December 5, 2007

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: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 119 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Brown:

By letter dated August 24, 2005, GE-Hitachi Nuclear Energy Americas, LLC (GEH) submitted an application for final design approval and standard design certification of the economic simplified boiling water reactor (ESBWR) standard plant design pursuant to 10 CFR Part 52. The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed design.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter.

To support the review schedule, you are requested to provide the requested additional information within 45 days of the date of this letter.

If you have any questions or comments concerning this matter, you may contact me at 301-415-6256 or djg3@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or aec@nrc.gov.

Sincerely,

/RA/

Dennis Galvin, Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure:
Request for Additional Information

cc w/encl: See next page

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Senior Vice President, Regulatory Affairs
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Dennis Galvin, Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
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Docket No. 52-010

Enclosure: Request for Additional Information
cc: See next page
Distribution: See next page
ACCESSION NO: ML073390629 Template: NRR-084

OFFICE	NGE1	NGE1/BC
NAME	ACubbage	MShuaibi
DATE	12/5/2007	12/5/2007

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 119 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

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Requests for Additional Information (RAIs)
ESBWR Design Control Document (DCD)

RAI Number	Reviewer	Question Summary	Full Text
9.2-15 Supplement 1 (MFN 07-591, November 8, 2007)	Li C	Describe how water hammer has been addressed in the CWS	The information referred in the RAI response cannot be found in the DCD for Chilled Water System (CWS). There is no mention of water hammer mitigation in DCD Tier 2 Revision 4, Sections 9.2.7.2 and 9.2.7.5. Section 9.2.7.2 states that the surge tank is designed for thermal expansion. Section 9.2.7.5 discusses the instrumentation requirements, which have nothing to do with water hammer. The operation and maintenance procedures for mitigating water hammer for the CWS cannot be found in the two referenced sections. In its RAI response, GEH stated that there are no DCD changes needed. However, water hammer mitigation for CWS is not addressed in the DCD. Therefore, the RAI response is not acceptable. Furthermore, it is not clear whether the CWS has any high point venting in the design and how the surge tank alone is adequate for mitigating water hammer.
9.3-40 Supplement 1 (MFN 07-527, October 17, 2007)	Shum A	Address whether the failure of the ABS would adversely affect safety-related systems.	The response to the RAI is incomplete. Please address in the RAI response and in the DCD whether the failure of the Auxiliary Boiler System (ABS) as a result of a pipe break or malfunction of the system would adversely affect safety-related systems or associated components and instrumentations. Please clarify the apparent difference between the RAI response and DCD Tier 2, Revision 4, Section 9.3.12.3. The response to item (c) in the RAI indicates that failure of the ABS piping may impact safety-related sensors. DCD Tier 2, Revision 4, Section 9.3.12.3 states, “High-energy pipe rupture analysis is not required for the ABS because none of the lines pass through areas where safety-related equipment is located.”

Enclosure

RAI Number	Reviewer	Question Summary	Full Text
9.5-60 Supplement 1 (MFN 07-401, July 31, 2007)	Pal A	Clarify remote shutdown area emergency lighting and use of 72-hour safety-related UPS.	Clarify remote shutdown area emergency lighting and use of 72-hour safety-related uninterruptible power supply (UPS). 1. In Tier 2, Revision 4, Section 9.5.3.3.3.2, GEH stated that "In areas outside the MCR and remote shutdown area, emergency lighting is provided by 8-hour, self-contained, battery packs, sealed beam lighting units." In response to RAI 9.5-60, GEH stated that "emergency lighting in areas outside the main control room such as remote shutdown room is accomplished by 8-hour, self contained, battery pack, sealed-beam lighting units." Provide justification for not providing an emergency lighting capacity of 72 hours at the remote shutdown rooms such that the emergency lighting capability in these rooms is equivalent to that in the main control room. Also, provide a discussion about the emergency lighting in remote shutdown area in DCD Tier 2, Section 9.5.3.3.3. 2. In response to RAI 9.5-60, GEH stated that the 72-hour Class 1E UPS is utilized for safety-related Distributed Control and Information System (DCIS) system, instrumentation required for regulatory compliance and the main control room emergency lighting. However, Tier 2, Revision 4, Sections 9.5.3.3.3 and 9.5.3.3.3.1 indicate that only control room emergency lighting power is supplied from four divisions of 72-hour safety-related UPS. Clarify the difference.
18.8-2 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Provide step-by-step, specific guidance on how to perform the human-system interface (HSI) design.	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

RAI Number	Reviewer	Question Summary	Full Text
			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 that document(s) before the 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 the 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, Revision2 (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?

RAI Number	Reviewer	Question Summary	Full Text
			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.
18.8-8 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Clarify the use of old document versions.	In the original RAI, the staff noted that the 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.
18.8-16 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Will ESBWR have computer-based Alarm Response Procedures (ARPs)?	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 annunciated 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.

RAI Number	Reviewer	Question Summary	Full Text
18.8-17 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	What database is referred to in NEDO-33268, Page 20?	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.
18.8-18 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Clarify statement on controls, NEDO-33268, Page 62.	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, Revision2, Section 4.3.4.9, as Item 3 (on Page 62). Please clarify this statement.
18.8-31 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Clarify the terms used and provide a consistent discussion regarding tools, techniques, methods and procedures for the HSI Design.	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.

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18.8-32 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Clarify use of the criteria listed in NEDO-333268, Section 3.	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"?
18.8-33 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 7, 2007)	Bongarra J	Clarify list of HFE activities provided in Figure 4, NEDO-33268, Page 95.	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 the "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.
18.8-35 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Provide description of methods of evaluation listed in NEDO-33268, Section 3.3.5.6.	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.

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18.8-41 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Clarify design inputs listed in NEDO-33268, Figure 3.	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.
18.8-49 Supplement 1 (MFN 07-076, NEDO-33268 Rev-2, March 29, 2007; MFN 06-443, November 20, 2006; MFN 07-334, June 27, 2007)	Bongarra J	Consistency of HSI Design DCD Tier 2 and the Plan	The HSI Design process is described in Section 18.8 of DCD Rev 3. The described process in 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.
18.8-50	Bongarra J	Concept of Operations Development	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.
18.8-51	Bongarra J	Functional Requirements Development	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 inSection 5, Results.

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18.8-52	Bongarra J	Design for Risk-Important Human Actions	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.
18.8-53	Bongarra J	Developing Requirements for Monitoring and Control	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.
18.8-54	Bongarra J	Layout of HSIs	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.
18.8-55	Bongarra J	Performance during Varying Staffing Levels	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.
18.8-56	Bongarra J	Use of HSIs Over a Shift	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.
18.8-57	Bongarra J	Use of HSIs Under a Full Range of Environmental Conditions	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.
18.8-58	Bongarra J	HSI support for Test, Inspection, and Maintenance	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.

RAI Number	Reviewer	Question Summary	Full Text
18.8-59	Bongarra J	HSI Test And Evaluation Methodology	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?

DC GE - ESBWR Mailing List

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
AREVA, Framatome ANP, 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)
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)
dlochbaum@UCSUSA.org (David Lochbaum)
don.lewis@ge.com (Don Lewis)
erg-xl@cox.net (Eddie R. Grant)
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)
jgutierrez@morganlewis.com (Jay M. Gutierrez)
jim.kinsey@ge.com (James Kinsey)
jim.riccio@wdc.greenpeace.org (James Riccio)
JJNesrsta@cpsenergy.com (James J. Nesrsta)
joel.Friday@ge.com (Joel Friday)
john.o'neil@pillsburylaw.com (John O'Neil)
john.sorensen@ge.com (John Sorensen)
Joseph.savage@ge.com (Joseph Savage)
Joseph_Hegner@dom.com (Joseph Hegner)
junichi_uchiyama@mnes-us.com (Junichi Uchiyama)
kathy.sedney@ge.com (Kathy Sedney)
kenneth.ainger@exeloncorp.com (Kenneth Ainger)
KSutton@morganlewis.com (Kathryn M. Sutton)
kurt.schaefer@ge.com (Kurt Schaefer)
kwaugh@impact-net.org (Kenneth O. Waugh)
lou.lanese@ge.com (Lou Lanese)
lynchs@gao.gov (Sarah Lynch - Meeting Notices Only)
MaddenG@BV.com (George Madden)
Margaret.Bennet@dom.com (Margaret Bennet)

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)
RJB@NEI.org (Russell Bell)
RKTemple@cpsenergy.com (R.K. Temple)
roberta.swain@ge.com (Roberta Swain)
ronald.hagen@eia.doe.gov (Ronald Hagen)
sandra.sloan@areva.com (Sandra Sloan)
SauerB@BV.com (Robert C. Sauer)
sfrantz@morganlewis.com (Stephen P. Frantz)
sharon.lyons@ge.com
steven.hucik@ge.com (Steven Hucik)
steven.stark@ge.com (Steven Stark)
tom.miller@hq.doe.gov (Tom Miller)
trsmith@winston.com (Tyson Smith)
VictorB@bv.com (Bill Victor)
waraksre@westinghouse.com (Rosemarie E. Waraks)
wayne.marquino@ge.com (Wayne Marquino)
whorin@winston.com (W. Horin)