerns, such as voluntarily implementing at Westinghouse plants the diverse scram system (DSS). Based on the analyses of the three pressurized water reactor (PWR) manufacturers at the time of the ATWS rulemaking, the UET was concluded to be generally maintained at about 1 percent for Westinghouse PWRs, and at about 50 percent for Combustion Engineering (CE) and Babcock & Wilcox (B&W) PWRs. As a result, CE and B&W PWRs were required in 10 CFR 50.62 (the ATWS rule) to install a DSS to ensure a reactor trip and to compensate for longer

UETs of these designs. Westinghouse PWRs were not required to install the DSS, primarily due to lower UETs at the time of the ATWS rulemaking, as well as their greater pressure relief and heat removal capabilities. However, the higher reactivity cores being designed and proposed by Westinghouse are now approaching the same UET range that was the primary basis for the requirement of CE and B&W PWRs to install the DSS. The voluntary implementation of DSS would achieve regulatory consistency between the PWR manufacturers regarding ATWS UET considerations; provide more flexibility in fuel design, cycle length, and plant operation; and make the staff's comments and requests for additional information on the WOG TR unnecessary.

The issuance of this request for additional information was discussed with Mr. Ken Vavrek of your staff on June 24, 2003. We recognize that the complexity of this request prevents you from predicting your response schedule at this time.

Pursuant to 10 CFR 2.790, we have determined that the enclosed RAI does not contain proprietary information. However, we will delay placing the RAI in the public document room for a period of ten (10) working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects only. If you believe that any information in the enclosure is proprietary, please identify such information line by line and define the basis pursuant to the criteria of 10 CFR 2.790.

We request that the WOG advise the staff of the direction it plans to pursue on this subject.

Sincerely,

/RA/

Drew Holland, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 694

Enclosure: Request for Additional Information

cc w/encl:
Mr. H. A. Sepp, Manager
Regulatory and Licensing Engineering
Westinghouse Electric Company
P.O. Box 355
Pittsburgh, PA 15230-0355

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REQUEST FOR ADDITIONAL INFORMATION

TOPICAL REPORT WCAP-15831-P,
"WOG RISK-INFORMED ATWS ASSESSMENT
AND LICENSING IMPLEMENTATION PROCESS"

PROJECT NO. 694

In an application dated July 23, 2002, the Westinghouse Owners Group (WOG) requested the NRC staff review and approval of WCAP-15831-P, "WOG Risk-Informed ATWS Assessment and Licensing Implementation Process." During the review of WCAP-15831-P, the NRC staff identified a number of technical areas in which additional information is required in order for the staff to complete its review. In addition, the staff has included comments on some aspects of the topical report (TR) that are not correct or are potentially confusing that need to be revised in order to be acceptable to the staff.

1. The Executive Summary states that steam generator (SG) tubes were identified as the first component of the reactor coolant system (RCS) pressure boundary that will fail as the RCS pressure increases during an anticipated transient without scram (ATWS) event. For the limiting ATWS case, the peak RCS pressure reaches 4110 psia. The RCS pressure at which the SG tubes fail, resulting in a large release is shown to be 3584 psi. How many SG tubes are expected to fail, and what is the expected magnitude of the release? Please discuss the impacts/consequences (both on the plant equipment and systems and release/societal dose) of an ATWS that causes multiple SG tube ruptures and the actions to be taken to mitigate this accident to minimize releases. Also, please describe the potential for other failures that might occur, including failures on the secondary side, in addition to the SG tubes, at the peak RCS pressure of 4110 psia. Please discuss the full impacts/consequences associated with all of these failures occurring simultaneously, as well as the mitigative actions to be taken for this proposed multiple component failure accident.

2. The Executive Summary states that all applicable acceptance criteria for the final safety analysis report (FSAR) Chapter 15 design basis events will continue to be met with the implementation of this risk-informed approach and that all applicable safety margins will continue to be maintained. Please provide information that demonstrates that this conclusion is true, as the TR does not address the basis for this conclusion. Include a description of the analyses performed to reach this conclusion, including codes and methods of analysis and acceptance criteria versus results. If analyses to confirm this were not necessary, please discuss the evaluations performed to reach this conclusion.

3. Throughout the TR reference is made to an unfavorable exposure time (UET) that is conditioned by a specific plant configuration (i.e., 100 percent power-operated relief valve (PORV) capacity available, 100 percent auxiliary feedwater (AFW) system availability, no control rod insertion capability, and 100 percent ATWS mitigating system actuation circuitry (AMSAC) availability). Though this conditional definition was used in WCAP-11992 and was allowed as part of the current method of calculating and controlling the UET for some licensees, the staff does not believe this configuration condition is a valid aspect of the basic UET definition and can lead to misunderstandings. A more basic definition of UET would be the time in which the

reactor core reactivity feedback is not sufficient to prevent RCS pressure from exceeding 3200 psig following an ATWS event. With this definition, the UET is defined by the plant's pressure response, which can change as the plant's conditions and configurations change. Thus, for example, with all equipment operable, a plant might not be in a UET condition, but if a specific ATWS significant component becomes unavailable, the plant could then immediately enter a UET condition. This definition is then very similar to the definition of unfavorable moderator temperature coefficient (MTC) that is used in the supporting technical bases of the ATWS rule (10 CFR 50.62). To avoid confusion, whenever referring to the specific plant configuration consisting of 100 percent PORV capacity, 100 percent AFW system availability, no control rod insertion capability, and 100 percent AMSAC availability, it should be identified as the "reference case UET" or similar phrase that distinguishes this conditional definition from the basic UET definition. It should also be recognized that this reference case UET may be a small portion of the actual UET experienced at a plant. Please revise WCAP-15831-P accordingly.

4. The TR includes the statement that SECY-83-293 demonstrates that the installation of AMSAC reduces the risk from ATWS events to an acceptable level. It should be noted that the SECY-83-293, supporting risk analysis and other related analyses performed in support of the ATWS rule (10 CFR 50.62), were performed in the late 1970s and early 1980s based on the plant operating conditions (i.e., plant equipment configurations and availability, fuel design, etc.) at that time. These analyses were performed well before the advent of the risk-informed decision-making processes within the NRC, such as described by Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," et al. As such, the risk analyses developed in support of the ATWS rule were relatively simplistic and made some significant assumptions regarding plant operating conditions. Finally, current plant operating conditions, especially for Westinghouse-type reactors, are considerably different from those assumed in these analyses. Based on the above facts, it is misleading to state that the SECY-83-293 analyses (performed almost two decades ago) demonstrates (present tense) an acceptable level of risk from ATWS events with the installation of AMSAC, when some of the most significant assumptions of those analyses are no longer valid. Please revise WCAP-15831-P accordingly.

5. The TR includes the statement that the ATWS rule only required the installation of AMSAC for Westinghouse reactors and that "[t]he acceptability of specific plant conditions as related to the ATWS events is determined within the context of total ATWS core damage frequency, per SECY-83-293." Though the staff agrees that the only requirement for Westinghouse reactors in the ATWS rule was the installation of AMSAC, the staff has not been able to identify in SECY-83-293 where it states the acceptability of specific plant conditions is solely determined within the context of core damage frequency (CDF). Please clarify the intent of this statement in WCAP-15831-P.

6. There is an incorrect statement in Section 2.4.2 of the TR. The statement is: "Several members of the staff did indicate that even if Reg. Guide 1.174 is used and all the requirements are met, there could be overriding deterministic arguments that guide their final decision." In applying RG 1.174, an applicant must address probabilistic and

deterministic aspects of the licensing basis change. At the NRC/WOG August 23, 2000 meeting, the staff emphasized the need for the WOG to fully address the deterministic aspects in its TR and not rely solely on probabilistic arguments. Sections 2.2.1.1 and 2.2.1.2 of RG 1.174 indicate that engineering evaluations must be performed to ensure that adequate defense-in-depth and safety margins are maintained. Please revise WCAP-15831-P accordingly.

7. A description of key assumptions and models used in the deterministic analyses needs to be provided. Specifically, the staff requests the following information:

   a. Please provide a listing of key assumptions used in performing the deterministic analyses discussed in Sections 4.1 through 4.5 of the TR. Are the assumptions identical to those used in the Westinghouse 1979 ATWS analyses (i.e., NS TMA-2182) or have they been updated to reflect changes in plant configurations and operating characteristics since the original analyses were performed (e.g., power uprate conditions, increased levels of SG tube plugging, changes in peaking factors, etc.)? Please provide initial and boundary conditions consistent with the information provided in Tables 3.1 and 3.2 of Westinghouse letter NS-TMA-2182, "ATWS Submittal," dated December 30, 1979.

   b. Please provide a detailed description of the bounding reactivity core model used in the deterministic analyses. Include a listing of the key parameter values (i.e., reactor physics and thermal-hydraulics) for this model and compare these values to a typical Westinghouse four-loop designed pressurized water reactor (PWR) to demonstrate that the model is indeed bounding.

8. Regarding the calculation of critical power trajectory (CPT), the staff requests the following information:

   a. The CPTs were calculated for the two pressure-limiting ATWS events based on the 1979 generic Westinghouse ATWS analyses (i.e., Westinghouse letter NS-TMA-2182). The two events involve the complete loss of all main feedwater without reactor trip and the two events are the loss of normal feedwater ATWS and loss of load ATWS. Did the WOG consider any other ATWS events in examining the consequences of an ATWS for this updated TR? Discuss why these two events remain limiting.

   b. The CPT calculations are described in Section 4.1 of the TR and are based on a nuclear steam supply system (NSSS) power level of 3579 MWth. This power level represents approximately a 5 percent power uprate for a typical 3411 MWth, four-loop Westinghouse PWR. The NRC staff expects that PWR licensees will soon begin submitting license amendment requests for stretch power uprates that may exceed a 5 percent uprate and 3579 MWth. As such, the analyses performed as part of this TR may not be bounding for all future applications. Please discuss how this will be addressed for PWRs that exceed 3579 MWth.

c. The CPTs were calculated based on the four-loop Westinghouse plant configuration with Model 51 steam generators to be consistent with the generic case presented in NS-TMA-2182. Please provide information to demonstrate that this configuration and assumptions associated with this configuration continue to bound all Westinghouse-designed PWRs. Is it still valid to use this general case? Otherwise, what is limiting for other vintages of Westinghouse PWRs (i.e., not four-loop PWRs or four-loop PWRs not using model 51 SGs)?

d. The CPTs were calculated using the LOFTRAN computer code. Please demonstrate that all restrictions and limitations are satisfied for the present application of the code.

e. The CPT results are presented in Tables 4-1 and 4-2, but the TR does not provide a clear description of how these values were generated. For at least one representative point in the tables, please provide a detailed explanation of the methodology used to generate the CPT value. Please include the LOFTRAN generated plots for the key system parameter values used and show how the CPT was generated.

f. Table 4-2 provides the loss of load ATWS CPTs. For no power operated relief valves (PORVs) available and an inlet temperature (T_{in}) of 660°F, a dash is shown in the table (i.e., no value is given). Please discuss the meaning of this dashed line and discuss how a UET is calculated for this condition. What is the UET associated with these ATWS conditions?

g. Tables 4-1 and 4-2 of the TR provide CPT results for core inlet temperatures (T_{in}) ranging from 600°F to 660°F. Please discuss the basis for the range of inlet temperatures (T_{in}) used. Does this temperature range bound all ATWS scenarios?

9. The UETs were calculated using the ANC computer code. Regarding the use of the ANC computer code, the staff requests the following information:

a. Please provide a sample calculation demonstrating the method used to calculate the UETs provided in Section 4.2 of the TR. Include a detailed description of the ANC computer code model (e.g., noding, full core, etc.) and provide output plots for the key parameters generated by ANC. Demonstrate how the ANC output is compared to the CPTs to determine UETs.

b. Please demonstrate that all restrictions and limitations are satisfied for the present application of the ANC computer code.

10. Tables 4-20 and 4-21 of the TR show that the peak RCS pressures reached following an ATWS event are considerably above the 3200 psig American Society of Mechanical Engineers (ASME) stress level C limit, at which core damage is assumed to occur. The bounding reactivity core results in a peak RCS pressure of 4110 psia. With the higher reactivity cores, the Westinghouse-designed plants are now calculating ATWS peak RCS pressures that are very similar to those calculated for Babcock & Wilcox (B&W)

and Combustion Engineering (CE) plants. The peak RCS pressure results had a significant impact on the ATWS rule and the requirement for B&W and CE PWR types to install a diverse scram system (DSS) in addition to an AMSAC system. Considering the convergence of peak RCS pressure results between Westinghouse high reactivity cores and B&W and CE PWRs for ATWS events, please address the differences between Westinghouse-designed PWRs and B&W- and CE-designed PWRs that would justify why Westinghouse-designed PWRs should not also be required to install a DSS.

11. Table 5-2 of the TR identifies 240 transient events that have occurred by "ATWS State" while Table 5-3 of the TR identifies only 194 transient events. Please explain the difference in the total number of transient events between these two tables and also please explain why there are a fractional number of events identified for the various ATWS states in Table 5-2.

12. Section 6.1 of the TR states that "[t]he barriers protecting the public and the independence of these barriers are maintained. ... In addition, this change does not provide a mechanism that degrades the independence of the fuel cladding, RCS, and containment barriers." Tables 4-20 and 4-21 of the TR show that the peak RCS pressures reached following an ATWS event are considerably above the 3200 psig ASME stress level C limit, at which core damage is assumed to occur. Please discuss the potential impacts on these defense-in-depth barriers and please provide the basis for the conclusion that the barriers protecting the public are maintained under the limiting ATWS conditions.

13. Section 6.1 of the TR states that "[f]or higher reactivity cores, the MTC will be less negative (but always negative) at full power than for lower reactivity cores. The higher reactivity cores will result in higher pressure transients for similar conditions, time in life and AFW flow than low reactivity cores. But actions can be implemented during normal operation with higher reactivity core designs to counter this increased reactivity so that any higher pressure transients can be successfully mitigated." Please list the specific mitigative actions envisioned to support this statement and discuss how such actions would be implemented and controlled.

14. To address the potential degradation of defense-in-depth, Section 7 of the TR discusses an ATWS significant equipment configuration management approach (i.e., Approach 1) that can be implemented by utilities. Please discuss how such a program would be managed, controlled and implemented to ensure that UET conditions will be minimized. Address the analytical methods to be used to form the basis for the configurations required for such a program. Also discuss the types of compensatory actions that would be taken to prevent the existence of UETs for prolonged periods. More specifically, please address the following:

    a. The analyses that will be performed on a cycle-specific basis (i.e., the detailed technical analyses/methods to be performed to establish the UETs for the various ATWS equipment configurations) and how these analyses and results will be controlled and verified to be appropriate prior to, during, and following plant startup.

b. The criteria or conditions governing when to voluntarily enter into a UET, the controls and limitations on these entries, when these entries will be allowed or not allowed, how long specific entries will be allowed without taking compensatory actions and what actions will be taken in response to a prolonged or extended entry, and any other compensatory actions that will be implemented prior to and during any planned voluntary entries, etc. The staff believes voluntary entries into a UET must be kept to the minimum required activities.

c. The actions that will be taken whenever UET conditions arise that cannot be immediately alleviated, how long a UET condition will be allowed prior to taking compensatory response, how the response will be controlled and implemented, and any supporting analyses for the recommended response. The staff believes that time limits and response actions should be established for UET conditions. The TR does not explicitly limit the time in these conditions. Though the identified actions in the TR might mitigate making the plant condition worse, they do not address the fact that the plant is already in an unacceptable configuration if an ATWS event occurs. In accordance with the ATWS rule's technical analysis, if operating in a UET condition and an ATWS occurs, core damage is assumed to occur. Thus, the time in a UET should be minimized, while recognizing that equipment failures can occur, equipment unavailability conditions can be found, and that the licensee needs to voluntarily enter a UET condition on occasion. An appropriate compensatory response if such a situation were to last for many hours or days, for example, may be to perform a power reduction to some set level that will preclude the UET condition and if that or a similar action is what the WOG envisions as a proper response by a licensee under these conditions, then this needs to be explicitly stated in the TR. How it is to be implemented (e.g., in the technical specifications (TS), the TS's surveillance requirements (SRs), emergency operating procedures, etc.) and the analyses and results demonstrating the acceptability of that power level for not creating a UET should also be provided.

d. The equipment status considerations of the ATWS equipment configuration management structure. The staff believes that the management structure needs to address not just maintenance-related activities, which seems to be the only focus under the current approach, but any time these components/systems are out-of-service or in any way unavailable or not in their expected state/condition (e.g., testing, discovery of inoperable or failed conditions, etc.) such that they are unable to perform their functional response to an ATWS event.

e. The TR needs to state explicitly how plants will respond to conditions in which the ATWS-related equipment is unavailable, as identified above. The staff does not accept the concept that there will be no situations that may require changing operation to a plant mode where ATWS events are no longer applicable, such as moving to Mode 3. There should be administrative requirements, if there are not TS requirements, to proactively respond to these conditions to minimize and/or eliminate the UET, which may include actions to lower power, shut down, extend an outage, or terminate startup, as appropriate.

f. The SRs that will be implemented in support of the ATWS equipment configuration management structure need to be identified and justified as acceptable in periodically assuring that the availability and functionality of the ATWS-related equipment is consistent with the cycle-specific ATWS equipment configuration management structure matrix.

15. For Approach 1 in Section 7 of the TR, it is stated that the identified actions are proposed "... to restore defense-in-depth." Four of the identified five actions restrict further activities that would not change the existing condition of being vulnerable to an ATWS event. Though these actions might mitigate making the plant condition worse, they do not address the fact that the plant is already in an unacceptable configuration if an ATWS event occurs. Thus, these actions do not restore defense-in-depth, except for possibly the situations in which placing the rod control system in automatic could eliminate the unfavorable configuration. Please revise the text and actions to properly address eliminating the unfavorable configuration when they occur.

16. In Section 4.3.3 of WCAP-11992, it is stated that "... an initial power less than 70 percent will not result in RCS pressures greater than that corresponding to the ASME Level C service criterion ..." The staff interprets this statement as meaning that a UET is not possible at less than 70 percent power. Is this a correct interpretation and is this situation still valid for all current and expected plant cases and fuel designs (e.g., the bounding reactivity case)? If this situation is not valid for these conditions, please explain what has changed since the development (and recent efforts for approval) of WCAP-11992 that make this statement not correct for WCAP-15831-P. If this situation is still valid, then the staff suggests that the mitigative strategies consider how this power limitation could be used as a proactive response to potentially prolonged UETs.

17. Approach 2 identified in Section 7 of the TR relies on the plant's configuration risk management program (CRMP) to determine the impact of ATWS mitigation equipment unavailability on plant risk and is proposed to be used, in conjunction with the plant's TS, to determine the acceptability of entering and/or remaining in specific plant configurations. The TR states that this approach does not specifically address defense-in-depth, since that is not the purpose of the CRMP evaluations. The staff has previously determined that this risk-based approach is not an acceptable approach for addressing ATWS mitigation equipment unavailability precisely because it does not address defense-in-depth. Please eliminate this approach from WCAP-15831-P.

18. In Section 8.2 of the TR, the clarifying bullet regarding when the engineered safety feature actuation system (ESFAS) is credited seems to be internally inconsistent and confusing. The first sentence states that the ESFAS is only credited if the reactor trip signal failure is not a common cause failure (CCF) that can also be associated with the ESFAS signal. However, the second sentence states that the ESFAS signal is only credited if the reactor trip fails due to failure of the control rods to fully insert into the core, which the staff assumes is referring to top event CR. Please clarify when ESFAS is and is not credited in the ATWS probabilistic analyses.

19. In Section 8.2.4 of the TR, it is stated that "[r]egardless of whether this action succeeds or fails, the ATWS event can be mitigated depending on the availability of AFW and RCS pressure relief." How does this statement and resulting logic modeling address the conditions for some fuel designs (e.g., bounding reactivity) in which the UET exists even with all equipment available with the exception that the rod control system is in manual (cf. Table 4-36). By definition, for the fuel designs that create a UET even with all equipment available and the rod control system in manual, a success state cannot be achieved if top events reactor trip (RT), operator action to trip the reactor via the motor generator sets (OAMG), and action to drive control rods into the core (CRI) all fail (or if top event involving a sufficient number of control rods to shut down the reactor (CR) is failed by itself). Please revise the text and ATWS event tree logic models to address these potential fuel design-specific conditions. Also, please identify if there are any other situations in which the ATWS event tree logic is not consistent with any of the analyses presented in Chapter 4 and the resulting ATWS significant-equipment management approaches.

20. The relationship between top events CR and CRI needs to be clarified throughout WCAP-15831-P per the following specific comments:

    a. The phrase "control rod insertion" is not used consistently in the TR. In some cases it refers to top event CRI and in other cases it refers to top event CR. Top events RT and OAMG also play a role in success or failure of control rod insertion. In particular, on page 2-3 of the TR, it states that the UET is determined based on the "... success or failure of control rod insertion (CRI) ... In this case, CRI is equated to 72 steps insertion of the lead bank." However, on page 8-3 of the TR, the first bullet states "Control rod insertion (CR) is addressed following success of the reactor trip signal (RT) or failure of reactor trip signal and success of the operator to trip the reactor from the motor-generator (MG) sets (OAMG)." Since these top events represent different conditions, it is important to make sure that the text is clear. Please revise WCAP-15831-P accordingly.

    b. It is noted in the TR that "... it is not necessary to address CR following success of CRI. The probability of rods failing to insert is assumed to be included in the probability of CRI failing (CR is very small compared to CRI)." The latter sentence may be true, but that does not make the former sentence true. This logic infers that there are no means of the rods failing to insert, if the actions identified in CRI are successful. However, CRI success is only dependent on the mode of the rod control system and, if it is in manual, the successful actions of the operators. It does not include the potential for the rods to fail to insert even though the system is in automatic or the operators take the correct actions. If actions related to CRI are successful, there is still the chance that the control rods will not insert. Please revise WCAP-15831-P accordingly.

    c. In Section 8.2.5 of the TR, it is stated that even "[i]f CR fails, it is assumed that sufficient rods have inserted to be equivalent to 72 steps of D-bank insertion ..." It is also stated that failing to get this amount of insertion "... is not credible." This assumption limits the pressure peak and resulting consequences of the

ATWS event. The staff does not accept this assumption without significant supporting justification that there are no failure modes that could effectively result in no insertion. The staff believes, absent additional justification, that if top event CR fails, it should be assumed that no rods insert, instead of crediting some insertion even in failure, and the resulting analyses should be based on this assumption (i.e., no insertion at all if top event CR fails). Please revise WCAP-15831-P accordingly.

d. The text and logic modeling would be more clear and concise if top events RT and OAMG were combined into a single top event (RT/OAMG) in the ATWS event tree to address scram success/failure and top event CRI were to address initial/partial control rod insertion success/failure. With this approach, the specific component and action failure combinations would need to be addressed via a fault tree logic model, including current top event CR as a potential failure mechanism of both of these top events. Under this streamlining of the logic model, success of the top event RT/OAMG would result in no ATWS (i.e., success sequence) and failure would lead to the CRI event. CRI success would mean there would be initially 72 steps of insertion of the lead bank to help mitigate the pressure resulting from the ATWS and the rods would continue to be inserted so that the reactor would be maintained subcritical (i.e., no need to address the long term shutdown (LTS) top event for these sequences). CRI failure would mean that there is no rod insertion and the LTS top event would need to be addressed for these sequences. This approach would seem reasonably realistic and it would not be necessary to provide additional justification for the current model assumption that even with failure of CR there are 72 steps of insertion. Please revise WCAP-15831-P accordingly.

21. Section 10 of the TR discusses actions a licensee must take to demonstrate that transitioning to a high reactivity core is acceptable, given that the plant is not consistent with the bases for the ATWS rule. Please discuss how such a plant would be "not consistent with the bases for the ATWS rule." Because some licensees currently operate with a positive MTC and can at times operate in some of the adverse plant configurations analyzed in this TR (e.g., PORVs blocked, AFW train out-of-service, etc.), does the discussion in this section imply that licensees are currently operating in a manner not consistent with the bases for the ATWS rule? Please describe the analyses that are currently performed to ensure that the bases for the ATWS rule are satisfied. Please discuss how licensees currently track UET to ensure that the bases for the ATWS rule are satisfied.

22. Given that a plant is not consistent with the bases for the ATWS rule, the WOG proposes that licensees should either: (a) demonstrate that the best estimate UET assuming no control rod insertion, 100 percent AFW, and no PORVs blocked is 5 percent or less, **OR** (b) implement the WOG ATWS model to demonstrate that the impact on CDF meets the RG 1.174 acceptance guideline shown on Figure 3 of RG 1.174 and implement a CRMP similar to either Approach 1 or 2 described in Section 7 of the TR.

For option a. above, how will the licensees address an unexpected and less favorable configuration during the operating cycle that would increase the UET (e.g., 50 percent AFW or one or more PORVs blocked)? How will the licensees track changes in UET during the operating cycle and what actions will the licensees take if the UET is trending towards and/or becomes greater than 5 percent?

23. In Appendix A of the TR, issues 2, 3, and 4 address the structural integrity of the RCS pressure boundary during potential ATWS events. In issue 2, the WOG states that "[i]t is assumed that a LOCA, that cannot be mitigated, will eventually occur that will relieve the RCS pressure in a relatively controlled manner; containment systems and the containment will not be degraded." The WOG provides no basis for the conclusion that containment is not degraded and evaluates the RCS integrity considering the bounding reactivity case peak pressure of 4110 psia. Please discuss the loss-of-coolant accident (LOCA) that is credited with relieving pressure and provide containment pressure and temperature profiles following the peak RCS pressure ATWS event considering a pressure relieving LOCA. Please discuss the impacts on the continued integrity of the containment structure, which is the final barrier to fission product release.

24. In Appendix B of the TR, issues 6 and 7 address the NRC staff's requests for ATWS peak RCS pressure results for power levels lower than hot full power, where the MTC can be positive, and also following a forced shutdown of greater than 3 days, at a time in core life corresponding to the period of maximum core reactivity. The WOG's response to the staff's requests includes a risk-based argument that considers impacts on CDF and large early release frequency (LERF) and concludes that the RCS peak pressure results for these ATWS conditions are not necessary and would not provide any benefit in the decision-making process. The WOG response does not adequately address the staff's concerns. Regardless of CDF and LERF impacts, the staff requests deterministic peak pressure results for these conditions for the purpose of confirming that the 100 percent power cases are bounding for peak RCS pressure. For example, would the peak pressure results at 100 percent power (with a negative MTC) bound the results for all percent powers less than 100 percent power with a positive MTC at the TS limits?

25. In Appendix B of the TR, the plots in Figures B-3 and B-4 provide representative MTC values for equilibrium xenon and no xenon conditions, respectively. However, the MTC plot in typical positive MTC plant TS would be more positive than shown in these figures. How do these plots relate to and bound the typical positive MTC TS limit plot? If it does not bound the positive MTC TS, please discuss the impact on the peak RCS pressure and UET results presented in WCAP-15831-P.

26. The peak pressure analyses described in Appendix C of the TR provide the conclusions regarding charging line check valve operability following an ATWS event. It appears that these analyses were performed at the ASME service level C limit of 3200 psig. Will the conclusions reached in this section be different if the bounding reactivity case peak pressure of 4110 psia was used in the analyses? Is so, what are the impacts of using a peak pressure of 4110 psia? In addition, why was the peak RCS pressure of 4110 psia not used in this analysis?