From: "Lindgren, Donald A." <lindg1da@westinghouse.com>
To: "'jnw@nrc.gov'" <jnw@nrc.gov>, "'LNQ@nrc.gov'" <LNQ@nrc.gov>
Date: Fri, Oct 21, 2005 2:52 PM
Subject: AP1000 Tier 1 Comment Responses

The following is provided in response to your E-mail of October 20 with questions that remain on the proposed Tier 1 changes. Note that some of these responses were sent previously. An MSWord file of the text is attached.

D. A. Lindgren

1.2

Comment: Make a minor clarification to the discussion in the 4th paragraph under "Implementation of ITAAC" (Section 1.2) so that it is consistent with the discussion under "Treatment of Individual Items."

Response:

The subject paragraph follows. Your suggestion has been lightly edited for editorial/clarification reasons.

Many of the acceptance criteria include the words "A report exists and concludes that..." When these words are used, it indicates that the ITAAC for that design commitment will be met when it is confirmed that appropriate documentation exists and the documentation shows that the design commitment is met. Appropriate documentation can be a single document or a collection of documents that show that the stated acceptance criteria are met. Examples of appropriate documentation include design reports, test reports, inspection reports, analysis reports, evaluation reports, design and manufacturing procedures, certified data sheets, commercial dedication procedures and records, quality assurance records, calculation notes, and equipment qualification data packages

2.1.2

Comment: Westinghouse needs to provide more detailed information regarding the use of the hot leg elbow taps rather than the cold leg elbow taps used in operating reactors, and evaluate the effects on flow measurement uncertainties (2 hot legs vs. 4 cold legs).

Response:

Some of the early Westinghouse PWRs, such as Zorita in Spain, used hot leg elbow taps, at the elbow between the end of the hot leg and the steam generator. Cold leg elbow taps were preferred, and became the standard, since the hot leg volumetric flow varies with power due to temperature difference between hot leg and cold leg, whereas the cold leg volumetric flow is relatively constant. With modern-day digital systems, measured elbow tap dP can easily be compensated for the hot leg to cold leg temperature difference to generate a signal proportional to RCS flow.

There are no cold leg elbows in the AP1000, and Westinghouse evaluation of the dP from the long-radius bend in the cold leg indicates that its signal-to-noise ratio would not be suitable for reactor protection purposes.

Therefore alternate means of monitoring RCS flow are needed.

The Westinghouse standard for cold leg elbow taps is to place them 22.5° around the first 90° elbow downstream of the steam generator; i.e., one-fourth of the way around the bend. For the AP1000, the hot leg taps are also expected to be placed approximately 22.5° around the hot leg elbow. Thus, the intended arrangement is similar to current practice.

The primary function of the elbow tap dP signal is to monitor changes in RCS flow. Because the upstream geometry (SG plenum, elbow, and short section of pipe) of operating W-PWRs did not lend itself to laboratory calibration of the elbow tap dP, Westinghouse has not used cold leg elbow tap signals as an absolute measure of RCS flow. However, since the RCS geometry does not change, the flow coefficient of the elbow tap does not change. For this reason, elbow taps are quite useful to monitor both short term (transient) and long term changes (over months or years) in flow once they have been calibrated in situ by other means. Further, for the same reason, uncertainties in monitoring both short term and long term changes in flow through the reactor core depend on the type and number of instrument channels monitoring the flow elements, and not upon the number or accuracy of flow elements themselves.

For trip of all AP1000 RCPs (reactor coolant pumps), the RCP speed signals provide the design reactor protection. The AP1000 electric supply is arranged such that simultaneous trip of the two RCPs in one loop will occur only for loss of power to all RCPs. For trip of one RCP, or trip of two RCPs in opposite loops, flow in the unaffected cold leg increases substantially as the flow in the other cold leg of that loop decreases. Thus, hot leg flow is a relatively direct measure of core flow, and permits a reliable trip setpoint that preserves the essential core flow-to-power ratio with ample margin for noise and instrument drift. The reactor trip point assumed for AP1000 safety analysis (including allowance for instrument error) is intended to be 87%, the same as standard for cold leg flow signals in W-PWRs.

Comment: In Tier 1 Table 2.1.2-3, Westinghouse proposed to change Tag Number of RCP 2B Breaker from ECS-ES-63 and ECS-ES-62. Westinghouse needs to confirm that "62" in the first entry for RCP 2B Breaker is not a typographic error intended for "61."

Response:

"61" is correct. We will correct this typographical error.

Comment: In Table 2.1.2-4, Item 9.b, Westinghouse proposed to change the acceptance criterion for the pressurizer heater backup groups A and B rated capacity from 166 to 168 kW. Westinghouse needs to explain why the rated capacity in the acceptance criterion is different from the power capacity of Groups A and B of 245 kW listed in DCD Table 5.4-10.

Response:

The 245 kw listed in Tier 2 DCD Table 5.4-10 is the capacity of the backup heaters with all heaters in the backup group energized.

The heater capacity being checked in the Tier 1 DCD Table 2.1.2-4 is the minimum backup heater capacity to make up for steady state pressurizer heat losses. The difference from 166 to 168 was based on a recent update to the heat loss calculation.

2.1.3

Comment: In Table 2.1.3-2, Item 13, the Design Commitment column still keep the proposed phrase "established design requirements." Table 2.1.3-2 needs to be changed back to "principal design requirements."

Response:

We will withdraw this change and keep the term principal design requirements.

Comment: Westinghouse proposed to change the nominal values of the reactor vessel inside diameter and wall thickness at beltline from 157 and 8.0 inches to 159 and 8.4 inches, respectively, in Tier 1 Table 2.1.3-4. With the change to the diameter and wall thickness of the reactor vessel (Tier 1, Table 2.1.3-4), have Westinghouse considered if/how this change will affect any other sections like pressure-temperature limits and neutron fluence.

Response:

The changes to the reactor vessel would not have an adverse effect on the neutron fluence at the vessel wall or on the reactor vessel pressure temperature curves. The curves previously calculated are conservative compared to ones calculated using the increased vessel wall thickness and larger vessel diameter.

2.2.2

Comment: ITAAC 2.2.2 - Item 7.f verifies PCS tank makeup to spent fuel pool. The 118 gpm flow rate to the SFP in the ITAAC does not appear to have a basis, at least in DCD Section 9.1. Based on DCD Tier 2 Figure 6.2.2-1 (Sheet 1) the SFP piping is attached to the two lowest standpipes so there would be about 392,000 gals available when both pipes are covered, or about 55 hours of full, 118 gpm, flow. When the first standpipe uncovers, the flow will be reduced and an acceptance criteria would have to be developed to provide the remaining 17 hours of flow.

Response:

The piping connection from the PCS PCCWST for providing water to the SFS spent fuel pool connects to the lowest PCS standpipe and is upstream of the flow adjustment orifice. This makes all the PCCWST water available for long-term makeup to the spent fuel pool by gravity drain. As discussed in the response to the following question, this gravity driven flow does not vary significantly with time as the PCCWST water level decreases. It is noted that the SFS gravity drain line is also connected to the next higher standpipe, upstream of its flow adjustment orifice, and contains a normally closed valve. This connection is only provided for added redundancy but its use does not impact the flow rate of water supplied to the SFS pool. It should also be noted that water can flow from all four standpipes to the spent fuel pool gravity makeup piping connection.

Comment: Validation of the PCS tank capacity for containment cooling is based on validation of the safety analysis flow rates as presented in WCAP-15846, which are flows as a function of time - too much or too little over a time span would impact the performance and licensing analyses. A similar flow versus time requirement for SFP cooling does not appear to exist. The 118 gpm value when the tank level is at its nominal value will decease over time as the level drops and standpipes uncover, so a similar flows as a function of time should be part of the criteria developed. Is there a flow vs. time figure for makeup to the Spent Fuel Pool??

Response:

The gravity driven flow rate from the PCS PCCWST to the SFS spent fuel pool does not vary greatly with time as the PCCWST water level decreases. This is because the water elevation driving head between the PCCWST water level to the SFS pool water level, which dictates the flow rate, only decreases from ~193 feet (PCCWST full) to 163 feet (PCCWST empty). Thus the initial 118 gpm flow rate with the PCCWST nominally full would only decrease to 108 gpm when the PCCWST was empty. Additionally, this flow is not affected by the number of standpipes that are submerged since the piping resistance is dictated by the single 2-inch SFS pool makeup line and its valves. Therefore no flow function vs. time is required. It is noted that the initial PCCWST flow to the SFS pool is established manually using a globe valve and local flow indicator, and this flow rate could be periodically adjusted (e.g. once per day) if desired. However there is no requirement to make this adjustment.

2.3.2

Comment: The second paragraph on page 3-262 of AP1000 SER Section 3.12.3.7 includes a discussion of AP 1000 design approach for nonseismic/seismic interaction. In that section of the SER, the staff finds the AP1000's approach consistent with the acceptance criteria of SRP Section 3.9.2.II.2.k. SRP section 3.9.2.II.2.k states that for nonseismic Category I piping systems attached to seismic Category I piping systems, the nonseismic Category I piping from the attachment point to the first anchor should be evaluated to ensure that, under all loading conditions, it will not cause a failure of the seismic Category I piping system. However, the proposed change of Note 1 in Table 2.3.2-2 states that seismic consideration beyond the first normally closed isolation valve is not required. The staff would like clarification on the decision to use the first normally closed isolation valve as the point where seismic consideration is not required, specifically, explain how the criteria as described in Note 1 is consistent with the AP1000 approach as described in SER Section 3.12.3.7.

Response:

The note at the end of Table 2.3.2-2 was not intended to supersede the analysis methods outlined in the DCD for the consideration of the effect of non seismic pipe connected to seismically analyzed piping. The note will be rewritten to make that clear. The note will be rewritten as follows:

1. Special seismic requirements include only the portion of piping normally exposed to RCS pressure. Seismic consideration beyond the first

normally closed isolation valve is not required except as necessary to satisfy analysis requirements for nonseismic piping connected to seismic Category 1 piping systems.

2.3.4

Comment: In the fire protection systems P&ID there are no lines numbers written in AP1000 DCD Rev. 14. All flow diagrams are without lines numbers.

This is correct. The line numbers in the fire protection system Tier 1 information are from the FPS P&ID design documentation.

2.3.6

Comment: Need to provide justification for the change on the RNS suction line connection to the RCS from Schedule 160 pipe to 140 pipe.

Response:

The change in pipe schedule in the Tier 1 information is a correction to make the Tier 1 information consistent with the detailed design information. A review of the piping classification specified for the RNS shows that Schedule 140 is the appropriate size for nominal 20 inch diameter pipe and the design conditions.

2.3.7

Comment: The reviewer has a concern that our words would permit a plant to continue to operate when normal cooling has failed and boiling is occurring in the spent fuel pool.

Response:

The opening paragraph of the design description is rewritten as follows: We have used language from the FSER to try to clarify.

The spent fuel pool cooling system (SFS) removes decay heat from spent fuel by transferring heat from the water in the spent fuel pool to the component cooling water system during normal modes of operation. The SFS purifies the water in the spent fuel pool, fuel transfer canal, and in-containment refueling water storage tank during normal modes of operation. Following events such as earthquakes, fires, passive failure or multiple active failures, if the normal heat removal method is not available, decay heat is removed from spent fuel by boiling water in the pool. In the event of long term station blackout makeup water is supplied to the spent fuel pool from onsite storage tanks.

2.3.9

Comment: ITAAC 2.3.9 - we can't accept the 1600 F value and request that this change be removed from Rev. 15.

Response:

We will withdraw this proposed change.

3.3.1

Comment: Reviewer needs to audit the wall dimensions information differences between Tier 1 and Tier 2. Will these differences cause significant impact on the seismic analysis results (seismic forces and floor response spectra) used for the design? Provide basis for answer.

Response:

We are setting up a meeting for the reviewer to verify that the Tier 1 table is consistent with the design documentation used to develop the seismic model.
<<DCD_respond5.doc>>

CC: "Cummins, Ed" <cumminwe@westinghouse.com>, "Winters, James W." <winterjw@westinghouse.com>, "Vijuk, Ronald P." <vijukrp@westinghouse.com>

Mail Envelope Properties (435938E7.841 : 18 : 22593)

Subject: AP1000 Tier 1 Comment Responses
Creation Date: Fri, Oct 21, 2005 2:52 PM
From: "Lindgren, Donald A." <lindg1da@westinghouse.com>

Created By: lindg1da@westinghouse.com

Recipients
nrc.gov
owf4_po.OWFN_DO
JNW (Jerry Wilson)
LNQ (Lauren Quinones)

westinghouse.com
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winterjw CC (James W. Winters)
cumminwe CC (Ed Cummins)

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Files	**Size**	**Date & Time**
MESSAGE	14021	Friday, October 21, 2005 2:52 PM
DCD_respond5.doc	44544	
Mime.822	77370	

Options

Expiration Date:	None
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard

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