May 4, 2007

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SUBJECT: WESTINGHOUSE AP1000 COMBINED LICENSE (COL) PRE-APPLICATION TECHNICAL REPORT 45 - REQUEST FOR ADDITIONAL INFORMATION (TAC NO. MD2495)

Dear Ms. Sterdis:

By letter dated June 30, 2006 (DCP/NRC1753), you submitted AP1000 Technical Report 45, "Operator Actions Minimizing Spurious ADS Actuation," which discusses operator actions to reduce the probability of a spurious automatic depressurization system actuation as the result of a fire. The NRC staff has reviewed the application and has determined that additional information is required. Our questions are provided in the Enclosure. We discussed these issues with your staff on April 26, 2007. Your staff indicated that you would attempt to provide your response within 30 days of the date of this letter.

Please contact me at (301) 415-1313, if you have any other questions on these issues.

Sincerely,

/RA/

Steven D. Bloom, Senior Project Manager
AP1000 Projects Branch 2
Division of New Reactor Licensing
Office of New Reactors

Project No. 740

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

WESTINGHOUSE AP1000 DOCUMENT NO. APP-GW-GLR-027, REV 1

TECHNICAL REPORT 45 - OPERATOR ACTIONS MINIMIZING SPURIOUS AUTOMATIC DEPRESSURIZATION SYSTEM ACTUATION

PROJECT NUMBER 740

TR45-7 The report states that, "NRC should consider the combined license (COL) Information Item closure to be acceptable and generically applicable to COL applications referencing the AP1000 design certification." The report presents analyses to show operators can remove power in areas of the plant where a prolonged fire may result in multiple hot shorts requiring the operator action within 30 minutes. The analysis considers the specific locations for these rooms and specific distances from the main control room (MCR). However, the location of the rooms in relation to the MCR may be plant-specific and could significantly affect the time required to carry out the actions. Please justify why the analysis presented can be generically applicable to all AP1000 COL applications.

TR45-8 The report presents analyses for selected rooms, e.g., Division A I&C Room, Division A Battery Room, Division C Reactor Coolant Pump Switchgear Room. The analysis considers that the fire starts in specific plant rooms or in the same fire area as one of these rooms and eventually spreads to the entire fire area. Please provide further details that identify all rooms where there is a potential for hot short, and all rooms in each fire area where a fire may start or may eventually spread. The details presented should identify the rooms, the associated fire area, other rooms in the fire area, and the reason for not considering any of the rooms.

TR45-9 Standard Review Plan (SRP) 9.5.1, Rev. 4, Section 7.1.2, states that the plant layout should allow for safe access and egress to areas for personnel performing safe shutdown operations. Considerations should include fire and post-fire habitability in safe shutdown areas, protection or separation from fire, conditions of access and egress, pathways to safe shutdown structures, systems, and components, and potential restrictions or delays to safe shutdown area access potentially caused by (security) locking systems.

A. The analysis assumes that there are no vital access doors that need to be bypassed by security due to the fire. The operability and accessibility of vital access doors that the operator may need during a fire should be demonstrated. Please expand on the assumption and explain how a fire may require bypassing access doors by security and discuss additional time that may be required, if there is a need for bypassing a door by security.

Enclosure

B. Justify why this assumption can be assured for all future plants generically, since future plant security modifications could significantly impact the future validity of this assumption.

TR45-10 The operator's ability to access areas where manual actions are performed should be demonstrated by a comprehensive analysis, to include the environmental conditions that could negatively effect the ability to perform the manual actions, including radiation, lighting, temperature, humidity (caused, for instance, by water from sprinkler operation), smoke, toxic gases, and noise.

A. The analysis assumes that operators will have unimpeded access to these areas without smoke or heat. In some of these rooms, it appears that the fire has started in one room and has propagated to another. It seems possible that the operator may have to pass through areas affected by fire and smoke. Please justify the basis for the assumption.

B. Personnel protection equipment (PPE) may need to be worn to permit access to and egress from locations where the operator manual actions must be performed, since the routes could be negatively affected by fire effects (such as smoke) that propagate beyond the immediate fire area. Hence, PPE is an extension of the equipment needed to achieve and maintain hot shutdown. NUREG-0800, Section 18.0, references NUREG-0700, "Human-System Interface Design Review Guidelines," Rev. 2, May 2002. NUREG-0700 supports the need to consider personnel protection equipment as follows: "[t]he operation of controls should be compatible with the use of protective clothing, if it may be required… The likelihood of operators requiring protection… is greater outside the control room." Please provide the results of your evaluation of these concerns.

TR45-11 In analyzing the overall time needed for the operator to complete needed actions to minimize spurious actuation of automatic depressurization system (ADS) valves, the time needed to complete each of the steps is determined. For example, 3 minutes is assessed for verifying the alarm by the equipment operator (EO) for a fire in Division A direct current equipment room. However, variability exists in completing the action, e.g., difficulty in distinguishing the alarms between two adjacent rooms because of fire and smoke, and impediments in accessing the area. It may be useful to present a time range rather than a single value. The average values of the ranges can then be used to estimate the total average time for the task. Please, justify why using the single value is appropriate for analysis or, re-analyze using a time range methodology.

TR45-12 In the analysis, to estimate the total time (in minutes) for a task, time (in minutes) for each of the steps is delineated (Tables 1 to 17). Please discuss the approach used to define the time for a step. In comparing one Table to another, it is difficult to decipher an approach for selecting a time for a step. For a defined approach, with the information given, an analyst or review should be able to directly obtain the time presented.

TR45-13 The analysis presents the time required to carry out the task of removing power for fires in different areas. This analysis is presented to demonstrate that the operators can accomplish the task within 30 minutes. The staff believes that further analysis using an human reliability analysis methodology is necessary to support deterministic conclusions for this highly risk-important event. A low human error probability (HEP) will be an indicator that the task can be accomplished within 30 minutes. Please present an analysis of HEP for three of the fire areas, i.e., by selecting the analysis presented in 3 of the 17 Tables (Tables 1 to 17).

TR45-14 Typically, in considering the time needed to carry out a task by an operator, two aspects are considered: time for diagnosis and time needed to carry out the needed activities once a diagnosis has been made to determine the need. Diagnosis is not specifically addressed in the Tables. Please discuss how the diagnosis time was included in these operator actions.

TR45-15 In step 4 of each table in the report, the reactor operator (RO) identifies the power that needs to be secured. Please discuss the process for the RO to identify the power that needs to be secured. If a procedure is available clearly delineating the power that needs to be secured for fires in different locations, then the time required for the step will be short. An alternate process requiring an analysis to identify the applicable cabinets will require a longer time. Please discuss the available information for the RO to carry out this step and calculation of “2 minutes” for the step considering the available information.

TR45-16 In general, the analysis does not appear to be consistent with staff guidance related to the acceptability of manual actions as a means of achieving and maintaining hot shutdown conditions during and after fire events. NUREG-1852, “Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire,” (Draft Report for Comment, September, 2006), provides criteria and associated technical bases for use in evaluating the feasibility and reliability of post-fire operator manual actions implemented in nuclear power plants. As indicated by the observations and questions in the following RAIs, the analysis does not appear to be consistent with that guidance. Please provide a comparison of this analysis against the criteria of NUREG-1852, and, if necessary, provide a suitable justification/technical basis where the analysis does not meet those criteria. Though the NUREG is in draft form, the staff anticipates implementing the basic criteria contained therein.

TR45-17 A. The 30-minute time frame assumed to be available to perform operator actions outside the MCR, appears to be based on the physical separation of control circuits. That is, appropriately-separated circuitry could survive an ongoing fire for 30 min., allowing time for operators to de-energize those circuits. However, the analysis does not provide any information that describes the physical separation of these circuits in each of the affected fire areas or how this separation will be assured for future plants. Please provide.

B. In addition, for each of the affected fire areas / rooms, the estimate of the time available should account for unique fire-related uncertainties that could affect that estimate, such as:

- nature of the fire (e.g., whether the fire is a fast energetic fire, failing equipment quickly, or a slow developing fire with little or no equipment failures for some time)
- variations in fire detector response times and sensitivities
- variations in air flows that could affect the fire and its growth
- specific fire initiation location relative to important targets
- presence (or lack thereof) of temporary transient combustibles

TR45-18 The third paragraph of the Technical Background section of the report states that the analysis is provided to demonstrate that operators can remove power in areas of the plant where fire could result in spurious actuation of ADS within 30 minutes of fire initiation (emphasis added). However, the accompanying time lines appear to be based on a time frame of 30 minutes after fire detection. Depending on the type/method of detection, the time from fire initiation to detection could be on the order of several minutes. Please clarify/justify.

TR45-19 The analysis assumes the EO begins the task at the MCR. The basis for this assumption is not clear since the EO could be (and typically is) located in areas of the plant more remote than the MCR.

TR45-20 The analysis credits portable lighting carried by the operator. As stated in SRP 9.5.1, §7.1.7, "Emergency Lighting," emergency lighting should be provided throughout the plant as necessary to support fire suppression actions and safe shutdown operations, including access and egress pathways to safe shutdown areas during a fire event. Detailed guidance on the acceptable design, testing and maintenance of emergency lighting is addressed in Regulatory Guide I.189, "Fire Protection for Nuclear Power Plants." Please clarify/justify the apparent lack of fixed emergency lighting units.

TR45-21 Adequate communications capability should be demonstrated for operator manual actions that need to be coordinated with other plant operations and personnel. Any necessary communications capability should be routinely and readily available for all personnel involved in the actions and should be protected from the effects of a postulated fire. This should include initial notification of the EO. The unpredictability of fires can force plant staff to deviate from planned activities (hence, the need for effective, and in some cases, constant communications). In addition, communications permit the performance of sequential operator manual actions (where one action must be completed before another can be started) and provide verification that procedural steps have been accomplished, especially those that must be conducted at remote locations.

Based on the above, it does not appear that the impact of the loss of communications has been fully considered in the analysis or accompanying time-lines. Please clarify.

TR45-22 Operator actions outside the MCR should be shown such that they can be dependably and repeatably performed within the available time, by different crews, under somewhat varying conditions with a high success rate (see definition of reliable actions action in NUREG-1852).

The "Conclusion" section of the report states: *"no specific analysis is provided for a fire in the MCR. The process of moving to the remote shutdown workstation and the switching action at the transfer switches minimizes the potential for spurious ADS with no additional action required."* Please provide the results of the evaluation which demonstrates that spurious actuation of ADS will not occur prior to actuation of isolation / transfer switches at the remote shutdown panel (RSP). This evaluation should consider such aspects as the physical and electrical separation of circuits of concern and the time for operators to abandon the main control room and implement the alternative shutdown capability. In addition, the evaluation should demonstrate that operators will be capable of mitigating the event at the RSP should it occur.

TR45-23 For fires in the various fire areas and rooms, the analysis assumes that many actions can be reliably taken from the MCR to mitigate the effects of these fires. As an example, Table 1, Step 5 states that the RO takes action from the MCR to open motor control center circuit breakers.

Please provide the results of the evaluation which demonstrates that the circuits necessary for these operator actions in the MCR will remain free of fire damage prior to the operator actions being completed.

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