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Your ref: Docket No. 52-006
Our ref: DCP/NRC2135

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Subject: AP1000 COL Response to Requests for Additional Information (TR 45)

Westinghouse is submitting revised responses to the NRC requests for additional information (RAI) on AP1000 Standard Combined License Technical Report (TR) 45, APP-GW-GLR-027, "Operator Actions Minimizing Spurious ADS Actuation". These RAI responses are submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in the response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Revised responses are provided for RAI-TR45-008 and RAI-TR45-016, as sent in an email from Perry Buckberg to Sam Adams dated March 12, 2008. These responses complete 25 of 27 requests received to date for Technical Report 45. Revision 0 responses for RAI-TR45-001 through -023 were submitted under letter DCP/NRC1960 dated July 13, 2007. A revised response for RAI-TR45-017 is scheduled to be completed by May 21, 2008. A response to RAI-TR45-024 is scheduled to be completed by May 23, 2008.

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

A handwritten signature in black ink, appearing to read 'Robert Sisk'.

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Requests for Additional Information on Technical Report 45

cc:	P. Buckberg	- U.S. NRC	1E
	E. McKenna	- U.S. NRC	1E
	P. Ray	- TVA	1E
	P. Hastings	- Duke Power	1E
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	A. Monroe	- SCANA	1E
	J. Wilkinson	- Florida Power & Light	1E
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	G. Zinke	- NuStart/Entergy	1E
	R. Grumbir	- NuStart	1E
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ENCLOSURE 1

Response to Requests for Additional Information on Technical Report 45

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR45-008

Revision: 1

Question:

Original RAI sent May 2007

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.

Follow-up RAI request sent February 2008

Westinghouse should present a basis and discuss the evaluations conducted to identify both the rooms that are susceptible to multiple hot shorts causing spurious ADS actuation and the rooms that are not susceptible.

Westinghouse Response:

The specific plant rooms where there is a potential for multiple hot shorts causing spurious ADS actuation are identified in the Technical Report: the Main Control Room (MCR), Division A I&C room, Division B I&C room, Division C I&C room, Division D I&C room, Division A penetration room, and Division C penetration room.

Rooms within the same fire area as those listed above are not susceptible to causing a spurious ADS actuation.

Rooms that are in the same Fire Area as those identified in the Technical Report are listed in the table below:

Room	Fire Area	Room #	Other Rooms in Area	FPA Reference
Main Control Room	1242 AF 01	12401	none	9A.3.1.2.5.1
Div. A I&C Room	1202 AF 04	12301	12101, 12201	9A.3.1.2.1.1
Div. B I&C Room	1201 AF 02	12304	12104, 12204, 12207	9A.3.1.2.2.1
Div. C I&C Room	1202 AF 03	12302	12102, 12202, 12203, 12312, 12313	9A.3.1.2.3.1
Div. D I&C Room	1201 AF 03	12305	12105, 12205	9A.3.1.2.4.1
Div. A Penetration Room	1242 AF 02	12412	none	9A.3.1.2.1.2
Div. C Penetration Room	1202 AF 03	12313	12102, 12202, 12203, 12302, 12312	9A.3.1.2.3.1

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Amended Response:

The rooms where spurious hot shorts of ADS valves could occur were identified within the standard design license by DCD, Chapter 9, Appendix 9A for each potential fire zone/fire area.

Fire areas that have been identified as potential locations for spurious actuations have statements similar to the following in the Safe Shutdown Evaluation section:

Spurious DAS actuation of squib valves is prevented by the use of a squib valve controller circuit, which requires multiple hot shorts for actuation, physical separation of potential hot short locations, and provisions for operator action to remove power from the fire area. No postulated fire can spread to the hot short locations before the operator can remove power from the fire area.

Following detection of a fire in the non-Class 1E equipment/penetration room, the operators can close the automatic depressurization system stage 4 block valves, then remove DAS actuation power. This operator action will prevent spurious actuation of squib valves resulting from multiple hot shorts in the non-Class 1E equipment/penetration room.

Corresponding to this, every fire area that was determined in the AP1000 certified design to not contribute to spurious actuation has text similar to the following in the Safe Shutdown Evaluation:

No fire in this fire area can cause spurious actions which could cause a breach in the reactor coolant boundary or defeat safety-related decay heat removal capability or cause an increase in shutdown reactivity of the reactor.

The fire areas/zones and corresponding rooms within these areas have been properly identified in the table above.

References:

1. APP-GW-GLR-027, Operator Actions Minimizing Spurious ADS Actuation.
2. APP-GW-GL-700, Revision 16, Design Control Document.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

None

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR45-016

Revision: 1

Question:

Original RAI sent May 2007:

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.

Follow-up RAI request sent February 2008:

The response to RAI-TR-45-002, W states that in the event ADS were to spuriously actuate as a result of fire, the feed and bleed cooling capability of the Passive Core Cooling System (PXS) would be used to achieve and maintain safe (hot) shutdown. As described in Section 7.4 of the DCD, the Passive Core Cooling System (PXS) operates in conjunction with the Passive Containment Cooling System (PCS).

With regard to the spurious actuation of valves in the Passive Containment Cooling System, DCD Appendix 9A, states that two valves in series are used to isolate each of three discharge flow paths from the PCS storage tank. One valve in each flow path is normally open and the other is normally closed. The analysis further states that spurious actuation of one of these valves is assumed to occur in fire zones through which the applicable electrical cables are routed.

Based on the above, it appears that two or more spurious actuations could significantly impact the capability of the containment cooling system to perform its intended post-fire safe shutdown function. The regulations do not set a limit on the number of spurious actuations that can occur and the EPRI/NEI fire test data clearly show that the use of a "one-at-a-time" spurious actuations assumption is not credible. In addition, this assumption has not been generically endorsed by the staff in the past and has not been specifically endorsed by the staff in Section 9.5.1 of the AP1000 FSER. Further, although they perform a required shutdown function to mitigate the effects of a spurious ADS actuation, it does not appear that all components of the PCS and PXS systems have been included in the Safe Shutdown Equipment List. Typically, only components included on the Safe Shutdown Equipment List are evaluated for the effects of fire damage. In summary, from the information provided it is not clear if redundant trains of the

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passive core cooling and passive containment cooling systems meet the separation criteria of Regulatory Position C.5 of BTP CMEB 9.5-1 or have been evaluated for the effects of multiple spurious actuations (i.e., more than one) as a result of a single fire. Please clarify.

Westinghouse Response:

As documented in the AP1000 DCD, it is understood that no fire shall result in the breeching of the reactor coolant system pressure boundary; therefore, in the event of a fire, safe shutdown, which for AP1000 is hot shutdown, is achieved by means other than ADS actuation. The focus of Technical Report (TR) 45 is to remove power from the ADS valves so as to eliminate the possibility of actuating those valves in the event of certain prolonged fires. In the event that power is not removed, ADS actuation is unlikely; however, it is not possible to assure that ADS will not actuate. While not desirable, if ADS were to actuate as the result of a fire, the plant would still achieve and maintain safe (hot) shutdown.

The AP1000 DCD provides an evaluation of the ability to achieve hot shutdown (safe shutdown) from the Main Control Room and from the Remote Shutdown Room without passive system operation (including ADS operation). Disabling ADS has no impact on the ability to achieve safe shutdown as described in the DCD evaluation.

Draft NUREG-1852 evaluates the acceptability of manual actions as a means of achieving and maintaining hot shutdown conditions during and after fire events. As discussed in the previous paragraph, the manual actions described in TR 45 are not related to achieving and maintaining hot shutdown conditions during and after fire events and Westinghouse therefore considers the guidance in draft NUREG-1852 to be not applicable to the procedure described in TR 45.

Amended Response:

Multiple spurious actuations of valves in PCS or PXS have not been evaluated for the AP1000 certified plant. However, the PCS and PXS features required to support safe shutdown following the opening of one or more ADS paths could still perform their safe shutdown functions even if multiple spurious valve actuation occurred due to a PMS room fire.

The PCS has three water drain lines. Two of the lines have a normally closed AOV in series with a normally open MOV. The third path has a normally closed MOV in series with a normally open MOV. A different PMS division is used to power / actuate each of the three lines. As a result, a fire could affect one of the PCS lines. The effect would be to spuriously close the open MOV which would disable one line; since the other two lines would be unaffected the PCS would be operable. The other effect would be to spuriously open the normally closed AOV or MOV. This also would not be a problem in that if a spurious ADS has occurred, the PCS will need to be actuated at less than an hour. Having PCS actuate 1 hour before it is needed will have no effect on its ability to perform its safety function; it will still operate for 72 hours following

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the accident. In addition, there are multiple additional water supplies that can be used to provide makeup to the PCS including the PCS Ancillary Water Storage Tank and the Fire Protection System.

The other PXS functions include PRHR HX, CMT, Accumulator, IRWST injection, containment recirculation and ADS actuation.

For the PRHR HX, the normally open inlet MOV can not be spuriously actuated by a fire because its power is locked out. One outlet AOV could spuriously open which is no problem since that action is what is needed to support safe shutdown. If one AOV somehow remained energized (closed) due to fire damage of a cabinet that is no problem because there is a second AOV that is controlled by an unaffected PMS division.

For the CMTs, each tank has a normally open inlet MOV that is controlled by a different PMS division; one of these MOVs could be spuriously closed since its power is not locked out. However, the other CMT would be unaffected since its inlet MOV is controlled by a different PMS division. The CMT outlet AOVs (2 per CMT) are controlled by 4 separate PMS divisions; this arrangement ensures that one CMTs inlet MOV and outlet AOVs would be unaffected by the fire. Only one CMT is needed to support safe shutdown.

For the Accumulators, the normally open outlet MOVs can not be spuriously actuated by a fire because their power is locked out.

For IRWST injection, the normally open outlet MOVs can not be spuriously actuated by a fire because their power is locked out. In addition to the MOVs there are four squib valves, two per injection line; each is actuated by a different PMS division. Spurious actuation of a squib would not normally occur because of the arm / fire circuit that is located in different PMS cabinets. However, if it did occur it would not adversely affect plant operation because the check valve in series with the squib would prevent back flow of reactor coolant into the IRWST. The failure of one of these squib valves to open is not a problem since there are three other unaffected squibs and only one is needed to support safe shutdown.

For containment recirculation, there are 4 normally closed squib valves arranged with two parallel valves in each of two recirculation paths. Each squib is actuated by a different PMS division. Spurious actuation of a squib would not normally occur because of the arm / fire circuit that is located in different PMS cabinets. However, if it did occur it would not adversely affect plant operation. One path has a check valve in series with the squib that prevents flow from the IRWST from entering the containment. The other path has a normally open MOV. If a squib in series with a open MOV spuriously opened it would cause the IRWST to drain faster than it would normally drain. If the MOV were operable it would be closed by the operator. However, the MOV is controlled by the same PMS division that controls the squib valve that it is series with. Note that this situation is similar but less severe than a LOCA of a direct vessel injection (DVI) line in that a DVI LOCA also results in the spill of one CMT, Accumulator in addition to one IRWST injection line. In addition, the DVI LOCA case as analyzed in the DCD chapter assumes

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the failure of one ADS stage 4 valve which would not be the case in this fire scenario. If one of the MOVs in series with a squib were to spurious close that would not adversely affect PXS operation because there are three other paths that would open since they would be unaffected by the fire.

Note that the PXS and PCS valves discussed in the previous paragraphs that are used to support safe shutdown are listed in Table 9A-2 as Safe Shutdown Components.

To note, the AP1000 certified design states, per Appendix 9A – Section 9A.2.7.1, that “. . . spurious actuations or signals resulting from the fire are postulated one at a time. . . .” It is recommended that questions on the AP1000 certified design are completed pursuant to the guidelines available in 10 CFR 52.

The spurious actuation of any circuits or valves associated with the PCS or PXS, however unlikely, have not been included into Technical Report 45 since it pertains only to the operator actions necessary to minimize the potential for spurious ADS valve actuation.

References:

1. APP-GW-GLR-027, Operator Actions Minimizing Spurious ADS Actuation (TR 45).
2. APP-GW-GL-700, Revision 15, Design Control Document.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

Technical Report (TR) Revision:

None