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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002543

June 30, 2009

Subject: AP1000 Response to Request for Additional Information (SRP 15)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 15. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI(s):

RAI-SRP15.0-SRSB-04

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,

John DeBlasio

Robert Sisk, Manager
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/Enclosure

1. Response to Request for Additional Information on SRP Section 15

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 15

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP15.0-SRSB-04
Revision: 0

Question:

In Revision 17 of DCD Table 15.0-4a, the ADS stage 4 actuation time delay for squib valve to begin open on core makeup tank low-low level signal is changed from 30 seconds to 2.0 seconds. DCD Section 7.3.1.2.4 states that upon a fourth stage actuation signal, the substage-A depressurization valves are opened following a preset time delay. The signal to open the substage-B depressurization valve is provided following a preset time delay after the substage-A depressurization valves are sent a signal to open.

Clarify the relationship among the 2 seconds time delay for squib valve to begin to open, the opening time delay sequence described in DCD Section 7.3.1.2.4, and the ADS stage 4 actuation time delay assumed in the Chapter 15 safety analyses.

Westinghouse Response:

There are 3 different ways by which ADS stage 4 actuation can be initiated:

1. Coincidence of core makeup tank level less than the Low -2 setpoint, low reactor coolant system pressure, and a preset time delay following a open signal initiation for the third stage depressurization valves; or

2. Coincidence of loop 1 and loop 2 hot leg levels below the Low – 2 setpoint for a duration exceeding an adjustable time delay; or

3. Manual Initiation; due to interlocks, this can only occur after the reactor pressure has decreased below a preset setpoint, or until the third stage depressurization valve open signal has been generated.

The Small Break LOCA analysis in DCD 15.6.5.4 actuates ADS stage 4 from signal 1 above. The two second time delay for the ADS stage 4 actuation on core makeup tank Low – 2 level identified in Table 15.0-4a represents the accident analysis delay time assumed specifically for the squib valve to begin to open, otherwise considered as an assumed "pertinent signal processing delay." The accident analysis assumes the two second signal processing delay after CMT Low -2 level is reached or the preset time delay after the third depressurization valve open signal is generated, which ever is later.

In section 7.3.1.2.4 where the automatic depressurization system actuation is described, it discusses the actions after the fourth stage actuation signal where the substage A depressurization valves open following a preset time delay. Based on the ADS logic changes in Revision 17 of the DCD this preset time delay is zero.

Prior to the receipt of this RAI, Westinghouse has identified other inconsistencies in the DCD Chapters 7 and 15 which may cause confusion during the review of Revision 17. DCD modifications relating to these items are provided in the response to this RAI to assist in the review process. The following changes are provided:

- Section 7.3.1.2.4, page 7.3-6 describes interlocks which do not exist in the 3rd and 4th paragraphs where is states that the 2nd stage ADS actuation is interlocked with the 1st stage, and the 3rd stage is interlocked to the 2nd stage. The sentences at the end of these paragraphs have been deleted. The only controls on the sequencing of ADS stages 2 and 3 are the programmable time delays; there are no interlocks.

- Table 15.0-4a has been modified for the ADS Stage 1 actuation on core makeup tank low level signal Time Delay. This delay is actually 32 seconds, consistent with Table 15.6.5-10. The time delays provided in Table 15.0-4a include signal processing delays. For the ADS Stage 1 actuation on the core make tank low level signal the delay includes a 30 second programmable delay with a 2 second signal processing delay. This is consistent with the Small Break LOCA evaluation results provided in response to RAI-SRP-5.4.6-SRSB-01. Additionally the note on Table 15.0-4a has been modified to indicate the appropriate delay times.

- Table 15.0-4b incorrectly lists Table 15.6.5-13 for the Automatic depressurization system (ADS) valve opening times. These ADS valve opening times are provided in Table 15.6.5-10. Additionally the table has been modified to indicate the appropriate items for the note.

- Table 15.6.5-10 has been modified to add two notes. These notes include: (1) a description of the interlock of CMT Low-2 level as well as 128 seconds after stage 3 actuation signal is generated for initiation of the Stage 4A ADS valves and (2) that the Valve Opening Time of the Stage 4 ADS valves includes a "arm-fire" processing delay.

Design Control Document (DCD) Revision:

Section 7.3.1.2.4, page second and third paragraphs (there are no interlocks between the first and second and second and third stages):

The second stage isolation valves are sent a signal to open following a preset time delay after the first stage isolation valves are sent a signal to open. The second stage depressurization valves are sent a signal to open following a preset time delay after the second stage isolation valves are sent a signal to open, similar to stage one.

Similar to the second stage, the third stage isolation valves are sent a signal to open following a preset time delay after the second stage depressurization valves are sent a signal to open. The third stage depressurization valves are sent a signal to open following a preset time delay after the third stage isolation valves are sent a signal to open.

Table 15.0-4a (Sheet 2 of 2):

Table 15.0-4a (Sheet 2 of 2)

PROTECTION AND SAFETY MONITORING SYSTEM SETPOINTS AND TIME DELAY ASSUMED IN ACCIDENT ANALYSES

Function	Limiting Setpoint Assumed in Analyses	Time Delays (seconds)
"S" signal on high-2 containment pressure	8 psig	2.0 2.2 (LBLOCA)
Reactor coolant pump trip following "S"	–	15.0 4.0 (LBLOCA)
PRHR actuation of high-3 pressurizer water level	76% of span	2.0 (plus 15.0-second timer delay)
Chemical and volume control system isolation on high-2 pressurizer water level	63% of span	2.0
Chemical and volume control system isolation on high-1 pressurizer water level coincident with "S" signal	28% of span	2.0
Boron dilution block on source range flux doubling	3 over 50 minutes	80.0
ADS Stage 1 actuation on core makeup tank low level signal[1]	67.5% of tank volume	32.0 seconds for control valve to begin to open)
ADS Stage 4 actuation on core makeup tank low-low level signal[1]	20% of tank volume	2.0 seconds for squib valve to begin to open)
CMT actuation on pressurizer low-2 water level	0% of span	2.0

Note:

[1]The delay times reflect the design basis of the AP1000. The applicable DCD Chapter 15 accidents were evaluated for the design basis delay times. The results of this evaluation have shown that there is a small impact on the analysis and the conclusions remain valid. The output provided for the analyses is representative of the transient phenomenon.

Table 15.0-4b last entry:

Table 15.0-4b

LIMITING DELAY TIMES FOR EQUIPMENT ASSUMED IN ACCIDENT ANALYSES

Component	Time Delays (seconds)
Feedwater isolation valve closure, feedwater control valve closure, or feedwater pump trip	10 (maximum value for non-LOCA) 5 (maximum value for mass/energy)
Steamline isolation valve closure	5
Core makeup tank discharge valve opening time	15 (maximum) 10 (nominal value for best-estimate LOCA)
Chemical and volume control system isolation valve closure[1]	30
PRHR discharge valve opening time	15 (maximum) 10 (nominal value for best-estimate LOCA) 1.0 second (small-break LOCA value: follows a 15-second interval of no valve movement)
Demineralized water transfer and storage system isolation valve closure time	20
Steam generator power-operated relief valve block valve closure	44
Automatic depressurization system (ADS) valve opening times[1]	See Table 15.6.5-10

Note:

[1]The valve stroke times reflect the design basis of the AP1000. The applicable DCD Chapter 15 accidents were evaluated for the design basis valve stroke times. The results of this evaluation have shown that there is a small impact on the analysis and the conclusions remain valid. The output provided for the analyses is representative of the transient phenomenon.

Table 15.6.5-10:

Table 15.6.5-10

AP1000 ADS PARAMETERS(1)

Actuation Signal (percentage of core makeup tank level)		Actuation Time (seconds)	Minimum Valve Flow Area (for each path, in^2)	Number of Paths	Valve Opening Time (seconds)
Stage 1 – Control Low 1	67.5	32 after CMT-Low 1	4.6	2 out of 2	≤ 40
Stage 2 – Control		48 after Stage 1	21	2 out of 2	≤ 100
Stage 3 – Control		120 after Stage 2	21	2 out of 2	≤ 100
Stage 4A	20	128 after Stage 3(2)	67	1 out of 2	≤ 4(3)
Stage 4B		60 after Stage 4A	67	2 out of 2	≤ 4(3)

Note:

1) The valve stroke times reflect the design basis of the AP1000. The applicable DCD Chapter 15 accidents were evaluated for the design basis valve stroke times. The results of this evaluation have shown that there is a small impact on the analysis and the conclusions remain valid. The output provided for the analyses are representative of the transient phenomenon.

2) Interlock requires coincidence of CMT Low -2 level as well as 128 seconds after stage 3 actuation signal is generated.

3) Includes "arm-fire" processing delay and the assumed valve opening time.

PRA Revision:
None

Technical Report (TR) Revision:
None