April 24, 2008

Dr. William J. Shack, Chairman
Advisory Committee on Reactor Safeguards
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

SUBJECT: INTERIM LETTER: CHAPTERS 9, 10, 13, AND 16 OF THE NRC STAFF'S SAFETY EVALUATION REPORT WITH OPEN ITEMS RELATED TO THE CERTIFICATION OF THE ESBWR DESIGN

Dear Dr. Shack:

I am responding to your letter from the Advisory Committee on Reactor Safeguards (ACRS or the Committee) dated March 20, 2008. The letter discussed the committee's concerns about the review of the General Electric-Hitachi Nuclear Energy Americas, LLC, (GEH) application for certification of the economic simplified boiling-water reactor (ESBWR) plant design.

During the ACRS meeting on March 6–7, 2008, the staff discussed its safety evaluation reports (SERs) with open items for Chapters 9, 10, 13, and 16 of the ESBWR design certification application. These discussions included the status and technical concerns of open items identified in the SERs. The ACRS raised specific concerns with the instrument air (IA) system described in Chapter 9, "Auxiliary Systems." The Committee expressed that the IA system design is not safety related or included in the scope of regulatory treatment of non-safety systems (RTNSS) and there is potential for the IA system to become contaminated. In addition, the Committee raised concerns about surveillance test procedures and test frequencies for the passive safety systems described in Chapter 16, "Technical Specifications." The enclosure to this letter discusses the staff's responses to these specific ACRS concerns.

Regarding the ACRS comment that the staff needs to more fully examine adverse inter-systems interactions, GEH has completed an evaluation to identify potential adverse systems interactions and to identify systems, structures and components functions relied upon to prevent significant adverse systems interactions. This evaluation was performed as part of the RTNSS process, consistent with Commission policy for passive designs. The staff and GEH will discuss this evaluation during a planned briefing regarding the SER with open items related to Chapters 19 and 22 on June 3, 2008.

The staff also notes the Committee's interest in relation to: (1) control room habitability and equipment operability in the 72-hour post-accident period; (2) the effects of inadvertent injection of nitrogen gas during operation of the standby liquid control system; and (3) interaction of systems across different SER chapters. The staff continues to work with GEH to obtain satisfactory resolution to the open items presented in the SERs. The staff looks forward to presenting the resolutions to these open items and discussing other items of interest with the ACRS during future presentations on the ESBWR design certification application.

Thank you for your comments. I appreciate the willingness of the ACRS to engage with the staff on a chapter-by-chapter SER review. I believe this process has greatly facilitated the staff's work. My staff looks forward to continued interactions with the committee for the remaining chapters of the ESBWR design certification application.

Sincerely,

/RA/

Luis A. Reyes
Executive Director
for Operations

Enclosure:
Staff Response to ACRS Comments

cc: Chairman Klein
Commissioner Jaczko
Commissioner Lyons
Commissioner Svinicki
SECY

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U.S. Nuclear Regulatory Commission Staff Response to the Advisory Committee on Reactor Safeguards Interim Letter Dated March 20, 2008, Regarding Safety Evaluation Reports with Open Items on the ESBWR Design Certification Application

Following are the staff's responses to comments from the Advisory Committee on Reactor Safeguards (ACRS) on the staff's safety evaluation report (SER) with open items for Chapter 9, "Auxiliary Systems" and Chapter 16, "Technical Specifications" of the economic simplified boiling-water reactor (ESBWR) design certification application. The staff plans to discuss final resolution of these concerns during the ACRS committee meetings on the final SER for the ESBWR design certification application.

ACRS Comment: It is not apparent whether the staff has fully examined potential inter-system impacts. For example, the instrument air (IA) system is not an ESBWR safety system or regulatory treatment of non-safety systems (RTNSS) system. However, it does interface with safety and RTNSS systems. According to the ESBWR design application, the nitrogen systems are normally removed from service during outages. During this time, the IA system is aligned to all pneumatic loads normally supplied by nitrogen. If contamination enters the nitrogen piping through the IA system during these periods, it could later affect equipment operation, even after nitrogen is re-connected.

Contamination has been a problem in existing plants. Despite redundant oil-free compressors and dryers, moisture detectors, and designer expectations, operating experience has shown that dryers have failed or have been bypassed, allowing moisture to enter the system, and desiccant has been released from dryers. Movement of such contaminants through IA systems has led to spurious actuation of air-operated components, and prevented "fail-safe" operation of valves due to mechanical binding of the pneumatic solenoids. These impacts are often not revealed until a substantial time after the initial contamination, and they have sometimes affected multiple components. Many of these events have proved challenging for operators.

The staff's review does not seem to account for the normal alignment of IA to the nitrogen systems during outages, nor consider the extent of possible interactions that could occur, should IA become contaminated. It is difficult to understand how the staff's review of these impacts can be complete without an evaluation of the specific components and failure modes that may be affected by the IA system. This is an example of the need for the staff to more fully examine adverse inter-system interactions.

Staff Response: The SER that staff presented to the ACRS prior to the subcommittee meeting on November 15, 2007, for the IA system and service air (SA) system in the ESBWR design was based on the ESBWR DCD, Revision 3. Since then, GEH has redesigned the IA and SA system. Prior to the ACRS subcommittee meeting, the staff had not had the opportunity to review the new IA and SA designs in the DCD, Revision 4. The staff appreciates the ACRS subcommittee meeting comment concerning impacts of potential moisture and contamination in IA and SA systems on safety related equipment. Consequently, the staff submitted a request for additional information from GEH to describe the impacts on safety-related equipment from operating the IA system (using the bypass line) without the benefits of filters and dryers. The

staff is in the process of reviewing GEH's response to the request for additional information and will address its finding in the final SER.

ACRS Comment: The ESBWR Technical Specifications are designed to provide a common technical basis for any COL (combined operating license) applicant to ensure that the ESBWR is operated under conditions consistent with the Design Control Document and that the equipment essential to prevent accidents or mitigate their consequences is operable. The staff is evaluating the ESBWR Technical Specifications to confirm that they do ensure that the plant will remain within its design bases during operation. At this time, the Technical Specifications documented in Chapter 16 are still incomplete and the staff identified a number of open items that require the applicant's response. Of particular interest are the surveillance test procedures and test frequencies for the passive safety systems. The test procedures are still under development. A sound technical basis for testing passive safety systems that goes beyond sole reliance on past experience and engineering judgment should be required by the staff.

Staff Response: The staff recognizes the importance of establishing a sound technical basis for testing passive safety systems. Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.36(d)(3), "Surveillance Requirements," states, "surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met." Surveillance requirements in standard technical specifications (STS) establish a precedent that satisfies these objectives. These surveillance requirements are in turn based on precedents principally derived from past experience with testing and operating similar components and systems under the same or equivalent conditions. Considerations used to establish appropriate surveillance requirements and frequencies may include the following:

- vendor-or manufacturer-specified maintenance and testing
- testing specified in industry codes and standards such as those from the American Society of Mechanical Engineers and the Institute of Electrical and Electronics Engineers
- historical system and component failure rates
- maintenance rule availability and reliability guidelines
- benefits of improved detection of potential common-cause mechanisms for system or component failure and degradation
- the degree to which the surveillance provides a conditioning exercise to maintain proper functioning, such as lubrication of bearings and removal of oxidation from electrical contacts
- risk insights
- the need to perform the test during certain operational conditions, such as cold shutdown
- minimizing radiation exposure

Use of the precedents, such as provided in the STS, is an acceptable means of establishing appropriate testing for similar components and systems in a different application provided the precedents are shown to apply. The STS and ESBWR generic technical specifications (TS) contain a programmatic specification for implementing in-service testing, which is required by 10 CFR 50.55a, "Codes and Standards." Most tests under this program are not explicitly

specified in TS surveillance requirements. Surveillance frequencies may be chosen in consideration of this testing, which augments the surveillance in assuring safety system operability and quality.

For example, the DCD states that the gravity-driven cooling system injection lines will be flushed each refueling outage following the guidance of the in-service testing program. The 10-year frequency in the generic TS for verifying that those lines are unobstructed is reasonable, considering that the injection lines will be flushed each refueling outage.

Prior to initial fuel load, it is the responsibility of the licensee to establishing procedures to implement surveillance requirements. A design certification or licensing review does not include a Nuclear Regulatory Commission staff review of surveillance tests procedures. The design certification document should describe the acceptance criteria, key steps, conditions, and considerations for conducting the test. Procedures that a licensee develops should be consistent with the acceptance criteria, key steps, conditions, and considerations described in the licensing basis.