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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 111 Related to ESBWR Design Certification Application – Human Factors Engineering - RAI Numbers 18.10-1 S02, 18.10-2 S01, and 18.10-3**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) Requests for Additional Information (RAI) dated October 16, 2007, Reference 1.

RAI 18.10-1 S02 was previously provided via Reference 2 in response to Reference 3. The original RAI responses were submitted to the NRC via Reference 4 in response to NRC Letter No. 64, Reference 5. RAIs 18.10-2 S01 was originally provided via Reference 4 in response to NRC Letter No. 64, Reference 5.

GEH's response to RAIs 18.10-1 S02, 18.10-2 S01, and 18.10-3 are addressed in Enclosure 1.

If you have any questions or require additional information, please contact me.

Sincerely,

Joseph Savagé

for James C. Kinsey
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 07-556 - Letter from U.S. Nuclear Regulatory Commission to James C. Kinsey, GEH, *Request For Additional Information Letter No. 111 Related To ESBWR Design Certification Application*, dated October 15, 2007
2. MFN 07-334 - Submittal of *"ESBWR DCD Chapter 18, Human Factors Engineering - RAI to DCD Roadmap Document"* dated June 27, 2007
3. Email from AE Cubbage to DL Lewis, *List of Chapter 18 RAIs for Roadmap Request*, dated 5/18/07
4. MFN 06-401, *Response to Portion of NRC Request for Additional Information Letter No. 64 – Human Factors Engineering – RAI Numbers 18.5-1 through 18.5-32*, dated October 28, 2006
5. MFN 06-352, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 64 Related to ESBWR Design Certification Application*, dated September 25, 2006

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 111 Related to ESBWR Design Certification Application ESBWR Human Factors Engineering - RAI Numbers 18.10-1 S02, 18.10-2 S01, 18.10-3

Attachment:

1. MFN 07-625 –Attachment - Markups and Added Text for RAIs 18.10-2 S01, 18.10-3

cc:	AE Cubbage	USNRC (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	GB Stramback	GEH/San Jose (with enclosures)
	eDRF	0000-0077-8848

Enclosure 1

MFN 07-625

Response to NRC Request for Additional Information Letter No. 111 Related to ESBWR Design Certification Application
Human Factors Engineering
RAI Numbers
18.10-1 S02, 18.10-2 S01, 18.10-3

For historical purposes, the original text of RAIs 18.10-1 S02 and 18.10-2 S01 and any previous supplemental text and GE responses are included preceding each supplemental response. Any original attachments or DCD mark-ups are not included to prevent confusion.

NRC RAI 18.10-1

Training requires significant input from the plant designer, yet is classified as an operational program under the ultimate responsibility of an ESBWR COL licensee. The areas in NEDO-33275, Section 3.4, that address the content of the training program appear to be primarily a COL holder's responsibility. Is GE proposing to certify these aspects of training as well? Please clarify which aspects of Training Program Development that GE is requesting be design certified.

GEH Response

The need to have a centralized and generic training program for ESBWR is recognized. The scope of work relative to training including and beyond operations will be determined after the Combined Operating Licensee Owners Group (COLOG) charter has been drafted. GE is requesting that the requirements for the following be design certified:

- lesson plans,
- training procedures,
- reference training simulator (RTS),
- simulator scenarios, and
- job performance measures.

Refer to response to RAI 18.13-5.

DCD/LTR Impact

No DCD changes will be made in response to this RAI.
No changes to the subject LTR will be made in response to this RAI.

NRC RAI 18.10-1 S01

GE response to RAI 18.13-1 (F) renamed the BSS as the Representative Training Simulator (RTS). The response to this RAI refers to a Reference Training Simulator (RTS). Are they the same? Also, please provide a description of the various proposed simulators: the baseline simulator (BS), the part task simulator, the full scope simulator (FSS), and the representative or reference training simulator (RTS). Include the purpose, properties, scope, number (e. g., just one or one per each operating ESBWR plant), location and use of each. Also note which simulators will meet RG 1.149 and ANS 3.5. If some of this information is not yet available, please indicate when it will be.

The implementation plan addresses several of the NUREG-0711 criteria for training, but defers others to the COL holder. RAI 18.10.1 requested clarification on which aspects of the training development program were to be certified. In response to the RAI, GE listed five items for which they were seeking design certification. However, none of these five items are discussed in the Training Implementation Plan. If these five items from the RAI response are to be certified, then more information will be needed on them.

GEH Response

Chapter 18 Roadmap Document								
RAI NO	SEC	#	NRC Supplemental	DocName/Question	Resolved	Plan	Section	Resolution Description
18.10-1	10	1	Y	Clarify scope of training program to be certified	From GE response	33275	3.1.4.3 4.1.3.2 4.1.4.2 4.1.4.4 4.1.4.5	COL responsibility for training is removed. Additional information provided about training lesson plans and training design and development Information provided about training program guidelines and course materials Simulators described in context of training facility requirements- As described in audit, GE has tried to remove confusion with the use of part-task and full-scope simulators

NRC RAI 18.10-1 S02

A. Revision 1 of the "ESBWR Training Development Implementation Plan" provides only very general information on simulators used for training in Section 4.1.4.5.

NUREG-0711, Section 10.4.2 Criterion (3) states that "Facilities and resources such as plant-referenced simulator and part-task training simulators needed to satisfy training design requirements and the guidance contained in ANSI 3.5 and Regulatory Guide 1.149 should be defined." Please provide more details as follows:

1. GEH response to RAI 18.13-1 (F) renamed the Baseline Specific Simulator (BSS) as the Representative Training Simulator (RTS). The response to RAI 18.10-1 refers to a Reference Training Simulator (RTS). Are they the same?

2. Please provide a description of the various proposed simulators: the baseline simulator (BS), the part task simulator, the full scope simulator (FSS), and the representative or reference training simulator (RTS). Include the purpose, properties, scope, number (e.g., just one or one per each operating ESBWR plant), location and use of each. Also note which simulators will meet RG 1.149 and ANS 3.5. If some of this information is not yet available, please indicate when it will be.

B. The implementation plan addresses several of the NUREG-0711 criteria for training, but defers others to the COL holder. RAI 18.10.1 requested clarification on which aspects of the training development program were to be certified. In response to the RAI, GEH listed five items for which they were seeking design certification. Revision 1 of the "ESBWR Training Development Implementation Plan" is still not clear on what is being certified. It appears from a review of Revision 1 that potentially all aspects of training, addressed by NUREG-0711 criteria, could be certified at the implementation plan level except for Criterion (1) relating to the Chapter 13 review items. Please provide confirmation of what is desired to be certified.

GEH Response

A. 1. NEDO-33275 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN Rev 1 refers to a "representative training simulator" in the last paragraph of section 3.1.4.1. Additionally the document refers to a "reference training simulator" in the third bullet of section 5.3.1. All other references in the document refer to part task, full-scope, or training simulators. To eliminate confusion, references to representative and reference training simulators will be removed from NEDO-33275 Rev 1.
NEDO-33275 Rev 1 Section 3.1.4.1 final paragraph, first sentence will be changed to read as follows:
"Resources such as part-task, full scope, and training simulators are utilized in the ESBWR HFE implementation process for both design verification and training."

NEDO-33275 Rev 1 Section 5.3.1 third bullet will be changed to read as follows: "Training Simulator"

Following these changes, NEDO-33275 will reference only part task, full scope, and training simulators. Detailed descriptions of these simulators are provided as an attachment.

2. Following the revision described in part A.1 of this RAI, NEDO-33275 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN will refer only to part task, full scope, and training simulators. Definitions of each of these simulators types outlining their purpose, properties, scope, and number are provided as an attachment.

B. GEH is requesting that all aspects of training addressed by NUREG-0711 criteria, except for Criterion (1) relating to the Chapter 13 review items, be design certified including:
   - Development of training program guidelines.
   - Task and job analysis leading the development of the task to training matrix
   - Training design leading to JPM development, exam questions, training setting determinations, and learning objectives
   - Training development leading to the development of training materials, selection of training methods, development of lesson plans, and development of simulator scenarios.

   Implementation of the training program will primarily be a COL holder responsibility supported as needed by GEH.

DCD/LTR Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33275, Rev 1 will be revised as noted in the attached markup.

NRC RAI 18.10-2

A. NEDO-33275, Section 1.1, appears to limit the plan and training program to operators, while other parts, Section 3.1 and Table 1, are more appropriately complete. Please clarify.

B. NEDO-33275, Section 2.2, Codes and Standards, list the 1976 version of ANS 3.2 but should refer to the current 1994 version (reaffirmed 1999).

C. Reg Guide 1.149 on simulators is addressed in NEDO-33275, Section 3.2, but is not in the reference section 2.3. Please clarify these discrepancies.

GEH Response

A. The scope of the training program elements to be provided by GE will be determined after the COLOG has been established and its charter has been drafted. NEDO-33275 Section 1.1 and Section 3.1 will be aligned to be compatible with Table 1 in the next revision.

B. NEDO-33275 Section 2.2 will be updated in the next revision to reflect current standards.

C. NEDO-33275 Sections 3.2 and 2.3 will be aligned line and compatible in the next revision.

DCD/LTR Impact

No DCD changes will be made in response to this RAI.
LTR NEDO-33275, Rev 0 will be revised as described above.

NRC RAI 18.10-2 S01

This RAI had three parts. Parts A and C were acceptably addressed in Rev. 1.

Part B stated "NEDO-33275, Section 2.2, Codes and Standards, lists the 1976 version of ANS 3.2 but should refer to the current 1994 version (reaffirmed 1999)."

Rev. 1 still refers to the 1976 version.

Please update NEDO-33275 in the next revision to reflect current standards.

GEH Response

NEDO-33275, Rev 1 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN page 10, section 2.2, item 2 will be changed to read: "ANSI/ANS 3.2-1994: (Reaffirmed 1999) "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants""

DCD/LTR Impact

No DCD changes will be made in response to this RAI.
LTR NEDO-33275, Rev 1 will be revised as noted in the attached markup.

NRC RAI 18.10-3

NUREG-0711, Section 10.4.2, Criterion (1) states in part "The roles of all organizations, especially the applicant and vendors, should be specifically defined for the development of training requirements, development of training information sources, development of training materials, and implementation of the training program...". This information was previously in Table 2 of Rev. 0, but is currently not provided in Rev. 1 of the Plan.

Criterion (2) states "The qualifications of organizations and personnel involved in the development and conduct of training should be defined." This information is similarly not provided in Rev. 1. Please provide the necessary information.

GEH Response

Organizational roles discussed in NEDO-33275 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN sections 3.1.4.1, 3.1.5.4, 4.1, and 4.1.3.1 Item 3 & 8 do not provide the specificity needed to fully address the requirements of NUREG-0711, Section 10.4.2, Criterion (1). Clarification will be added to sections 3.1.4.1 and 4.1.4.1 as described below.

A) NEDO-33275, Rev 1 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN page 12, section 3.1.4.1, will have the following inserted in the next revision as the first paragraph:

"The HFE design process shown in Figure 1 and the training development process shown in Figure 2 outline the steps that will be taken to design the MMIS and develop the supporting Staffing and Qualifications requirements, procedures, and training. The training development process will be performed by GE Hitachi Nuclear Energy (GEH) and supported by COL Applicant participation through the completion of training material development specific to the ESBWR. GEH has the ability to provide ESBWR training to the COL Applicant's Instructors. Training implementation and evaluation is the responsibility of COL Applicants. GEH has the ability to support the COL Applicant's training program."

B) NEDO-33275, Rev 1 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN page 24, section 4.1.4.1, will have the following inserted in the next revision as the first three bullets:

- The roles of all organizations involved in the development of training including requirements, training information sources, and materials.
- The roles of all organizations involved in the implementation of training.

- The qualification requirements for organizations and personnel developing or conducting training and the process for documenting compliance with these requirements.

DCD/LTR Impact

No DCD changes will be made in response to this RAI.
LTR NEDO-33275, Rev 1 will be revised as noted in the attached markup.

MFN 07-625

Attachment

Markups and Added Text
For RAIs
18.10-2 S01, 18.10-3

1. ANSI/ANS 3.1-1993, R1999 Selection, Qualification, and Training of Personnel for Nuclear Power Plants NRC RAI 18.10-251 part B Insert see Attachment

2. ~~ANS 3.2 (ANSI N18.7-1976), "Administrative Controls and QA for the Operational Phase of Nuclear Power Plants"~~

3. ANSI/ANS 3.4-1996, "Medical Certification and Monitoring of Personnel Requiring Operator Licenses for Nuclear Power Plants"

4. ANSI/ANS 3.5-2005: Nuclear Power Plant Simulators for Use in Operator Training, American Nuclear Society

5. IEEE Std. 338-1993 "Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems," The Institute of Electrical and Electronics Engineering

6. IEEE Std. 603-1991, "Criteria for Safety Systems for Nuclear Power Generating Stations," The Institute of Electrical and Electronics Engineering

7.. IEEE Std. 610, IEEE Standard Glossary of Software Engineering Terminology, 1990

2.3 Regulatory Guidelines

1. IP 41500, Training and Qualification Effectiveness, NRC, periodically updated
2. NUREG-0700, Rev 2, Human-System Interface Design Review Guidelines, 2002

3. NUREG-0711 Rev 2, Human Factors Engineering Program Review Model, 2004

4 NUREG-0737, Clarification of TMI Action Plan Requirements, Supplement 1, Requirements for Emergency Response Capability, 1983

5. NUREG-0800, Standard Review Plan, Section 13.2.1, Reactor Operator Training, 2002

6. NUREG-0800, Standard Review Plan, Section 13.2.2, Training for non-licensed Plant Staff, 2002

7. NUREG-0800, Standard Review Plan, Section 13.5.2.1, Operating and Emergency Operating Procedures, 2002

8. NUREG-1021, Rev 9, Operator Licensing Examination Standards For Power Reactors, 2004

9. NUREG-1123, Rev 2, Knowledge and Abilities Catalog for Nuclear Power Plant Operators: Boiling Water Reactors, 1998

10. NUREG-1220, Rev 1, Training Review Criteria and Procedures, 1993

3 METHODS

3.1 Systematic Approach to Training

3.1.1 Background

Industry experience has shown that well trained plant personnel are critical to safe and reliable operation of nuclear power plants. Incorporation of human factors in the development of training programs ensures consistency, completeness, usability, and alignment with procedures and HSI design.

3.1.2 Goals

The training program provides assurance that personnel have the qualifications commensurate with job performance requirements.

3.1.3 Requirements

The training approach follows applicable guidance in NUREG-0800 Section 13.2 Training, as defined in 10 CFR 55.4, and as required by 10 CFR 52.78 and 50.120. Categories of personnel trained in the ESBWR training program are in accordance with 10 CFR 50.120 and are listed in Table 1. The training program satisfies the training program design requirements and the guidance contained in ANSI 3.5 and Regulatory Guide 1.149. The training program is based on the systematic approach to training and is an integral part of the overall HFE design process, as shown in Figure 1.

3.1.4 General Approach

The training program follows a systematic approach to training and includes classroom, simulator, and on the job training. This approach provides assurance that trainers and plant personnel have the knowledge, skills, and abilities to discharge their responsibilities. A systems approach to the training of plant personnel is illustrated in Figure 2. It also shows HFE design inputs to the training program including inputs developed and incorporated into the HSI as described in Section 4. Other plant personnel such as administrative staff responsible for the elements listed in Tables 2 to 6 are also trained.

NRC RAI 18.10-3
Insert part A
see Attachment

3.1.4.1 Organization of Training

Training materials are developed and implemented using existing sources of information and design specific information from the ESBWR HFE design team. The role of the HFE design team is to provide input to the training program and, if requested, to conduct specific training modules. For example, the ESBWR design team supplies system descriptions, planned operator tasks, and the Emergency Procedure Guidelines (EPG's), which are integrated into specific training programs.

The Staffing and Qualifications implementation plan for the ESBWR established the required responsibilities, skill sets, and qualifications of plant personnel. The training development process establishes the organization and process required to achieve and maintain the qualifications and certifications of plant personnel. Initial and requalification training are provided to establish and maintain proficiency with required job tasks.

4.1.3.7 Human Performance Monitoring

Human Factor Engineering during the design process addresses a wide range of potential causes of human error to produce training and procedures that match the HSI. However, a good operational safety culture from the COL applicant encourages the continual identification of issues for improvement including further reducing the potential for human errors. The potential for improvements to the HSI, training, and procedures continues into the operational phase. Thus, when the plant is turned over to the COL applicant improvements to the HSI, training, and procedures are still sought, evaluated, tracked, and resolved through the HPM process. This process ensures training practices, materials, and presentations are refined over time as a result of industry/ESBWR OER and modifications to the plant.

4.1.4 Outputs

The training development process is an integral part of the MMIS HFE design process for the ESBWR. The process outputs include training program guidelines, qualification requirements, training needs analyses, training course materials, facility requirements, and ultimately, trained personnel. Training evaluation, V&V, and HPM verify that trained plant staff can competently, safely, and efficiently operate and maintain the ESBWR during normal, abnormal, and emergency conditions.

4.1.4.1 Training Program Guidelines

The training program guidelines delineate the overall structure of the program, documents, and processes including the following attributes:

NRC RAI 18.10-3 Insert Part B See Attachment

- Breakdown of ownership for various training types including licensed and non-licensed operators, fire protection, engineering and technical, maintenance, and radiation control
- Process descriptions for program implementation including, analysis, design, development, implementation, and evaluation
- Generic process descriptions and requirements for different training venues including classroom, part-task simulators, mock-ups, full scope simulator, and OJT
- Course material editorial, content, and structure requirements to ensure consistency and quality
- Instructor qualification and certification processes
- Course material document control requirements to ensure only controlled and current materials are presented to trainees
- Trainee and training program evaluation processes including instructor/trainee feedback, observations, tests, V&V, and HPM
- Industry/ESBWR OER and plant design change training input processes to ensure training remains refined, up-to-date, and accurate

RAI 18.10-2 S1 part B

NEDO-33275, Rev 1 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN page 10, section 2.2, item 2 will be changed to read:

ANSI/ANS 3.2-1994: (Reaffirmed 1999) "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants"

RAI 18.10-3 part A

NEDO-33275, Rev 1 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN page 12, section 3.1.4.1, will have the following inserted as the first paragraph:

"The HFE design process shown in Figure 1 and the training development process shown in Figure 2 outline the steps that will be taken to design the MMIS and develop the supporting Staffing and Qualifications requirements, procedures, and training. The training development process will be performed by GE-Hitachi Nuclear Energy (GEH) and supported by COL Applicant participation through the completion of training material development specific to the ESBWR. GEH has the ability to provide ESBWR training to the COL Applicant's Instructors. Training implementation and evaluation is the responsibility of COL Applicants. GEH has the ability to support the COL Applicant's training program."

RAI 18.10-3 part B

NEDO-33275, Rev 1 ESBWR HFE TRAINING DEVELOPMENT IMPLEMENTATION PLAN page 24, section 4.1.4.1, will have the following inserted as the first three bullets:

- The roles of all organizations involved in the development of training including requirements, training information sources, and materials.
- The roles of all organizations involved in the implementation of training.
- The qualification requirements for organizations and personnel developing or conducting training and the process for documenting compliance with these requirements