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MFN 06-298
Supplement 5

Docket No. 52-010

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U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555-0001

Subject: Response to Portion of NRC Request for Additional Information Letter No. 124 Related to ESBWR Design Certification Application, Seismic Category I Structures, RAI Numbers 3.8-5 S03 and 3.8-9 S03

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) sent by NRC letter dated January 14, 2008 (Reference 1). Previous NRC requests and GEH responses were transmitted via references 2 through 5. RAI Numbers 3.8-5 S03 and 3.8-9 S03 are addressed in Enclosure 1.

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

Sincerely,

James C. Kinsey

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Vice President, ESBWR Licensing

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References:

1. MFN 08-029, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 124 Related To ESBWR Design Certification Application*, January 14, 2008

2. MFN 06-298, Supplement 3, Letter from James C. Kinsey, GEH, to U.S. Nuclear Regulatory Commission, *Response to NRC Request for Additional Information Related to ESBWR Design Certification Application – Structural Analysis - RAI Numbers 3.8-5 S02 and 3.8-9 S02 – DCD Section 3.8 – Structural Analysis,* August 13, 2007

3. MFN 06-298, Supplement 1, Letter from James C. Kinsey, GEH, to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 38 Related to ESBWR Design Certification Application – Structural Analysis - RAI Numbers 3.8-1 S01, 3.8-2 S01, 3.8-4 S01, 3.8-5 S01, 3.8-7 S01, 3.8-9 S01, 3.8-10 S01, 3.8-12 S01, 3.8-15 S01, 3.8-29 S01, 3.8-30 S01, 3.8-31 S01, 3.8-42 S01, 3.8-52 S01, 3.8-53 S01, 3.8-54 S01, 3.8-58 S01, 3.8-60 S01, 3.8-61 S01, 3.8-67 S01, 3.8-70 S01, 3.8-71 S01, 3.8-72 S01, 3.8-74 S01 & 3.8-98 S01,* January 29, 2007

4. MFN 06-298, Letter from David H. Hinds, GEH, to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 38 Related to ESBWR Design Certification Application – Structural Analysis - RAI Numbers 3.8-1, 3.8-2, 3.8-4, 3.8-5, 3.8-7 through 3.8-12, 3.8-15, 3.8-16, 3.8-21, 3.8-22, 3.8-29 through 3.8-31, 3.8-39, 3.8-42, 3.8-43, 3.8-45, 3.8-50, 3.8-52 through 3.8-55, 3.8-57, 3.8-58, 3.8-60, 3.8-61, 3.8-66 through 3.8-68, 3.8-70 through 3.8-72, 3.8-74, 3.8-75, 3.8-78, and 3.8-98,* August 31, 2006

5. MFN 06-197, Letter from U.S. Nuclear Regulatory Commission to Mr. David H. Hinds, GEH, *Request for Additional Information Letter No. 38 Related to ESBWR Design Certification Application*, June 23, 2006

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 124 Related to ESBWR Design Certification Application – Seismic Category I Structures, RAI Numbers 3.8-5 S03 and 3.8-9 S03

cc:	AE Cubbage	USNRC (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	eDRF	0000-0079-9382

ENCLOSURE 1

MFN 06-298, SUPPLEMENT 5

Response to Portion of NRC Request for Additional Information Letter No. 124 Related to ESBWR Design Certification Application [1]

Seismic Category I Structures

RAI Numbers 3.8-5 S03 & 3.8-9 S03

[1] Original Response, Supplement 1 and Supplement 2 previously submitted under MFNs 06-298, 06-298S1 and 06-298S3 without DCD updates are included to provide historical continuity during review.

NRC RAI 3.8-5

a) *DCD Section 3.8.1.2.2 and Table 3.8-9 indicate that ASME BPVC – 2004 is used for the design, fabrication, construction, testing, and in-service inspection of the concrete containment. The 2004 edition of the Code has not as yet been endorsed by the NRC; however, the 1989 edition was reviewed and accepted during the advanced boiling water reactor (ABWR) review process. Please provide a description of the differences between these two editions of the Code that are applicable to the design of the ESBWR containment (e.g., Subsections CC, NCA, and NE).*

b) *Assuming that the staff accepts the implementation of ASME Code 2004 edition for design of the ESBWR containment, the staff considers any deviation from the ASME Code 2004 edition for the design and construction of the containment would require NRC review and approval prior to implementation. This needs to be stated in Sections 3.8.1 and 3.8.2.*

c) *Since DCD Section 3.8.1.2.3 does not reference Regulatory Guide (RG) 1.94 (item 29 in Table 3.8-9), provide a discussion of how the provision of ANSI N45.2.5 and RG 1.94 are incorporated in the referenced codes and standards.*

GE Response

a) The differences between 1989 edition and 2004 edition (including the addenda after 1989 edition) of the ASME Section III Code for Subsections CC, NCA, and NE are summarized in two tables. One table presents the reduction in requirements due to the change from 1989 edition to the editions after 1989, while the other table presents the increase in requirements due to the change. When the requirements are reduced, a column called "Comments" at the end of the table summarizes those changes accepted by the USNRC and those that have not been endorsed. When the requirements are increased, the design is more conservative and meets 1989 edition requirements.

The changes found in the table of reduction in requirements not endorsed by the USNRC, which are applicable to the ESBWR design, need NRC review and approval. They are:

(1) Item III-1-A97 (96-250), Table NE-4622.7(b)-1, Exemption from PWHT

(2) Item III-1-A95 (94-316), NE-3221.1(c)(1), Stress Intensity Values

(3) Item III-2-A04, III-2 (BC03-472), CC-4331.2(b)(6) etc. (See Table), Cold Rolled Parallel Threaded Splices

(4) Item III-2-A02 (BC01-698), CC-4542.1 and CC-4542.2, Back-up Bars

(5) Item III-2-A01 (2001 Edition, BC00-182), CC-4333.2.3 Splicing of Reinforcing Bars-Performance Tests

(6) Item III-2-A01 (2001 Edition, BC00-183), Table CC-4552-2 Postweld Heat Treatment Exemptions

(7) III-2-A01 (2001 Edition, BC00-357), CC-5531.2, Extent of Examination

(8) III-2-A95 (94-306), CC-4331.2(b)(5) etc. (See Table), Splicing of Reinforcing Bars

(9) III-2-A91 (91-212), CC-3421.4.1(c) etc. (See Table), Evaluation of Membrane Stress

(10) III-2-A91 (91-222), CC-4321.1(c), CC-4321.2, CC-4322(a), Bending of Reinforcing Bar

(11) III-2-A91, Table I-2.2, Material for Concrete Containment Vessel Liner - Remove limitations on the use of SA-738, Grade B

(12) III-2-A90 (89-332), CC-4321.2, Bending of Reinforcing Bar

(13) III-2-A90 (90-174), CC-4240(c), CC-4240(d), CC-4260, Cold Weather Concrete Placement

No DCD change was made in response to this item.

b) There are no deviations from ASME Code 2004 edition for the design and construction of the ESBWR containment; therefore, no revisions to the DCD were necessary in response to this item.

c) Markup of DCD Subsection 3.8.1.2.3 to include item 29 as well as 31 and 33 of DCD Table 3.8-9 was provided under MFN 06-298.

Table 3.8-5(1) Reductions in Requirements from 1989 Edition to 2004 Edition

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
III-1-A99 (BC98-563) (2/99)	NCA-1140(a)(2) Code Edition and Addenda Permitted for Construction	This revision permits the use of the latest Edition and Addenda endorsed by the regulatory authority having jurisdiction at the plant site at the time the construction permit application is docketed. This change incorporates the provisions of Case N-608, "Applicable Code Edition and Addenda, NCA-1140(a)(2), Section III, Division 1."	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A97 (97-200)	NCA-8320, NCA-8321, NCA-8322 Use of N-Symbol Stamp at Field Locations	This revision rewrites the paragraph to clarify the provisions by placing the requirements in two paragraphs. NCA-8322 addresses the application of the Stamp in the field without requiring extension of the Certificate of Authorization to the site, when only a pressure test is involved. The change also addresses subcontracting the pressure test.	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A04 (BC03-765)	NE-3352.2(b), NE-5280(b) Examination of Category B Butt Welds in Electrical Penetrations	This revision provides for the use of liquid penetrant examination or magnetic particle examination of root pass and the surface of the completed weld as an alternative to the radiographic examination requirements for Category B butt welds in electrical penetration assemblies. It also adds an allowable stress reduction factor and limits the base materials that can be used to P-No. 1 materials. The revision incorporates the provisions of Case N-505, "Alternative Rules for the Examination of Butt Welds Used as Closure Welds for Electrical Penetration Assemblies in Containment Structures, Section III, Division 1."	These provisions have been accepted by the USNRC, in Case N-505, in Regulatory Guide 1.84, Rev. 33.
III-1-A02 (BC00-771)	NE-2331, NE-2431, NE-4335 Impact Testing of Heat Affected Zone (HAZ)	Changes in steel making technology have enabled materials to be supplied with much better impact toughness properties than in the past. One problem associated with this is that it does not take much heat input to reduce the toughness of the HAZ to levels below the unaffected base material. This results in the need for more testing and test coupons. This revision allows three methods of qualifying the HAZ. 1) An upward adjustment of RT_{NDT}, which was the original basic method. 2) Downward adjustment in test temperature, which is currently permitted, but	These provisions have been accepted by the USNRC, in its endorsement of the 2002 Addenda of Section III, Subsections NB, NC, and ND

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
		requires many tests for the development of the transition curves. This is difficult when using existing materials, without enough coupons. 3) Evaluation of actual material impact toughness test data with an adjustment upward of the toughness acceptance criteria to compensate for the loss of toughness shown on the Welding Procedure Specification (WPS). This can be used with existing material or new material. These changes include a 15F penalty without further test data. This alternative is based on many years of testing. An exemption is also provided for gas tungsten arc welding (GTAW) weld metal with a maximum of two layers for the HAZ.	
III-1-A02 (BC01-613)	Table NE-2121(a)-1 Addition of SA-738 Material	This revision permits the use of SA-738, Grade B material for construction of containment vessels. This material is a P-1, Group 3 ferritic material. The change incorporates the provisions of Case N-655, "Use of SA-738, Grade B for Metal Containment Vessels, Class MC, Section III, Division 1."	These provisions have been accepted by the USNRC, in its endorsement of the 2002 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A00	NE-4000 Standard Weld Procedure Specifications (SWPS)	Standard Weld Procedures Specifications were added to Section IX in the A00 Addenda. These SWPSs are acceptable for use in Section III by reference to Section IX. Highlights of the Section IX (QW-500) requirements are: 1) Not all AWS SWPSs are permitted. 2) A demonstration test coupon must be welded and tested; QW-520 lists specific information that must be recorded as part of the demonstration. 3) SWPSs must be used exactly as they are written; there are no "nonessential variables" when using SWPS. 4) The applicable fabrication document (i.e., construction code, customer specification, etc.) and the demonstration test number must be shown on the SPWS, and it must be signed and dated by the manufacturer or contractor.	These provisions have been accepted by the USNRC, in its endorsement of the 2000 Addenda of Section III, Subsections NB, NC, and ND.

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
III-1-A99 (BC98-414) (12/98)	NE-3226, NE-6221 Test Limits	The purpose of this revision is to remove inconsistencies in the rules for testing. The change provides that a stress analysis for the test condition is not required unless the test pressure at some point in the vessel exceeds the required test pressure by more than six percent. For Class 1 components, the change reduces the pneumatic test pressure from 1.2 to 1.1 times the design pressure. The change also reduces the hydrostatic test pressure for Class 2 and 3 components from 1.5 to 1.25 times the design pressure, and the pneumatic test pressure from 1.25 to 1.1 times the design pressure. For Class MC containment vessels, the hydrostatic test pressure was reduced from 1.35 to 1.2 times the design pressure. These changes compensate for the reduction in design factor from 4 to 3.5 that was made to increase allowable stresses in Section II, Part D, Table 1A and Table 1B for Class 2 and 3 components. The pneumatic test pressure for containment vessels was not changed.	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A99 (BC98-571) (2/99)	NE-5279, NE-5280 Special Exemptions to Radiography	Previously these paragraphs provided rules for special exemptions to radiographic examination when weld joint details did not permit a meaningful examination. This revision changes the requirements to be consistent for all subsections. The effect of the change is to allow exceptions to radiography whenever radiographic examination is not practical.	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NB, NC, and ND.
II-D-A99 (BC98-165)	TABLE 1A, TABLE 1B STRESS TABLES Reduced Design Factor	This revision significantly increased all allowable stress values in these tables by reducing the design factor on tensile strength from 4 to 3.5. There was no change in the factor on yield strength, so not all allowable stresses are changed. The increase in allowable stress decreases as the design temperature increases. The increase in allowable stress is not dependent on any change in design formulas, nondestructive examination, or material properties. The main reason for the change is to be more consistent with the allowable stresses used in Europe and other parts of the world. The change will make the use of the ASME Code more competitive in the	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NC and ND.

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
		international market on an economical basis. This change incorporates the provisions of Case 2278, "Alternative Method for Calculating Maximum Allowable Stresses Based on a Factor of 3.5 on Tensile Strength, Section II and Section VIII, Division 1," Case 2290, "Alternative Maximum Allowable Stresses Based on the Factor of 3.5 on Tensile Strength, Section II, Part D, and Section VIII, Division 1," and Case 2284, "Alternative Maximum Allowable Stresses for Section I Construction Based on a Factor of 3.5 on Tensile Strength, Section I." To make this change, all of the Stress Tables were reviewed, and many changes were made to correct chemistry designations, product forms, external pressure chart references, heat treatments, and Notes. Also, many stress lines were merged. Changes to the Stress Tables, not directly associated with the change in the design factor used to determine allowable stresses, are identified with separate comments. In a number of places, the Summary of Changes printed with the Addenda identified materials as being deleted that were not. It only appeared that way because the stress lines were merged. The National Board of Boiler and Pressure Vessel Inspectors permits the use of the new allowable stresses for rerating pressure retaining equipment now in service that was produced to ASME Codes as far back as the 1968 Edition of the ASME Code. Provisions for doing this are given in National Board Interpretation 98-14. ERROR: Appendix 1, 1-100(a)(1), 1-100(a)(2), and Table 1-100 should have been revised to show the change in the design factors. Corrected by Special Notice.	
III-1-A97 (96-250)	Table NE-4622.7(b)-1	This change allows an exemption from postweld heat treatment for welds attaching nozzles and penetrations up to and including NPS 12.	The exemption is limited to P-No. 1 material; the shell and

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
	Exemptions to Mandatory Postweld Heat Treatment		nozzle thickness do not exceed 1-1/2 in.; the preheat and carbon content limits are identical to the limits for exemption of other welds in P-No. 1 materials; and nozzle diameter is irrelevant to the need for PWHT.
III-1-A95 (94-305)	NE-7726 Proration of Valve Capacity	This revision provides for proration of valve capacities to pressures greater than the pressure to which the valve capacity was certified.	These provisions have been accepted by the USNRC, in its endorsement of the 1995 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A95 (94-316)	NE-3221.1(c)(1) Stress Intensity Values	This change allows, under limited conditions, an increase in the primary membrane stress for Service Level D Limits, up to the maximum value permitted for Service Level C Limits.	This is a small increase in allowable stress and is limited to no more than the allowable stress for Service Level C Limits, which are otherwise generally lower than the allowable stress for Service Level D Limits.
III-1-A93	NE-2545.3(b), NE-2545.3(b)(3), NE-2545.3(b)(4), NE-2546.3(b), NE-2546.3(b)(3),	This change clarifies the NDE acceptance criteria and provides consistency with NB-2576(c), NB-2677(c), NC-2576(c), NC-2677(c), ND-2576(c), ND-2677(c), NE-2576(c), NE-2677(c), NG-2576(c), and NG-2677(c). The significant change is to refer to only "relevant" indications.	These provisions have been accepted by the USNRC, in its endorsement of the 1987 Addenda of Section III, Subsections NB, NC, and ND.

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
	NE-2546.3(b)(4) Acceptance Standards		
III-1-A92	NE-5112 Nondestructive Examination Procedures	This revision provides for the digitization of radiographic film and radioscopic images in accordance with the provisions of Section V, Article 2, Appendix III.	These provisions have been accepted by the USNRC, in its endorsement of the 1992 Addenda of Section III, Subsections NB, NC, and ND.
II-D-1992 Edition	TABLE 1A SECTION III-1, Class MC	Corrected Stress Values for SA-516 - 55 (K01800) from 15.1 ksi to 15.2 ksi.	The prior values were incorrect.
III-1-A91 (91-208)	NE-7512, NE-7721.3, NE-7724.2(a) Tolerances on Pressure Relief Valves	This revision increases the set pressure tolerances for pressure relief valves.	These provisions have been accepted by the USNRC, in its endorsement of the 1991 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A90	NE-2510 Attachment Material	This revision deletes the requirement for examining the attached material in the same manner as the pressure retaining material to which it is welded. (TECHNICAL ERRATA to A87)	These provisions have been accepted by the USNRC, in its endorsement of the 1990 Addenda of Section III, Subsections NC and ND.
III-1-A90	Table NE-3132-1 Dimensional Standards	- Updated: ANSI B1.20.3-76 (R82) ANSI B16.5 to 88 This change extended nickel alloy ratings to higher temperatures,	These provisions have been accepted by the USNRC, in its endorsement of the 1990 Addenda of Section III,

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
		clarified flat face flange requirements, updated the referenced standards, and made other minor editorial revisions. Metric equivalents were deleted. ANSI B16.9 to 86 ANSI B16.11 to 80 ANSI B16.25 to 86 ANSI B16.28 to 86 ANSI B18.2.2 to 87 ANSI B18.3 to 86 ANSI B36.10 to 85 ANSI B36.19 to 85 ANSI B16.34 to 88 The scope of the standard was increased by the addition of socket welded end and threaded end valves. The listings for nickel alloy and other alloy valve materials were expanded. Also, rules for threaded body joints were added and wafer-type valve body rules were revised. MSS SP-43 to 82 (R86) MSS SP-44 to 85	Subsections NB, NC, and ND.
III-1-A90	Table I-10.1 Stress Tables for Class MC Ferritic Steels	- Added: SA-738 - C (to 2-1/2 in.) (TS/YS = 80/60) (2-1/2 in. to 4 in.) (TS/YS = 75/55) (4 to 6 in.) (TS/YS = 70/46) - Changed designation for: SA-738 - ... to SA-738 - A (K12447)	SA-738 Grade C has been accepted by the USNRC, in its endorsement of the 1990 Addenda of Section III, Subsections NC and ND (see Table I-7.1 for permitted materials for Class 2 and 3 applications).

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
III-2-A04, III-2 (BC03-472)	CC-4331.2(b)(6), CC-4333.2.3(a), CC-4333.2.3(b), CC-4333.2.4(e)(3), CC-4333.2.4(g), CC-4333.3(b)(6), CC-4333.3(c)(4), CC-4333.3(d)(5), CC-4333.3(f), CC-4333.5.3(b) Cold Rolled Parallel Threaded Splices	This revision adds cold rolled formed parallel threaded splices as an acceptable form of splice. Cold roll formed parallel threaded splices are being widely used in the construction industry. Cold rolled formed parallel threaded splices have a special thread and locknut to lock the coupler. This mechanical splice is limited to cold formed parallel threaded splices to prevent any single threaded rebar from being included, which would not possess the extra cold rolling process. Requirements for locknuts, which need to be used on both ends of the device to prevent loosening and to improve slip performance, are included. A testing requirement for cold rolled parallel threaded splices at 20F is also required.	This revision adds a new type of mechanical splice called a "cold-roll-formed parallel-threaded splice." This splice for reinforcing bars is widely used in the construction industry. The new coupler meets the current requirements for the "taper-threaded splices" to have threads, and the requirements of the "thread-deformed reinforcing bars," which require locknuts to lock the coupler. The new mechanical splice is limited to "cold-formed parallel-threaded splices," to prevent any single threaded re-bar from being included that would not possess the extra cold rolling process.
III-2-A02 (BC01-698)	CC-4542.1, CC-4542.2 Back-up Bars	This revision deletes the prohibition against the use of back-up bars in Category A and B welded joints.	For more than 70 years, Section VIII, Division 1 has permitted use of back-up bars for butt welds in the vessel shell. During this time, there has been no evidence of leakage caused by the back-up bars, even though they are subjected to the same stress as the pressure vessel shell. In Section III, Division 2,

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
			the containment liner plate is assumed to have no structural strength. It is logical to permit the same weld details in containment liners as permitted for pressure shells.
III-2-A01 (2001 Edition) (BC00-182)	CC-4333.2.3 Splicing of Reinforcing Bars-Performance Tests	This revision incorporates the provisions of Case N-363-1, "Splicing of Reinforcing Bars-Performance Tests, Section III, Division 2." The change permits acceptance of performance test results for reinforcing bar mechanical splices when the load extension does not achieve 2% strain. The alternative test results must meet the lesser of 2% strain or 125% of the specified minimum yield strength of the reinforcing bar.	The alternative test is more than adequate to assure the structural capability of the splices. (The USNRC has not endorsed Case N-363-1.)
III-2-A01 (2001 Edition) (BC00-183)	Table CC-4552-2 Postweld Heat Treatment Exemptions	This revision changes the Table to permit containment liners the same PWHT exemptions that were allowed for concrete reactor vessel liners. The change incorporates the provisions of Case N-536, "Alternative to Table CC-4552-2 Exemptions to Mandatory PWHT Concrete Containment Liner, Section III, Division 2."	There is no reduction in requirements when the alternative rules for containment liners are the same as for reactor liners. (The USNRC has not endorsed Case N-536.)
III-2-A01 (2001 Edition) (BC00-357)	CC-5531.2 Extent of Examination	This revision removes the requirement to increase number of radiographs of double-sided welds, when a portion of the liner uses backup bars and single-sided welding. This was an arbitrary requirement intended to discourage the use of single-sided welds with backup bars. The change also clarifies that the welds made using back-up bars shall be examined by UT or MT for the full length of the backed-up weld.	The number of radiographs has no effect on assuring acceptable weld quality.
III-2-A00 (BC00-005)	CC-2231.4 Specified Concrete	This revision provides conditions under which the required creep testing of CC-2231.4, may be delayed. The change incorporates the provisions of Case N-529 "Creep Testing, Section III, Division 2."	It takes about 28 days for concrete to set. However, early in that time frame, it is possible

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
	Properties		to accurately evaluate the creep of the concrete based on early tests. This is common industry practice. Not applicable to the ESBWR RCCV. (The USNRC has not endorsed Case N-529.)
III-2-A00 (BC00-006)	CC-3543(a) Tendon Anchor Reinforcement	CC-3543(a) requires that reinforcement "be located starting not more than 2 inches from the bearing plate and not extending more than twice the minimum bearing plate width." This revision provides conditions under which that requirement can be waived. The change incorporates the provisions of Case N-488, "Design of Tendon and Anchorage Reinforcement, Section III, Division 2."	Not applicable to ESBWR.
III-2-A00 (BC00-007)	CC-4432.5 Twisting and Coiling Prestressing Tendons	This revision provides an alternative to the provisions of CC-4432.5 regarding intentional twisting for all horizontal circumferential tendons comprised of multiple elements. The change incorporates the provisions of Case N-487, "Twisting of Horizontal Prestressing Tendons, Section III, Division 2."	Not applicable to ESBWR
III-2-A96 (96-55)	CC-3740, CC-3750 Penetration Assemblies, Brackets and Attachments	Previously, Division 2 limited attachment loads in the through-thickness direction of plate. This revision eliminates that restriction and allows the full strength of the plate to be used in the through-thickness direction. This is a continuation of the similar change started in the 1995 Addenda.	Similar provisions in Section III, Division 1, Subsection NF have been permitted for Class 1, 2, and 3 supports by USNRC endorsement on the Winter 1982 Addenda.
III-2-A95 (94-309)	CC-3750(b), CC-4543.6, Fig. CC-4543.6-1, Fig. CC-4543.6-2	The Code restricted allowable stresses in liners to one-half of the allowable stress for tensile loads normal to the liner, because of lamellar tearing, laminations, and through-thickness strength. Because of improved steel melting practices and examination techniques, the one-half factor has been eliminated. This revision provides new requirements that must be met when liner materials one inch and	Similar provisions in Section III, Division 1, Subsection NF have been permitted for Class 1, 2, and 3 supports by USNRC endorsement on the Winter 1982

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
	Through-Thickness Loads	greater in thickness are loaded in the through-thickness direction. When loaded in this direction, the materials must meet the acceptance standards of SA-770, "Through-Thickness Tension Testing of Steel Plates for Special Applications." Special welding procedure qualifications are required, and must use either inlays or overlays, or special weld deposition techniques. After completion of welding, the base metal underneath the attachment weld must be ultrasonically examined. Special examination methods and acceptance standards are provided. This revision is similar to changes made to Section III, Division 1, Subsection NF in the Winter 1978 and Winter 1982 Addenda.	Addenda.
III-2-A95 (94-306)	CC-4331.2(b)(5), CC-4333.2.3(a), CC-4333.2.4(f), CC-4333.3(e), CC-4333.4, CC-4333.5.3(a) Splicing of Reinforcing Bars	This revision adds provisions for a new mechanical reinforcing bar splice. The new splice is identified as a "sleeve with cementitious grout splice." The splice has been evaluated for use by building officials organizations and found to meet the requirements of ACI-318.	This splice has been in use for more than ten years and meets the requirements of ACI-318, which has served as the basis for the Section III, Division2 Concrete Code.
III-2-A93	CC-4532.2.1 Group Identification of Welders to Weld Joints	The revision allows multiple welds to have group identification for the purposes of verifying that all welders and welding operators were properly qualified. Previously, this group identification was only allowed for structural attachment welds. This revision incorporates the provisions of Case N-507, "Identification of Welders, Section III, Division 2."	The USNRC previously approved these provisions through endorsement of Case N-507 in RG 1.84, Rev. 32.
III-2-A92	Table CC-2160-1, Note (2), Codes, Standards, and Specifications Referenced in Text	This revision updates the listed standards and moves the dates to "Codes, Standards, and Specifications Referenced in Text." Pipes and Tubes	These provisions have been accepted by the USNRC, in its endorsement of various early-1990's Editions and Addenda of

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
	Dimensional Standards	- Updated: ASME B36.10 to M85 ASME B36.19 to M85 Fittings, Flanges and Gaskets - Deleted: ANSI B70.1 Refrigeration Flare Type Fittings - Updated: ASME B16.5 to 88 Comments on the changes to this standard can be found in the RA-search data base Rev_B31. ASME B16.9 to 86 ASME B16.11 to 80 ASME B16.21 to 78 ASME B16.25 to 86 ASME B16.28 to 86 - Titles for Standards were changed to: ASME B16.5 Pipe Flanges and Flanged Fittings ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges AWWA C207 Standard for Steel Pipe Flanges for Waterworks Services Bolting - Titles for Standards were changed to: ASME B18.2.1 Square and Hex Bolts and Screws (Inch Series) Including Hex Cap Screws, and Lag Screws ASME B18.2.2 Square and Hex Nuts (Inch Series) ASME B18.3 Socket Cap, Shoulder, and Set Screws (Inch Series) - Updated: ASME B18.2.2 to 87 ASME B18.3 to 86	Section III, Subsections NB, NC, and ND. Most of the changes are editorial.

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
		Threads - Updated: ASME B1.1a to 84 - Changed Standard Numbers from: ANSI B2.1 to ASME B1.20.1-83 Pipe Threads, General Purpose (Inch) ANSI B2.2 to ASME B1.20.5-78 (R80) Gaging for Dryseal Pipe Threads (In.) Valves - Updated: ASME B16.34 to 88 Comments on the changes to this standard can be found in the RA-search data base Rev_B31. - Titles for Standards were changed to: ASME B16.34 Valves - Flanged, Threaded, and Welded End This revision corrects the title of the dimensional standards to ASME because they are no longer subject to approval by ANSI. This revision also deletes the revision year from Table CB-2160 and CC-2160 because the revision dates are now given in, "Codes, Standards, and Specifications Referenced in Text," located at the end of the book.	
III-2-A92	Codes, Standards, and Specifications Referenced in Text	- Deleted: ANSI B2.1 Pipe Threads (Except Dryseal) ANSI B2.2 Dryseal Pipe Threads ANSI B70.1-60 Refrigeration Flare Type Fittings - Added:	These provisions have been accepted by the USNRC, in its endorsement of various early-1990's Editions and Addenda of Section III, Subsections NB, NC,

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
		ANSI B1.20.1-83 Pipe Threads (Except Dryseal) ANSI B1.20.5-78 (R80) Gaging for Dryseal Pipe Threads - Updated: ANSI B1.1 to ASME B1.1a-84 ANSI B16.5 to ASME B16.5-88 Comments on the changes to this standard can be found in the RA-search data base Rev_B31, and are available upon request. ANSI B16.9 to ASME B16.9-86 ANSI B16.11 to ASME B16.11-80 ANSI B16.20 to ASME B16.20 ANSI B16.21 to ASME B16.21 ANSI B16.25 to ASME B16.25-86 ANSI B16.28 to ASME B16.28-86 ANSI B16.34 to ASME B16.34-88 Comments on the changes to this standard can be found in the RA-search data base Rev_B31, and are available upon request. ANSI B18.2.1 to ASME B18.2.1 ANSI B18.2.2 to ASME B18.2.2-87 ANSI B18.3 to ASME B18.3-86 ANSI B36.10 to ASME B36.10M-85 ANSI B36.19 to ASME B36.19M-85	and ND. Most of the changes are editorial.
III-2-A91 (91-212)	CC-3421.4.1(c), CC-3421.4.2, CC-3421.4.2(h) Evaluation of Membrane Stress	This revision modifies the definition of membrane stress to be at the centroid of the concrete section where the shear load is applied. Previously the definition described the stress at the extreme fiber of the section.	Use of the centroid of the section is a more accurate approach to determination of stress.

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
III-2-A91 (91-222)	CC-4321.1(c), CC-4321.2, CC-4322(a) Bending of Reinforcing Bar	This revision changes the rules for bending reinforcing bar to conform to the provisions of ACI 318-89. The change provides that the minimum diameter of the bend in the bar and the extension length are dependent on the diameter of the reinforcing bar being bent. This revision removes the change made in the 1990 Addenda.	This change is consistent with the provisions of ACI-318.
III-2-A91	CC-5536.2 Leak Chase System	This revision allows leak chase channels to be tested by air using the "maintenance of pressure" method. The change incorporates the provisions of Case N-231, "Alternate Methods for Leak Detection in the Attachment Weld to Leak Chase Channels for Section III, Division 2, Class CC Construction."	The USNRC previously approved these provisions through endorsement of Case N-231 in RG 1.84, Rev. 32.
III-2-A91	Table I-2.2 Material for Concrete Containment Vessel Liners	- Added: SA-210 - C (K03501) SA-738 - B (K12447) and C - Deleted: SA-234 - WPA SA-376 - 316L (S31603) - Changed: SA-181 - ... to 60 (K03502) & 70 (K03502) SA-210 - ... to A-1 (K02707) SA-738 - ... to A (K12447)	SA-210 is not applicable to ESBWR. SA-738 Grade B has been accepted by the NRC with limitations, in their endorsement of Case N-655 in RG 1.84 Rev. 33. The limitations require compliance with SA-738 Supplementary Requirements S17 and S20. SA-738 Grade C has been accepted by the USNRC, in its endorsement of the 1990 Addenda of Section III, Subsections NC and ND (see Table I-7.1 for permitted materials for Class 2 and 3 applications).

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels	Comments
III-2-A90	CC-2242.5, CC-2242.6 Use of Prepackaged General Purpose Cement Grouts	This change incorporates the provisions of Case N-384-1, "Use of Prepackaged General Purpose Cement Grouts, Epoxy Grouts, and Epoxy Bonding Materials, Section III, Division 2, Class CC." The Case permitted the use of prepackaged grouts and bonding materials in lieu of materials mixed at site.	The USNRC previously approved these provisions through endorsement of Case N-384-1 in RG 1.84, Rev. 32.
III-2-A90 (90-174)	CC-4240(c), CC-4240(d), CC-4260 Cold Weather Concrete Placement	This revision provides a definition for cold weather concrete placement and clarifies the requirements for these conditions. The revision changes the period of temperature control at the surface of the concrete from seven days to three days.	The only effect of this change is to allow slower curing of the concrete, if the temperature falls below 32F. The concrete will cure sufficiently in three days to prevent damage due to freezing.
III-2-A90 (89-332)	CC-4321.2 Bending of Reinforcing Bar	This revision adds a standard industry tolerance for bending reinforcing bars. The specified tolerance is one bar diameter.	This change is consistent with the provisions of ACI-318. Furthermore, this change was removed by the revision in the 1991 Addenda.

Table 3.8-5(2) Increases in Requirements from 1989 Edition to 2004 Edition

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
III-1-1995 Edition (94-229)	NCA-4134.10 Reporting Independence of Inspectors	This paragraph references NQA-1, Supplement 10S-1, for inspection. Paragraph 2.1 of the Supplement provides that inspection personnel shall not report directly to the immediate supervisors who are responsible for performing the work being inspected. This revision deletes the provisions of Paragraph 2.1, Personnel, for Section III work because such restrictions were felt unnecessary with the other controls already in NQA-1. (ERROR: The revision also deleted the provisions of Paragraph 2.2, Qualification. However, the provisions of Paragraph 2.2 are intended to be applicable to qualification of inspection personnel. Corrected A96.) (ERROR: The A94 Addenda now refers to the 1992 Addenda to NQA-1, which renumbered Paragraph 2.1, Personnel, as paragraph 3.1. Therefore this change should refer to the deletion of Paragraph 3.1 of NQA-1. Corrected A96.)
III-1-A94 (93-380)	NCA-3800, NCA-3810, NCA-3820, NCA-3830, NCA-3840, NCA-3841, NCA-3842, NCA-3850, NCA-3851, NCA-3852, NCA-3853, NCA-3855, NCA-3856, NCA-3857, NCA-3858, NCA-3859, NCA-3860, NCA-3861, NCA-3862	This revision modifies the quality assurance requirements for organizations providing metallic material. The terms "Material Manufacturer" and "Material Supplier" have been changed to "Material Organization." The purpose of the change is allow any material organization to perform the work activities detailed in their Quality Assurance Program rather than to limit work activities based on whether the organization is considered a material manufacturer or a material supplier. This change is significant because it will require most organizations furnishing material under the provisions of NCA-3800 to extensively modify their QA Manual prior to their next ASME Survey. The revision adds or revises definitions for approved supplier, material, performance assessment, Quality System Program, source material, supplier, and unqualified source material. NCA-3842.2(h)(3) was added to permit annual performance assessments of qualified Material Organizations in lieu of annual audits. The performance assessments are to include evaluation of sample testing of furnished material to assure conformance with the material specification, along with evaluation of nonconformances and corrective actions. The old paragraph NCA-3867.4(e), which identified the rules for upgrading material, has been renumbered NCA-3855.5(a). "Stock material" is now identified as "unqualified source material." NCA-3855.5(a)(1) clarifies that the restriction, "no welding," on an unqualified source material means no

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
	Material Quality System Programs	welding with filler material added. Autogenous welding is exempt from this restriction. This revision deleted the exemption that allowed allows bars with a cross-sectional area of one square inch and less to be furnished with a Certificate of Compliance in lieu of a Certified Material Test Report. (ERROR: Not corrected.)
III-1-A93	NCA-3220(d), NCA-3220(n), NCA-3220(s), NCA-3270, NCA-3271, NCA-3272, NCA-3273, NCA-3280, NCA-3290 Overpressure Protection Report	This revision adds new provisions regarding the Owner's responsibilities for providing, certifying, and filing Class 1, 2, 3, and MC Overpressure Protection Reports. Other than the changes to the NCA-3270 paragraphs, the revision corrects references and renumbers paragraphs.
III-1-A92	NCA-5121(a) Authorized Inspection Agency	This revision requires that Authorized Inspection Agencies are to be accredited by ASME, not States nor Provinces.
III-1-A91	NCA-4110(b) Quality Assurance Program Requirements	This revision updates the reference to NQA-1 to the 1989 Edition, including the NQA-1a-1989 Addenda. The change also includes NQA-1a-1986 Addenda, NQA-1b-1987 Addenda, and NQA-1c-1988 Addenda. The following changes were included in the NQA-1a-1989 Addenda: 3S-1 - 5 Design Control Change Control *- Adds additional provisions for incorporating design changes into the appropriate design*

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
		documents. 3A-1 Design Control - Rewritten for clarity. - Expanded provisions on interfaces. - *Added provisions regarding load path requirements for installation, removal, repair and replacement of equipment.* - Added provisions regarding the design process. - Added provisions regarding design interface control. - Deleted Figs. 3A-1.1, 3A-1.2, and 3A-1.3 regarding design responsibilities and drawing checklists. The following changes were included in the NQA-1c-1988 Addenda: Technical Inquiries - Revised guidelines for preparation of technical inquiries. II - 11 Test Control - Modified item to address computer program tests. S-1 - 2 Definitions - Added definition of computer program. - Revised definition of design output to include computer programs, and added footnotes 2 and 3. 3S-1 - 4, 4.1 Design Verification - Modified to address computer programs. 11S-2 Computer Program Testing - Added Supplementary Requirements for Computer Program Testing. 17S-1 - 4.4.2, 4.4.3 QA Records - Clarified provisions regarding storage facilities and updated NFPA documents to the 1986 Edition. This change incorporates the provisions of NQA-1 Case 1, "Records Storage Facility - Use of NFPA 232. ANSI/ASME NQA-1-1979 with the 1c-1981 Addenda, and Later Editions and Addenda through the 1c-1987 Addenda, Supplement 17S-1, Paragraph 4.4.2." 17A-1 - 3.1 Design Records

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
		- Modified item to address computer programs. The following changes were included in the NQA-1b-1987 Addenda: S-1 - 2 Terms and Definitions - Revised definition [paragraph (a)] for "Commercial Grade Item," and added Footnote 1 regarding nuclear facilities as they relate to commercial grade items. 17A-1 - 1.3 Records - Added provision for using records stored on magnetic or optical media. The following changes were included in the NQA-1a-1986 Addenda: 17S-1 - 4.4.2 Alternate Single Facilities - *Corrected address for NFPA.* 4A-1 - 3.2(a) Document Control - Added guidelines regarding radioactive products and by products.
III-1-A90	NCA-3820(a) Quality System Certificate	This revision restricts the qualification of Material Manufacturers to organizations with a Quality System Certificate (QSC) from ASME or to Certificate Holders who use the material. This change will have a profound effect on many material suppliers who do not have a QSC.
III-1-A90	NCA-3851, NCA-3852(c), NCA-3852(d), NCA-9000 Material Manufacturers and Material Suppliers	This revision clarifies the definitions of organizations which are considered by ASME to be "Material Manufacturers." The revision provides that an organization which machines stock material from one product form to another must be qualified as a Material Manufacturer in order to issue a Certificate for the new product form. A "Material Supplier" who is not qualified as a Material Manufacturer cannot issue Certificates of Compliance or CMTR's with the materials as provided in NCA-3867.4(b).
III-1-A02 (BC01-613)	NE-2211 Exemption from Postweld Heat Treatment for Ferritic	This change eliminates the exemption from PWHT for test coupons for P-1, Group 3 ferritic material.

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
	Material Test Coupons	
III-1-A97 (96-160)	NE-5521(a), NE-5521(a)(1)(a), NE-5521(a)(1)(b), NE-5521(a)(3), NE-5521(a)(4) & Footnotes 1 & 2, NE-5521(a)(6), NE-5530 ASNT SNT-TC-1A	This revision updates the nondestructive examination qualification requirements to the 1992 Edition of SNC-TC-1A. The change requires that personnel performing visual examination be qualified to SNT-TC-1A.
III-1-A95 (94-397)	NE-3338.2(d)(3), XIII-2124(c) Stress Indices for Nozzles	This revision modifies the thickness and diameter dimensional ratios to be consistent with the provisions in Section VIII, Division 2. It restricts the outside nozzle radius on cylindrical shells.
III-1-A95 (94-302)	NE-3112.4 Allowable Stress Intensity and Stress Values	This change identifies the criteria for establishing the allowable stress intensity and allowable stress values for Class MC containments. The allowable stress intensity is now limited to 90% of the yield strength of the material, based on the values given in Table Y-1 of Section II, Part D. This is a new stress limit for containment vessels. The original design philosophy was to allow stresses at 1.1 times the Section VIII allowable stresses, regardless of the yield strength.
III-1-A94 (94-79)	NE-4212, NE-4213 Forming and Bending	This revision adds references for qualifying forming and bending material processes when impact testing is required. The change also revises and clarifies the requirements for confirming minimum wall thickness after forming and bending pipe and tube. The actual thickness may be measured or the forming procedure must show that the required thickness will be maintained.
III-1-A92 (92-174)	NE-4435 Removal of Temporary Attachments	This revision clarifies the fabrication requirements for nonstructural and temporary attachments. The change also reinstates requirements for the examination of the area when temporary attachments are removed. NB-4435(b), NC-4435(b), ND-4435(b), and NE-4435(b) were deleted by mistake in the 1987 Addenda. (TECHNICAL ERRATA to 1987 Addenda.)

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
III-1-A91 (91-226)	NE-7111(b), NE-7727, NE-7734.2(a), NE-7734.3, NE-7735 Laboratory Acceptance of Pressure Relieving Capacity Tests	This revision updates the reference to PCT 25.3 to the 1988 Edition. The change also adds a limit for the coefficient of design.
III-1-A91 (90-340)	NE-7723, NE-7724.2(b), NE-7733, NE-7734.2(b) Pressure Relief Valve Capacity Certification	This revision standardizes the procedure for replacing unacceptable valves, with more restrictive limits, and standardizes and clarifies the types of test failures that are to be used as a basis for ASME refusing certification of a particular valve design.
III-1-A90	Table I-10.2 Stress Tables for Class MC	Austenitic Steels and High Nickel Alloys - Deleted: SA-376 - TP304 (S30400) (NPS 8 & >) (< Sch 140) (ERROR: Corrected 1995 Edition.) (< NPS 8) (Sch 140 & >) *(ERROR: Corrected 1995 Edition.)* TP304H (S30409) (NPS 8 & >) (< Sch 140) (ERROR: Corrected A92 Add.) (< NPS 8) (Sch 140 & >) (ERROR: Corrected A92 Add.) (ERROR: Should have deleted SA-813 - TP309 (S30900) & TP310 (S31000) which were deleted from Section II. Table deleted A91 Add.) (ERROR: Should have deleted SA-814 - TP309 (S30900) & TP310 (S31000)

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
		which were deleted from Section II. Table deleted A91 Add.) - Reduced TS/YS for: SA-376 - TP321 (S32100) (> 3/8 in.) from 75/30 to 70/25 and reduced stress values TP321H (S32109) (> 3/8 in.) from 75/30 to 70/25 and reduced stress values - *Reduced TS/YS for:* (ERROR: Should have reduced TS/YS for: SA-312 - TP321 (S32100) (Sml) (> 3/8 in.) from 75/30 to 70/25) TP321H (S32109) (Sml) (> 3/8 in.) from 75/30 to 70/25) Table deleted A91 Add.) - *Reduced YS from 75 to 70 for:* SA-376 - TP304 (S30400) (NPS 8 & >) (Sch. 140 & >) and reduced stress values (TECHNICAL ERRATA to S72) TP304H (S30409) (NPS 8 & >) (Sch. 140 & >) and reduced stress values (ERROR: This reduction does not apply to TP304H (S30409). Corrected A92 Add.) - Revised stress values for: SA-182 - F321 (S32100), F321H (S32109) SA-213 - TP321 (S32100), TP321H (S32109) SA-240 - 321 (S32100) SA-249 - TP321 (S32100), TP321H (S32109) SA-312 - TP321 (S32100), TP321H (S32109) SA-336 - F321 (S32100), F321H (S32109) SA-376 - TP304 (S30400) (NPS 8 & >) (Sch. 140 & >) TP321 (S32100), TP321H (S32109) SA-403 - 321 (S32100), 321H (S32109) SA-479 - 321 (S32100) SA-813 - TP321 (S32100), TP321H (S32109) SA-814 - TP321 (S32100), TP321H (S32109)

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
		- Added notes (15), (16), (17), (18) regarding thickness and pipe sizes.
III-1-A90	Table I-10.3 Stress Tables for Class MC	Bolting Materials - Reduced stress values for: SA-193 - B8C (S34700), B8M (S31600)
III-2-A95 (94-307)	CC-3570, CC-3571, CC-3572, CC-3573, CC-3574, CC-3575 Containment External Anchors	This revision adds requirements for anchorage of structural members, supports, and embedments affixed to the external surface of the containment structure.
III-2-A93	CC-3530, CC-3531, CC-3532, CC-3533, CC-3534 Reinforcing Steel Requirements	This revision adds the requirement that mechanical devices for the end anchorages are to be capable of developing at least 125 percent of the specified minimum yield strength of the bar. The change also provides that no reinforcement should be terminated in a tension zone except under certain identified conditions.
III-2-A92 (92-177)	VII-3211 Level I Technician Qualifications	This revision increases the education and experience requirements and clarifies the training and evaluation requirements for Level I Concrete Inspection and Testing Technicians.
III-2-A92 (92-178)	VII-3212 Level II Technician	This revision increases the education and experience requirements and clarifies the training and evaluation requirements for Level II Concrete Inspector qualifications.

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
	Qualifications	
III-2-A91 (91-210)	CC-3421.8, CC-3424, CC-3431.3(a), CC-3431.3(c) Brackets and Corbels	This revision revises the design rules for brackets and corbels to be consistent with the provisions in ACI-318-83. The new rules are much more detailed and modify the formula for determining acceptable shear stress.
III-2-A91 (91-215)	CC-3531, CC-3532, CC-3532(c), CC-3532.1.2(a), CC-3532.1.2(c), CC-3532.1.2(e), CC-3532.1.2(g), CC-3532.1.2(h)(1), CC-3532.1.2(h)(2), CC-3532.1.2(i)(4), CC-3532.1.3, CC-3532.1.5, CC-3532.2.3(b), CC-3533.1(a)(3), CC-3533.1(c), CC-3533.2, CC-3534 Reinforcing Steel	This revision clarifies the requirements regarding design of reinforcing steel. New provisions are added for mechanical devices used for end anchorages.
III-2-A91 (91-217)	CC-3730(c), CC-3740(f), CC-3750(c) Anchorage Design	These new paragraphs provide guidance regarding the design of reinforcing steel for anchorage forces.

Affecting Addenda after 1989 Ed.	Affected chapters	INCREASES IN REQUIREMENTS: differences in ASME Section III 2004 Edition from 1989 Edition, for steel and concrete containment vessels
III-2-A90	CC-2131.3, CC-2224 Admixtures	This change adds new provisions for mineral admixtures, chemical admixtures and special grouting admixtures as well as adding a new ASTM specification C 1017, "Chemical Admixtures for Use in Producing Flowing Concrete."
III-2-A90	CC-2131.3.1 & Footnote 10 Laboratory Accreditation for Testing Concrete Constituents	This revision provides that laboratories testing concrete constituents must meet the provisions of ASTM C 1077-87, "Standard Practice for Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation." The purpose of the change is to assure the use of properly qualified laboratories and personnel.
III-2-A90	CC-2232, CC-2233, Table CC-2233.1.2-1, Table CC-2233.2.2-1 Selection of Concrete Mix Proportions	This revision was made to make the provisions concerning concrete mix proportions consistent with the existing ACI-318 Building Code requirements. The change also addresses concerns raised by the American Concrete Institute in a report titled "Special Awareness Concerning Structural Mass Concrete."
III-2-A90	CC-5211, Footnote 4 Laboratory Qualification	This revision provides that tests which are required by CC-5200 are to be performed by an accredited laboratory that complies with ASTM C 1077, "Standard Practice for Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation."
III-2-A90	CC-2231.3 Alkali Content	This revision adds provisions for a program to control alkali content when known reactive materials are present in the aggregate.

NRC RAI 3.8-5, Supplement 1

NRC Assessment Following the December 14, 2006 Audit

GE identified 13 items in their comparison table where the criteria in the 2004 edition of the Code is considered to be a relaxation of the 1989 Code. For each reduction in requirements tabulated in the table, GE needs to submit its technical basis for concluding that an equivalent level of safety will be achieved. Parts a), b) and c) are Acceptable.

During the audit, GE provided an update to the Table which provides the explanation for these items. Some of the 13 items do not apply to ESBWR which is acceptable. GE indicated that for the remaining items, they will provide additional technical information to justify these items.

GE Response

The comparison table provided in the original response under MFN 06-298 where the criteria in the 2004 edition of the ASME Section III Code is considered to be a relaxation of the 1989 edition is updated as follows in Table 3.8-5 (1) R1. Please note that none of the changes reduce the levels of previous conservatisms in the ASME Section III 1989 edition.

DCD Impact

No DCD change was required in response to this RAI Supplement.

Table 3.8-5 (1) R1 Reductions in Requirements from 1989 Edition to 2004 Edition

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: *differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved*	Explanation/Justification *None of the changes reduce the levels of previous conservatism in the Code*
III-1-A99 (BC98-563) (2/99)	NCA-1140(a)(2) Code Edition and Addenda Permitted for Construction	This revision permits the use of the latest Edition and Addenda endorsed by the regulatory authority having jurisdiction at the plant site at the time the construction permit application is docketed. This change incorporates the provisions of Case N-608, "Applicable Code Edition and Addenda, NCA-1140(a)(2), Section III, Division 1."	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A97 (97-200)	NCA-8320, NCA-8321, NCA-8322 Use of N-Symbol Stamp at Field Locations	This revision rewrites the paragraph to clarify the provisions by placing the requirements in two paragraphs. NCA-8322 addresses the application of the Stamp in the field without requiring extension of the Certificate of Authorization to the site, when only a pressure test is involved. The change also addresses subcontracting the pressure test.	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A04 (BC03-765)	NE-3352.2(b), NE-5280(b) Examination of Category B Butt Welds in Electrical Penetrations	This revision provides for the use of liquid penetrant examination or magnetic particle examination of root pass and the surface of the completed weld as an alternative to the radiographic examination requirements for Category B butt welds in electrical penetration assemblies. It also adds an allowable stress reduction factor and limits the base materials that can be used to P-No. 1 materials. The revision incorporates the provisions of Case N-505, "Alternative Rules for the Examination of Butt Welds Used as Closure Welds for Electrical Penetration Assemblies in Containment Structures, Section III, Division 1."	These provisions have been accepted by the USNRC, in Case N-505, in Regulatory Guide 1.84, Rev. 33.
III-1-A02 (BC00-771)	NE-2331, NE-2431, NE-4335 Impact Testing of Heat Affected Zone (HAZ)	Changes in steel making technology have enabled materials to be supplied with much better impact toughness properties than in the past. One problem associated with this is that it does not take much heat input to reduce the toughness of the HAZ to levels below the unaffected base material. This results in the need for more testing and test coupons. This revision allows three methods of qualifying the HAZ. 4) An upward adjustment of RT_{NDT}, which was the original basic method. 5) Downward adjustment in test temperature, which is currently permitted, but	These provisions have been accepted by the USNRC, in its endorsement of the 2002 Addenda of Section III, Subsections NB, NC, and ND

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: *differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved*	Explanation/Justification *None of the changes reduce the levels of previous conservatism in the Code*
		requires many tests for the development of the transition curves. This is difficult when using existing materials, without enough coupons. 6) Evaluation of actual material impact toughness test data with an adjustment upward of the toughness acceptance criteria to compensate for the loss of toughness shown on the Welding Procedure Specification (WPS). This can be used with existing material or new material. These changes include a 15F penalty without further test data. This alternative is based on many years of testing. An exemption is also provided for gas tungsten arc welding (GTAW) weld metal with a maximum of two layers for the HAZ.	
III-1-A02 (BC01-613)	Table NE-2121(a)-1 Addition of SA-738 Material	This revision permits the use of SA-738, Grade B material for construction of containment vessels. This material is a P-1, Group 3 ferritic material. The change incorporates the provisions of Case N-655, "Use of SA-738, Grade B for Metal Containment Vessels, Class MC, Section III, Division 1."	These provisions have been accepted by the USNRC, in its endorsement of the 2002 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A00	NE-4000 Standard Weld Procedure Specifications (SWPS)	Standard Weld Procedures Specifications were added to Section IX in the A00 Addenda. These SWPSs are acceptable for use in Section III by reference to Section IX. Highlights of the Section IX (QW-500) requirements are: 5) Not all AWS SWPSs are permitted. 6) A demonstration test coupon must be welded and tested; QW-520 lists specific information that must be recorded as part of the demonstration. 7) SWPSs must be used exactly as they are written; there are no "nonessential variables" when using SWPS. 8) The applicable fabrication document (i.e., construction code, customer specification, etc.) and the demonstration test number must be shown on the SPWS, and it must be signed and dated by the manufacturer or contractor.	These provisions have been accepted by the USNRC, in its endorsement of the 2000 Addenda of Section III, Subsections NB, NC, and ND.

Affecting Addenda after 1989 Ed.	**Affected chapters**	**REDUCTIONS IN REQUIREMENTS:** ***differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved***	**Explanation/Justification** ***None of the changes reduce the levels of previous conservatism in the Code***
III-1-A99 (BC98-414) (12/98)	NE-3226, NE-6221 Test Limits	The purpose of this revision is to remove inconsistencies in the rules for testing. The change provides that a stress analysis for the test condition is not required unless the test pressure at some point in the vessel exceeds the required test pressure by more than six percent. For Class 1 components, the change reduces the pneumatic test pressure from 1.2 to 1.1 times the design pressure. The change also reduces the hydrostatic test pressure for Class 2 and 3 components from 1.5 to 1.25 times the design pressure, and the pneumatic test pressure from 1.25 to 1.1 times the design pressure. For Class MC containment vessels, the hydrostatic test pressure was reduced from 1.35 to 1.2 times the design pressure. These changes compensate for the reduction in design factor from 4 to 3.5 that was made to increase allowable stresses in Section II, Part D, Table 1A and Table 1B for Class 2 and 3 components. The pneumatic test pressure for containment vessels was not changed.	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A99 (BC98-571) (2/99)	NE-5279, NE-5280 Special Exemptions to Radiography	Previously these paragraphs provided rules for special exemptions to radiographic examination when weld joint details did not permit a meaningful examination. This revision changes the requirements to be consistent for all subsections. The effect of the change is to allow exceptions to radiography whenever radiographic examination is not practical.	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NB, NC, and ND.
II-D-A99 (BC98-165)	TABLE 1A, TABLE 1B STRESS TABLES Reduced Design Factor	This revision significantly increased all allowable stress values in these tables by reducing the design factor on tensile strength from 4 to 3.5. There was no change in the factor on yield strength, so not all allowable stresses are changed. The increase in allowable stress decreases as the design temperature increases. The increase in allowable stress is not dependent on any change in design formulas, nondestructive examination, or material properties. The main reason for the change is to be more consistent with the allowable stresses used in Europe and other parts of the world. The change will make the use of the ASME Code more competitive in the	These provisions have been accepted by the USNRC, in its endorsement of the 1999 Addenda of Section III, Subsections NC and ND.

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: *differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved*	Explanation/Justification *None of the changes reduce the levels of previous conservatism in the Code*
		international market on an economical basis. This change incorporates the provisions of Case 2278, "Alternative Method for Calculating Maximum Allowable Stresses Based on a Factor of 3.5 on Tensile Strength, Section II and Section VIII, Division 1," Case 2290, "Alternative Maximum Allowable Stresses Based on the Factor of 3.5 on Tensile Strength, Section II, Part D, and Section VIII, Division 1," and Case 2284, "Alternative Maximum Allowable Stresses for Section I Construction Based on a Factor of 3.5 on Tensile Strength, Section I." To make this change, all of the Stress Tables were reviewed, and many changes were made to correct chemistry designations, product forms, external pressure chart references, heat treatments, and Notes. Also, many stress lines were merged. Changes to the Stress Tables, not directly associated with the change in the design factor used to determine allowable stresses, are identified with separate comments. In a number of places, the Summary of Changes printed with the Addenda identified materials as being deleted that were not. It only appeared that way because the stress lines were merged. The National Board of Boiler and Pressure Vessel Inspectors permits the use of the new allowable stresses for rerating pressure retaining equipment now in service that was produced to ASME Codes as far back as the 1968 Edition of the ASME Code. Provisions for doing this are given in National Board Interpretation 98-14. ERROR: Appendix 1, 1-100(a)(1), 1-100(a)(2), and Table 1-100 should have been revised to show the change in the design factors. Corrected by Special Notice.	
III-1-A97 (96-250)	Table NE-4622.7(b)-1	This change allows an exemption from postweld heat treatment for welds attaching nozzles and penetrations up to and including NPS 12.	The exemption is limited to P-No. 1 material; the shell and

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: *differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved*	Explanation/Justification *None of the changes reduce the levels of previous conservatism in the Code*
	Exemptions to Mandatory Postweld Heat Treatment		nozzle thickness do not exceed 1-1/2 in.; the preheat and carbon content limits are identical to the limits for exemption of other welds in P-No. 1 materials; and nozzle diameter is irrelevant to the need for PWHT.
III-1-A95 (94-305)	NE-7726 Proration of Valve Capacity	This revision provides for proration of valve capacities to pressures greater than the pressure to which the valve capacity was certified.	These provisions have been accepted by the USNRC, in its endorsement of the 1995 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A95 (94-316)	NE-3221.1(c)(1) Stress Intensity Values	This change allows, under limited conditions, an increase in the primary membrane stress for Service Level D Limits, up to the maximum value permitted for Service Level C Limits.	This is a small increase in allowable stress and is limited to no more than the allowable stress for Service Level C Limits, which are otherwise generally lower than the allowable stress for Service Level D Limits.
III-1-A93	NE-2545.3(b), NE-2545.3(b)(3), NE-2545.3(b)(4), NE-2546.3(b), NE-2546.3(b)(3),	This change clarifies the NDE acceptance criteria and provides consistency with NB-2576(c), NB-2677(c), NC-2576(c), NC-2677(c), ND-2576(c), ND-2677(c), NE-2576(c), NE-2677(c), NG-2576(c), and NG-2677(c). The significant change is to refer to only "relevant" indications.	These provisions have been accepted by the USNRC, in its endorsement of the 1987 Addenda of Section III, Subsections NB, NC, and ND.

Affecting Addenda after 1989 Ed.	**Affected chapters**	**REDUCTIONS IN REQUIREMENTS:** ***differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved***	**Explanation/Justification** ***None of the changes reduce the levels of previous conservatism in the Code***
	NE-2546.3(b)(4) Acceptance Standards		
III-1-A92	NE-5112 Nondestructive Examination Procedures	This revision provides for the digitization of radiographic film and radioscopic images in accordance with the provisions of Section V, Article 2, Appendix III.	These provisions have been accepted by the USNRC, in its endorsement of the 1992 Addenda of Section III, Subsections NB, NC, and ND.
II-D-1992 Edition	TABLE 1A SECTION III-1, Class MC	Corrected Stress Values for SA-516 - 55 (K01800) from 15.1 ksi to 15.2 ksi.	The prior values were incorrect.
III-1-A91 (91-208)	NE-7512, NE-7721.3, NE-7724.2(a) Tolerances on Pressure Relief Valves	This revision increases the set pressure tolerances for pressure relief valves.	These provisions have been accepted by the USNRC, in its endorsement of the 1991 Addenda of Section III, Subsections NB, NC, and ND.
III-1-A90	NE-2510 Attachment Material	This revision deletes the requirement for examining the attached material in the same manner as the pressure retaining material to which it is welded. (TECHNICAL ERRATA to A87)	These provisions have been accepted by the USNRC, in its endorsement of the 1990 Addenda of Section III, Subsections NC and ND.
III-1-A90	Table NE-3132-1 Dimensional Standards	- Updated: ANSI B1.20.3-76 (R82) ANSI B16.5 to 88 This change extended nickel alloy ratings to higher temperatures,	These provisions have been accepted by the USNRC, in its endorsement of the 1990 Addenda of Section III,

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: *differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved*	Explanation/Justification *None of the changes reduce the levels of previous conservatism in the Code*
		clarified flat face flange requirements, updated the referenced standards, and made other minor editorial revisions. Metric equivalents were deleted. ANSI B16.9 to 86 ANSI B16.11 to 80 ANSI B16.25 to 86 ANSI B16.28 to 86 ANSI B18.2.2 to 87 ANSI B18.3 to 86 ANSI B36.10 to 85 ANSI B36.19 to 85 ANSI B16.34 to 88 The scope of the standard was increased by the addition of socket welded end and threaded end valves. The listings for nickel alloy and other alloy valve materials were expanded. Also, rules for threaded body joints were added and wafer-type valve body rules were revised. MSS SP-43 to 82 (R86) MSS SP-44 to 85	Subsections NB, NC, and ND.
III-1-A90	Table I-10.1 Stress Tables for Class MC Ferritic Steels	- Added: SA-738 - C (to 2-1/2 in.) (TS/YS = 80/60) (2-1/2 in. to 4 in.) (TS/YS = 75/55) (4 to 6 in.) (TS/YS = 70/46) - Changed designation for: SA-738 - ... to SA-738 - A (K12447)	SA-738 Grade C has been accepted by the USNRC, in its endorsement of the 1990 Addenda of Section III, Subsections NC and ND (see Table I-7.1 for permitted materials for Class 2 and 3 applications).

Affecting Addenda after 1989 Ed.	**Affected chapters**	**REDUCTIONS IN REQUIREMENTS:** ***differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved***	**Explanation/Justification** ***None of the changes reduce the levels of previous conservatism in the Code***
III-2-A04, III-2 (BC03-472)	CC-4331.2(b)(6), CC-4333.2.3(a), CC-4333.2.3(b), CC-4333.2.4(e)(3), CC-4333.2.4(g), CC-4333.3(b)(6), CC-4333.3(c)(4), CC-4333.3(d)(5), CC-4333.3(f), CC-4333.5.3(b) Cold Rolled Parallel Threaded Splices	This revision adds cold rolled formed parallel threaded splices as an acceptable form of splice. Cold roll formed parallel threaded splices are being widely used in the construction industry. Cold rolled formed parallel threaded splices have a special thread and locknut to lock the coupler. This mechanical splice is limited to cold formed parallel threaded splices to prevent any single threaded rebar from being included, which would not possess the extra cold rolling process. Requirements for locknuts, which need to be used on both ends of the device to prevent loosening and to improve slip performance, are included. A testing requirement for cold rolled parallel threaded splices at 20F is also required.	This revision adds a new type of mechanical splice called a "cold-roll-formed parallel-threaded splice."
III-2-A02 (BC01-698)	CC-4542.1, CC-4542.2 Back-up Bars	This revision deletes the prohibition against the use of back-up bars in Category A and B welded joints.	This is a logical extension of existing requirements in Section VIII Div. 1 to permit the same weld details in containment liners as permitted for pressure shells.
III-2-A01 (2001 Edition) (BC00-182)	CC-4333.2.3 Splicing of Reinforcing Bars-Performance Tests	This revision incorporates the provisions of Case N-363-1, "Splicing of Reinforcing Bars-Performance Tests, Section III, Division 2." The change permits acceptance of performance test results for reinforcing bar mechanical splices when the load extension does not achieve 2% strain. The alternative test results must meet the lesser of 2% strain or 125% of the specified minimum yield strength of the reinforcing bar.	The alternative test provides an alternative way to assure the structural capability of the splices.
III-2-A01 (2001 Edition)	Table CC-4552-2 Postweld Heat	This revision changes the Table to permit containment liners the same PWHT exemptions that were allowed for concrete reactor vessel liners. The change incorporates the provisions of Case N-536, "Alternative to Table CC-4552-2	There is no reduction in requirements when the alternative rules for containment

Affecting Addenda after 1989 Ed.	**Affected chapters**	**REDUCTIONS IN REQUIREMENTS:** ***differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved***	**Explanation/Justification** ***None of the changes reduce the levels of previous conservatism in the Code***
(BC00-183)	Treatment Exemptions	Exemptions to Mandatory PWHT Concrete Containment Liner, Section III, Division 2."	liners are the same as for reactor liners. (The USNRC has not endorsed Case N-536.)
III-2-A01 (2001 Edition) (BC00-357)	CC-5531.2 Extent of Examination	This revision removes the requirement to increase number of radiographs of double-sided welds, when a portion of the liner uses backup bars and single-sided welding. This was an arbitrary requirement intended to discourage the use of single-sided welds with backup bars. The change also clarifies that the welds made using back-up bars shall be examined by UT or MT for the full length of the backed-up weld.	The number of radiographs has no effect on assuring acceptable weld quality.
III-2-A00 (BC00-005)	CC-2231.4 Specified Concrete Properties	This revision provides conditions under which the required creep testing of CC-2231.4, may be delayed. The change incorporates the provisions of Case N-529 "Creep Testing, Section III, Division 2."	It takes about 28 days for concrete to set. However, early in that time frame, it is possible to accurately evaluate the creep of the concrete based on early tests. This is common industry practice. Not applicable to the ESBWR RCCV. (The USNRC has not endorsed Case N-529.)
III-2-A00 (BC00-006)	CC-3543(a) Tendon Anchor Reinforcement	CC-3543(a) requires that reinforcement "be located starting not more than 2 inches from the bearing plate and not extending more than twice the minimum bearing plate width." This revision provides conditions under which that requirement can be waived. The change incorporates the provisions of Case N-488, "Design of Tendon and Anchorage Reinforcement, Section III, Division 2."	Not applicable to ESBWR.
III-2-A00 (BC00-007)	CC-4432.5 Twisting and Coiling Prestressing Tendons	This revision provides an alternative to the provisions of CC-4432.5 regarding intentional twisting for all horizontal circumferential tendons comprised of multiple elements. The change incorporates the provisions of Case N-487, "Twisting of Horizontal Prestressing Tendons, Section III, Division 2."	Not applicable to ESBWR

Affecting Addenda after 1989 Ed.	**Affected chapters**	**REDUCTIONS IN REQUIREMENTS:** ***differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved***	**Explanation/Justification** ***None of the changes reduce the levels of previous conservatism in the Code***
III-2-A96 (96-55)	CC-3740, CC-3750 Penetration Assemblies, Brackets and Attachments	Previously, Division 2 limited attachment loads in the through-thickness direction of plate. This revision eliminates that restriction and allows the full strength of the plate to be used in the through-thickness direction. This is a continuation of the similar change started in the 1995 Addenda.	Similar provisions in Section III, Division 1, Subsection NF have been permitted for Class 1, 2, and 3 supports by USNRC endorsement on the Winter 1982 Addenda.
III-2-A95 (94-309)	CC-3750(b), CC-4543.6, Fig. CC-4543.6-1, Fig. CC-4543.6-2 Through-Thickness Loads	The Code restricted allowable stresses in liners to one-half of the allowable stress for tensile loads normal to the liner, because of lamellar tearing, laminations, and through-thickness strength. Because of improved steel melting practices and examination techniques, the one-half factor has been eliminated. This revision provides new requirements that must be met when liner materials one inch and greater in thickness are loaded in the through-thickness direction. When loaded in this direction, the materials must meet the acceptance standards of SA-770, "Through-Thickness Tension Testing of Steel Plates for Special Applications." Special welding procedure qualifications are required, and must use either inlays or overlays, or special weld deposition techniques. After completion of welding, the base metal underneath the attachment weld must be ultrasonically examined. Special examination methods and acceptance standards are provided. This revision is similar to changes made to Section III, Division 1, Subsection NF in the Winter 1978 and Winter 1982 Addenda.	Similar provisions in Section III, Division 1, Subsection NF have been permitted for Class 1, 2, and 3 supports by USNRC endorsement on the Winter 1982 Addenda.
III-2-A95 (94-306)	CC-4331.2(b)(5), CC-4333.2.3(a), CC-4333.2.4(f), CC-4333.3(e), CC-4333.4, CC-4333.5.3(a)	This revision adds provisions for a new mechanical reinforcing bar splice. The new splice is identified as a "sleeve with cementitious grout splice." The splice has been evaluated for use by building officials organizations and found to meet the requirements of ACI-318.	This splice has been in use for more than ten years and meets the requirements of ACI-318, which has served as the basis for the Section III, Division2 Concrete Code.

Affecting Addenda after 1989 Ed.	**Affected chapters**	**REDUCTIONS IN REQUIREMENTS:** ***differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved***	**Explanation/Justification** ***None of the changes reduce the levels of previous conservatism in the Code***
	Splicing of Reinforcing Bars		
III-2-A93	CC-4532.2.1 Group Identification of Welders to Weld Joints	The revision allows multiple welds to have group identification for the purposes of verifying that all welders and welding operators were properly qualified. Previously, this group identification was only allowed for structural attachment welds. This revision incorporates the provisions of Case N-507, "Identification of Welders, Section III, Division 2."	The USNRC previously approved these provisions through endorsement of Case N-507 in RG 1.84, Rev. 32.
III-2-A92	Table CC-2160-1, Note (2), Codes, Standards, and Specifications Referenced in Text Dimensional Standards	This revision updates the listed standards and moves the dates to "Codes, Standards, and Specifications Referenced in Text." Pipes and Tubes - Updated: ASME B36.10 to M85 ASME B36.19 to M85 Fittings, Flanges and Gaskets - Deleted: ANSI B70.1 Refrigeration Flare Type Fittings - Updated: ASME B16.5 to 88 Comments on the changes to this standard can be found in the RA-search data base Rev_B31. ASME B16.9 to 86 ASME B16.11 to 80 ASME B16.21 to 78 ASME B16.25 to 86 ASME B16.28 to 86	These provisions have been accepted by the USNRC, in its endorsement of various early-1990's Editions and Addenda of Section III, Subsections NB, NC, and ND. Most of the changes are editorial.

Affecting Addenda after 1989 Ed.	Affected chapters	**REDUCTIONS IN REQUIREMENTS:** *differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved*	**Explanation/Justification** *None of the changes reduce the levels of previous conservatism in the Code*
		- Titles for Standards were changed to: ASME B16.5 Pipe Flanges and Flanged Fittings ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges AWWA C207 Standard for Steel Pipe Flanges for Waterworks Services Bolting - Titles for Standards were changed to: ASME B18.2.1 Square and Hex Bolts and Screws (Inch Series) Including Hex Cap Screws, and Lag Screws ASME B18.2.2 Square and Hex Nuts (Inch Series) ASME B18.3 Socket Cap, Shoulder, and Set Screws (Inch Series) - Updated: ASME B18.2.2 to 87 ASME B18.3 to 86 Threads - Updated: ASME B1.1a to 84 - Changed Standard Numbers from: ANSI B2.1 to ASME B1.20.1-83 Pipe Threads, General Purpose (Inch) ANSI B2.2 to ASME B1.20.5-78 (R80) Gaging for Dryseal Pipe Threads (In.) Valves - Updated: ASME B16.34 to 88 Comments on the changes to this standard can be found in the RA-search data base Rev_B31. - Titles for Standards were changed to:	

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: *differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved*	Explanation/Justification *None of the changes reduce the levels of previous conservatism in the Code*
		ASME B16.34 Valves - Flanged, Threaded, and Welded End This revision corrects the title of the dimensional standards to ASME because they are no longer subject to approval by ANSI. This revision also deletes the revision year from Table CB-2160 and CC-2160 because the revision dates are now given in, "Codes, Standards, and Specifications Referenced in Text," located at the end of the book.	
III-2-A92	Codes, Standards, and Specifications Referenced in Text	- Deleted: ANSI B2.1 Pipe Threads (Except Dryseal) ANSI B2.2 Dryseal Pipe Threads ANSI B70.1-60 Refrigeration Flare Type Fittings - Added: ANSI B1.20.1-83 Pipe Threads (Except Dryseal) ANSI B1.20.5-78 (R80) Gaging for Dryseal Pipe Threads - Updated: ANSI B1.1 to ASME B1.1a-84 ANSI B16.5 to ASME B16.5-88 Comments on the changes to this standard can be found in the RA-search data base Rev_B31, and are available upon request. ANSI B16.9 to ASME B16.9-86 ANSI B16.11 to ASME B16.11-80 ANSI B16.20 to ASME B16.20 ANSI B16.21 to ASME B16.21 ANSI B16.25 to ASME B16.25-86 ANSI B16.28 to ASME B16.28-86 ANSI B16.34 to ASME B16.34-88 Comments on the changes to this standard can be found in the RA-search data base Rev_B31, and are available upon request.	These provisions have been accepted by the USNRC, in its endorsement of various early-1990's Editions and Addenda of Section III, Subsections NB, NC, and ND. Most of the changes are editorial.

Affecting Addenda after 1989 Ed.	Affected chapters	REDUCTIONS IN REQUIREMENTS: *differences with ASME 1989 Edition, and Technical Basis for concluding that an equivalent level of safety will be achieved*	Explanation/Justification *None of the changes reduce the levels of previous conservatism in the Code*
		ANSI B18.2.1 to ASME B18.2.1 ANSI B18.2.2 to ASME B18.2.2-87 ANSI B18.3 to ASME B18.3-86 ANSI B36.10 to ASME B36.10M-85 ANSI B36.19 to ASME B36.19M-85	
III-2-A91 (91-222)	CC-4321.1(c), CC-4321.2, CC-4322(a) Bending of Reinforcing Bar	This revision changes the rules for bending reinforcing bar to conform to the provisions of ACI 318-89. The change provides that the minimum diameter of the bend in the bar and the extension length are dependent on the diameter of the reinforcing bar being bent. This revision removes the change made in the 1990 Addenda.	This change is consistent with the provisions of ACI-318.
III-2-A91	CC-5536.2 Leak Chase System	This revision allows leak chase channels to be tested by air using the "maintenance of pressure" method. The change incorporates the provisions of Case N-231, "Alternate Methods for Leak Detection in the Attachment Weld to Leak Chase Channels for Section III, Division 2, Class CC Construction."	The USNRC previously approved these provisions through endorsement of Case N-231 in RG 1.84, Rev. 32.
III-2-A90	CC-2242.5, CC-2242.6 Use of Prepackaged General Purpose Cement Grouts	This change incorporates the provisions of Case N-384-1, "Use of Prepackaged General Purpose Cement Grouts, Epoxy Grouts, and Epoxy Bonding Materials, Section III, Division 2, Class CC." The Case permitted the use of prepackaged grouts and bonding materials in lieu of materials mixed at site.	The USNRC previously approved these provisions through endorsement of Case N-384-1 in RG 1.84, Rev. 32.
III-2-A90 (90-174)	CC-4240(c), CC-4240(d), CC-4260 Cold Weather Concrete Placement	This revision provides a definition for cold weather concrete placement and clarifies the requirements for these conditions. The revision changes the period of temperature control at the surface of the concrete from seven days to three days.	This change allows slower curing of the concrete, if the temperature falls below 32F.

NRC RAI 3.8-5, Supplement 2

NRC Assessment from Chandu Patel E-mail Dated May 24, 2007

The staff notes that Regulatory Guide (RG) 1.136, Revision 3, entitled "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments," was officially issued in March 2007. This regulatory guide endorses the 2001 Edition of the ASME Code, Section III, Division 2, through the 2003 addenda, subject to the exceptions cited in Section C, Regulatory Position, of the RG. Since the staff has officially accepted the Code, through the 2003 addenda, the applicant needs to identify any applicable relaxations between the 2004 Code referenced for the ESBWR design and RG 1.136, Rev. 3, including the regulatory positions. The deviations will require technical justification for acceptability. As an alternative, to facilitate resolution, the applicant may reference RG 1.136, Rev. 3 directly, and thereby revise the applicable code for the ESBWR design to the 2001 Edition of the ASME Code, Section III, Division 2, through the 2003 addenda. If the applicable code edition is revised, it needs to be documented in the DCD.

GE Response

Regulatory Guide 1.136, Revision 3, which endorses the 2001 Edition of the ASME Code, Section III, Division 2, through the 2003 addenda, did not exist six months prior to the ESBWR design certification application. Consequently, Regulatory Guide 1.136, Revision 2 is applicable to the ESBWR.

As requested in the original NRC RAI 3.8-5, differences between the 1989 Edition of the ASME Code, Section III, Division 2, which was reviewed and accepted during the advanced boiling water reactor (ABWR) review process, and the 2004 Edition (including the addenda after 1989 edition) were summarized in a table in the response.

In this table, the differences between the 2004 Edition and the 2001 Edition through the 2003 addenda were included. None of the changes in the 2004 Edition reduce the levels of previous conservatisms in the Code since the 1989 Edition as stated in the response to NRC RAI 3.8-5S1.

DCD Impact

No DCD change was required in response to this RAI Supplement.

NRC RAI 3.8-5, Supplement 3

In the response dated August 13, 2007, GEH stated that RG 1.136, Revision 3, which endorses the 2001 Edition of the ASME Code, Section III, Division 2, through the 2003 Addenda, did not exist six months prior to the ESBWR design certification application. Therefore, GEH stated that RG 1.136, Revision 2 (not Revision 3) is applicable to the ESBWR. In addition, GEH referred to the ASME Code Section III comparisons presented in the original and Supplement 1 responses to RAI 3.8-5 which included the differences between the 2004 Edition of the ASME Code, Section III and the 2001 Edition of the ASME Code, Section III through the 2003 Addenda.

The staff reviewed the comparisons presented in the prior responses to RAI 3.8-5, which included the differences between the 2004 Edition of the ASME Code, Section III and the 2001 Edition of the ASME Code, Section III through the 2003 Edition. The staff agrees with GEH that the revisions identified in the 2004 Edition of the ASME Code, Section III, Division 2, Subsection CC for the concrete portions of the containment are acceptable. However, since GEH utilized the recent 2004 Edition of the ASME Code, Section III, Division 2, Subsection CC, based on a comparison to the Code through the 2003 Addenda, GEH needs to confirm that the regulatory positions in the current RG 1.136, Revision 3, which endorses the Code through the 2003 Addenda, are also met.

GEH Response

GEH confirms that the ESBWR design certification meets the regulatory positions stated in Regulatory Guide 1.136, Revision 3, which endorses ASME Section III, Division 2, Subsection CC, 2001 Edition through the 2003 Addenda.

DCD Tier 2 Table 1.9-21 will be revised to show Regulatory Guide 1.136, Revision 3 as being applicable to the ESBWR design certification.

DCD Tier 2 Tables 3.8-6 and 3.8-9 will be revised so that the title given for Regulatory Guide 1.136 agrees with Regulatory Guide 1.136, Revision 3.

DCD Tier 2 Subsection 3.8.1.5 and Table 3.8-3 will be revised to agree with the allowable upper limit of the tangential shear strength provided by orthogonal reinforcement given in Regulatory Guide 1.136, Revision 3. The revision to DCD Tier 2 Table 3.8-3 will also include changing the units of f'_c to "MPa" from "kgf/cm^2" in the equations for tangential shear strength provided by orthogonal reinforcement for consistency.

DCD Impact

DCD Tier 2 Subsection 3.8.1.5 and Tables 1.9-21, 3.8-3, 3.8-6, & 3.8-9 will be revised in the next update as noted in the attached markups.

NRC RAI 3.8-9

Provide a description of the different subcategories for SRV discharge (e.g., single valve, two valve, automatic depressurization system (ADS), and all valves) and for LOCA (large, intermediate, and small) if applicable, and how they are treated in the load combinations described in DCD Section 3.8.1.3. Also, provide a description and the basis for the method used to combine all of the dynamic loads.

In addition, (1) identify the applicable detailed report/calculation (number, title, revision and date, and brief description of content) that will be available for audit by the staff, and (2) reference this report/calculation in the DCD.

GE Response

LOCA (large, intermediate, and small break) and SRV discharges (single valve first actuation, single valve subsequent actuation, and multiple valves) are discussed the in Containment Load Definition (CLD) - NEDE-33261P. The bounding pressure and temperature values are used respectively as accident pressure P_a and LOCA temperature T_a in load combinations for design. The bounding pressure values are used as SRV loads for design. The SRV pressure values for these three limiting conditions (single valve first actuation, single valve subsequent actuation, and multiple valves) are furnished in Table 6 of NEDE-33261P. The multiple valve case bounds ADS. The SRV pressure values for these three limiting conditions cover the different subcategories of SRV discharge (e.g., single valve, two valve, ADS, and all valves). The bounding values of these three limiting conditions are shown in DCD Figure 3B-1 and are considered as SRV loads in DCD Subsections 3.8.1.3 and in the load combination DCD Tables 3.8-2, 3.8-4 and 3.8-7. Depending on the distribution of SRV loads in the suppression pool, they are further classified as axisymmetrical loads, or non-axisymmetrical loads. The SRV pressure loads are applied throughout the entire suppression pool as axisymmetrical SRV (DCD Subsection 3.8.1.4.1.1.2), which represents all of the (or multiple) valve cases. The SRV pressure loads are applied on half of the entire suppression pool as non-axisymmetrical SRV (DCD Subsection 3.8.1.4.1.1.1), which represents the single valve or two-valve case. Because the total load for the axisymmetrical SRV load case is greater than those for the non-axisymmetrical cases, only the former is considered in the RCCV and vent wall design. The design evaluation of the affected structures for SRV loads is performed using equivalent static pressure input equal to a dynamic load factor (DLF) of 2 times the peak dynamic pressure (i.e., the bounding values). The resulting forces or stresses were combined with those due to other loads in the most conservative manner by systematically varying the signs associated with dynamic (including seismic) loads. (See also response to RAI 3.8-48).

The SRV pressure time history and other related information is presented in DCD Appendix 3B. The SRV forcing function as defined in DCD Appendix 3B and the CLD (NEDE-33261P) has a range between 5 to 15 Hz. To perform dynamic analyses to generate response spectra, a finite number of cases using various forcing function frequencies are selected to match with the natural frequencies of the structure to maximize the responses and is described in DCD Appendix 3F as follows:

Axisymmetrical SRV (all) response analysis is covered by n=0 harmonic. Non-axisymmetrical of SRV actuation is covered by n=1 harmonic that corresponds to the effect of the overturning moment.

Frequency range of SRV Loads: $f_1 \leq f \leq f_2$ (f_1 = 5 Hz, f_2 = 12 Hz)

For vertical structural frequencies $(fs)_v$ (n=0):

a. If $(fs)_v > f_2$ then use f_2

b. If $f_1 < (fs)_v < f_2$ then use $(fs)_v$

c. If $f_1 > (fs)_v$ then use f_1

For horizontal structural frequencies $(fs)_h$ (n=1):

a. If $(fs)_h > f_2$ then use f_2

b. If $f_1 < (fs)_h < f_2$ then use $(fs)_h$

c. If $f_1 > (fs)_h$ then use f_1

In an axisymmetrical load case, three vertical frequencies of 5 Hz, 6.06 Hz and 12 Hz are selected. In a non-axisymmetrical load case, 3 horizontal frequencies of 5 Hz, 8.83 Hz and 12 Hz, of the structure satisfying the above selection are adopted as SRV forcing function frequencies.

The bounding response spectra of these cases are documented in DCD Appendix 3F. They are to be used with the response spectra due to seismic and other hydrodynamic loads for the design of safety-related structures, systems, and components inside of containment using the SRSS method of combination.

(1) The applicable detailed report/calculation that will be available for the NRC audit is:

NEDE-33261P, *Containment Load Definition, Revision 1*, May 2006, containing the description of the hydrodynamic loads.

(2) Since this information exists as part of GE's internal tracking system, it is not necessary to add it to the DCD submittal to the NRC.

A markup of DCD Section 3.7 was provided under MFN 06-298.

NRC RAI 3.8-9, Supplement 1

NRC Assessment Following the December 14, 2006 Audit

a) *If NEDE-33261P indicates that SRV has a range of 5 to 15 Hz, why does the analysis only consider a range of 5 to 12 Hz.*

b) *Are the values 6.06 and 8.83 the fundamental natural frequencies of the structure in the vertical and horizontal direction respectively?*

c) *Provide a comparable description for selecting the appropriate forcing functions for the different LOCA loads (chugging, CO, pool swell, AP, vent clearing, etc.)*

d) *Since this is done for generation of floor response spectra throughout the building (not just local containment response), aren't there other structural natural frequencies that should be considered?*

e) *GE provided a markup to 3.7 (first paragraph) where it states that the method for combining seismic and RBV loads for reinforced concrete structures varies the sign (+ or -), equivalent to ABS. This is acceptable for reinforced concrete structures. However, it also states that the method used (presumably for all other SSCs) is the SRSS in accordance with NUREG-0484., Rev. 1. This is acceptable for seismic plus LOCA; however, the criteria for combining other dynamic loads (e.g., SRV and individual LOCA loads (AP, PS, CO, CH, LCO, HVL, etc) are not clearly defined. According to NUREG-0484, the use of SRSS for the other loads would require demonstrating a non-exceedance probability (NEP) of 84 percent or higher is achieved. Some of this information may be implied and buried within various scattered sections of the DCD (e.g., response spectra for some of the loads in App. 3F; however, the criteria should be clearly specified in one location. e) If time permits during the audit, the referenced NEDE report should be looked at, not for development of the loads (not within BNL's scope) but for proper application of the defined loads to the plant structures. Note: This is also identified as an RAI (RAI-3.12-17) during the piping review of DCD Section 3.9.*

During the audit, GE provided a draft supplemental response to this RAI. The staff needs to review this information. The response for items a, b, c, and d are acceptable. For item e, GE needs to provide documentation which describes the use of the SRSS method based on demonstrating that the NEP criteria was met.

GE Response

a) Frequency range of 5 to 15 Hz, as stated in the original response, was a typographical error. NEDE-33261P, page 6-5 specifies the bubble frequency range to be 5 to 12 Hz.

b) Yes, 6.06 and 8.83 Hz are the fundamental frequencies of the structure in the vertical and horizontal directions respectively.

a) Sixteen chugging and five CO cases, as described in DCD Tier 2 Subsection 3F.2.3 (4), cover the entire range of forcing functions, and there is no need to select specific structural frequencies.

b) The dynamic analysis model includes all structures in the reactor building. The resulting natural frequencies of 6.06 and 8.83 Hz are the only structural frequencies within the SRV forcing frequency range of 5 to 12 Hz.

c) ESBWR hydrodynamic loads are the same as the ABWR. The ABWR loads satisfy the 84-percentile non-exceedance (NEP) requirement of NUREG-0484, Rev. 1 as shown in the following memorandum that documents the applicability of the SRSS method for hydrodynamic loads.

Confirmation of Hydrodynamic Loads

Reference:
1. Letter, GE-1997-0731, U.C. Saxena to Ai-Shen Liu, Confirmation of Hydrodynamic Loads, dated 12/19/97
2. Response of Structures Due to Containment Loads, 299X700-001, Rev. 2
3. Containment Load, 299X701-030, Rev. 1
4. FOAKE Containment Accident Response Calculations Report, 24156-1A10-1820, Rev. 0

As a follow-up to my letter (Reference 1), additional analyses were performed to determine and confirm applicability of hydrodynamic loads for Lungmen application. Conclusion results from these analyses are summarized in this letter.

1. SRSS in Combining Dynamic Loads

NUREG-0484, Rev. 1 allows SRSS combination of dynamic loads, if these loads meet the Condition B (i). This condition requires that the loads must have an 84% non-exceedance probability or have a load magnitude which is 1.15 times the median, whichever is greater.

Results from the additional analyses confirm that SRV/CO/Chugging loads described in Reference 3 and used in Reference 2, meet the Condition B (i) of NUREG-0484, Rev. 1.

This letter, we hope, addresses your project needs. If you have any questions, please let us know. Evidence of verification is contained in DRF U71-00024/18.

DCD Impact

No DCD change was required in response to this RAI Supplement.

NRC RAI 3.8-9, Supplement 2

NRC Assessment from Chandu Patel E-mail Dated May 24, 2007

In response to item (e), the applicant stated that ESBWR hydrodynamic loads are the same as the ABWR. The ABWR loads satisfy the 84-percentile non-exceedance (NEP) criteria of NUREG 0484, Rev. 1, as shown in the memorandum attached to the response that documents the applicability of the square root of sum of squares (SRSS) method for hydrodynamic loads. The staff could not confirm that the ESBWR hydrodynamic loads are the same as the ABWR. In addition, the memorandum attached to the response does not clearly establish that the NEP criteria was satisfied for ABWR. Therefore, the staff requests the applicant to provide additional information demonstrating that the ESBWR hydrodynamic loads satisfy the 84 percentile NEP criteria of NUREG 0484, Rev. 1.

GE Response

The ESBWR hydrodynamic load definitions and bases are described in the ESBWR containment loads report NEDE-33261P (Reference 1). These include the SRV loads, the LOCA CO loads and the LOCA chugging loads. As described in Reference 1 the ESBWR load definitions are developed based on the corresponding ABWR loads.

SRV Loads

The ESBWR plant uses X-Quencher devices based on the design used in Mark II and Mark III plants and also in the ABWR. The ESBWR SRV induced pool boundary bubble pressure loads are defined using the GE X-Quencher SRV load methodology which is described in Appendix 3B, Attachment A of GESSAR II (Reference 2). The GE X-Quencher load methodology was approved for BWR plants with X-Quenchers in Mark II and Mark III plants in NUREG-0802 (Reference 3). The GE X-Quencher load methodology was also used to define the ABWR X-Quencher SRV loads. The GE X-Quencher SRV load methodology employs empirically derived correlations, developed from partial and full scale tests, to generate a load definition with a statistical 95%/95% confidence level. This means that there is 95% confidence that the defined load will bound 95% of all future occurrences. This statistical confidence level bounds 84% non-exceedance probability (NEP) required by NUREG-0484.

LOCA CO and Chugging Loads

The ESBWR LOCA CO and chugging load definition consists of wall pressure time histories, which were originally defined for the ABWR. Justification for application of the ABWR CO and chugging wall pressure histories to the ESBWR containment is provided in NEDE-33261P (Reference 1).

The basis for the ABWR CO and chugging loads are described in Appendix 3B of the ABWR SSAR and is also included in the ESBWR containment loads report (Reference 1). A source load approach was used to define both the ABWR CO load and the ABWR chugging loads. With this approach, a test source load is initially developed with an acceptance criterion that the

source load, when applied to the analytical model of the test facility, produces wall pressure histories, which match the test data. This test source, with appropriate adjustments is then applied to the full-scale ABWR containment to generate the ABWR wall pressure loads.

The sources loads for CO and chugging were developed from a comprehensive database (Reference 4) developed to envelope the range of expected conditions during CO and chugging in an ABWR plant. A set of sources for CO and chugging were developed with the criteria that when the sources are applied to an analytical model of the test facility, the Power Spectral Densities (PSD) of the resultant pressure histories envelope the PSDs for the measured CO and chugging test data.

Since the CO and chugging source loads, used to generate the load definition, were developed to envelope all available test data, the associated non-exceedance probability is considered to be near 100%. Therefore the ABWR CO and chugging load definitions, which have been applied to the ESBWR, meet the 84% NEP criteria required by NUREG-0484.

REFERENCES:

1. NEDE-33261P, "Licensing Topical Report, ESBWR Containment Load Definition," May 2006.
2. GESSAR II, 238 Nuclear Island, General Electric Company, Docket No. STN 50- 447, Amendments 1 through 21, Appendix 3B (Attachment A).
3. NUREG-0802, "Safety/Relief Valve Quencher Loads: Evaluation for BWR Mark II and III Containment," Oct. 1982.
4. NEDC-31393, "ABWR Containment Horizontal Vent Confirmatory Test, Part I," March 1987.

DCD Impact

No DCD change was required in response to this RAI Supplement.

NRC RAI 3.8-9, Supplement 3

In the response dated August 13, 2007, GEH stated that the ESBWR hydrodynamic load definitions and bases are described in the ESBWR containment loads report NEDE-33261P. These include the SRV loads, LOCA CO loads, and LOCA chugging loads. The ESBWR load definitions are developed based on the corresponding ABWR loads. The response explained, for each of these loads, how the specific defined load bounds all future occurrences of the load with a confidence level that is greater than 84% non-exceedance probability. The concern raised by the staff in the RAI was not in demonstrating a confidence level of 84% when defining each individual load, but rather the technical basis for combining multiple dynamic loads using the SRSS method. SRSS combination method is acceptable for combining the structural responses from seismic plus LOCA; however, the basis of the criteria for combining other dynamic loads (e.g., SRV and individual LOCA loads (AP, PS, CO, CH, LCO, HVL, etc) is not evident. According to NUREG-0484, Revision 1, the use of SRSS (rather than the absolute sum method) for combining the other loads would require demonstrating that a non-exceedance probability (NEP) of 84% or higher is achieved for the combined response due to multiple dynamic loadings considering the time-phase relationship. Acceptable methods for achieving this goal are clearly described in the conclusion section of NUREG-0484, Revision 1. If GEH uses the SRSS method for combining the other dynamic loads, then the technical basis for using this method needs to be provided as discussed above.

GEH Response

Compliance with NUREG-0484, Revision 1 requirements to justify the SRSS response combination for the combined response of dynamic loads other than SSE and LOCA was demonstrated by extensive studies in the following GEH reports for existing GEH BWR plants of various containment configurations:

1. NEDE-24010-P, Technical Basis for the Use of the Square Root of the Sum of Squares (SRSS) Method for Combining Dynamic Loads for Mark II Plants, July 1977. NEDE-24010-1, Supplement 1, SRSS Application Criteria as Applied to Mark II Load Combination Cases, October 1978. NEDE-24010-2, Supplement 2, Bases for Criteria for Combination of Earthquake and Other Transient Responses by the Square-Root-Sum-of-the-Squares Method, December 1978. NEDE-24010-3, Study to Demonstrate the SRSS Combined Response has Greater than 84 Percent Non-Exceedance Probability When the Newmark-Kennedy Acceptance Criteria are Satisfied, August 1979. These reports were reviewed by the NRC and quoted as references in NUREG-0484, Revision 1.

2. NEDE-24632, Mark I Containment Program Cumulative Distribution Functions for Typical Dynamic Responses of Mark I Torus and Attached Piping Systems, December 1980. This report was reviewed and accepted by the NRC in a March 10, 1983 NRC letter, Acceptability of SRSS Method for Combining Dynamic Responses in Mark I Piping Systems.

3. SMA 12109.01-R001, Study to Demonstrate the Generic Applicability of SRSS Combination of Dynamic Responses for Mark III Nuclear Steam Supply System and Balance-of-Plant Piping and Equipment Components, November 1981. This report was reviewed by the NRC and quoted as a reference in NUREG/CR-2686.

An important observation from these studies is that the combined response for dynamic loads other than SSE and LOCA achieves a non-exceedance probability (NEP) of 84% or higher due to the similarities of hydrodynamic loadings and responses in all GEH BWR plants, despite the different containment configurations. On the basis of similarity, it can be concluded that the SRSS combination of response to dynamic loads, other than SSE and LOCA, is also applicable to the ESBWR.

DCD Impact

No DCD change is required in response to this RAI Supplement.

Table 1.9-21

NRC Regulatory Guides Applicability to ESBWR

RG No.	Regulatory Guide Title	Appl. Rev.	Issued Date	ESBWR Appli-cable?	Comments
1.133	Loose-Part Detection Program for the Primary System of Light-Water-Cooled Reactors	1	05/1981	No	A loose-parts monitoring system is not included in the ESBWR design.
1.134	Medical Evaluation of Licensed Personnel at Nuclear Power Plants	3	03/1998	—	COL
1.135	Normal Water Level and Discharge at Nuclear Power Plants	0	09/1977	Yes	
1.136	Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments ~~(Articles CC-1000, -2000, and -4000 through -6000 of the "Code for Concrete Reactor Vessels and Containments"~~	3~~2~~	03/2007~~0 6/1981~~	Yes	
1.137	Fuel-Oil Systems for Standby Diesel Generators	1	10/1979	No	No safety-related Diesel Generators for ESBWR. URD intent – see Table 1.9-21a
1.138	Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants	2	12/2003	—	COL
1.139	Guidance for Residual Heat Removal	0	05/1978	Yes	URD optimization – see Table 1.9-21a

3.8.1.4.2 Ultimate Capacity of the Containment

A deterministic analysis is performed to determine the ultimate capacity of the containment and the details are described in Appendix 19B. A probabilistic analysis for containment pressure fragility is also performed and the details are described in Appendix 19C.

3.8.1.5 Structural Acceptance Criteria

For evaluation of the adequacy of the concrete containment structural design, the major allowable stresses of concrete and reinforcing steel for service load combinations and factored load combinations according to ASME Code Section III, Division 2 (except for tangential shear stress carried by orthogonal reinforcement for which a lower allowable is adopted for ESBWR) are shown in Table 3.8-3.

The allowable tangential shear strength provided by orthogonal reinforcement without inclined reinforcement is limited to ~~4.41~~4.88 MPa (~~639~~ 708 psi) for factored load combinations. Inclined reinforcement is not used to resist tangential shear in the ESBWR containment.

3.8.1.6 Material, Quality Control and Special Construction Techniques

Materials used in construction of the containment are in accordance with Regulatory Guide 1.136 and ASME Code Section III, Division 2, Article CC-2000. Specifications covering all materials are in sufficient detail to assure that the structural design requirements of the work are met.

3.8.1.6.1 Concrete

All concrete materials are approved prior to start of construction on the basis of their characteristics in test comparisons using ASTM standard methods. Concrete aggregates and cement, conforming to the acceptance criteria of the specifications, are obtained from approved sources. Concrete properties are determined by laboratory tests. Concrete admixtures are used to minimize the mixing water requirements and increase workability. The specified compressive strength of concrete at 28 days, or earlier, is:

Structure	Specified Strength f'_c MPa (psi)
Containment	34.5 (5000)
Foundation Mat	27.6 (4000)

All structural concrete is batched and placed in accordance with Subarticle CC-2200 and Article CC-4000 of ASME Code Section III, Division 2.

(1) Cement

Cement is Type II conforming to the Specification for Portland Cement (ASTM C 150). The cement contains no more than 0.60% by weight of alkalis calculated as sodium oxide plus 0.658 percent by weight potassium oxide. Certified copies of material test reports showing the chemical composition and physical properties are obtained for each load of cement delivered.

Type V cement is used, or other suitable means are employed, to prevent sulfate attack and concrete deterioration at locations where concrete is in contact with soils having more than

Table 3.8-3

Major Allowable Stresses in Concrete and Reinforcing Steel

	Concrete		Reinforcing Steel	
	Compression	**Tangential Shear**	**Tension**	
Service Load Combination	**Foundation** 12.4 MPa (For primary case) 16.6 MPa (For primary plus secondary case) **Others** 15.5 MPa (For primary case) 20.7 MPa (For primary plus secondary case)	(1) Provided by concrete $v_c = 0$ (2) Provided by orthogonal reinforcement v_{so} = ~~1.2~~0.415 $\sqrt{f_c'}$ * = ~~1.97~~2.18 MPa (For foundation) =~~2.21~~2.44 MPa (For others)	206.8 MPa 273.0 MPa 310.2 MPa	(For primary case) (For primary plus secondary case) (For test pressure case)
Factored Load Combination	**Foundation** 20.7 MPa (For primary case) 23.5 MPa (For primary plus secondary case) **Others** 25.9 MPa (For primary case) 29.3 MPa (For primary plus secondary case)	(1) Provided by concrete $v_c = 0$ (2) Provided by orthogonal reinforcement v_{so} = ~~2.4~~0.830 $\sqrt{f_c'}$ * = ~~3.95~~4.36 MPa (For foundation) =~~4.41~~4.88 MPa (For others)	372.2 MPa	

*: " f_c' " is in MPa~~kgf/cm²~~

Table 3.8-6

Codes, Standards, Specifications, and Regulations Used in the Design and Construction of Seismic Category I Internal Structures of the Containment

Specification Reference Number	Specification or Standard Designation	Title
1	ACI 301-05	Specifications for Structural Concrete
2	ACI 347-04	Guide to Formwork for Concrete
3	ACI 305R-99	Hot Weather Concreting
4	ACI 211.1-91	Standard Practice for Selecting Proportions for Normal, Heavy Weight and Mass Concrete
5	ACI 315-99	Details and Detailing of Concrete Reinforcement
6	ACI 306.1-90	Standard Specification for Cold Weather Concreting (Reapproved 2002)
7	ACI 309R-05	Guide for the Consolidation of Concrete
8	ACI 308.1-98	Standard Specification for Curing Concrete
9	ACI 212.3R-04	Chemical Admixtures for Concrete
10	ACI 214R-02	Evaluation of Strength Test Results of Concrete
11	ACI 311.5-04	Guide for Concrete Plant Inspection and Testing of Ready-Mixed Concrete
12	ACI 304R-00	Guide for Measuring, Mixing, Transporting, and Placing Concrete
13	ACI 349-01/349R-01	Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary
14	Not Used.	
15	ANSI/AISC N690-1994 (R2004) and S2	Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities and Supplement No. 2(1)
16	AWS D1.1/D1.1M 2004	Structural Welding Code – Steel (AWS D1.1/D1.1M) Rev. 05
17	EPRI NP-5380, 1987	Visual Weld Acceptance Criteria for Structural Welding at Nuclear Power Plants (Nuclear Construction Institute Group) Rev. 2, Sep. 1987.
18	ANSI/ASME NQA-1-1983	Quality Assurance Program Requirements for Nuclear Facilities, 1983 Edition with NQA-1a-1983 Addenda, (Reference Section 17.0)
19	Regulatory Guide 1.54	Service Level I, II and III Protective Coatings Applied to Nuclear Power Plants, Rev. 1, July 2000.
20	Regulatory Guide 1.94	Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants, Rev. 1 and Draft 2.
21	Regulatory Guide 1.136	~~Materials for Concrete Containments (Article CC-2000 of the Code for Concrete Reactor Vessels and Containments), Jun. 1981~~Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments, Rev. 3, March 2007.

Table 3.8-9

Codes, Standards, Specifications, and Regulatory Guides Used in the Design and Construction of Seismic Category I Structures

Specification Reference Number	Specification or Standard Designation	Title
29	Regulatory Guide 1.94	Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants, Rev. 1 and draft 2
30	Regulatory Guide 1.136	~~Materials, Construction and Testing of Concrete Containments (Article CC 2000 of the Code for Concrete Reactor Vessels and Containments), Jun. 1981~~Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments, Rev. 3, March 2007.
31	Regulatory Guide 1.142	Safety-Related Concrete Structures for Nuclear Power Plants (Other than Reactor Vessels and Containments), Nov. 2001
32	Regulatory Guide 1.143	Design Guidance for Radioactive Waste Management Systems, Structures and Components installed in Light Water Cooled Nuclear Power Plants, Nov. 2001
33	Regulatory Guide 1.199	Anchoring Components and Structural Supports in Concrete, November 2003.
34	(Applicable ASTM Specifications for Materials and Standards)	
35	ASME N509-2002	Nuclear Power Plant Air-Cleaning Units and Components
36	ASME/ANSI AG-1-2003	Code on Nuclear Air and Gas Treatment
37	AISI-2001 Edition and 2004 Supplement	AISI Specification for the Design of Cold-Formed Steel Structural Members
38	SMACNA 1481, Third Edition, 2005	HVAC Duct Construction Standards-Metal and Flexible
39	IEEE-344-1987	Recommended Practices for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations

Explanation of Abbreviation

ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society for Mechanical Engineers
AWS	American Welding Society
IEEE	Institute of Electrical and Electronics Engineers, Inc.
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSPC	Steel Structures Painting Council

See Subsections 3.8.1.2 and 3.8.3.2 for Applications.