September 1, 2009

APPLICANT: GE Hitachi Nuclear Energy

PROJECT: Economic Simplified Boiling Water Reactor (ESBWR) Design Certification

SUBJECT: SUMMARY OF THE JULY 20 TO 24, 2009, REGULATORY AUDIT OF DESIGN SPECIFICATION OF RISK SIGNIFICANT ESBWR COMPONENTS AT GENERAL ELECTRIC HITACHI (GEH) OFFICE IN WILMINGTON, NC

From July 20-24, 2009, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an audit of the Risk Significant ESBWR Components which supports Chapter 3 of the ESBWR Design Certification Application. The audit was conducted at the GEH offices in Wilmington, North Carolina. An audit summary, including participants, audit activities, and list of follow-up items, is provided in Enclosure 1. A response from GEH to the follow-up items is requested to consider all the issues resolved.

/RA/

Zahira Cruz Perez, Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure:
1. Audit Summary

cc: See next page

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Enclosure:
1. Audit Summary
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ADAMS ACCESSION NO. ML092390403 NRO-002

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Summary of the July 20-24, 2009, Regulatory Audit of Design Specification of Risk Significant ESBWR Components Economic Simplified Boiling Water Reactor (ESBWR) Design Certification

During July 20 to 24, 2009, the U.S. Nuclear Regulatory Commission (NRC) staff conducted a regulatory audit of Economic Simplified Boiling Water Reactor (ESBWR) risk significant component design specifications at the GE Hitachi Nuclear Energy (GEH) office in Wilmington, NC. The purpose of the regulatory audit was to verify that the ESBWR components design and qualification are being performed in accordance with the methodology and criteria described in the ESBWR Design Control Document (DCD) in support of the ESBWR Design Certification (DC). This includes verification that the design information described in ESBWR DCD Section 3.9.3 was adequately translated into documentation for the components designed to ASME Code Section III, Class 1, 2, and 3 requirements. In addition, the staff reviewed the design documents described in ESBWR DCD Sections 3.2, 3.9.3, 3.9.5 and 3.9.6, and identified further information that is necessary for the applicant to submit for the staff to reach a safety determination for the ESBWR DC application.

GEH had provided a list of risk significant components for which the design specifications would be completed and available for the NRC audit. From the list of risk significant components, the NRC staff selected component design specifications to be audited. These included: Reactor Pressure Vessel, Reactor Pressure Vessel Internals, Control Rod Drive System, Nuclear Boiler System, Isolation Condenser System, Gravity Driven Cooling System, Standby Liquid Control System, Depressurization Valves, and Safety Relief Valves. The classification, Regulatory Treatment of Non-Safety Systems (RTNSS) design documents and piping and instrumentation diagrams (P & IDs) were also provided for the audit. Based on the information reviewed, the staff found that the design documents for the reviewed components reflected the methodology and criteria contained in the DCD, and met the requirements of ASME Code, Section III, Article NCA-3000. Based on the audit findings, GEH committed to revise ESBWR DCD Table 3.2-2 “Minimum safety Class Requirements” ASME Section III Code Class 2 to be “ASME Section III Code Class 2, CC, MC or CS”. Also, GEH committed to revise DCD Table 6.1-1 regarding materials associated with PCCS. In the Table 6.1-1, GEH committed to change the Class 2 (Subsection NC) to Class MC (Subsection NE). All of these changes will be reflected in Revision 6 of the DCD. These changes will be considered confirmatory items, and the staff will verify that they have been incorporated when DCD Revision 6 is submitted by GEH. During the audit, some issues and questions were raised by the staff, and are considered follow-up items. The follow-up items will be considered closed when GEH supplies additional information in response to this audit, or the staff performs an additional onsite review for confirmatory purposes.

<u>ASME COMPONENTS</u>

The staff with the assistance of BNL contractors conducted an audit of the design documents of ASME components. The scope of the ASME component audit was limited to the following risk significant ESBWR components selected by the staff prior to the audit:

1. Reactor Pressure Vessel (RPV)
2. Reactor Vessel Internals (RVI) – Core Support and Internal Structures
3. Control Rod Drive System (CRDS) - Reactor Coolant Pressure Boundary Components
4. Isolation Condenser (IC) Pool Heat Exchanger

5. Passive Containment Cooling (PCC) Pool Heat Exchanger
6. Hydraulic Control Unit (HCU)

DOCUMENTS REVIEWED

- Reactor pressure vessel drawings, reactor pressure vessel specification, steam dryer assembly information

- Design specification, cyclic and loading, steam dryer specification and other documents containing core support drawings, and material and process specifications

- Isolation condenser system design specifications, PCCS condenser design specification, hydraulic control unit specification and other documents containing support frame, and HCU components and drawings

FOLLOW-UP ITEMS FOR ASME COMPONENTS

In accordance with RPV system design specification (26A6631), the fatigue evaluation of all ASME Class 1 components will be performed per Regulatory Guide (RG) 1.207 and NUREG/CR-6909 guidance for including environmental effects. However, ESBWR DCD (preliminary) Revision 6, Section 3.9.3 has not indicated that this is applicable for component design, although for Class 1 piping design GEH is committed in the DCD to include the environmental effects using RG 1.207 and NUREG/CR-6909 guidance.

The staff requests that the applicant update ESBWR DCD Revision 6, Section 3.9.3.1 to indicate that the fatigue evaluation of ASME Class 1 components will be performed using RG 1.207 and NUREG/CR 6909 guidance for including the environmental effects.

CLASSIFICATION DESIGN BASIS DOCUMENTS

The staff conducted an audit of the classification design basis documents. The purpose of the classification audit was to review available design basis documentation concerning the seismic and quality group classification of ESBWR structures, systems, and components (SSCs) to determine the extent that the design is complete, the extent that regulatory criteria/licensing commitments are included in design documents, and the adequacy of the classification and RTNSS processes to resolve open items identified in the safety evaluation report (SER) with open items.

DOCUMENTS REVIEWED

- ESBWR Classification List, Classification of Equipment and Services, Composite Design Specification, Standard Review Plan and Regulatory Guides Data Sheet, Reactor Pressure Vessel System, Core Support Structure Design Specification, ESBWR Control Rod Drive Housing and In-core Housing, Steam Dryer Design Specification, Isolation Condenser Purchase Specification, Hydraulic Control Unit Purchase Specification, and Purchase Specification for SLC Accumulator Vessel

- Other documents containing drawings and classification documents

FOLLOW-UP ITEMS FOR CLASSIFICATION DESIGN BASIS DOCUMENTS

Staff recommended the following classification document improvements and specific changes to the ESBWR DCD to supplement those identified in the Preliminary Rev. 6 that was submitted by GEH. GEH will respond to these items to inform the staff how they were addressed:

1. During the audit, GEH committed to revise DCD Table 3.2-2 to identify that ASME Section III Code Class CC, MC or CS are applicable in addition to Code Class 2 for Quality Group B. This change will be submitted in DCD Rev 6 and is considered a confirmatory item.

2. During the audit, GEH committed to revise DCD Table 6.1-1 regarding materials associated with PCCS. GEH will change the Class 2 (Subsection NC) to Class MC (Subsection NE) in Table 6.1-1 in Revision 6 of the DCD. This change is considered a confirmatory item.

3. DCD Table 3.2-2 should be revised to reference ASME NG to include Class IS for RPV internals, or otherwise clarify classification.

4. DCD Table 3.2-2 should be revised to more clearly identify quality assurance applicable to Quality Group D Special class and seismic Category II.

5. Descriptions in DCD Table 3.2-1 may not be consistent with detailed P&ID drawings and should be reviewed for consistency. For example, classification changes at a venturi on the isolation condenser are not consistent with the DCD description.

6. P&ID classification boundaries may not be consistent with actual configuration boundary and should be reviewed for consistency. For example, the containment boundary connection to the isolation condenser tee is not shown correctly on the P&ID drawing.

7. The simplified diagram of the main steam drains in the DCD does not appear to be consistent with the detailed P&ID and should be updated accordingly.

8. Special treatment, such as Special QA Class, for RTNSS SSCs based on the PRA requires further clarification in DCD and/or RTNSS requirements document.

9. Design basis documents such as P&IDs and ASME design specifications should be finalized to enhance the level of design completion.

10. Classification review checklists should be completed to establish the basis for each component classification from a safety function aspect.

11. Basis for seismic requirements applicable to RTNSS SSCs should be better defined in the DCD and/or RTNSS requirements document

12. Classification of risk-significant SSCs and DCD to be updated as needed to be consistent with Topical Reports such as NEDO-33411 Rev.1 currently being reviewed by other NRC staff.

13. Special treatment for any passive components such as nonmetallic piping used in risk-significant RTNSS systems should be coordinated with the COLA.

ASME VALVES AND ENVIRONMENTAL QUALIFICATION

The staff conducted an audit of the valve and environmental qualification (EQ) specifications, including review of the ESBWR DC application (RAI 3.9-178 and Supplement 1). The purpose of the audit was to confirm the implementation of the ESBWR DCD provisions for the design and qualification of applicable pumps, valves, and dynamic restraints, and to support the full description of the inservice testing (IST) and EQ operational programs by the COL applicants.

DOCUMENTS REVIEWED

- General Valve Requirements Specification, Composite Design Specification, Condition Monitoring Specification, Equipment Qualification Specification (Draft), GEH Engineering Operating Procedure "Equipment Qualification for ESBWR" (Draft), and RTNSS Requirements Document (Draft)

- Purchase Specifications for Active Safety-Related Ball Valves, for Active Safety-Related Butterfly Valves, for Active Safety-Related Check Valves, for Pyrotechnic-Operated Valves, for Safety and Safety/Relief Valves and for Wetwell-to-Drywell Vacuum Breaker

FOLLOW-UP ITEMS FOR ASME VALVES AND ENVIRONMENTAL QUALIFICATION

1. ESBWR DCD Tier 2, Table 3.9-8, "Inservice Testing," needs to be clarified for some valve entries. In particular, the table is missing the number of applicable valves and their valve numbers for some valve entries. Further, the table includes multiple valve and actuator types for some valve entries.

2. General Valve Requirements Specification SR3-1-A11-TRD-5302 should be clarified as follows:
    - The specification should require that the valve supplier provide the vibration level for which applicable valves (such as safety and relief valves) are qualified for use as acceptance criteria when measuring flow-induced vibration (FIV) during plant startup testing.

    - Update the reference of Regulatory Guide (RG) 1.100 to Revision 3 (when issued) for acceptance of the use of ASME Standard QME-1-2007, and remove the reference to RG 1.148 (to be withdrawn by NRC when RG 1.100 updated).

    - Clarify the use of sealed gear operators on Page 20 to manual valves.

    - Clarify the degraded voltage criteria for AC and DC motors on Page 39.

    - Clarify the measurement of thrust and torque for rising stem and quarter-turn valves on Page 50 when referring to running load.

    - Address the use (if any) of thermal overload devices for MOVs.

- The specification provides gate and globe seat coefficients of friction and butterfly valve bearing coefficient of friction for the initial sizing of valve actuators that the supplier will need to justify as part of the valve qualification process with GEH review of each valve design calculation.

3. Check Valve Purchase Specification SR3-1-A60-PSP-0002 should be clarified in that it refers to “active” check valves although all check valves in the IST program should be considered to be active. Further, the ESBWR DCD IST table should be clarified, as necessary, where check valve P10-F016 is identified as a passive valve.

4. Pyrotechnic-Operated Valve Purchase Specification SR3-1-A60-PSP-0001 should be compared to the applicable piping & instrumentation diagram to clarify the specification listing of Gravity-Driven Cooling System (GDCS) deluge valves and their valve numbers in the diagram.

5. Equipment Qualification Specification SR3-1-A11-TRD-1002 should be completed to allow the NRC staff to rely on the information in the EQ specification for the audit report.

6. GEH should review its EQ specifications and EQ Engineering Operating Procedure EOP 35-4.00, and determine those operational aspects (such as establishment of maintenance intervals) of the environmental qualification program that should be described in the ESBWR DCD.

7. Condition Monitoring Specification SR3-1-A11-TRD-1003 should clarify the application of the Condition Monitoring Program with respect to regulatory programs. For example, the Condition Monitoring Specification should address its potential application in meeting IST provisions in the ASME OM Code and 10 CFR 50.55a. Further, the specification should address the quality assurance aspects of the Condition Monitoring Program where the program will be used to support regulatory programs.

8. RTNSS Requirements Document A11-5310 that provides specifications for the design of equipment within the Regulatory Treatment of Non-Safety Systems (RTNSS) program should be completed for NRC staff review.

9. GEH should inform the NRC staff of the qualification testing plans and schedule for valves and dynamic restraints, when available.

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Zahira Cruz	NRC
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