

July 15, 2010

APPLICANT: GE Hitachi Nuclear Energy

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

SUBJECT: SUMMARY OF THE JANUARY 16-18, 2007, AND JULY 25-27, 2007,
REGULATORY AUDITS OF THE ESBWR HUMAN FACTORS ENGINEERING
PROGRAM AT GENERAL ELECTRIC HITACHI (GEH) OFFICE IN
WILMINGTON, NC.

On January 16, 2007, and July 25-27, 2007, the U.S. Nuclear Regulatory Commission (NRC) staff conducted audits of the ESBWR human factors engineering program as part of the review of Chapter 18 of the ESBWR Design Certification Application. The audits were conducted at the GEH offices in Wilmington, NC. A summary of the audits, including participants and audit activities is provided in Enclosure 1.

/RA/

Dennis Galvin, 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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ADAMS ACCESSION NO. ML101960241

NRO-002

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DATE	7/15/2010	7/15/2010	7/15/2010

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**Summary of the January 16-18, 2007 and July 25-27, 2007 Regulatory Audits
Of The ESBWR Human Factors Engineering Program
Economic Simplified Boiling Water Reactor (ESBWR)
Design Certification**

On January 16-18, 2007, and July 25-27, 2007, the U.S. Nuclear Regulatory Commission (NRC) staff conducted audits of the Economic Simplified Boiling Water Reactor (ESBWR) human factors engineering (HFE) program as part of the review of Chapter 18 of the ESBWR Design Certification Application. These audits were conducted at the GE-Hitachi Nuclear Energy (GEH) offices in Wilmington, NC. As part of the January 16-18, 2007, audit, a public exit meeting was held on January 18, 2007. A notice for the exit meeting was issued on December 21, 2006, (it is available in the Agency-wide Documents Access & Management System (ADAMS) at Accession Number ML063540052).

Regulatory Audit on January 16-18, 2007

The purpose of the audit was to discuss the staff review, the ESBWR HFE program, and associated HFE implementation plans. The staff also reviewed supporting documentation for HFE implementation plans. Attachment 1 contains the audit agenda. Attachment 2 contains the list of documents reviewed during the audit. Attachment 3 lists audit meeting participants.

During the audit, GEH and the staff discussed the following topics:

- The Baseline Review Report (BRR)
- The relation of the ESBWR to ABWRs in general and specifically the Lungman ABWR
- Collection of operating experience (OE) information on the Japanese operating ABWRs
- Improvements in the man-machine interface system (MMIS) design based on ABWR OE
- Status of the various HFE implementation plans for the ESBWR
- Schedule of various HFE activities
- Issues with Minimum Inventory

The staff discussed the results of the audit in a public exit meeting. Key areas from the audit noted at the Exit Meeting were as follows:

- Reviewed status of all 12 HFE program implementation plans in detail
- Discussed and clarified several of the staff's requests for additional information (RAIs) and proposed responses by GEH
- Discussed and clarified several of the staff's followup RAIs prepared during the audit
- Summary of the staff's audit of the GEH-proprietary documents.

Regulatory Audit on July-25-27, 2007

The purpose of the audit was to discuss the staff review the ESBWR HFE program and associated HFE implementation plans. The staff also reviewed supporting documentation for HFE implementation plans. Attachment 4 contains the audit agenda. Attachment 5 contains the list of documents reviewed during the audit. Attachment 6 lists audit meeting participants. GEH presentation slides from the audit are available in ADAMS at ML073190210 (transmittal) and ML073190212 (slides). The staff notes that due to the proprietary nature of the audit, most of the information in the slides has been redacted.

The audit team held a number of discussions with GEH regarding the following aspects of the ESBWR DCD review:

- The new revision of the MMIS [Man-Machine Interface System] and HFE Program Management document
- Whether design certification could be based on the MMIS Plan or if the more detailed individual HFE element plans are also needed
- How to structure the Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)/ Design Acceptance Criteria (DAC) in the HFE area
- Referencing of proprietary material in the DCD and ITAAC
- Plans for the next revision to the DCD
- Status of development of Emergency Procedure Guidelines (EPGs)

In addition, the staff reviewed documents in the following areas:

- Draft summary report for Operating Experience Review (OER)
- Risk important human actions based on the ESBWR Probabilistic Risk Assessment (PRA), Level 1 Internal events
- HFE Roadmap
- Human Reliability Analysis (HRA) summary plan
- Color coding and units plan
- Allocation of Function plan

The results of the audit were summarized in an exit meeting conducted at GE offices on July 27, 2007, and attended by the participants of the review. The following areas were addressed:

- HFE-related RAI status
- Summary of documents reviewed
- Use of the GEH Roadmap of the various documents and issues
- NRC staff to review the set of revised IPs using the roadmap
- Provided NRC expectations for EPGs
- Items needed to support the DCD submittal
- 4 new RAIs to be issued based on audit

The results of the audit were incorporated into followup RAIs where necessary.

Agenda
ESBWR Human Factors Engineering Audit January 16-18, 2007

Tuesday January 16, 2007: 1:00 - 5:00 PM

Introduction and general discussion of the following topics:

- The new revision of the MMIS [Man-Machine Interface System] and HFE Program Management document
- Whether design certification could be based on the MMIS Plan or if the more detailed individual HFE element plans are also needed
- How to structure the ITAAC/DAC in the HFE area
- Referencing of proprietary material in the DCD and ITAAC
- Plans for the next revision to the DCD
- Status of development of Emergency Procedure Guidelines (EPGs)

Wednesday January 17, 2007: 8:30 a.m. - 5:00 p.m

AM – Discussion of DCD and Implementation Plans for Elements 1-6 and associated follow-up questions on GE RAI responses

PM – Discussion of DCD and Implementation Plans for Elements 7-12 and associated follow-up questions on GE RAI responses

Thursday January 18, 2007: 8:30 a.m. - 5:00 p.m

AM – NRC/ Brookhaven national Laboratory (BNL) review other GE documents not on docket:

- Baseline Review Report (BRR)
- ABWR System Functional Requirements Analysis (SFRA) Report as referenced in GE response to RAI 18.3-1
- GE document # 24156-1A10-6120-0004, Rev. 0, "Plant Staffing Evaluation (Requirements for a large evolutionary single unit GE ABWR)," dated April 15, 1996, as referenced in responses RAI 18.6-7 and 18.4-14
- ESBWR Human Factors Guidance Manual

Discussion of Tier 1 materials

PM – Continue discussions as needed and conduct exit meeting.

Attachment 1

Documents Reviewed
ESBWR Human Factors Engineering Audit January 16-18, 2007

- ABWR First-of-a-Kind Engineering (FOAKE) Program, “Operating Experience/Lessons Learned Evaluation,” Rev. 0, February 7, 1996
- “Standby Liquid Control Functional Requirements Analysis Report (Lungmen),” October 16, 1997
- “Reactor Water Clean-up Functional Requirements Analysis Report (Lungmen),” October 16, 1997
- General Electric ESBWR Baseline Record Review (BRR), Draft 1A, January 2007
- General Electric ABWR First-of-a-Kind Engineering (FOAKE) Program, Plant Staffing Evaluation, Rev. 0, May 24, 1996
- MMI Simulator Evaluation Reports, FOAKE, 24156-1A41-48D8, Class 2, 1996
- Final Phase of MMI-part Task Simulators

Audit Participants
ESBWR Human Factors Engineering Audit January 16-18, 2007

NRC

Jim Bongarra
Amy Cabbage

BNL (NRC Contractors)

Jim Higgins
John O'Hara

GE and consultants

Dan Wilkinson
Bill Hannaman
Tom Graham
Tom Jenkins
Skip Butler
Tom Jenkins
Dave Taylor
Dominic LoGalbo
Denise Brooks
Joe Walker
Don Taylor
David Hinds
Larry Tucker
D. Tidwell
J. Chang
S. Priete
Wayne Marquino

Exit Attendees

Audit participants plus the following phone attendees:

Jeff Jones, AREVA
Chris Carr, Excelon
Frank Quinn, Hurst Technology (ABWR, South Texas)
Guy Ceasar, NuStart (Enercon)
Tom Hixs, NuStart (Enercon)
Robert Atkinson, Dominion
Mohammed Shuaibi
Nancy Salgado

Agenda
ESBWR Human Factors Engineering Audit July 25-27, 2007

Wednesday, July 25, 2007: 1:00 p.m. - 4:45 p.m.

1:00 p.m. – 1:30 p.m.	Welcome by Management/ NRC Opening Remarks	GEH/NRC
1:30 p.m. - 2:30 p.m.	ESBWR HFE Overview	GEH
2:30 p.m. - 2:45 p.m.	Break (Breaks will be taken as needed)	
2:45 p.m. - 4:45 p.m.	Chapter 18 RAI Status and Roadmap	GEH

Thursday, July 26, 2007: 8:30 a.m. - 4:30 p.m.

8:30 a.m.	Introductions/Agenda	GEH/NRC
8:30 a.m. – 9:30 a.m.	Tier 1/Tier 2* Discussions	GEH/NRC
9:30 a.m. – 10:30 a.m.	MMIS and HFE Implementation Plan – Progress/Status	GEH
10:30 a.m. – 10:45 a.m.	Break	
10:45 a.m. - 12:15 p.m.	HFE Implementation Plans – Status/Progress	GEH
10:45 a.m. - 12:15 p.m.	Proprietary Breakout Session – Software Implementation Plans	GEH
12:15 p.m. – 1:15 p.m.	Lunch	
1:15 p.m. - 2:45 p.m.	Proprietary Session - HFE Product Review and Demonstrations	GEH
2:45 p.m. – 3:00 p.m.	Break	
3:00 p.m. - 4:30 p.m.	Proprietary Session – Review Draft HFE Documents	NRC

Friday, July 27, 2007: 8:30 a.m. - 4:00 p.m.

8:30 a.m. - 9:00 a.m.	Introductions/Agenda	GEH/NRC
9:00 a.m. - 10:00 a.m.	RAI Closure Status	GEH
10:00 a.m. - 11:00 a.m.	MMIS and HFE Schedule and Activity Preview	GEH
11:00 a.m. - 12:00 p.m.	Lunch and NRC Caucus	NRC
12:00 p.m. - 1:00 p.m.	Closing NRC Remarks	NRC

Note:

- The staff estimates the following times will be needed for the following topics
 - 2 hours - Chapter 18 RAI Status and Roadmap
 - 1 hour - Tier 1 / Tier 2* Discussions
 - 1 hour - MMIS and HFE Implementation Plan – Progress/Status
 - 1.5 hours - HFE Implementation Plans – Status/Progress
 - 1.5 hours - Proprietary Session - HFE Product Review/Demonstrations
 - 1.5 hours - Proprietary Session – Review Draft HFE Documents

Documents Reviewed
ESBWR Human Factors Engineering Audit July 25-27, 2007

Documents reviewed (all proprietary)

ESBWR Human Factors Engineering: Human Reliability Analysis Summary Report, Rev. 0, July 2007

ESBWR Human Factors Engineering: Operating Experience Review Summary Report, Rev. 0, no date

Criteria and Variables for Consideration, ESBWR Application of Units, D. Brooks, April 2007

ESBWR Work Plan and Instructions for Baseline Review Record (BRR) and Operation Experience Review (OER)

Plant Functional Requirements Analysis (PFRA) Work Plan, Design Phase draft

System Functional Requirements Analysis (PFRA) Work Plan, Design Phase draft

Allocation of Function (AOF) Work Plan, Design Phase draft

Task Analysis (TA) Work Plan, Design Phase draft

Color Coding: A Literature Review, D. Brooks, June 2007 draft

Audit Participants
ESBWR Human Factors Engineering Audit July 25-27, 2007

NRC

Jim Bongarra
Amy Cabbage
Norbert Carte
Leroy Hardin
Dennis Galvin

BNL (NRC Contractors)

Jim Higgins
John O'Hara

GE, COL representatives, and consultants

Rich Stattel
Greg Norris
Cathy Gaddy
D. Tidwell
Kahlin Miller
D. LoGalbo
R. Kohli
Ken Jackson
Don Lewis
Stan Pobutkiewicz
Jeff Grogan
Tom Graham
Bill Hannaman
Tom Jenkins
Don Taylor
Chris Gregg
Lee Griffith
Curtis Buford
William Sooy
Joyce McAllister
Dan Williamson
Var Tashjian
Anthony Milko
Jon Poppel
Andre Mahfouz
Denise Brooks
David Hinds
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(Revised 06/23/2010)

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