UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

May 19, 2011

Mr. R.W. Borchardt
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: RESPONSE TO THE FEBRUARY 5, 2011, EDO LETTER REGARDING THE FINAL SAFETY EVALUATION REPORT ASSOCIATED WITH THE AMENDMENT TO THE AP1000 DESIGN CONTROL DOCUMENT

Dear Mr. Borchardt:

During the 583rd meeting of the Advisory Committee on Reactor Safeguards, May 12 - 14, 2011, we reviewed your February 5, 2011, letter responding to our December 13, 2010, letter regarding the staff's final Safety Evaluation Report associated with the amendment to the AP1000 Design Control Document (DCD). In our December 13, 2010, letter, we expressed concern that the potential for failure of the reactor coolant pump (RCP) flywheel due to stress corrosion cracking (SCC) should be addressed by demonstrating that the material used is qualified for the primary water environment in which the flywheel is designed to operate. Your letter states that the staff believes this qualification testing is unnecessary because the safety consequences of a RCP flywheel failure have been adequately addressed by designing the pump casing to contain any potential missiles.

Westinghouse has committed to qualification testing as discussed further below. However, we also wish to respond to the rationale provided for the staff's determination that qualification testing of the flywheel material is unnecessary. As noted in our letter, a rotor seizure resulting from flywheel failure "could have significant consequences, as discussed in Chapter 15 of the AP1000 DCD, Revision 17, including short term departure from nucleate boiling in the core, potential fuel failures, and offsite dose consequences." The potential for these effects of a locked rotor accident, and the dynamic forces which would result at the bolted connection of the RCP to the primary system, should be minimized by using flywheel material which has been qualified to be resistant to SCC in the primary system.

Requiring use of available means to reduce the potential for a locked rotor event by using qualified flywheel material is warranted notwithstanding the fact that the flywheel is intended to be protected from exposure to the primary coolant by a surrounding Alloy 625 enclosure, because the integrity of the enclosure is not subject to periodic in-service inspection and therefore cannot be assured.

We have received a copy of the stress corrosion test program to be performed by Westinghouse to demonstrate the SCC resistance of the AP1000 RCP flywheel retaining ring material. We are concerned with the ability of the test program to provide reasonable assurance that the material will be resistant to SCC in the primary coolant environment. Our specific concern is with the proposed use of elastically loaded bent beam samples to demonstrate resistance to the

initiation of stress corrosion cracks. This test method has been found to be unreliable for all but highly susceptible materials. For example, testing of hundreds of bent beam specimens for thousands of hours by the General Electric Company in the early 1960s failed to predict the susceptibility of welded Type 304 stainless steel components to SCC in boiling water reactors (BWRs). The crack growth rate (CGR) tests proposed by Westinghouse can provide a sensitive assessment of susceptibility, but the test protocols are not easily standardized. Slow strain rate tests (SSRT) demonstrated SCC susceptibility for BWR environments consistent with in-reactor performance. Today, the SSRT method is widely used to demonstrate resistance to SCC initiation, and a standard protocol is available (ASTM G129-00). Passing this test provides a high degree of assurance that a material is highly resistant to SCC initiation, and SSRT are generally easier and quicker to perform than CGR tests. Furthermore, we consider SSRT to be the most appropriate method for demonstrating SCC resistance of the retaining ring material.

In our December 13, 2010, letter, we also identified a concern that allowing both the automatic and manual modes of actuation of the Diverse Actuation System (DAS) to be out of service at the same time would result in an unnecessary and significant reduction in diversity of the protection capability, which is credited in the AP1000 probabilistic risk assessment (PRA). Thus, we recommended that the staff seek commitments from combined license holders to not allow both automatic and manual DAS to be out of service at the same time. Following review of the staff's response to our letter, we continue to make this recommendation for all the reasons enumerated in our letter. Some compensatory actions should be taken, if both automatic and manual DAS are out of service.

While we understand the logic described by the staff, common cause failure of the Protection and Safety Monitoring System is poorly understood, and no credible reliability models or data are available. Therefore, there is substantial unquantified uncertainty in the PRA results used to evaluate the importance of DAS. We consider both automatic and manual DAS as defense-in-depth measures against a poorly understood set of "common cause" failure mechanisms that could disable a reactor trip. To ensure that the defense-in-depth role is fulfilled, unavailability of manual DAS should be minimized, limited to on the order of no more than 72 hours. The current limiting condition for operation on manual DAS of 30 days is too long. This is in addition to requiring compensatory action in the event that both automatic and manual DAS are out of service, as indicated above.

Sincerely,

/RA/

Said Abdel-Khalik
Chairman

References:

1. Letter to Chairman Jaczko, AP1000 DCD Amendment Review, 12/13/2010, (ML103410351)

2. Package: NRC EDO letter, Report on the Final Safety Evaluation Report Associated with the Amendment to the AP1000 Design Control Document, 02/05/2011, (ML103560411)

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