

February 28, 2008

Mr. Robert E. Brown
Senior Vice President, Regulatory Affairs
GE-Hitachi Nuclear Energy Americas, LLC
3901 Castle Hayne Road MC A-45
Wilmington, NC 28401

SUBJECT: ECONOMIC SIMPLIFIED BOILING WATER REACTOR (ESBWR) CHAPTER 18
OPEN ITEMS

Dear Mr. Brown:

As you are aware, the U.S. Nuclear Regulatory Commission staff is preparing the safety evaluation report (SER) for the ESBWR design certification application submitted by GE-Hitachi Nuclear Energy Americas, LLC (GEH) on August 24, 2005. The staff has identified 66 open items for SER Chapter 18, "Human Factors Engineering," which are enclosed for your information. The staff is prepared to review your responses to the open items and have conference calls and meetings with your staff, as appropriate, to resolve these open items to support issuance of the SER.

Please provide a response date for any late or unscheduled open items discussed in the enclosure.

This open item letter is based on the staff's review of the ESBWR Design Control Document (DCD) Revision 4, Request for Additional Information (RAI) responses and other submittals received to-date. The staff will continue its review as additional RAI responses and other deliverables are submitted, including future DCD Revisions. The staff will inform cognizant GEH staff of any resulting changes to the status of Chapter 18. If you have any questions, please contact Amy Cubbage at (301) 415-2875 or aec@nrc.gov or Dennis Galvin at (301) 415-6256 or djg3@nrc.gov.

Sincerely,

/RA B. Sosa for:/

Mohammed Shuaibi, Chief
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure: As stated

cc: See next page

February 28, 2008

Mr. Robert E. Brown
Senior Vice President, Regulatory Affairs
GE-Hitachi Nuclear Energy Americas, LLC
3901 Castle Hayne Road MC A-45
Wilmington, NC 28401

SUBJECT: ECONOMIC SIMPLIFIED BOILING WATER REACTOR (ESBWR) CHAPTER 18
OPEN ITEMS

Dear Mr. Brown:

As you are aware, the U.S. Nuclear Regulatory Commission staff is preparing the safety evaluation report (SER) for the ESBWR design certification application submitted by GE-Hitachi Nuclear Energy Americas, LLC (GEH) on August 24, 2005. The staff has identified 66 open items for SER Chapter 18, "Human Factors Engineering," which are enclosed for your information. The staff is prepared to review your responses to the open items and have conference calls and meetings with your staff, as appropriate, to resolve these open items to support issuance of the SER.

Please provide a response date for any late or unscheduled open items discussed in the enclosure.

This open item letter is based on the staff's review of the ESBWR Design Control Document (DCD) Revision 4, Request for Additional Information (RAI) responses and other submittals received to-date. The staff will continue its review as additional RAI responses and other deliverables are submitted, including future DCD Revisions. The staff will inform cognizant GEH staff of any resulting changes to the status of Chapter 18. If you have any questions, please contact Amy Cubbage at (301) 415-2875 or aec@nrc.gov or Dennis Galvin at (301) 415-6256 or djg3@nrc.gov.

Sincerely,
/RA B. Sosa for:/

Mohammed Shuaibi, Chief
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010
Enclosure: As stated
cc: See next page

DISTRIBUTION:

<u>Hard Copy:</u>	<u>E-Mail:</u>	WWang	
PUBLIC	NGE1 Group	MJunge	KWinsburg
ACubbage	JDonoghue	JBongarra	GThomas
DGalvin	RidsAcrcsAcnwMailCenter	RidsOgcMailCenter	

ADAMS ACCESSION NO. ML080500028

OFFICE	PM: NGE1	PM: NGE1	BC: COLP	BC: SRSB	BC: NGE1
NAME	DGalvin	ACubbage	MJunge	JDonoghue	MShuaibi-B. Sosa for:
DATE	02/27/08	02/27/08	02/22/08	02/25/08	02/28/08

OFFICIAL RECORD COPY

GE-Hitachi Nuclear Energy Americas LLC
ESBWR Preliminary Open Items
Chapter 18
Human Factors Engineering

RAI 18.2-10 Supplement No. 2, December 14, 2007, ML073340807

GEH's response to RAI 18.2-10 does not adequately address the staff's question. GEH has not provided any detail or referenced specific items.

NEDO-33217, Rev. 3, Section 3.1.4.2, #6 of the implementation plan identified process management tools and indicates that these are discussed in Section 4 of the document describing the technical program. However, in MFN 07-428, GEH indicated to the staff that they plan to significantly revise the section of the plan addressing the technical program. GEH provided a markup of the plan's table of contents providing a high-level overview of the changes planned. Please submit Rev. 4 of the plan incorporating these changes.

Status: GEH has not yet committed to a response date.

RAI 18.2-18, December 14, 2007, ML073340807

Review Based on NEDO-33217P, Rev. 3:

In MFN 07-428, GEH indicated to the staff that they plan to significantly revise the section of the plan addressing the technical program. GEH provided a markup of the plan's table of contents providing a high-level overview of the changes planned. These changes will be implemented in Rev. 4 of the plan which has not yet been submitted for staff review. Thus, this criterion will be reviewed upon receipt of the revised plan. The revised plan should reference each of the Human Factors Engineering (HFE) activity detailed implementation plans for detailed methodology descriptions.

Status: GEH has not yet committed to a response date.

RAI 18.2-19, December 14, 2007, ML073340807

The staff has determined that the material contained in NEDO-33217, Rev 3 and in the detailed implementation plans for the HFE activities reviewed in Sections 18.3 through 18.13 provide the basis for the staff's safety determination. This NEDO and the implementation plans should be identified as Tier 2* in the DCD.

Status: GEH has not yet committed to a response date.

RAI 18.2-20, January 14, 2008, ML080090684

DCD, Revision 4 references Revision 3 of the ESBWR MMIS and HFE Implementation Plan (NEDE 33217P). It is the staff's understanding that the plan will undergo a significant revision to remove detailed discussions of HFE program elements documented in the individual implementation plans. This reference should be updated to the revised plan.

Status: GEH has not yet committed to a response date.

RAI 18.4-16 Supplement No. 2, December 14, 2007, ML073340807

The staff asked for additional information in RAI 18.4-16. Some parts were addressed, but the following parts of the original RAI are still open:

- (b) This is a follow-up to RAI 18.4-16. This section contains many criteria for allocating functions. Most are stated at a very general level. Are more specific criteria available for analysts to use as part of the decision making process?
- (f) This is a follow-up to RAI 18.4-16. For non-safety functions for which configuration change is required during normal or emergency operations, the methodology assumes the function will be handled by the Plant Automation System (see Figure 3). It would seem that the same set of human performance considerations should be made here as for safety functions. Please clarify the rationale for using the Plant Automation System as this is not clearly presented in NEDO-33220, Rev 1.

Status: GEH has not yet committed to a response date.

RAI 18.4-21 Supplement No. 1, December 14, 2007, ML073340807

Please clarify the role of NEDO-33220, Rev 1, Appendix A. For example, how does the analyst use HRA significance to conclude that automation is desirable? There is some guidance for several human performance considerations (from NUREG/CR-2623) in Appendix A of NEDO-33220, Rev 1, but the appendix is not referenced in the FRA Implementation Plan and the list of considerations in the Appendix is not the same as those presented in the Implementation Plan description.

Status: GEH has not yet committed to a response date.

RAI 18.4-25 Supplement No. 1, December 14, 2007, ML073340807

The content of 18.4.2 is not consistent with NEDO-33220, Rev 1. Please clarify and update DCD Section 18.4.2.

Status: GEH has not yet committed to a response date.

RAI 18.4-26 Supplement No. 1, February 12, 2008, ML080370628

In response to RAI 18.4-26, GEH responded as follows:

Detailed guidance for the conduct of the Plant Functional Requirements Analysis (PFRA) is contained in the PFRA Work Instruction that has been drafted to implement NEDO-33219, Revision 1. The work instruction requires that the information specified in NUREG-0711, Section 4, Criterion 4 be determined and documented for each high level function. This data for each high level function will be an integral part of the PFRA structure, and as such will be validated and summarized along with the PFRA data structure. A draft copy of the PFRA Work Instruction will be available for review during the on-site audit scheduled for July 25, 2007.

Please include this description of the PFRA work instruction in the implementation plan, NEDO-33219.

Status: GEH has not yet committed to a response date.

RAI 18.5-5 Supplement No. 1, October 16, 2007, ML072880064

NEDO-33221, Rev 1, is an extensive revision of Rev 0. However, the methodology is presented in outline form with little explanation of how the task analysis is actually performed. Most of the implementation sections are limited to bullet lists (see Section 4). This does not provide sufficient information to evaluate the methodology to be used. Also NEDO-33221, Rev 1 does not appear to describe the actual methodology being used that was demonstrated during the July 2007 Design Process Audit. The methodology discussed by GEH in the July 2007 Audit included many considerations that cannot be found in the implementation plan, such as the evaluation of critical steps. Many of the terms used to describe the methodology and the example shown cannot be found in the plan. While this apparent difference may be due in part to differences in level of detail, it does provide an example of the staff's concern that an engineer using the plan would not clearly produce the type of results shown during the audit. Clarification is needed of (1) the relationship between the plan and the actual task analysis, and (2) how an engineer makes the transition from the plan to the actual conduct of the analysis.

*Status: GEH responded on 1/17/2008, MFN 07-624.
GEH's response is under staff review.*

RAI 18.5-19 Supplement No. 1, October 16, 2007, ML072880064

NEDO-33221, Rev 1, on page 3 makes the commitment to perform task analysis for "task identified as risk-important as determined by the HRA/PRA." NEDO-33267, the PRA/HRA Integration Plan, should be referenced since that is where the criteria for risk-important actions are identified.

*Status: GEH responded on 1/17/2008, MFN 07-624.
GEH's response is under staff review.*

RAI 18.5-26 Supplement No. 1, October 16, 2007, ML072880064

NEDO-33221, Rev 1 Sections 4.1.3.6 and 4.2.3.6 provide information regarding workload assessments that list workload, crewmember skills, and work allocation; however no information about how such considerations are made is provided. Please clarify how these considerations are addressed.

*Status: GEH responded on 1/17/2008, MFN 07-624.
GEH's response is under staff review.*

RAI 18.5-27 Supplement No. 1, October 16, 2007, ML072880064

In the original RAI, staff requested additional information as to how the minimum inventory will be identified and what criteria will be used in the selection process. The GEH response to

RAIs 18.8-13, 18.8-23 and 18.5-27 all address minimum inventory. While they are not all the same, GEH clearly indicates that the minimum inventory will be developed and is not done yet. The response to 18.5-27 sounds very broad and seems to include all the task requirements identified through task analyses in the minimum inventory. This response needs further explanation.

GEH's task analysis methodology in NEDO-33221, Rev. 1 also does not fully address minimum inventory. Provide a discussion and clarification on how minimum inventory is identified consistent with DI&C-ISG-05, "Digital Instrumentation and Controls Interim Staff Guidance on Highly-Integrated Control Rooms--Human Factors Issues (HICR-HF)," dated September 28, 2007.

*Status: GEH responded on 1/17/2008, MFN 07-624.
GEH's response is under staff review.*

RAI 18.5-30 Supplement No. 1, October 16, 2007, ML072880064

The task analysis methodology presented in NEDO-33221, Rev. 1 is not consistent with the methodology summarized in DCD Section 18.5, Rev 3. For example, the implementation plan discusses two major levels of analysis, plant and system. This is not addressed in the DCD. Please revise DCD, Section 18.5 to ensure consistency with the NEDO-33221, Rev. 1 and any modifications made to address other 18.5 RAIs.

*Status: GEH responded on 1/17/2008, MFN 07-624.
GEH's response is under staff review.*

RAI 18.6-13, January 14, 2008, ML080090684

Section 18.6.8, "References", has the incorrect date for the staffing implementation plan, NEDO-33266, Revision 1. It is listed as March, 2007, rather than January, 2007.

Status: GEH has not yet committed to a response date.

RAI 18.7-7 Supplement No. 2, December 14, 2007, ML073340807

The staff asked for additional information in RAI 18.7-7 regarding the PRA/HRA which was addressed; however, the following parts of the original RAI are still open:

2. Table 19.1-3, Importance Analysis Results, is not discussed or explained in the text of Ch. 19. Col. 2 of the Table gives the basis for inclusion of items in the Table as RAW, FV, and CCF, but does not list values or selection criteria. Rev. 2 of Plan gives acceptance criteria as FV greater than 0.1 and RAW of 2.0 for both CDF and LERF. However, these criteria are not specifically linked to the RI HAs. This should be clarified.
8. The row for Human Actions in Table 19.2-1 states that "No operator actions are required for safety function success in the ESBWR for the first 72 hours of an event." This is a deterministic statement. What does the PRA analysis show? Are the important HAs, as identified in the PRA, from the pre-72 hour regime? This RAI was not satisfactorily answered. Please provide a response.

9. For Item 2b in Table 19.2-3 (spurious actuation of GDCS deluge to containment) was an error of commission modeled in the PRA? The Roadmap answer provided a discussion of the EOC method used for the HRA but didn't answer the specific question related to Item 2b.

Status: GEH has not yet committed to a response date.

RAI 18.7-8 Supplement No. 2, December 14, 2007, ML073340807

NEDO-33267, Section 4, states that, "These analyses will use a variety of importance measures and HRA sensitivity analyses assumptions to ensure that risk important actions are not overlooked." However, the particular importance measures to be used and the acceptance criteria (or cutoff values), for determining which human actions (HAs) are risk important, are not given in the report. It is noted that cutoff values, using the risk achievement worth (RAW) and Fussell-Vesely (FV) importance measures (IMs), are specified in DCD Tier 2, Section 19.5.2 for important SSCs. Please provide the IMs and the criteria to be used for determining the risk important HAs. Rev. 2 of the Plan (33267) cites a RAW value of > 2.0 and a FV of > 0.1 in Section 3.2.1. Clarify that these are the criteria for selection of the R-I HAs that will be addressed in the HFE Program.

Status: GEH has not yet committed to a response date.

RAI 18.7-9 Supplement No. 3, December 14, 2007, ML073340807

The ESBWR PRA, as submitted, includes both Level 1 and Level 2 analyses and both internal and external events analyses. Clarify why NEDO-33267 does not specifically commit to use all of these analyses in determining the risk important HAs. The RAI response dated 10/1/2007 states that the following bullet will be added to Section 1.2, Scope of NEDO-33267 "Using both the ESBWR PRA level 1 and level 2 analyses and both internal and external events analysis to determine the risk important HAs. The approach for determining risk importance of human actions is described in section 3.2.1." Also, the DCD, Chapter 18.7.2 states that the process for determining the risk-important HAs includes the use of level 1, level 2, internal and external events, and the low power and shutdown PRA. This is acceptable, but the Plan should be revised per the RAI and should be clear on how all of these portions of the PRA will be used to compute the actual list of R-I HAs.

Status: GEH has not yet committed to a response date.

RAI 18.8-2 Supplement No. 1, December 5, 2007, ML073390629

In the initial RAI, the staff raised a concern about the lack of a detailed step-by-step methodology of HSI design. GEH's response to this question indicated that NEDO-33268 is a high-level document and that it will be revised to provide step-by-step guidance to develop the ESBWR Human Factor (HF) Guidance Manual that will include a style guide.

At the July 2007 HFE Audit, GEH said the detailed steps are in detailed work plans. The staff reviewed one sample work plan (for allocation of function), but that plan provided little additional guidance to that found in the implementation plan.

The HSI Design Implementation Plan, NEDO-33268, Revision 2, does not mention a Guidance Manual nor does it make reference to an HSI Design Work Plan. It does discuss the development of a style guide, but such a document would not typically include the detailed step-by-step design guidance to be used by engineers. Thus the initial concern still exists. To illustrate: The steps for developing a concept design are listed on Page 19. Step 3 addressed the alarm system design. The step says "The alarm system is defined including conceptual display hierarchy, presentation, and layout." This is a high-level step description that could not be used by an engineer to develop an alarm concept design. Please clarify where the methodology to address HSI design is made available to the design team. The staff will need to review the document(s) before a review of the HSI design element can be completed. Note that many of the following HSI Design RAIs reflect concern over the lack of detail in the methodology description provided in NEDO-33268, Revision 2.

Similar issues arise when considering the development and use of the style guide. It is discussed in Sections 3.2 and 4.2 of NEDO-33268, Revision 2. However, little information is provided regarding its structure, content, level of detail and usage by the design team. NEDO-33268, Revision 2, contains many high-level guidelines pertaining to the HSI rather than the process. What is the relationship between these guidelines and those that will be developed for the style guide? Note that many of the responses to the RAIs for this section indicated that the details will be provided in the HF Manual (style guide). The treatment of guidance in Revision 0 Sections 5 and 6 seem to follow this approach (they were removed from the NEDO, see RAI 18.8-36). Yet much of this guidance is still in the NEDO. For example, the response to RAI 18.8-22 concerning operator access to suppressed alarms indicated that the topic would be addressed in the manual. The GEH roadmap stated that the style guide has the details. But it is, in fact, addressed in NEDO-33268, Revision 2 (on Page 70, last bullet above Workstations). Please clarify the relationship between the HSI guidelines in NEDO-33268 and those to be included in the style guide. Also, many of the individual guidelines are expressed in high-level form rather than specific design descriptions. At what level of specificity will the style guide guidance be presented?

Additionally, in NEDO-33268, Revision 2, the Tables, Figures, and Appendix may have been overlooked. There are three tables, but none are referenced in the document. The Appendix is not referenced. All six figures are referenced, but not always correctly. For example, on Page 14 a reference is made to Fig 3. That was correct for Revision 0, but should be changed to Fig 4 in new version. This should be addressed in the next revision.

Status: GEH has not yet committed to a response date.

RAI 18.8-8 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff noted that HSI Design Implementation Plan, NEDO-33268, Section 2 had many references to old documents. GEH's response indicated the references would be revised and updated. NEDO-33268, Revision 2, Section 2 has provided a revised document list, however, many of the concerns raised in the original RAI still apply, specifically the large number of old, outdated documents. As noted in the original RAI, the applicability of such old documents to today's modern HSIs is questionable.

Status: GEH has not yet committed to a response date.

RAI 18.8-16 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff requested clarification of (1) whether the ESBWR Alarm Response Procedures will be computerized, and (2) a statement in NEDO-33268 that "An alarm is announced where the operator has the necessary means for initiating corrective actions." GEH's response to this RAI stated that on-line computer based procedures are planned and NEDO-33268, Revision 2 identifies them as an output of the design process in Section 4.1.4. Thus this aspect of the RAI is acceptably addressed. However, GEH has not clarified the statement regarding corrective actions and the statement is still presented in Revision 2 (see Page 69). Please clarify the statement.

Status: GEH has not yet committed to a response date.

RAI 18.8-17 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff requested clarification of the anthropometric database. GEH's response to this RAI clearly indicated that the anthropometric data will come from NUREG-0700 and deviations from it will be justified. GEH indicated that this information would be included in Revision 2. Section 3.2 of NEDO-33268, Revision 2, suggests the use of available anthropometric data from HFE guidelines (Page 20); however, the source of data is not clearly identified. Please clarify the source of anthropometric data.

Status: GEH has not yet committed to a response date.

RAI 18.8-18 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff requested clarification of two statements concerning the guidance on controls. GEH's response to this RAI clearly indicated that the NEDO-33268 would be revised to refer to the HF Guidance Manual for this guidance. While the first statement, "Placement of controls in keeping with their conformance to safety functions," has been removed, the second statement, "The form of control adopted is consistent with HSI requirements," still appears in NEDO-33268, Revision 2, Section 4.3.4.9, as Item 3 (on Page 62). Please clarify this statement.

Status: GEH has not yet committed to a response date.

RAI 18.8-31 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff requested clarification of methods and criteria for design tests and evaluations. GEH's response to the RAI indicated that a consistent discussion of the design and evaluation tools would be provided in Revision 2. However, the material has been included in Revision 2 (in Section 3.3.5.5, Tests and Evaluations, specifically Pages 34-36) with little modification and without the requested clarifications. Note that Revision 0, Figure 4, is Figure 5 in NEDO-33268, Revision 2 and Revision 0, Figure 5, does not appear in Revision 2. Section 4.3.4.6 contains the same list of techniques and criteria as is listed on Pages 34-35 except an additional criteria related to "safety and/or risk significance" has been added. Why is

this information relisted in Section 4 and why has an additional criterion been added. Please provide the clarifications requested.

Status: GEH has not yet committed to a response date.

RAI 18.8-32 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff requested clarification of the criteria in Section 3 of NEDO-33268, Revision 0. The statement referenced in the original RAI is now in Section 3.3.5.6 (on Page 35) and still references Section 3: "Considering the criteria listed in Section 3 and criteria to be used in selecting HFE/HSI Design and Evaluation Tools, the following techniques are used in the conduct of the HSI design analyses." Please clarify the Section 3 criteria being referred to and which criteria are being referred to by "criteria to be used in selecting HFE/HSI Design and Evaluation Tools"?

Status: GEH has not yet committed to a response date.

RAI 18.8-33 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff requested clarification of the HFE activities listed in Figure 4 of NEDO-33268, Revision 0. GEH's response indicated that the plan would be revised for clarification and that "Table" (Figure 4?) would be eliminated. However, the clarification has not been provided and the figure remains in the plan (now Figure 5). Please clarify.

Status: GEH has not yet committed to a response date.

RAI 18.8-35 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff requested clarification of the methods of evaluation to be used. The descriptions of the methods of evaluation from the original RAI are now on Pages 37-38 of NEDO-33268, Revision 2 and have been slightly abbreviated. The same need for clarification still exists. The section still does not describe how a user of the document conducts the evaluations. Also, the lead-in paragraph references Figure 6, but Figure 6 does not address methods of evaluation. In Revision 0, the same paragraph referenced Figure 7, which did illustrate how multiple methods of evaluation can be sequenced, but this Figure has been removed in Revision 2. Please clarify.

Status: GEH has not yet committed to a response date.

RAI 18.8-41 Supplement No. 1, December 5, 2007, ML073390629

In the original RAI, the staff requested clarification of Figure 2 of NEDO-33268, Revision 0. GEH provided clarification in their response to RAIs of the staff's questions concerning the figure. GEH indicated the NEDO would be revised to include the clarifying material, but it was not included. These clarifications included revising NEDO-33268 to establish the preparation of the ESBWR Human Factors Guidance Manual to include the guidance for HSI design from the

RAI response (Note: Figure 2 is now Figure 3). These clarifications should be included in the next revision.

Status: GEH has not yet committed to a response date.

RAI 18.8-47, October 10, 2006, ML062790403

As part of the general resolution of the issue pertaining to lack of control room detail, the staff has requested that applicants for design certification identify a minimum group of fixed-position controls, displays, and alarms (CDAs) that are required for transient and accident mitigation. Also, the minimum inventory for safe shutdown from the remote shutdown panel should be specified (but not necessarily be a fixed-position at the remote panel). The NRC review criteria for the minimum inventory are given in Standard Review Plan (SRP) Chapter 14.3.9. Sections 4.3.3, 4.3.5.1, and 4.3.6 of NEDO-33268 briefly discuss fixed-position dedicated CDAs, but do not specify the CDAs or provide the criteria used to select all of them. Many of the criteria given in SRP 14.3.9, such as risk, are not mentioned. Also Section 4.4.3 addresses minimum controls, displays and alarms but does not mention fixed-position. Further, it is not clear if the intent is to use criteria in IEEE Std 497 discussed elsewhere in NEDO-33268 for fixed displays. Please provide information relative to the selection criteria and selection process for minimum inventory for ESBWR as it is described in SRP 14.3.9.

Status: GEH responded on 11/20/2006, MFN-06-443. GEH's response is under staff review. However, resolution of this RAI is dependent on the resolution of RAI 18.5-27. GEH responded to RAI 18.5-27 on 1/17/2008, MFN 07-624. GEH's response is under staff review.

RAI 18.8-49 Supplement No. 1, December 5, 2007, ML073390629

The HSI Design process is described in Section 18.8 of DCD Rev 3. The described process is ("in" used in the transmitted RAI) not consistent with the process described in NEDO-33268, Revision 2. For example, the plan describes three major activities: concept design, style guide development, and detailed design and integration. Concept design is not addressed in DCD Section 18.8. Similarly, DCD Section 18.8 discusses "procedures governing permissible operator initiated changes to HSIs" that is not addressed in NEDO-33268, Revision 2. The DCD should be revised to be consistent with NEDO-33268, Revision 2 and any changes that result from modifications made as a result of these RAIs.

Status: GEH has not yet committed to a response date.

RAI 18.8-50, December 5, 2007, ML073390629

Concept of operations is briefly mentioned in Sections 3.1.3 and 3.3.5.4 of NEDO-33268, Revision 2. Additional clarification is needed as to how the concept of operations will be developed by the HFE team, what factors will be included in the concept of operations description, and how it will be documented. Note that the concept of operations is not identified in NEDO-33268, Revision 2, Section 5, Results.

Status: GEH has not yet committed to a response date.

RAI 18.8-51, December 5, 2007, ML073390629

NEDO-33268, Revision 2, Section 3.1.3, states that the HFE team will develop functional requirements for the HSI that encompass the considerations identified in the two criteria for the Functional Requirements Specification. However, no additional information is provided. Additional clarification is needed as to how the requirements will be developed by the HFE team and how it will be documented. Note that the functional requirements are not identified in Section 5, Results.

Status: GEH has not yet committed to a response date.

RAI 18.8-52, December 5, 2007, ML073390629

In NEDO-33268, Revision 2, Section 3.3.4 General Approach, GEH states that with respect to risk-important actions, the design seeks to minimize the probability that errors occur and maximize the probability that an error is detected if one is made. However, no guidance is provided in the methodology for how this design objective will be achieved.

Status: GEH has not yet committed to a response date.

RAI 18.8-53, December 5, 2007, ML073390629

In NEDO-33268, Revision 2, Section 3.3.4 General Approach, GEH states that the factors identified in the criterion are to be considered in the development of requirements for monitoring and control capabilities. However, no guidance is provided in the methodology for how this design objective will be achieved.

Status: GEH has not yet committed to a response date.

RAI 18.8-54, December 5, 2007, ML073390629

In NEDO-33268, Revision 2, Section 3.3.4 General Approach, GEH states that the layout of HSIs will be based on the considerations presented in the review criterion. However, no guidance is provided in the methodology for how this design objective will be achieved.

Status: GEH has not yet committed to a response date.

RAI 18.8-55, December 5, 2007, ML073390629

In NEDO-33268, Revision 2, Section 3.3.4 General Approach, GEH states that personnel performance during minimal, nominal, and high-staffing levels should be considered. However, no guidance is provided in the methodology for how this design objective will be achieved.

Status: GEH has not yet committed to a response date.

RAI 18.8-56, December 5, 2007, ML073390629

In NEDO-33268, Revision 2, Section 3.3.4 General Approach, GEH states that the designer should consider use of the HSIs over a shift. However, no guidance is provided in the methodology for how this design objective will be achieved.

Status: GEH has not yet committed to a response date.

RAI 18.8-57, December 5, 2007, ML073390629

In NEDO-33268, Revision 2, Section 3.3.4 General Approach, GEH states that the designer should consider use of HSIs under a full range of environmental conditions. However, no guidance is provided in the methodology for how this design objective will be achieved.

Status: GEH has not yet committed to a response date.

RAI 18.8-58, December 5, 2007, ML073390629

In NEDO-33268, Revision 2, Section 3.3.4 General Approach, GEH states that the designer should consider HSI support for test, inspection, and maintenance activities. However, no guidance is provided in the methodology for how this design objective will be achieved.

Status: GEH has not yet committed to a response date.

RAI 18.8-59, December 5, 2007, ML073390629

With respect to trade-off evaluations, how are the factors identified in NEDO-33268, Revision 2, Page 33 used to develop selection criteria and how are they applied by the HFE engineer. And how will the HFE engineer determine the relative benefits of design alternatives and document the bases for their selection. In addition, what guidance will be provided to design engineers for the conduct of performance-based tests, including the selection of participants, testbeds, performance measures, and analyses?

Status: GEH has not yet committed to a response date.

RAI 18.9-1 Supplement No. 2, December 19, 2007, ML073521482

GEH's response to part A of this RAI is outdated in that it refers to DCD Chapter 18, Appendix A and B that are now deleted. Revision 2 of NEDO-33274 is still not clear on the development and use of ESBWR-specific EPGs and their submittal to NRC. Please provide more detail on the development process for the ESBWR-specific EPGs, and a schedule for their completion. If not planned for design certification, provide a justification as to why the EPGs are not required for design certification.

Status: GEH has not yet committed to a response date.

RAI 18.9-2 Supplement No. 1, December 19, 2007, ML073521482

Supplemental RAI for Part A of original RAI only.

DCD Tier 2, Chapter 13.5 shows the commitment to ANSI/ANS-3.2 1994: R1999 (R=Reaffirmed), Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants, as endorsed by Regulatory Guide 1.33 Revision 2, February 1978. However it is not clear whether all aspects of procedure development addressed in RG 1.33 will be met, for example procedures in Appendix A of RG 1.33.

Status: GEH has not yet committed to a response date.

RAI 18.9-6 Supplement No. 2, December 19, 2007, ML073521482

Supplemental RAI for Part C of original RAI only.

In response to Item C, GEH provides a restriction in scope similar to NEDO-33274, Rev. 0. Per NUREG-0711, Element 11, both the HSI Task Support Verification and the HFE Design Verification should apply to HSIs that are contained in both normal and emergency procedures. The actual tests and verification would be selected using operational condition sampling of the V&V program. In the Purpose section, NEDO-33274, Rev. 2, does include Task Support Verification, but it does not appear in the methodology portion. Revision 2 also specifies that procedures are developed using an appropriate writer's guide, however, there doesn't seem to be a selective design verification that would check or verify the application of HGFE principles into procedures when they are completed. Please provide for verification of procedures per the V&V guidance of NUREG-0711.

Status: GEH has not yet committed to a response date.

RAI 18.9-8 Supplement No. 1, December 19, 2007, ML073521482

NEDO-33274 states in Section 4.6 that "Sufficient laydown space is provided for hard copies of EOPs, other procedures and other documents required by the operators during accident management and the performance of their regular duties." However, it is not clear if this applies to the main control room only or if it also applies to the remote shutdown facility and appropriate local control stations. Please clarify. Also, while the loss of CBPs is noted in Operational Conditional Sampling in the V&V Plan, in item 4.3.1.4.1.1.b, it should be addressed in the Procedure Development Plan.

GE Response: The main control room will have a lay-down space for hard copies of EOPs and other procedures or documents required by the operators during accident management and the performance of their regular duties. The remote shutdown panel area and local control stations do not have dedicated lay down areas for plant procedures, but empty area room space is available for temporary procedure carts, work tables, or other devices for procedure use. Section 4.3.1.4.1.1.b of NEDO-33276, HFE Validation and Verification Implementation Plan, HSI failures, lists loss of processing and/or display capabilities for computer-based procedures. The original intent was to have back-up hard copies of all plant procedures for such a scenario when the computer based procedures were not available. The use of hard-copy paper procedures are discussed in Section 3.1 of NEDO-33274.

Partially acceptable. The aspects related to lay-down space are acceptable. Further clarification is needed on how loss of CBPs will be addressed procedurally and in NEDO-33274.

Status: GEH has not yet committed to a response date.

RAI 18.11-3 Supplement No. 1, February 12, 2008, ML080370628

NEDO-33276, Rev. 1 provides a high-level summary of the sampling dimensions in Section 4.1.4.1. Items 1 through 3 in the section largely restate the review criteria for sampling dimensions in NUREG-0711 (Section 11.4.1.2). The staff cannot perform an implementation plan review when the plan simply restates the staff's review criteria. The plan should identify the operational conditions to be used for V&V and the process by which the sampling dimensions were used to identify them. The staff can then use the NUREG-0711 criteria in NUREG-0711 to review the acceptability of the operational conditions that have been identified.

Status: GEH has not yet committed to a response date.

RAI 18.11-4 Supplement No. 1, February 12, 2008, ML080370628

NEDO-33276, Rev. 1 provides a high-level summary of the scenario identification in Section 4.1.4.2. The section largely restates the review criteria for scenario identification in NUREG-0711 (Section 11.4.1.3). The staff cannot perform an implementation plan review when the plan simply restates the staff's review criteria. The plan should identify scenarios to be used and how the selected operational conditions were developed into scenarios. The plan should also identify how bias was avoided in the development of scenarios. The staff can then use the criteria in NUREG-0711 to review the acceptability of the scenarios that have been identified.

Status: GEH has not yet committed to a response date.

RAI 18.11-7 Supplement No. 1, February 12, 2008, ML080370628

In the original RAI, the staff requested clarification as to what criteria were to be used in task support verification. GEH's response referred to their response to RAI 18.11-5. However, the RAI 18.11-5 response addresses the criteria for selecting tasks rather than the requested clarification of the criteria to be used to evaluate the Human-Systems Interfaces (HSIs) that support tasks. Please clarify the criteria to be used in task support verification.

Status: GEH has not yet committed to a response date.

RAI 18.11-8 Supplement No. 1, December 14, 2007, ML073340807

Follow-up RAI based on NEDO-33226, Rev. 1: In the original RAI, the staff requested clarification as to which organization(s) are responsible for task support verification and why the evaluation appears limited to drawings and computer-generated displays. GEH's response referred to their response to RAI 18.11-2 and 18.11-5. The staff followed up indicating that those RAI's responses do not pertain to this question. However, the material is unchanged in NEDO-33226, Rev. 1.

Status: GEH has not yet committed to a response date.

RAI 18.11-13 Supplement No. 1, December 14, 2007, ML073340807

In the original RAI, the staff requested clarification of various aspects of HFE Design verification in NEDO-33226. GEH's responses and changes in Rev. 1 to items B and D were acceptable. The following questions remain:

Regarding A. Section 4.3.4.1 discusses HFE design verification for panel anthropometrics. Rather than discussing the comparison of panel characteristics to HFE guidelines, the section discusses the validation of operator actions. Thus it is unclear how the verification will be performed.

Regarding C. Section 4.3.4.3 discusses HFE design verification for HSI components. Rather than discussing the comparison of HSI characteristics to HFE guidelines, the section discusses verification criteria such as ease of monitoring and usability. Thus it is unclear how the verification will be performed. Thus, the RAI remains open.

Status: GEH has not yet committed to a response date.

RAI 18.11-19 Supplement No. 1, February 12, 2008, ML080370628

This follow-up RAI on testbeds has two parts:

1. Regarding the testbed to be used for integrated system validation, Section 3.4 of NEDO-33276 states that integrated system validation is performed using dynamic HSI prototypes and high-fidelity simulators. Section 4.3.4 describes a variety of test beds that are to be used to address the different objectives of the validation program. Three of the main simulation facilities to be used in this program are the GEH Test System, Baseline Simulator (BS), and the Full Scope Simulator (FSS), described in Sections 4.3.5.2, 4.3.5.3, and 4.3.5.4, respectively. These simulators provide incremental levels of fidelity, and the BS and FSS models are ANSI/ANS-3.5 compatible. While ANSI/ANS 3.5 compatibility provides an acceptable basis for an integrated system validation testbed as described in NUREG-0711, the BS does not provide the full control room HSI. Thus, based on the staff's validation testbed criteria in NUREG-0711, Section 11.4.3.2.2, only the FSS is suitable for implementing integrated system validation. While the other simulators can provide valuable information to GEH during their test and evaluation program, the final validation addressed in NUREG-0711 should be performed using the FSS. GEH should clarify the role of the FSS in the final validation. In addition, in response to RAI 18.10-1 GEH submitted the attachment to MFN 07-625 in which simulation capabilities are defined, including a Part Task Simulator, Full-Scope Simulator, and Site Specific Training Simulator. The BS is not included in this response. Please describe how these descriptions correspond to those provided in NEDO-33276 and provide any changes to descriptions in NEDO-33276 that may be necessary to reconcile the two documents.
2. Regarding the simulation of remote actions, Section 4.3.4.1 indicates that actions at local system control stations are evaluated using drawings or mockup panels, but no information as to what evaluations are performed or how the actions will be analyzed. This statement is in the HFE Design Verification section rather than an integrated system validation section. Beyond this statement, no information about the treatment of local actions is provided.

Please identify what remote actions are needed for the scenarios to be used in validation testing and provide information as to how these actions will be modeled and evaluated for validation.

Status: GEH has not yet committed to a response date.

RAI 18.11-21 Supplement No. 1, December 14, 2007, ML073340807

NEDO-33276, Rev 1, Section 4.4.3 generally discusses participants in validation exercises. However, several aspects of participant selections are not identified in the plan:

- how the sample of participants will account for human variability
- how minimum and normal crew configurations will be assembled and what they will consist of
- how sampling bias will be prevented

NEDO-33276 should be revised to provide the information or indicate that the detailed V&V implementation plan will address these participant sampling considerations.

Status: GEH has not yet committed to a response date.

RAI 18.11-22 Supplement No. 1, February 12, 2008, ML080370628

In RAI 18.11-4, the staff asked how the selected operational conditions were developed into scenarios. This RAI addresses the detailed definition of the scenarios so they can be run on the validation testbed. GEH's response to the original RAI indicated that specific scenario details are not included in the implementation plan as they will be developed as a part of the ESBWR design process. While in the context of a programmatic review, the staff agreed that this level of detail would be premature at this point in the process, GEH should provide this information if the staff is to conduct an Implementation Plan level review. The descriptions should provide sufficient detail so they can be reviewed using the criteria in NURGE-0711, Section 11.4.3.2.4.

Status: GEH has not yet committed to a response date.

RAI 18.11-23 Supplement No. 1, February 12, 2008, ML080370628

In the original RAI, the staff requested information on measurement characteristics. GEH's response to the RAI indicated that the level of detail in the implementation plan was not intended to discuss measurement characteristics. GEH should provide this information on applicable measurement characteristics, such as reliability and validity, for all performance measures identified in response to RAI 18.11-24 so the staff is able to conduct an Implementation Plan level review (consistent with NUREG-0711, Section 11.4.3.2.5.1).

Status: GEH has not yet committed to a response date.

RAI 8.11-24 Supplement No. 1, February 12, 2008, ML080370628

In the original RAI, the staff requested information on the selection of performance measures. For the staff to perform an implementation plan review, GEH should identify the hierarchical set of performance measures (including plant/system level performance, operator task performance, situation awareness, operator workload, and anthropometric/physiological factors) that will be used in validation tests. The response should provide a clear picture of the range of measures to be used (consistent with NUREG-0711, Section 11.4.3.2.5.2). GEH's response to this RAI should consider the specific issues identified in the original RAI in RAI Letter 74.

GEH should also consider questions on specific performance measures based on the RAI response in MFN 06-446, dated November 11, 2006:

- Operator task measures: The response addresses how operator tasks for validation will be selected. Please address how performance on selected tasks will be measured.
- Situation awareness: The response discusses how situation awareness will be measured. The Situation Awareness Control Room Inventory (SACRI) method is discussed in NEDO-33276, Rev 1 but not in the RAI response. Please discuss the performance measures that will be used with the SACRI method.
- Operator Workload: The response indicates that workload rating scales will be used and will be integrated by converting the ratings into a "fraction of the time involved over the simulated event." How will such a conversion be performed?

Status: GEH has not yet committed to a response date.

RAI 18.11-25 Supplement No. 1, December 14, 2007, ML073340807

GEH's response to the RAI and NEDO-33276, Rev. 1, provided some clarification of how automation will be addressed, but the procedures and displays aspects of this RAI were not clarified. Please provide additional clarification.

Status: GEH has not yet committed to a response date.

RAI 18.11-26 Supplement No. 1, February 12, 2008, ML080370628

In the original RAI, the staff requested information on specific acceptance criteria for performance measures. For the staff to perform an implementation plan review, GEH should identify the criteria to be used for performance measures (consistent with NUREG-0711, Section 11.4.3.2.5.3). The specific criteria that is used for decisions as to whether the design is validated or not should be specified and distinguished from those being used to better understand the results. In addition, GEH should identify the basis for the criteria established. Note that the question of acceptance criteria is related to the discussion in RAI 18.11-29.

Status: GEH has not yet committed to a response date.

RAI 18.11-27 Supplement No. 1, February 12, 2008, ML080370628

In the original RAI the staff requested the detailed test design methodology. In NEDO-33276, Rev. 1, GEH added a new section 4.4.9 to present a high level description of test design. However, GEH should provide the detailed information requested if the staff is to conduct an Implementation Plan level review. Please provide descriptions of the following aspect of test design (consistent with NUREG-0711, Section 11.4.3.2.6):

- presentation of scenarios to crews
- test procedures
- training of test conductors
- training of test participants
- pilot studies.

Status: GEH has not yet committed to a response date.

RAI 18.11-28 Supplement No. 1, December 14, 2007, ML073340807

GEH has not addressed the staff's concern regarding scenario reuse. Further, Section 4.4.9.1, of NEDO-33226, Rev. 1, discusses the presentation of scenarios to crews, but does not address how scenarios will be assigned to crews or scenario sequencing. Please provide a high-level discussion of scenario sequencing and address the staff's concern about scenario reuse.

Status: GEH has not yet committed to a response date.

RAI 18.11-29 Supplement No. 1, February 12, 2008, ML080370628

To support the staff's review of the implementation plan, please describe (consistent with NUREG-0711, Section 11.4.3.2.7):

- what methods will be used to analyze data and to assess performance criteria
- how HEDs will be identified
- how consistency across different measures will be evaluated
- how data analysis will be verified for correctness

NEDO-33276, Rev. 1, Section 4.4.8, contains high-level information about data analysis. Please clarify the following information in Section 4.4.8:

The methods for analyzing the simulation results will draw from experience in EPRI OER program as summarized in EPRI NP-6560L, which provides estimates of the median response time and the standard deviation associated with different types of cue response as measures of consistency between crews and individuals. Acceptability of the MMIS clarity is that standard deviation falls within the ranges of responses demonstrated in existing plant simulations for multiple crews. For larger deviations between crews an examination of the MMIS for improvement is documented in an HED.

This does not seem to be an appropriate means of analyzing validation data. Assuming there will be sufficient data to generate reliable statistics; the analysis is based on response variability and a comparison of that variability to the range of responses demonstrated in existing plant

simulations. The approach seems to focus on variability alone, and not the acceptability of performance, e.g., are required tasks performed within an acceptable time for plant safety.

It would seem the approach to analyzing data should focus on whether observed integrated system performance (as defined by the set of performance measures selected for use in validation) is acceptable (as defined by the acceptance criteria for each of the performance measures). Please provide an explanation of the approach to data analysis in light of the staff's concern.

Note that the question of acceptance criteria is related to the discussion in RAI 18.11-26.

Status: GEH has not yet committed to a response date.

RAI 18.11-32 Supplement No. 1, December 14, 2007, ML073340807

Section 4.6 NEDO-33226, Rev. 1, describes the resolution process for addressing HFE issues identified in V&V. The process is depicted graphically in Figure 4. GEH's process considers the impact on human performance and risk importance of issues from both quantitative (PRA) and qualitative perspectives. Where issues are found to qualitatively impact risk, the methodology seeks to determine if they can be addressed in PRA. While the methodology appears generally complete, there are three points of clarification requested.

- A. Is there a provision for justifying a discrepancy, e.g., deviation from the style guide with justification?
- B. In Figure 4, at decision point 4, "Does Issue Meet Style Guide Requirements," actions are described for answering the question as "yes" or "no." However, for some issues meeting the style guide requirements is irrelevant. For example, an issue may be identified in integrated system validation, that a task could not be completed in time due to operator workload. In this case, the style guide requirements are not likely to be related to the issue. Instead, task reallocation to other personnel or automation may be the solution. Why is there no path to follow when the analyst concludes the issue is not related to style guide compliance?
- C. Another point of clarification relates to the final solutions identified. They appear to be overly restrictive. For example, if an issue cannot be addressed in PRA, the analyst is guided to consider changing training, procedures, or staffing/qualifications. However, as in the example above, task redesign or increased automation may be warranted. Are the proposed solutions limited to those shown in the figure?

Status: GEH has not yet committed to a response date.

RAI 18.11-35, December 14, 2007, ML073340807

The material in DCD Tier 2, Section 18.11, is not completely consistent with NEDO-33276, Rev. 1. For example, the DCD discusses HED identification and resolution, while no such language is used in the NEDO. Also, the DCD does not reference the V&V implementation plan. Please update the DCD accordingly.

Status: GEH has not yet committed to a response date.

RAI 18.11-36, December 6, 2007, ML073381170

Please add a COL action item as follows, or alternatively, GEH is requested to provide the requested information as part of the design certification scope: The COL applicant shall develop a detailed HFE V&V implementation plan that provides the methodology and procedures for operation condition sampling, design verification, integrated system validation, and human engineering discrepancy resolution. The plan shall be submitted to the NRC staff for review using the review criteria contained in NUREG-0711, Section 11.

Status: GEH has not yet committed to a response date.

RAI 18.11-37, January 14, 2008, ML080090684

DCD Revision 4, Section 18.11, Human Factors Verification and Validation does not reference the V&V implementation plan (NEDO-33276) in the discussion of V&V implementation in Section 18.11.1. NEDO-33276 should be referenced in Section 18.11.1. NEDE 33217P should not be referenced. Note that NEDO-33276 is included in the references listed in Section 18.11.4. (The issue of referencing the implementation plans existed with the earlier version of the DCD and has been corrected in the other HFE program elements.)

Status: GEH has not yet committed to a response date.

RAI 18.12-2 Supplement No. 1, December 14, 2007, ML073340807

A question was raised in the original RAI concerning the acceptance criteria for final design verification. In GEH's response, they indicated the criteria are derived from the "ESBWR style guide," which is included in the "HF Guidance manual." NEDO-33278, Rev. 2, states that the criteria for final design verification will be derived from an "HSI Report." Please clarify what specific document will be used for the criteria to determine that the as-built design is acceptable.

Status: GEH has not yet committed to a response date.

RAI 18.12-3 Supplement No. 1, December 14, 2007, ML073340807

GEH's response to RAI 18.12-2 indicates that the style guide will provide acceptance criteria. The staff expects these criteria to be applied by verifying that the as-built design conforms to these criteria. The staff expected the verification to be made using the HFE Style Guide. Yet GEH's response to this RAI discusses procurement documents and the HSI Report. Please explain in more detail the HSI Report and the acceptance criteria for the final design implementation verification.

NEDO-33278, Rev. 2, describes a final design verification methodology that appears to be based on a review of documentation rather than a review of the actual as-built design. Section 3.1.4, "General Approach" indicates that the review is conducted on documents. The individual implementation sections are all consistent with this general approach and focus on documents, not the implemented design. As per NUREG-0711, Section 12.4.6, criterion 2, it should be the design itself; as-built that is verified against the design documentation. Verifying documents with documents only establishes that the documents are in agreement, not that the controls and displays in the control room are in agreement with the design documentation. Provide justification of the proposed approach to address this concern.

Status: GEH has not yet committed to a response date.

RAI 18.12-4 Supplement No. 2, December 14, 2007, ML073340807

GEH's RAI response acceptably addressed the role of the COL and GEH as part of the HFE team. However, in reviewing NEDO-33278, Rev. 2 of the plan two follow up questions were identified.

- (1) Section 1.2 of the plan describes a somewhat different organization than was identified in the RAI response. It states that the verifications are the responsibility of the COLOG. Will the COLOG be the COL license applicant?
- (2) Section 1.2 of the plan indicates that the verifications described for the plan "apply to the initial COL plants associated with the ESBWR design effort." The staff's position is that "as-built" verifications are needed for every new plant construction. Please explain why only the initial plants will be verified.

Status: GEH has not yet committed to a response date.

RAI 18.12-7, December 14, 2007, ML073340807

Design implementation activities are described in DCD Tier 2, Section 18.12. The Tier 2 description is not fully consistent with NEDO-33278, Rev 2, and should be revised. Note that the resolution of other remaining open 18.12 RAIs may necessitate additional revisions to the DCD.

Status: GEH has not yet committed to a response date.

DC GE - ESBWR Mailing List

(Revised 02/14/2008)

cc:

Ms. Michele Boyd
Legislative Director
Energy Program
Public Citizens Critical Mass Energy
and Environmental Program
215 Pennsylvania Avenue, SE
Washington, DC 20003

W. Craig Conklin, Director
Chemical and Nuclear Preparedness &
Protection Division (CNPPD)
Office of Infrastructure Protection
Department of Homeland Security
Washington, DC 20528

Mr. Marvin Fertel
Senior Vice President
and Chief Nuclear Officer
Nuclear Energy Institute
1776 I Street, NW
Suite 400
Washington, DC 20006-3708

Mr. Ray Ganthner
Senior Vice President
AREVA, NP, Inc. 3315
Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935

Vanessa E. Quinn, Acting Director
Technological Hazards Division
National Preparedness Directorate
Federal Emergency Management Agency
500 C Street, NW
Washington, DC 20472

Email

APH@NEI.org (Adrian Heymer)
art.alford@ge.com (Art Alford)
awc@nei.org (Anne W. Cottingham)
bennettS2@bv.com (Steve A. Bennett)
bevans@enercon.com (Bob Evans)
bob.brown@ge.com (Robert E. Brown)
BrinkmCB@westinghouse.com (Charles Brinkman)
chris.maslak@ge.com (Chris Maslak)
CumminWE@Westinghouse.com (Edward W. Cummins)
cwaltman@roe.com (C. Waltman)
dan1.williamson@ge.com (Dan Williamson)
david.hinds@ge.com (David Hinds)
david.lewis@pillsburylaw.com (David Lewis)
David.piepmeyer@ge.com (David Piepmeyer)
dennis.chin@ge.com (Dennis Chin)
dlochbaum@UCSUSA.org (David Lochbaum)
don.lewis@ge.com (Don Lewis)
erg-xl@cox.net (Eddie R. Grant)
Eugene_Grecheck@dom.com (Eugene S. Grecheck)
frankq@hursttech.com (Frank Quinn)
Frostie.white@ge.com (Frostie White)
gcesare@enercon.com (Guy Cesare)
george.honma@ge.com (George Honma)
george.stramback@gene.ge.com (George Stramback)
george.wadkins@ge.com (George Wadkins)
GovePA@BV.com (Patrick Gove)
greshaja@westinghouse.com (James Gresham)
gzinke@entergy.com (George Alan Zinke)
hickste@earthlink.net (Thomas Hicks)
james.beard@gene.ge.com (James Beard)
jcurtiss@winston.com (Jim Curtiss)
jeff.waal@ge.com (Jeff Waal)
jgutierrez@morganlewis.com (Jay M. Gutierrez)
jim.kinsey@ge.com (James Kinsey)
jim.riccio@wdc.greenpeace.org (James Riccio)
jim.rogers@ge.com (Jim Rogers)
JJNesrsta@cpsenergy.com (James J. Nesrsta)
joel.Friday@ge.com (Joel Friday)
John.O'Neill@pillsburylaw.com (John O'Neill)
john.sorensen@ge.com (John Sorensen)
Joseph_Hegner@dom.com (Joseph Hegner)
junichi_uchiyama@mnes-us.com (Junichi Uchiyama)
kathy.sedney@ge.com (Kathy Sedney)
kathy.warnock@ge.com (Kathy Warnock)
kenneth.ainger@exeloncorp.com (Kenneth Ainger)
kimberly.milchuck@ge.com (Kimberly Milchuck)
KSutton@morganlewis.com (Kathryn M. Sutton)

kurt.schaefer@ge.com (Kurt Schaefer)
kwaugh@impact-net.org (Kenneth O. Waugh)
laura.bello@ge.com (Laura Bello)
lou.lanese@ge.com (Lou Lanese)
maria.webb@pillsburylaw.com (Maria Webb)
mark.beaumont@wsms.com (Mark Beaumont)
Marvin.Smith@dom.com (Marvin L. Smith)
matias.travieso-diaz@pillsburylaw.com (Matias Travieso-Diaz)
media@nei.org (Scott Peterson)
mgiles@entergy.com (M. Giles)
mike_moran@fpl.com (Mike Moran)
mwetterhahn@winston.com (M. Wetterhahn)
nirsnet@nirs.org (Michael Mariotte)
PAC2@nrc.gov (Peter Cochran)
pareez.golub@ge.com (Pareez Golub)
Pat.Woodfin@ge.com (Pat Woodfin)
patriciaL.campbell@ge.com (Patricia L. Campbell)
paul.gaukler@pillsburylaw.com (Paul Gaukler)
Paul@beyondnuclear.org (Paul Gunter)
peter.jordan@ge.com (Peter Jordan)
phinnen@entergy.com (Paul Hinnenkamp)
pshastings@duke-energy.com (Peter Hastings)
randy.newton@ge.com (Randy Newton)
RJB@NEI.org (Russell Bell)
RKTemple@cpsenergy.com (R.K. Temple)
roberta.swain@ge.com (Roberta Swain)
sandra.sloan@areva.com (Sandra Sloan)
SauerB@BV.com (Robert C. Sauer)
sfrantz@morganlewis.com (Stephen P. Frantz)
sharon.lyons@ge.com (Sharon Lyons)
steven.hucik@ge.com (Steven Hucik)
steven.stark@ge.com (Steven Stark)
tjh2@nrc.gov (Thomas Herrity)
tom.miller@hq.doe.gov (Tom Miller)
trsmith@winston.com (Tyson Smith)
VictorB@bv.com (Bill Victor)
Wanda.K.Marshall@dom.com (Wanda K. Marshall)
waraksre@westinghouse.com (Rosemarie E. Waraks)
wayne.marquino@ge.com (Wayne Marquino)
whorin@winston.com (W. Horin)