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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002945

July 2, 2010

Subject: AP1000 Response to Request for Open Item (SRP 3)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 5. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following proposed Open Item(s):

RAI-SRP3.8.2-SEB1-02 R2
RAI-SRP3.8.2-SEB1-03 R2
RAI-SRP3.8.3-SEB1-05 R2

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

Thomas J. Ray
For Rob Sisk

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Request for Additional Information on SRP Section 3

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 3

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP-3.8.2-SEB1-02
Revision: 2

Question: (Revision 0)

Section 3.8.2.2, as well as other sections of the DCD related to structures, refers to DCD Section 1.9 for discussion of compliance with regulatory guides. The staff notes that for Regulatory Guides 1.7 and 1.57 the DCD complies with earlier revisions of the regulatory guides. For Regulatory Guide 1.160, the DCD indicates that it is not applicable to the AP1000 design certification and that Section 17.5 defines the responsibility for a plant maintenance program. Regulatory Guide 1.199 is not described at all in Section 1.9 of the DCD.

In view of the extension of the AP1000 design to soil sites, reanalysis for updated seismic spectra, design changes made to structures, and to ensure that the AP1000 meets the safety requirements in current staff positions, the staff requests Westinghouse to indicate whether the design, construction, and inspection of the AP1000 plant comply with the current regulatory guides stated above or explain how following the existing versions of the regulatory guides or Section 17.5 (for the plant maintenance program), referred to in the DCD, provides an equivalent level of safety to the guidance in the current versions of the regulatory guides. Describe the basis for the use of each regulatory guide, or alternative, separately.

In the case of Regulatory Guide 1.199, "Anchoring Components and Structural Supports in Concrete," what are the alternative requirements or criteria Westinghouse are using to meet the NRC's regulations in the design, evaluation, and quality assurance of anchors (steel embedments) used for component and structural supports on concrete structures as required by GDC 1, "Quality Standards and Records," GDC 2, "Design Bases for Protection Against Natural Phenomena," and GDC 4, "Environmental and Dynamic Effects Design Bases."

If your response to this request for additional information will reference Revision 17 to the AP1000 DCD, please provide an exact reference.

Additional Question: (Revision 1)

Design criteria/approach used by W vs the guidance contained in several key NRC regulatory guides not referenced in DCD. Westinghouse is requested to compare their design criteria/approach to the guidance contained in several key NRC regulatory guides. Westinghouse will provide a revised RAI response to address this item.

Additional Question: (Revision 2)

The staff reviewed the Westinghouse response to RAI-SRP3.8.2-SEB1-02, Rev.1 and determined that the response did not fully address all of the concerns related to NRC regulatory guides. Therefore, the following information is needed:

1. The RAI response did not identify whether the regulatory positions in RG 1.7 and RG 1.57 were applicable for the containment design for hydrogen generated pressure loads. Therefore, explain whether the regulatory positions in RG 1.7, Rev. 3 and RG 1.57, Rev. 1, related to containment structural integrity under the hydrogen generated pressure loads, were applicable or not. If not applicable, provide the methods used to address the containment design for hydrogen generated pressure loads.

2. The RAI response did not identify whether the regulatory positions in RG 1.57 were applicable for the containment design with respect to the design limits and load combinations in the RG. Therefore, explain whether the regulatory positions in RG 1.57, Rev. 1, related to the design limits and load combinations, were applicable or not. If not applicable, provide justifications for not using the design limits and load combinations in the RG and for the adequacy of the applicant design limits and loading combinations.

3. In the response, the applicant stated that DCD Appendix 1A indicates that RG 1.160 is, "Not applicable to AP1000 design certification. (DCD) Section 17.5 defines the responsibility for a Plant Maintenance Program," and the RAI response stated, "In (DCD) Subsection 17.5.6 the Combined License Information required to address the maintenance rule is provided." The staff believes that the DCD should document the basis for the design, construction, testing and inservice surveillance programs for plant structures. These review areas are clearly identified in SRP 3.8.1 through 3.8.5. In the case of the maintenance requirements, each SRP subsection identifies that RG 1.160 is applicable. Therefore, confirm that RG 1.160 is applicable for the maintenance of structures at the plant and confirm that it will be followed when implementing 10 CFR 50.65. Also, revise the DCD to reflect the applicability of RG 1.160, Rev. 2.

4. The response provided an assessment of the applicability of all regulatory positions in RG 1.199 (2003) to the AP1000 plant. In several cases, the response indicated that the regulatory positions do not have a design requirement or are not applicable to the AP1000 plant. As indicated in Item 3 above, the DCD should document the basis for the design, construction, testing and inservice surveillance programs for plant structures. Therefore, the DCD should be revised to indicate that the regulatory position in RG 1.199 (2003) is applicable for anchoring components and structural supports in concrete for the AP1000 plant or provide alternate methods for anchoring components and structural supports in concrete, or provide the basis for not following the position and any alternative taken.

Westinghouse Response: (Revision 0, 1)

Addition information is provided for Regulatory Guide 1.160 and Regulatory Guide 1.199 in Revision 1 of the response.

Regulatory Guide 1.7:

The current AP1000 certified design is consistent with Revision 3 of Regulatory Guide 1.7 (issued in March 2007). The AP1000 containment design is a passive system, using convective mixing. Design features promote free circulation of the containment atmosphere. NUREG-1793, "Final Safety Evaluation Report Related to the Certification of the AP1000 Standard Design, Docket 52-006," USNRC, Washington, DC, September 2004 (NUREG-1793), documents an analysis of the effectiveness of the passive mixing. Section 6.2.5.5 of NUREG-1793 concluded:

> "The (U.S. Nuclear Regulatory Commission) staff has determined that the Containment hydrogen control system meets the requirements of GDC 41 and 10 CFR 50.44, as well as the guidelines of draft RG 1.7, Revision 3."

Therefore, it can be concluded that there is no technical or safety issue impact due to this Regulatory Guide revision on the AP1000 design, design processes, or licensing documentation.

Regulatory Guide 1.57:

RG 1.57 Revision 1 (issued in March 2007) endorses ASME Boiler & Pressure Vessel Code (B&PV), Section III, "Rules for Construction of Nuclear Facility Components," Division 1, Subsection NE, "Class MC Components," 2001 Edition with 2003 Addenda and Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 2001 Edition with 2003 Addenda.

The containment vessel is designed to meet the requirements of ASME B&PV Code, Section III, "Rules for Construction of Nuclear Facility Components," Division 1, Subsection NE, "Class MC Components," 2001 Edition including 2002 Addenda. The 2003 Addenda did not include any requirements to impact the design of the containment vessel described in the DCD. There are only two changes (which are in Subsection NE-5000 "Examination") and are related to the examination of the welds and do not impact the design.

- NE-5222 socket welds: Socket welds shall be examined by the magnetic particle or liquid penetrant method.

- NE-5261 butt welded joints: All butt welded joints in pressure retaining parts not included in Categories A, B, C, and D – such as doors, opening frames, permanent attachments, and similar constructions – shall be radiographed.

Therefore, the containment vessel design is in conformance with this Regulatory Guide.

Regulatory Guide 1.160

Regulatory Guide 1.160 provides guidance on the effectiveness of maintenance at nuclear power plants. This guidance is provided for the establishment of maintenance programs consistent with the maintenance rule (10 CFR 50.65). This regulatory guide has no impact on the design, analysis, fabrication, or construction of the AP1000 containment. DCD Appendix 1A addresses the conformance of the AP1000 with Regulatory Guide 1.160. As noted in DCD Appendix 1A, Regulatory Guide 1.160 is "Not applicable to AP1000 design certification. Section 17.5 defines the responsibility for a Plant Maintenance Program." In Subsection 17.5.6 the Combined License information required to address the maintenance rule is provided. Section 17.5 has no impact on the design, analysis, fabrication, or construction of the AP1000 containment design. There are no special maintenance requirements for the containment identified in Subsection 3.8.2.

Regulatory Guide 1.199:

This new Regulatory Guide (Revision 0) was issued in November 2003, to provide guidance to licensees and applicants on methods acceptable to the U.S. NRC staff for complying with the U.S. NRC regulations in the design, evaluation, and quality assurance of anchors (steel embedments) used for component and structural supports on concrete structures. As a result of studies and tests performed, questions were raised regarding the design methodology used in Appendix B to American Concrete Institute (ACI) 349-80. After an extensive review of available test data, the ACI 349 code committee issued a revision to ACI 349 Appendix B in February 2001.

This Regulatory Guide 1.199 generally endorses Appendix B to ACI 349-01, with exceptions in the area of load combinations.

- The AP1000 nuclear island concrete structures are designed to meet the requirements of ACI 349-01 code, including Appendix B on the design of anchors in concrete.

- The load combinations used in the design of nuclear island concrete structures were reviewed and approved by the U.S. NRC, after the release of this Regulatory Guide, in the AP1000 design certification for the hard rock sites.

Itemized conformance with regulatory positions (discussed in Section C of this Regulatory Guide) is given in the attached table.

Westinghouse Additional Response: (Revision 2)

1. As noted previously, the AP1000 Containment Vessel design is consistent with the guidance of Regulatory Guides 1.7 Rev. 3 and 1.57 Rev. 1. These Regulatory Guides were published in March 2007 and are therefore not applicable to the AP1000 design certification. The method used to address hydrogen generated loads is included in the response to RAI-SRP3.8.2-SEB1-03, Rev. 1 Question #3.

2. The regulatory positions in RG 1.57, Rev. 1 are not applicable to the design of the AP1000 Containment Vessel. As noted previously, the containment vessel is consistent with the guidance provided in Regulatory Guide 1.57, Rev. 1. This Regulatory Guide was published in March 2007 and is therefore not applicable to the AP1000 design certification. Meeting the requirements provided in this RG and the SRP 3.8.2 are provided in the response to RAI-SRP3.8.2-SEB1-03, Rev. 2.

3. Although design information is provided in the DCD that supports the implementation of the maintenance program, conformance to Regulatory Guide 1.160 is the responsibility of the COL applicant. Westinghouse cannot commit in the DCD to conformance to Regulatory Guide 1.160 for the COL applicant.

   The design, construction information, and material requirements for the structures are captured in the DCD Section 3.8. Special construction techniques for the containment are outlined in DCD Subsection 3.8.2.6. Seals provided at the top of the concrete on the inside and outside of the vessel to prevent moisture between the vessel and concrete are identified in DCD Subsection 3.8.2.1.2. Provisions for corrosion protection for the containment are discussed in DCD Subsection 3.8.2.6. There are no inservice inspection requirements required to assure containment corrosion protection. Construction of the containment internal structures, including structural module is discussed in DCD Subsection 3.8.3.6. Special construction techniques for the structural module in the shield building and auxiliary building are the same as described in DCD Subsection 3.8.3.8. There are no special construction techniques used in the construction of the nuclear island structures foundation. The design and requirements for protective coatings are described in DCD Subsection 6.1.2.1. The COL Information Item for a coating program is described in DCD Subsection 6.1.3.2.

   The inservice inspection and testing requirements for the containment are consistent with ASME Boiler and Pressure Vessel Code and Regulatory requirements. See Subsection 3.8.2.7 of the DCD. Construction inspection for the containment internal structures is addressed in DCD Subsection 3.8.3.8. DCD Subsection 3.8.4.7 addresses the examination requirements of structures supporting the passive containment cooling water storage tank on the shield building before and after first filling of the tank. Construction inspection for the nuclear island structures foundation is addressed in DCD Subsection 3.8.5.8.

The statements about inservice inspection in Subsection 3.8.3.7, 3.8.4.7, and 3.8.5.7 will be deleted and a statement about the establishment of a structures inspection program will be added.

The AP1000 structures, with the exception of the containment, do not include design features that require continuing monitoring or inservice inspection or testing. The AP1000 does not include post-tension tendons, seismic isolators, flood gates or other features that would require inspection and maintenance.

In Regulatory Guide 1.206 "Combined License Applications for Nuclear Power Plants" Criterion C.I.1.9.1 states that"...COL applicants should provide an evaluation of conformance with the guidance in NRC regulatory guides...". In practice the COL application incorporates by reference DCD Table 1.8-2 and supplements this with a table that completes the evaluation of regulatory guides for which the DCD does not provide a conformance evaluation. Westinghouse works closely with the AP1000 Design Centered Working Group and it would not be appropriate for Westinghouse to make commitments for the COL applicants for operational programs such as monitoring conditions of structures. A COL information item on a structures inspection program will be added as Subsection 3.8.6.5.

4. Conformance to Regulatory Guide is defined in the appendix to this response. Conformance to Regulatory Guide 1.199 will be added to DCD Appendix 1A as shown below.

   Specific requirements for the design and construction of anchors and embedments to conform to the procedures and standards of Appendix B to ACI 349-01 conform with the regulatory positions of USNRC Regulatory Guide 1.199 will be added to Subsection 3.8.3.5, 3.8.4.5.1, and 3.8.5.5 as shown below.

   A specific commitment to conform to ASME NQA-2, 1983, for load-bearing steel embedments is not required or appropriate. As documented in DCD Section 17.3, NQA-1-1994 is the applicable revision of NQA-1 for work performed for the AP1000 project. The 1994 Edition of NQA-1 incorporates the quality assurance requirements of the previous NQA-2 as Part II of NQA-1. Subsection 3.8.4.6.2 applies the quality assurance program described in Chapter 17. This subsection is applicable to the structures discussed in Subsection 3.8.3, 3.8.4, and 3.8.5.

Design Control Document (DCD) Revision: (Revision 0, 1, 2)

Add an entry for Subsection 3.8.6.5 in Table 1.8-2 as shown at the end of this response.

Add the entries for Regulatory Guides 1.160 and 1.199 to Table 1.9-1 as follow:

Table 1.9-1 (Sheet 13 of 15)

REGULATORY GUIDE/DCD SECTION CROSS-REFERENCES

Division 1 Regulatory Guide		**DCD Chapter, Section or Subsection**
1.160	Monitoring the Effectiveness of Maintenance at Nuclear Power Plants (Rev. 2, March 1997)	3.8.6.5 17.5.6 The COL applicant is responsible for assessing conformance to Regulatory Guide 1.160 of monitoring the effectiveness of maintenance ~~This regulatory guide is not applicable to AP1000 design certification~~

Table 1.9-1 (Sheet 15 of 15)

REGULATORY GUIDE/DCD SECTION CROSS-REFERENCES

Division 1 Regulatory Guide		**DCD Chapter, Section or Subsection**
1.197	Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors (Rev. 0, May 2003)	9.4.1 6.4.5
1.199	Anchoring Components and Structural Supports in Concrete (Rev. 0, November 2003	3.8.4.6.3

Revise the conformance of Reg. Guides 1.160 in Appendix 1A as follows:

Reg. Guide 1.160, Rev. 2, 3/97 – Monitoring the Effectiveness of Maintenance at Nuclear Power Plants

General	N/A	Not applicable to AP1000 design certification. Section 17.5 defines the responsibility for a Plant Maintenance Program. The COL applicant is responsible for assessing conformance to Regulatory Guide 1.160 of monitoring the effectiveness of maintenance

Add the following to Appendix 1A following the conformance of Reg. Guides 1. 197

Reg. Guide 1. 199, Rev. 0, 11/03 – Anchoring Components and Structural Supports in Concrete

C.1 –C.7	Conforms

Make this the third paragraph of Subsection 3.8.3.5-:

The design and construction of anchors and embedments conform to the procedures and standards of Appendix B to ACI 349-01and are in conformance with the regulatory positions of USNRC Regulatory Guide 1.199, Revision 0.

Revise DCD Subsection 3.8.3.7 as follows:

3.8.3.7 In-Service Testing and Inspection Requirements

~~There are no containment internal structures design features that require special in service testing or inspection or special maintenance requirements.~~ The Combined License applicant is responsible for the establishment of an inspection program for structures. See Subsection 3.8.6.5.

Revise the third paragraph of Subsection 3.8.4.5.1 as follows:

[*Design of fastening to concrete is in accordance with ACI 349-01, Appendix B.*]* and are in conformance with the regulatory positions of USNRC Regulatory Guide 1.199, Revision 0.

Revise Subsection 3.8.4.7 as follows:

3.8.4.7 Testing and In-Service Inspection Requirements

Structures supporting the passive containment cooling water storage tank on the shield building roof will be examined before and after first filling of the tank.

- The boundaries of the passive containment cooling water storage tank and the tension ring of the shield building roof will be inspected visually for excessive concrete cracking before and after first filling of the tank. Any significant concrete cracking will be documented and evaluated in accordance with ACI 349.3R-96 (reference 50).
- The vertical elevation of the passive containment cooling water storage tank relative to the top of the shield building cylindrical wall at the tension ring will be measured before and after first filling. The change in relative elevation will be compared against the predicted deflection.
- A report will be prepared summarizing the test and evaluating the results.

~~There are no other in-service testing or inspection requirements for the seismic Category I shield building and auxiliary building. However, during~~ During the operation of the plant the condition of these structures should be monitored by the Combined License holder to provide reasonable confidence that the structures are capable of fulfilling their intended functions. The Combined License applicant is responsible for the establishment of an inspection program for structures. See Subsection 3.8.6.5.

Add a new paragraph following the existing first paragraph of Subsection 3.8.5.5 as follows:

3.8.5.5 Structural Criteria

The analysis and design of the foundation for the nuclear island structures are according to ACI-349 with margins of structural safety as specified within it. The limiting conditions for the foundation medium, together with a comparison of actual capacity and estimated structure loads, are described in Section 2.5. The minimum required factors of safety against sliding, overturning, and flotation for the nuclear island structures are given in Table 3.8.5-1.

The design and construction of anchors and embedments conform to the procedures and standards of Appendix B to ACI 349-01and are in conformance with the regulatory positions of USNRC Regulatory Guide 1.199, Revision 0.

Revise DCD Subsection 3.8.5.7 as follows:

3.8.5.7 In-Service Testing and Inspection Requirements

~~There are no nuclear island structures foundation design features that require special in-service testing, inspection, or special maintenance requirements.~~ The Combined License applicant is responsible for the establishment of an inspection program for structures. See Subsection 3.8.6.5.

The need for foundation settlement monitoring is site-specific as discussed in subsection 2.5.4.5.10.

Add a new Subsection 3.8.6.5 as follows:

3.8.6.5 Structures Inspection Program

Consistent with Subsection 17.5.6, the Combined License applicant is responsible for the establishment of a structures inspection program consistent with the maintenance rule (10 CFR 50.65) and guidance in Regulatory Guide 1.160 to address maintenance requirements for the seismic Category I and seismic Category II structures.

PRA Revision:
None

Technical Report (TR) Revision:
None

Add an entry for Subsection 3.8.6.5 in Table 1.8-2 as follows:

Table 1.8-2 (Sheet 4 of 13)

SUMMARY OF AP1000 STANDARD PLANT COMBINED LICENSE INFORMATION ITEMS

Item No.	Subject	Subsection	Addressed by Westinghouse Document	Action Required by COL Applicant	Action Required by COL Holder
3.8-4	Deleted In-Service Inspection of Containment Vessel	Deleted	APP-GW-GLR-021	N/A	N/A
3.8-5	Structures Inspection Program	3.8.6.5	N/A	Yes	-
3.9-1	Reactor Internal Vibration Response	3.9.8.1	WCAP-16687-P	No	No

Attachment 1 - Itemized Conformance with Regulatory Positions (from Section C of Regulatory Guide 1.199). Positions were provided for C1 through C1.4 in Revision 0. Positions for C1.5 through C7. are provided in Revision 1

REGULATORY POSITION	AP1000 POSITION
C1. The procedures and standards of Appendix B to ACI 349-01 are acceptable to the NRC staff as described and supplemented below. The recommendations are applicable to the types of anchors discussed in Section B.1, "Definitions," and B.2, "Scope," of Appendix B to ACI 349-01.	Conforms
C1.1 The notations and definitions given in Sections B.0 and B.1 of Appendix B toACI349-01 are acceptable to the NRC staff.	Conforms
C1.2 The position on load combinations is given in Regulatory Position 1.3. In addition to the guidance of Section B.3.3 of Appendix B, the testing recommendations defined in ASTME488-96, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements," are acceptable to the NRC staff as a guide for establishing a testing program. Test methods not covered by ASTM E488-96 (e.g., combined tension and shear, cracked concrete) should be established and executed using good engineering judgment. ACI 355.2-01, "Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete," provides guidance acceptable to the NRC staff for determining whether post-installed mechanical anchors are acceptable for use in uncracked as well as cracked concrete. For materials consideration, the NRC staff recommends that anchors be fabricated using a material that is compatible with the environment in which they will be installed.	Conforms

C1.3 The load factors used in Section 9.2.1 of ACI 349-01 are acceptable to the NRC staff except for the following: 1.3.1. In load combinations 9, 10, and 11, 1.2To should be used in place of l.05To. 1.3.2. In load combination 6, 1.4Pa should be used in place of 1.25Pa. 1.3.3. In load combination 7, 1.25Pa should be used in place of 1.15Pa. 1.3.4. The NRC staff endorses Section B.4, "General Requirements for Strength of Structural Anchors," of ACI 349-01. The NRC staff endorses the strength reduction factors given in Section B.4.4; however, load factors consistent with SRP Section 3.8.4, "Other Seismic Category I Structures," should be applied to the load combinations given in Section 9.2 of ACI 349-01.	Conforms
C1.4 The design standards given in Sections B.5, "Design Requirements for Tensile Loading," and B.6, "Design Requirements for Shear Forces," are acceptable to the staff.	Conforms
C1.5 The design standards given in Sections B.7, "Interaction of Tensile and Shear Forces," and B. 8, "Required Edge Distances, Spacing, and Thickness To Preclude Splitting Failure," are acceptable to the NRC staff.	Conforms
C1.6 Section B.9, "Installation of Anchors," is acceptable to the NRC staff.	Conforms
C1.7 The design standards given in Sections B.10, "Structural Plates, Shapes, and Specialty Inserts," and B.11, "Shear Capacity of Embedded Plates and Shear Lugs," are acceptable to the NRC staff. When grouting is the only option, it is recommended that tests be performed in accordance with Sections B.12.3 and B.12.4 of Appendix B.	Conforms

C2. All anchors should be inspected to verify that they are of the specified size and type. Installation standards should be consistent with accepted industry-specified tolerances. Anchor systems that are external (that part or portion of the anchor that is not embedded in concrete-visible part) to the concrete surface should be inspected to assure adequate performance during the life of the structure. In addition to the provisions in Section B.9.2 of Appendix B, the NRC staff recommends the following post-installed 6-step inspection program to verify the proper installation of post-installed anchors.	Conforms ~~This paragraph does not have a design requirement.~~
C3. All quality assurance standards of ASME NQA-2, 1983, "Quality Assurance Program Requirements for Nuclear Facilities," are applicable to load-bearing steel embedments and other load-bearing components of component and structural supports.	Conforms The AP1000 is in conformance with NQA-1-1994 which incorporated the assurance standards of ASME NQA-2, 1983 ~~This paragraph does not have a design requirement..~~
C4. The concrete constituents and embedded materials should be compatible with the anticipated environmental conditions to which they will be subjected during the life of the plant.	Conforms
C5. Loads and forces on embedments should be properly evaluated to account for baseplate flexibility and eccentricity of connections and the dynamic (strain rate and low-cycle fatigue) effects of loads and forces.	Conforms
C6. The hardness, materials, and heat treatment of high-strength anchor bolts and studs (Fy > 110 ksi) should be carefully controlled to prevent environmental and stress-corrosion cracking.	Conforms
C7. Because anchors are not generally specified for masonry, the NRC staff does not recommend the use of any type of anchor discussed in this guide to attach Seismic Category I components or systems to concrete block walls that are seismically qualified, except for extremely low load applications. In locations where it is impossible to avoid the use of anchors, users should verify through appropriate means (e.g., pull test) that the supports are structurally acceptable.	Conforms In AP1000 plant design, Seismic Category I components or systems are not attached to concrete block walls.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.8.2-SEB1-03
Revision: 2

Question: (Revision 0)

Table 3.8.2-1 of DCD Rev. 16, which provides the load combinations and service limits for the steel containment vessel, has been revised. Westinghouse is requested to explain the following items:

1. Why were other load combinations identified in NUREG-0800, SRP 3.8.2, Acceptance Criteria and Regulatory Guide 1.57, Rev. 1, omitted? (e.g., SRP 3.8.2 II.3.B.iii.(1)(a); II.3.B.iii.(3)(b), (d), and (e); and II.3.B.iii.(5) for post flooding condition). Please provide the bases for omitting the load combinations and reference any necessary documents to support this action.

2. A new load combination has been added in the DCD for Service Levels A and D, which includes the external pressure of 0.9 psid. Westinghouse is requested to provide the technical basis for this pressure load and provide the corresponding temperature value and the basis for this temperature.

   Clarify in the DCD what is meant by "loss of all AC in cold weather" used in Footnotes 3 and 5.

3. Although load combinations with OBE are not required because the OBE is defined as less than or equal to 1/3 of the SSE, there is no indication that the OBE loading is considered in the appropriate load combinations for fatigue as described in SRP 3.8.2 acceptance criterion - II.3.B.iii.(2).

If your response to this request for additional information will reference Revision 17 to the AP1000 DCD, please provide an exact reference.

Additional Question (Revision 1)

Confirm that several additional load combinations identified in the RAI were considered in the design of the containment. During a conversation with the NRC load combinations of interest were identified.

Additional Question (Revision 2)

10 CFR 50, Appendix A, General Design Criterion (GDC) 50, requires that nuclear power plant containment structures be designed with sufficient margin of safety to accommodate appropriate

design loads. In addition, 10 CFR 50.44 requires the capability of containments be demonstrated to resist loads associated with combustible gas generation from a metal-water reaction of the fuel cladding. As a result of the staff review of the Revision 1 response to RAI SRP-3.8.2-SEB1-03 and the related Revision 4 response to RAI TR09-08, the staff requests that the following items, related to the load combinations for the steel containment, be addressed:

1. Clarify the following items related to the revision of DCD Table 3.8.2-1 described in the Revision 4 response to RAI TR09-08;

   a. A load combination which combines W (wind) plus Pe (external pressure) is included in the proposed revision to Table 3.8.2-1. Explain why a load combination that combines W plus Pd (design pressure representing LOCA) is not also included. SRP 3.8.2 Section II.3.D indicates that for external environmental loads, a concrete shield building typically protects steel containments from the environment. If environmental loads external to the steel containment (e.g., wind, tornado, external flooding) either directly or indirectly impose loads on the steel containment, the design of the steel containment needs to consider these loads, such as W plus Pd. WEC should use load combinations and acceptance criteria that are consistent with those specified in SRP Section 3.8.1, or provide sufficient justification for an equivalent alternative.

   b. A load combination that combines Wt (tornado) plus Po (operating pressure) is included in the proposed revision to Table 3.8.2-1. Provide justification why a load combination that combines Wt plus Pe (external pressure) is not also included. Such a load combination is typically required for concrete containments.

   c. The proposed markup to the load combinations and the footnotes in DCD Table 3.8.2-1 identify four different pressures and associated temperatures of the containment. Provide, in the footnotes to the table, the values for the different pressures and the corresponding temperatures inside and outside containment that are used in each of these load combinations.

2. Clarify the following items related to the hydrogen generation load combinations described in the Revision 1 response to RAI SRP-3.8.2-SEB1-03:

   a. The RAI response states, "According to 10 CFR 50.34(f), the peak LOCA pressure plus the peak pressure from a hydrogen burn must be less than ASME Service Level C (not including buckling)." Provide a justification for the following: (1) 10 CFR 50.34(f) is identified rather than 10 CFR 50.44, since 10 CFR 50.34(f) is only applicable to a limited set of older plants, and (2) the term "peak LOCA pressure" is used rather than the term "hydrogen generated pressure loads from the 100% fuel clad metal-water reaction."

b. The RAI response states, "The peak pressure from the hydrogen burn (Pg1 +Pg2) is 90.3 psig as reported in Section 41.11 and Table 41-4 of the PRA report." Explain why the phrase "hydrogen burn" in this statement applies to both Pg1 and Pg2. The staff notes that SRP 3.8.2 defines Pg1 as the pressure load generated from the 100% fuel clad metal-water reaction and not the pressure due to hydrogen burn. Also, explain whether the 90.3 psig represents the maximum hydrogen generated pressure load from the fuel clad metal-water reaction plus the hydrogen burn load for the AP1000 plant.

Westinghouse Response: (Revision 0)

1. The containment vessel (CV) design has gone through a detailed review by the NRC staff and consultants. This review included the load combinations and service limits for the containment vessel.

   In the most recent Technical Audit meeting in Pittsburgh (held the week ending 5/23/2008), the CV design as described in the DCD Revision 16, and the CV design report and calculations related to Technical Report 9 (TR-09) (Reference 1) were reviewed in great detail. The CV design calculations include the various design load combinations. The governing combinations are present in DCD Rev. 16 Table 3.8.2-1, "Load Combinations and Service Limits for Containment Vessel." This table was revised in TR-09 and included in this review.

   The post flooding condition load combination was also discussed in the May 2008 NRC audit. In response to the revised request, RAI-TR09-005 Rev 2 was sent to the NRC in September 2008 (Reference 2). The following response is provided again:

   The post accident flooding load combination is not applicable in the design of the containment vessel. Containment flooding events are described in DCD subsection 3.4.1.2.2.1. Curbs are provided around openings through the maintenance floor at elevation 107'-2" to control flooding into the lower compartments. The maximum curb elevation of 110'-2" establishes the maximum flooding on the containment vessel boundary. There are seals at elevation 107'-2" between the containment vessel and maintenance floor as shown in sheet 2 of DCD Figure 3.8.2-8. In the event of seal leakage hydrostatic pressure could be imposed on the vessel behind the concrete.
   Pressure loads below elevation 100' are resisted by the mass concrete of the nuclear island basemat. Pressure loads above elevation 100' would be carried by the steel vessel. Hence, there could be a maximum hydrostatic head of 10' corresponding to a hydrostatic pressure of about 5 psi.

   The containment vessel is designed for a design pressure of 59 psi. This pressure exceeds the maximum calculated pressure in design basis accidents.

Maximum flooding occurs late during the accident transient. The combination of hydrostatic pressure at elevation 100' and containment pressure is less than the design pressure of 59 psi. Hence, the post-LOCA flooding event is enveloped by the other design cases.

2. This load combination corresponds to an external pressure based on an evaluation of a credible initiating event in cold weather

   Several possible credible initiating events were evaluated in order to verify this external pressure. See the response to RAI –TR09-008, Rev. 4 for more information on these scenarios.

3. ASME Section III, Division 1, Subsection NE, Paragraph NE-3221.5 provides the requirements for analysis for cyclic operation. Paragraph NE-3221.5(d) 'Vessels Not Requiring Analysis for Cyclic Service' provides a list of six conditions that if the specified Service Loadings of the vessel or portion thereof meet all six conditions, an analysis for cyclic service is not required.

   Westinghouse has a calculation, available for audit, to show how these six conditions are met.

Westinghouse Additional Response: (Revision 1)

The containment vessel is protected from the direct effects of wind//tornado loads (and associated potential missiles) by virtue of its location inside the shield building. The differential pressure effects of a tornado are also reduced because of the location; and are bounded by other pressure loadings for which the containment vessel is designed.

Westinghouse confirms that, as shown in DCD Table 3.8.2-1, the Containment Vessel shell is designed for the Tornado (W_t) and Wind (W) loads.

In the following specific load combinations for which the NRC reviewer requested information are addressed. The load combinations identified in the Design Control Document (DCD) in support of the Design Certification Amendment are not changed from the Certified Design.

1. SRP 3.8.2 II.3.B.iii.(1)(a)
   Normal operating plant condition

   $D + L + T_o + R_o + P_o$

   Response: This load combination calls for P_o, which is "External pressure loads resulting from pressure variation either inside or outside containment." For the AP1000 CV this results in an external pressure, "based on evaluation of credible initiating event in cold weather." Please note that the terms use in the DCD used for the load combinations are slightly different that the NRC guidance. Westinghouse uses P_e for external pressure.

2. SRP 3.8.2 II.3.B.iii.(3)(b)
Operating plant condition in combination with SSE

$D + L + T_o + R_o + P_o + E'$

Response: This load combination is included in the AP1000 Design Control Document (DCD) and the containment design specification. It is captured as a Service Level D Service Limit load combination in DCD Table 3.8.2-1. The application of Service Level D limits to this load combination was included in the DCD Revision 15 that is referenced by the AP1000 Design Certification. Westinghouse has not changed this load combination or how it is applied to the containment vessel in the DCD that supports the design certification amendment. The NRC approval of the application of Service Level D limits to this load combination it documented in the AP1000 FSER (NUREG-1793) as follows:

In addition to the four issues discussed above, the staff requested the applicant to provide the technical basis for using Service Level D allowable stress, instead of Service Level C allowable stress, for the load combination of seismic loads plus design external pressure when the evaluation of the containment vessel adequacy was performed. During the audit conducted on October 6–9, 2003, the applicant presented an evaluation based on the load combination, assuming that these two events occur simultaneously. In its submittal dated December 12, 2003 (Revision 3 of the response to Open Item 3.8.2.1-1), the applicant provided a final calculation that justifies the change of design basis from Service Level C to Service Level D. Based on its review of these documents and the discussion with the applicant, the staff found that the change from Service Level C to Service Level D for the load combination of seismic plus design external pressure is technically justified because of the extremely low sequence frequency (less than 1E-10 per year) leading to containment failure.

3. SRP 3.8.2 II.3.B.iii.(3)(d)
Deal Dead load plus pressure resulting from an accident that releases hydrogen generated from 100-percent fuel clad metal-water reaction accompanied by hydrogen burning

$D + P_{g1} + P_{g2}$

Response: The AP1000 addresses the production of large quantities of hydrogen from the oxidation of zirconium and other metals as a result of a postulated severe accident. The AP1000 includes hydrogen igniters inside containment to assure that hydrogen generated in a severe accident is burned prior to reaching an explosive mixture. The discussion of the generation and burning of hydrogen as a result of a severe accident is included in DCD Subsection 19.41.

The containment is also evaluated for the deterministic severe accident pressure capacity. This evaluation is discussed in DCD Subsection 3.8.2.4.2 "Evaluation of Ultimate Capacity". According to 10 CFR 50.34(f), the peak LOCA pressure plus the peak pressure from a hydrogen burn must be less than ASME Service Level C (not including buckling). The Service Level C maximum capacity is 117 psig at 300°F as presented in DCD section 3.8.2.4.2.8. The peak pressure from the hydrogen burn (Pg1 + Pg2) is 90.3 psig) as reported in Section 41.11 and Table 41-4 of the PRA report. The severe accident conditions are beyond design basis accidents and the load combinations for these severe accident evaluations are not included in the load combinations and service limits for the containment vessel provided in the DCD.

The containment ultimate capacity and the treatment of severe accidents that result in the generation of hydrogen is not altered from what was included in the AP1000 certified design. In the Final Safety Evaluation Report for AP1000 (NUREG-1793) the NRC states the following.

> "The staff considers the analysis procedures used in evaluating the ultimate capacity of the AP1000 containment to be consistent with sound engineering practice for such evaluations. On this basis, the staff concludes that the results of the AP1000 ultimate capacity evaluation constitute acceptable input for probabilistic risk assessment analyses and severe accident evaluations."

4. SRP 3.8.2 II.3.B.iii.(3)(e)

   $D + P_{g1} + P_{g3}$

   Response: The AP1000 does not have a post accident inerting system. Therefore, this load combination is not applicable to the AP1000.

5. SRP 3.8.2 II.3.B.iii.(5)
   Post Flooding Condition

   Response: This condition was previously addressed in the Response to Rev. 1.

Westinghouse Additional Response: (Revision 2)

1.

a. Design Wind load should only be considered in operating conditions. This is a mistake in the load combinations table as it is a construction wind load combined with a Service Level A load combination. During the service of the vessel, it will not experience a construction wind load. A load combination that combines design wind with operating pressure will be added to the Service Level A load combinations. The worst case of a tornado wind load, which results in the largest reduction in pressure, is included in load combination C2. The proposed load combination will be included in the markup of DCD Table 3.8.2-1 in RAI-TR09-008, Rev. 6. Justification for not combining W plus Pd is added to DCD Section 3.8.2.4.1.1 and is provided in the response to RAI-TR09-008, Rev. 6.

b. The AP1000 is designed to meet the ASME Boiler & Pressure Vessel Code, Section III, Subsection NE 2001 edition with the 2002 Addenda. The containment vessel is not designed to meet the requirements of a concrete containment and therefore does not need to be analyzed for tornado wind loads combined with Pe (external pressure). Environment loads such as tornados cannot impose a direct load on the containment vessel. The tornado wind load has been defined as a reduction in external pressure. If this is then combined with the external pressure, the tornado wind load would simply reduce the effect of the external pressure on the containment vessel. Therefore, this load combination was not considered to be evaluated in the design of the containment vessel.

c. Pressures and temperature values have been added to DCD Section 3.8.2.4.1.1. Please see the DCD Revision Section of the response to RAI-TR09-008, Rev. 6.

2.a. (1) 10 CFR 50.44 will be referenced in the DCD instead of 10 CFR 50.34(f).

(2) The term "peak LOCA pressure" should be "hydrogen generated pressure loads from 100% fuel clad metal-water reaction" in the RAI Response.

CHANGES TO RESPONSE TO REV. 1

Response: The AP1000 addresses the production of large quantities of hydrogen from the oxidation of zirconium and other metals as a result of a postulated severe accident. The AP1000 includes hydrogen igniters inside containment to assure that hydrogen generated in a severe accident is burned prior to reaching an explosive mixture. The discussion of the generation and burning of hydrogen as a result of a severe accident is included in DCD Subsection 19.41.

The containment is also evaluated for the deterministic severe accident pressure capacity. This evaluation is discussed in DCD Subsection 3.8.2.4.2 "Evaluation of Ultimate Capacity". According to 10 CFR 50.34(f), the hydrogen generated pressure loads from 100% fuel clad metal-water reaction ~~peak LOCA pressure~~ plus the peak pressure from a hydrogen burn must be less than ASME Service Level C (not including buckling). The Service Level C maximum capacity is 117 psig at 300°F as presented in DCD section 3.8.2.4.2.8. The peak pressure from the hydrogen generated pressure loads from 100% fuel clad metal-water reaction plus the hydrogen burn (Pg1 + Pg2) is 90.3 psig) as reported in Section 41.11 and Table 41-4 of the PRA report. The severe accident conditions are beyond design basis accidents and the load combinations for these severe accident evaluations are not included in the load combinations and service limits for the containment vessel provided in the DCD.

The containment ultimate capacity and the treatment of severe accidents that result in the generation of hydrogen is not altered from what was included in the AP1000 certified design. In the Final Safety Evaluation Report for AP1000 (NUREG-1793) the NRC states the following.

> "The staff considers the analysis procedures used in evaluating the ultimate capacity of the AP1000 containment to be consistent with sound engineering practice for such evaluations. On this basis, the staff concludes that the results of the AP1000 ultimate capacity evaluation constitute acceptable input for probabilistic risk assessment analyses and severe accident evaluations."

2.b. This was a mistake in the RAI response. Pg1 refers to the "hydrogen generated pressure loads from the 100% fuel clad metal-water reaction," and Pg2 refers to the pressure resulting from the hydrogen burn. Pg1 + Pg2 is 90.3 psig as reported in Section 41.11 and Table 41-4 of the PRA Report. See above changes to Response to Rev. 1 for corrections of this mistake.

References:

1. APP-GW-GLR-005, Revision 1, "Containment Vessel Design Adjacent to Large Penetrations," Technical Report Number 9, submitted with DCP/NRC1988, September 5, 2007.

2. Letter, Sisk (Westinghouse) to NRC, "AP1000 Response to Request for Additional Information (TR09)", DCP/NRC2261, September 15, 2008.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP3.8.3-SEB1-05
Revision: 2

***Question:* <u>*(Revision 0)*</u>**

DCD Section 3.8.3.5.8 describes the design summary of critical sections for the CIS. Westinghouse is requested to address the following items related to this revised section:

For DCD Section 3.8.3.5.8.1 – Structural Wall Modules

1. The last paragraph, was revised to eliminate some Tier 2* information and criteria (denoted by italicized text, square bracket, and a superscript *). Westinghouse is requested to provide the basis for removing this information. The information removed relates to DCD Rev. 16 Tables 3.8.3-3 through 3.8.3-6. These tables have been substantially revised from the prior DCD tables to remove significant design information. Westinghouse is requested to provide the same or comparable information that was provided in prior revisions of the DCD.

2. The last two sentences in the referenced paragraph are italicized but are outside the square bracket with a star. These sentences should be placed inside the square brackets.

3. The last sentence states "See Appendix 3H for more detailed discussion." Westinghouse should explain why a reference for more detailed information of structural wall modules inside containment is made to Appendix 3H which addresses auxiliary and shield building critical sections.

For DCD Section 3.8.3.5.8.2 – IRWST Steel Wall

4. Same issue discussed in item 3 above is also applicable to DCD Section 3.8.3.5.8.2.

For DCD Section 3.8.3.5.8.3 – Column Supporting Operating Floor

5. Same issues as items 1 and 3 above are also applicable to DCD 3.8.3.5.8.3

Updating of all analyses due to changes in seismic and other loads

6. Westinghouse is requested to explain whether the information presented for all structures in DCD Rev. 16, Sections 3.8.1 through 3.8.5, and associated appendices reflect the latest set of updated analyses for the revised seismic loads (e.g., extension of design to soil sites and resolution of RAIs related to seismic) and revision of other loads which might have been updated from the prior version of the DCD.

If your response to this request for additional information will reference Revision 17 to the AP1000 DCD, please provide an exact reference.

Additional Question: (Revision 2)

The staff reviewed the response provided in Westinghouse letter dated March 15, 2010 and concluded that the response addressed most of the concerns identified in this RAI; however, more information is needed to resolve the remaining items. In the response, most of the Tier 2* information, including descriptions, criteria, member forces, required plate thicknesses, and stress results, that were removed from the Section 3.8.3.5.8 of DCDs Rev. 16 and Rev. 17, will be placed back in DCD Sections 3.8.3.5.8.1 to 3.8.3.5.8.3 and Tables 3.8.3-4 through 3.8.3-6. However, in DCD Table 3.8.3-3, the applicant did not provide the required plate thicknesses which were provided in the same table in DCD Rev.15. In addition, there appears to be a Tier 2* "square bracket" missing in the last paragraph of the proposed mark-up to DCD Section 3.8.3.5.8.1, which, if in error, should be corrected. Therefore, provide the required plate thicknesses and correct DCD Section 3.8.3.5.8.1 for the missing square bracket.

Westinghouse Response: (Revision 0)

1. The removal of the subject information was identified and explained in APP-GW-GLR-045 (Reference 1). This report supports the removal of the design load summary tables in Design Control Document (DCD) Subsection 3.8.3 and 3.8.4 and the tables of member forces and moments in Appendix 3H. The last paragraph of DCD Section 3.8.3.5.8.1 in DCD Revision 15 referenced member forces tables in DCD Revision 15. The information removed from tables in the DCD represents the results of detailed calculations and analyses. These results change slightly during the design finalization due to changes related to constructability and construction sequence. Finalization of the design spectra can also result in minor changes in the as-designed results. The DCD changes between Revision 15 and Revision 16 also supported the change of the design spectra from a hard rock only case to design spectra acceptable for multiple rock and soil cases. Small changes in modeling and updates to software may also have a minor effect on the results. For these reasons, it is not practical to lock in these design and analysis results in the DCD.

   Subsection 3.8.3, 3.8.4, and Appendix 3H as shown in Revision 17 provide information on the requirements and criteria for design configuration, and concrete reinforcement. These requirements and criteria lock-in the design for NRC review and demonstrate that the requirements and criteria for the design conforms with review guidance or otherwise uses appropriate design and analysis methods. The level of detail represented by the design summary tables of forces and moments does not appear to be consistent with the guidance of Regulatory Guide 1.70 and Standard Review Plan Section 3.8.4. SRP Section 3.8.3 and 3.8.4 do not suggest that this detailed information should be included in the DCD. Attempting to lock in the design loads results over specifies the design. The design loads and related information removed in DCD Revision 16 included the amount of reinforcement provided and identified the fraction of the limit calculated. This overly restricted the changes to the design during design finalization.

Based on the above information, Westinghouse does not believe it is necessary to return the information on member forces and moments and the specific amount of reinforcement provided removed in DCD Revision 16 to the DCD. Detailed results of the analyses of the critical structures and other structures are available for NRC audit and have been reviewed by NRC review staff. These detailed design calculations include the design summary Tables of Forces and Moments. One of the reasons that the specific results for the critical structures were included in the DCD through Revision 15 was because of the relatively limited amount of design information available for the NRC review staff to look at to make a judgment about the implementation of the design methods, requirements, and criteria in the structural design. The information now available for NRC review is much more complete and comprehensive. Finally, the sufficiency of the as-built structural design is subject to verification with reports required by the inspections, tests, analyses, and acceptance criteria (ITAAC) in Tier 1 of the DCD. Tier 1 of the DCD includes dimensional requirements for structures in the AP1000 design including critical structures.

Based on the above information Westinghouse does not believe it is appropriate to return the information on member forces and moments, and the specific amount of reinforcement provided, to the DCD.

2. In DCD Revision 17, the last two sentences of the last paragraph of DCD Section 3.8.3.5.8.1 were corrected to be standard, non-italic text because the text only provides cross-references, not design information critical to the NRC approval.

3. The last sentence of the last paragraph of DCD Section 3.8.3.5.8.1 should have been "See Technical Report APP-GW-GLR-045 for more details."

   This correction will be incorporated in next DCD revision as shown below.

4. The last sentence of the last paragraph of DCD Section 3.8.3.5.8.2 should have been "See Technical Report APP GW GLR 045 for more details."
   The latest set of updated analyses for the revised seismic loads including the extension of design to soil sites (six soils cases) was included in DCD Revision 17. These analyses also reflected changes to methods and criteria that resulted from resolution of RAIs related to seismic design and analysis.

5. For the same reasons outlined in item 1 above Westinghouse does not believe it is necessary to return the information on member forces and moments and the specific amount of reinforcement provided removed in DCD Revision 16 to the DCD Section 3.8.3.5.8.3

The last sentence of the last paragraph of DCD Section 3.8.3.5.8.2 should have been "See Technical Report APP-GW-GLR-045 for more details."

This correction will be incorporated in next DCD revision as shown below.

6. The last sentence of the last paragraph of DCD Section 3.8.3.5.8.3 should have been "See Technical Report APP-GW-GLR-045 for more details."

   This correction will be incorporated in next DCD revision as shown below.

References:

1. APP-GW-GLR-045, "AP1000 Standard Combined License Technical Report, Nuclear Island, Evaluation of Critical Sections" Westinghouse Electric Company LLC.

Additional Westinghouse Response: (Revision 1)

This response addresses the tables that are contained in DCD Tier 2 Section 3.8. Comparable information removed from DCD Revision 16 is replaced in the DCD.

Also provided in this response are changes to Tier 2, Table 3.8.4-6, "Materials Used in Structural and Miscellaneous Steel." These changes resolve a Westinghouse corrective action issue report and an extent of condition review. It provides for new steel structural materials needed to support design changes in the AP1000 mechanical/structural modules and the enhanced shield building.

The revised Table 3.8.4-6 includes the major structural and miscellaneous steel shapes needed. The materials included in the table are consistent with the SRP guidance to include structural shapes and reinforcement. The changes are based on review of steel materials from the following sources: structural design changes (i.e. modules, enhanced shield building), materials listed in previous RAIs (RAI-SRP-3.8.3-SEB1-06; RAI-SRP-3.8.4-SEB1-02), design finalization, and conforming ASTM standards already listed in the DCD text or references. This is not an all-inclusive list and specifically excludes, for example, most pressure-retaining materials and fasteners (i.e. bolts, nuts, studs, and bolting materials).

Additional Westinghouse Response: (Revision 2)

Westinghouse has further updated DCD Tier 2 Table 3.8.3-3, "Definition Of Critical Locations And Thicknesses For Containment Internal Structures" below to include a column of the required plate thicknesses, as were provided in the same table in DCD Rev.15

Also, the unintentionally omitted square bracket has been restored in Section 3.8.3.5.8.1 at the end of the third sentence in the modified paragraph: *The other walls have stainless steel on one face and carbon steel on the other.*]*

The criterion in Subsection 3.8.3.5.8 on reporting requirements for Tier 2* information in Critical section tables is revised.

Design Control Document (DCD) Revision: (Revision 0, 1, 2)

Revise DCD Tier 2, Section 3.8.3.5.8, "Design Summary of Critical Sections," as follows: (Revision 2)

3.8.3.5.8 Design Summary of Critical Sections

[Changes in the values in the critical section tables that are designated as Tier 2 must be reported to the NRC if*

- *A change to design parameters is required. These design parameters include reinforcement provided, concrete strength, and steel section size. Both design parameter increases and decreases must be reported.*

- *Changes in the values of loads, moments, and forces in the critical section tables that are designated as Tier 2* must be reported to the NRC if the change results in a required reinforcement (or plate thickness for CA modules) increase greater than 10% of the provided reinforcement (or plate thickness for CA modules).]** For example the change must be reported if a change in moments or forces in Table 3H.5-2 results in a calculated required reinforcements value in Table 3H-3 more than 10% of the corresponding provided reinforcement value.

Revise DCD Tier 2, Section 3.8.3.5.8.1, "Structural Wall Modules," as follows:

3.8.3.5.8.1 Structural Wall Modules

(Previous paragraphs unchanged)

[*The three walls extend from the floor of the in-containment refueling water storage tank at elevation 103′ 0″ to the operating floor at elevation 135′ 3″. The south west wall is also a boundary of the refueling cavity and has stainless steel plate on both faces. The other walls have stainless steel on one face and carbon steel on the other.*]* ~~*Design summaries are given in Table 3.8.3-4, 3.8.3-5, and 3.8.3-6. See Appendix 3H for more detailed discussion.*~~ For each wall design information is summarized in Tables 3.8.3-4, 3.8.3-5 and 3.8.3-6 at three locations. [*Results are shown at the middle of the wall (mid span at mid height), at the base of the wall at its mid point (mid span at base) and at the base of the wall at the end experiencing greater demand (corner at base). The first part of each table shows the member forces due to individual loading. The lower part of the table shows governing load combinations. The steel plate thickness required to resist mechanical loads is shown at the bottom of the table as well as the thickness provided. The maximum principal stress for the load combination including thermal is also tabulated. If this value exceeds the yield stress at temperature, a supplemental evaluation is performed*]* as described in subsection 3.8.3.5.3.4; [*for these cases the maximum stress intensity range is shown together with the allowable stress intensity range which is twice the yield stress at temperature.*]* See Technical Report APP-GW-GLR-045 (Reference 56) for more details.

Revise DCD Tier 2 Section 3.8.3.5.8.2, "In-Containment Refueling Water Storage Tank Steel Wall," as follows:

3.8.3.5.8.2 In-Containment Refueling Water Storage Tank Steel Wall

(first paragraph unchanged)

The wall is evaluated as vertical and horizontal beams. The vertical beams comprise the T-section columns plus the effective width of the plate. The horizontal beams comprise the L-section angles plus the effective width of the plate. Table 3.8.3-7 shows the ratio of the design stresses to the allowable stresses. When thermal effects result in stresses above yield, the evaluation is in accordance with the supplemental criteria]* as described in subsection 3.8.3.5.3.4. ~~See Appendix 3H for more detailed discussions.~~ See Technical Report APP-GW-GLR-045 (Reference 56) for more details.

Revise DCD Tier 2 Section 3.8.3.5.8.3, "Column Supporting Operating Floor," as follows:

3.8.3.5.8.3 Column Supporting Operating Floor

(first paragraph unchanged)

The load combinations in Table 3.8.4-1 were used to assess the adequacy of the column. ~~*See Appendix 3H for more detailed discussion.*~~]* . *For mechanical load combinations, the maximum interaction factor due to biaxial bending and axial load is 0.59. For load combinations with thermal loads, the maximum interaction factor is 0.94. Since the interaction factors are less than 1, the column is adequate for all the applied loads.*]* See Technical Report APP-GW-GLR-045 (Reference 56) for more details.

Revise DCD Tier 2 Section 3.8.7, "References," as follows:

56. APP-GW-GLR-045, "AP1000 Standard Combined License Technical Report, Nuclear Island, Evaluation of Critical Sections" Westinghouse Electric Company LLC.

Revise DCD Tier 2 Table 3.8.3-3, "Definition Of Critical Locations And Thicknesses For Containment Internal Structures" as follows: (Revision 2)

Table 3.8.3-3

[DEFINITION OF CRITICAL LOCATIONS AND THICKNESSES FOR CONTAINMENT INTERNAL STRUCTURES(1)](4)*

Wall Description	*Applicable Column Lines*	*Applicable Elevation Range*	*Concrete Thickness(2)*	*Required Thickness of Surface Plates (inches)(3)*	*Thickness of Surface Plates Provided (inches)*
Containment Structures					
Module Wall 1	*West wall of refueling cavity*	*Wall separating IRWST and refueling cavity from elevation 103' to 135'-3"*	*4'-0" concrete-filled structural wall module with 0.5-in.-thick steel plate on inside and outside of wall*	*0.25*	*0.5*
Module Wall 2	*South wall of west steam generator cavity*	*Wall separating IRWST and west steam generator cavity from elevation 103' to 135'-3"*	*2'-6" concrete-filled structural wall module with 0.5-in.-thick steel plate on inside and outside of wall*	*0.44*	*0.5*
CA02 Module Wall	*North east boundary wall of IRWST*	*Wall separating IRWST and maintenance floor from elevation 103' to 135'-3"*	*2'-6" concrete-filled structural wall module with 0.5-in.-thick steel plate on inside and outside of wall*	*0.37*	*0.5*

Notes:

1. *The applicable column lines and elevation levels are identified and included in Figures 1.2-9, 3.7.2-12 (sheets 1 through 12), 3.7.2-19 (sheets 1 through 3) and on Table 1.2-1.*
2. *The concrete thickness includes the steel face plates. Thickness greater than 3'-0" have a construction tolerance of +1", -3/4". Thickness less than or equal to 3'-0" have a construction tolerance of +1/2", -3/8".*
3. *These plate thicknesses represent the minimum thickness required for operating and design basis loads except for designed openings or penetrations. These values apply for each face of the applicable wall unless specifically indicated on the table. For load combinations with thermal loads, the evaluation is performed as described in DCD subsection 3.8.3.5.3.4.*
4. *See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section. ~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~*

Revise DCD Tier 2 Table 3.8.3-4, Design Summary of West Wall of Refueling Canal" as follows:

Table 3.8.3-4 (Sheet 1 of 3) ***[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL]****	
Element Number 101870	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 55.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 110.0 ksi*(2)

Notes:

1. *This is a lot more than the plate thickness required for load combinations excluding thermal.*
2. *The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.*

Table 3.8.3-4 (Sheet 1 of 3)

[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL
DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA
MID-SPAN AT MID-HEIGHT]* (3)

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	0	-18	0	2	1	0	0	1	–
Hydro (F)	3	4	1	22	28	0	0	1	–
Live (L)	1	-9	0	4	2	0	0	1	During refueling
Live (L_o)	0	-2	0	1	0	0	0	0	During operation
ADS	0	6	4	19	21	-3	0	1	–
E_s	14	31	75	29	33	9	2	4	–
Thermal (T_a)	-193	-165	-21	435	404	-15	8	-16	–
LC (1)	4	-13	8	68	76	-5	0	5	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	6	-35	1	40	44	0	0	5	$1.4D+1.4F+1.7L_r$
LC (3)	4	-9	8	66	76	-5	0	5	$1.4D+1.4F+1.7ADS$
LC (4)	17	21	80	73	83	12	2	7	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-11	-53	-78	-23	-25	-12	-2	-3	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-176	-144	59	508	487	-3	10	-9	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-204	-218	-99	412	379	-27	6	-19	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	17	25	80	72	83	6	2	7	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number101870

Plate thickness required for load combinations excluding thermal: 0.042 inches
Plate thickness provided: 0.50 inches

Maximum principal stress for load combinations including thermal: 23.37 ksi
Yield stress at temperature: 55.0 ksi

Maximum stress intensity range for load combinations including thermal: 23.37 ksi
Allowable stress intensity range for load combinations including thermal: 110.0 ksi

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~

Table 3.8.3-4 (Sheet 2 of 3) [DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL]*	
Element Number 101788	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 55.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 110.0 ksi*(2)

Notes:

1. *This is a lot more than the plate thickness required for load combinations excluding thermal.*
2. *The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.*

Table 3.8.3-4 (Sheet 2 of 3)

[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT BASE]* (3)

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	-1	-27	0	-1	-3	0	0	1	–
Hydro (F)	6	7	1	-5	-50	0	0	17	–
Live (L)	0	-8	0	0	-5	0	0	1	During refueling
Live (L_o)	0	-2	0	0	-1	0	0	0	During operation
ADS	6	15	4	-5	-41	-1	-1	10	–
E_s	14	44	85	14	96	3	3	11	–
Thermal (T_0)	-417	-157	-98	522	619	-14	-13	-24	–
LC (1)	17	-6	8	-17	-146	-2	-2	42	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	7	-42	1	-8	-83	0	0	27	$1.4D+1.4F+1.7L_r$
LC (3)	17	-3	8	-17	-144	-2	-2	42	$1.4D+1.4F+1.7ADS$
LC (4)	25	37	90	13	83	4	4	39	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-15	-81	-88	-25	-191	-4	-4	-3	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-392	-120	-8	535	702	-10	-9	15	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-432	-238	-186	497	428	-18	-17	-27	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	25	42	90	3	2	2	2	39	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes:	
x-direction is horizontal, y-direction is vertical.	
element number 101788	
Plate thickness required for load combinations excluding thermal:	*0.02inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations including thermal:	*28.0 ksi*
Yield stress at temperature:	*55.0 ksi*
Maximum stress intensity range for load combinations including thermal:	*28.0 ksi*
Allowable stress intensity range for load combinations including thermal:	110.0 ksi

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~

Table 3.8.3-4 (Sheet 3 of 3) [*DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL*]*	
Element Number 101794	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 55.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 110.0 ksi*(2)

Notes:

1. *This is a lot more than the plate thickness required for load combinations excluding thermal.*
2. *The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.*

Table 3.8.3-4 (Sheet 3 of 3)

[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA NORTH END BOTTOM CORNER]* (3)

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	-2	-24	-6	0	-2	0	0	0	–
Hydro (F)	4	0	5	-8	-16	3	2	3	During operation
Live (L)	0	-13	-3	0	-1	0	0	0	During refueling
Live (L_o)	0	-2	0	0	0	0	0	0	During operation
ADS	7	-4	7	-5	-19	1	2	2	–
E_s	24	43	92	13	61	6	5	3	–
Thermal (T_0)	-294	-311	104	423	360	-24	-32	47	–
LC (1)	15	-44	11	-20	-58	6	6	8	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	3	-56	-7	-11	-27	4	3	4	$1.4D+1.4F+1.7L_r$
LC (3)	15	-40	11	-20	-58	6	6	8	$1.4D+1.4F+1.7ADS$
LC (4)	33	21	98	10	62	10	9	8	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-29	-73	-100	-26	-98	-4	-5	-2	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-261	-290	202	433	422	-14	-23	55	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-323	-384	4	397	262	-28	-37	45	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	33	17	99	0	24	10	9	8	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 101794

Plate thickness required for load combinations excluding thermal: 0.27 inches
Plate thickness provided: 0.50 inches

Maximum principal stress for load combinations including thermal: 28.1 ksi
Yield stress at temperature: 55.0 ksi

Maximum stress intensity range for load combinations including thermal: 35.26 ksi

Allowable stress intensity range for load combinations including thermal: 110.0 ksi

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~

Revise DCD Tier 2 Table 3.8.3-5, "Design Summary of South Wall of Steam Generator Compartment," as follows:

Table 3.8.3-5 (Sheet 1 of 3) [*DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT*]*	
Element Number 104228	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 36.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 72.0 ksi*(2)

Notes:
1. *This is a lot more than the plate thickness required for load combinations excluding thermal.*
2. *The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.*

Table 3.8.3-5 (Sheet 1 of 3)

[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT MID-HEIGHT] (3)*

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	-1	-20	0	1	0	0	0	0	–
Hydro (F_o)	-2	3	-7	19	22	0	0	-1	–
Live (L)	0	-10	0	2	0	0	0	0	During refueling
Live (L_o)	0	-3	0	0	0	0	0	0	During operation
ADS	-1	12	-16	15	16	0	0	1	–
E_s	11	42	78	28	31	3	3	3	–
Thermal (T_0)	-136	-139	-13	221	217	6	-3	-5	–
LC (1)	-6	-9	-37	54	58	0	0	0	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-4	-41	-10	31	31	0	0	-1	$1.4D+1.4F+1.7L_r$
LC (3)	-6	-3	-37	54	58	0	0	0	$1.4D+1.4F+1.7ADS$
LC (4)	9	34	87	63	69	3	3	3	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-15	-74	-101	-23	-25	-3	-3	-5	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-127	-105	74	284	286	9	0	-2	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-151	-213	-114	198	192	3	-6	-10	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	7	39	55	63	69	3	3	3	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 104228

Plate thickness required for load combinations excluding thermal: 0.04 inches
Plate thickness provided: 0.50 inches
Maximum principal stress for load combinations including thermal: 23.0 ksi
Yield stress at temperature: 36.0 ksi
Maximum stress intensity range for load combinations including thermal: 23.0 ksi
Allowable stress intensity range for load combinations including thermal: 72.0 ksi

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

Table 3.8.3-5 (Sheet 2 of 3) [DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT]*	
Element Number 101943	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 36.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 72.0 ksi*(2)

Notes:

1. *This is a lot more than the plate thickness required for load combinations excluding thermal.*
2. *The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.*

Table 3.8.3-5 (Sheet 2 of 3)

[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT BASE]* (3)

Load/Comb.	TX	TY	TXY	MX	MY	MXY	NX	NY	Comments
	k/ft	k/ft	k/ft	kft/ft	kft/ft	kft/ft	k/ft	k/ft	
Dead (D)	-3	-24	0	0	0	0	0	0	–
Hydro (F)	3	4	-12	-5	-41	0	0	15	–
Live (L)	-1	-9	-1	0	-2	0	0	0	During refueling
Live (L_o)	0	-3	0	0	0	0	0	0	During operation
ADS	2	14	-15	-4	-30	0	0	9	–
E_s	18	50	71	4	32	2	1	13	–
Thermal (T_0)	-300	-40	33	240	266	7	8	-6	–
LC (1)	3	-9	-42	-14	-108	0	0	36	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-2	-43	-19	-7	-61	0	0	21	$1.4D+1.4F+1.7L_r$
LC (3)	3	-4	-42	-14	-108	0	0	36	$1.4D+1.4F+1.7ADS$
LC (4)	20	41	74	3	21	2	1	37	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-20	-87	-98	-13	-103	-2	-1	-7	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-280	1	107	243	287	9	9	31	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-320	-127	-65	227	163	5	7	-13	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	20	46	44	-5	-39	2	1	37	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes:

x-direction is horizontal, y-direction is vertical.
element number 101943

Plate thickness required for load combinations excluding thermal: 0.04 inches
Plate thickness provided: 0.50 inches

Maximum principal stress for load combinations including thermal: 25.7 ksi
Yield stress at temperature: 36.0 ksi

Maximum stress intensity range for load combinations including thermal: 25.7 ksi

Allowable stress intensity range for load combinations including thermal: 72.0 ksi

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~

Table 3.8.3-5 (Sheet 3 of 3)

[*DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT*]*

Element Number 101933	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 36.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 72.0 ksi*(2)

Notes:

1. *This is a lot more than the plate thickness required for load combinations excluding thermal.*
2. *The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.*

Table 3.8.3-5 (Sheet 3 of 3)

[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA WEST END BOTTOM CORNER]* (3)

Load/Comb.	TX	TY	TXY	MX	MY	MXY	NX	NY	Comments
	k/ft	k/ft	k/ft	kft/ft	kft/ft	kft/ft	k/ft	k/ft	
Dead (D)	-6	-34	3	-1	3	0	-1	-3	–
Hydro (F)	6	16	-12	-5	-11	3	2	3	–
Live (L)	-3	-15	2	0	1	0	0	-1	During refueling
Live (L_o)	-1	-5	0	0	1	0	0	0	During operation
ADS	13	55	-16	-2	-13	2	3	5	–
E_s	44	193	78	6	26	4	9	26	–
Thermal (T_0)	-314	-139	179	170	341	12	-47	-123	–
LC (1)	20	60	-40	-12	-32	8	7	9	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-5	-51	-9	-8	-10	4	1	-2	$1.4D+1.4F+1.7L_r$
LC (3)	22	68	-40	-12	-33	8	7	9	$1.4D+1.4F+1.7ADS$
LC (4)	56	225	85	2	32	9	13	31	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-58	-271	-103	-14	-46	-3	-11	-31	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-258	86	264	172	373	21	-34	-92	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-372	-410	76	156	295	9	-58	-154	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	58	233	53	-2	5	9	13	31	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes:	
x-direction is horizontal, y-direction is vertical.	
element number 101933	
Plate thickness required for load combinations excluding thermal:	*0.04 inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations including thermal:	*43.1 ksi*
Yield stress at temperature:	*36.0 ksi*
Maximum stress intensity range for load combinations including thermal:	*52.6 ksi*
Allowable stress intensity range for load combinations including thermal:	*72.0 ksi*

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~

Revise DCD Tier 2 Table 3.8.3-6, "Design Summary of North-East Wall of IRWST," as follows:

Table 3.8.3-6 (Sheet 1 of 3) [*DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST*]*	
Element Number 140027	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 36.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 72.0 ksi*(2)

Notes:

1. This is a lot more than the plate thickness required for load combinations excluding thermal.

2. The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.

Table 3.8.3-6 (Sheet 1 of 3)

[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT MID-HEIGHT]* (3)

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	-1	-13	3	0	3	1	-1	-2	–
Hydro (F)	-5	1	0	8	5	1	2	2	–
Live (L)	0	-12	3	1	8	4	-2	-3	During refueling
Live (L_o)	0	-2	2	2	9	4	-2	-3	During operation
ADS	-7	4	3	8	3	2	2	3	–
E_s	14	27	38	19	32	15	6	14	–
Thermal (T_0)	-84	-65	43	208	218	8	-10	-12	–
LC (1)	-20	-13	13	28	32	13	1	0	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-8	-37	9	13	25	10	-2	-5	$1.4D+1.4F+1.7L_r$
LC (3)	-20	-10	9	25	16	6	5	5	$1.4D+1.4F+1.7ADS$
LC (4)	15	17	46	37	52	23	7	14	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-27	-45	-36	-17	-18	-11	-9	-20	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-69	-48	89	245	270	31	-3	2	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-111	-110	7	191	200	-3	-19	-32	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	1	20	44	35	43	19	9	17	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes: *x-direction is horizontal, y-direction is vertical.* *element number 140027*	
Plate thickness required for load combinations excluding thermal:	*0.04 inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations including thermal:	*23.4 ksi*
Yield stress at temperature:	*36.0 ksi*
Maximum stress intensity range for load combinations including thermal:	*23.4 ksi*
Allowable stress intensity range for load combinations including thermal:	*72.0 ksi*

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~

Table 3.8.3-6 (Sheet 2 of 3)	
*[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST]**	
Element Number 140005	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 36.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 72.0 ksi*(2)

Notes:

1. *This is a lot more than the plate thickness required for load combinations excluding thermal.*
2. *The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.*

Table 3.8.3-6 (Sheet 2 of 3)

[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT BOTTOM – ELEVATION 107'-2"]*(3)

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	-1	-16	3	0	2	0	0	-1	–
Hydro (F)	-1	2	-1	0	-8	1	0	9	–
Live (L)	0	-11	1	0	2	0	0	-1	During refueling
Live (L_o)	0	-4	1	0	1	0	0	-1	During operation
ADS	-2	4	3	0	-6	2	0	6	–
E_s	18	31	40	16	58	9	6	11	–
Thermal (T_0)	-220	-163	80	212	213	1	4	6	–
LC (1)	-6	-20	10	0	-17	5	0	20	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-3	-38	5	0	-5	1	0	10	$1.4D+1.4F+1.7L_r$
LC (3)	-6	-13	8	0	-19	5	0	21	$1.4D+1.4F+1.7ADS$
LC (4)	18	17	46	16	59	12	6	24	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-22	-53	-40	-16	-69	-10	-6	-10	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-202	-146	126	228	272	13	10	30	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-242	-216	40	196	144	-9	-2	-4	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	14	23	45	16	46	12	6	25	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 140005

Plate thickness required for load combinations excluding thermal:	*0.04 inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations including thermal:	*22.8 ksi*
Yield stress at temperature:	*36.0 ksi*
Maximum stress intensity range for load combinations including thermal:	*22.8 ksi*
Allowable stress intensity range for load combinations including thermal:	*72.0 ksi*

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~

Table 3.8.3-6 (Sheet 3 of 3) **{*DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST*}***	
Element Number 140001	
Plate thickness provided	*= 0.50 inches*(1)
Thermal Load Combinations	
Yield stress at design temperature	*= 36.0 ksi*
Allowable stress intensity range for load combinations (including thermal)	*= 72.0 ksi*(2)

Notes:

1. *This is a lot more than the plate thickness required for load combinations excluding thermal.*
2. *The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.*

Table 3.8.3-6 (Sheet 3 of 3)

[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST
DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA
NORTH END BOTTOM CORNER – ELEVATION 107'-2"]*(3)

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	-1	-21	3	0	0	0	0	0	–
Hydro (F)	-3	17	9	10	13	11	-6	-16	–
Live (L)	0	-15	2	0	0	0	0	0	During refueling
Live (L_o)	0	-6	1	0	0	0	0	0	During operation
ADS	-3	27	11	9	17	10	-5	-16	–
E_s	6	98	37	34	139	31	14	52	–
Thermal (T_0)	-49	-42	72	32	173	-40	-19	49	–
LC (1)	-11	30	37	29	47	32	-17	-50	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-6	-31	20	14	18	15	-8	-22	$1.4D+1.4F+1.7L_r$
LC (3)	-11	40	36	29	47	32	-17	-50	$1.4D+1.4F+1.7ADS$
LC (4)	5	115	61	53	169	52	13	52	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-13	-135	-35	-33	-143	-30	-25	-84	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-44	73	133	85	342	12	-6	101	$D+F+L_o+\|ADS\|+T_0+E_s$
LC (7)	-62	-177	37	-1	30	-70	-44	-35	$D+F+L_o-\|ADS\|+T_0-E_s$
LC (8)	-1	123	60	53	169	52	3	20	$0.9D+1.0F+1.0\|ADS\|+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 140001

Plate thickness required for load combinations excluding thermal:	*0.04 inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations including thermal:	*32.3 ksi*
Yield stress at temperature:	*36.0 ksi*
Maximum stress intensity range for load combinations including thermal:	*32.4 ksi*
Allowable stress intensity range for load combinations including thermal:	*72.0 ksi*

(3) See Subsection 3.8.3.5.8 for reporting requirements for changes to Tier 2* information in this section.
~~*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.~~

Revise DCD Tier 2, Table 3.8.4-6, "Materials Used in Structural and Miscellaneous Steel," as follows:

Table 3.8.4-6

MATERIALS USED IN STRUCTURAL AND MISCELLANEOUS STEEL

Standard	Construction Material
ASTM A1	Carbon steel rails.
ASTM A36/A36M	Rolled shapes, plates, and bars
ASTM A53	Welded and Seamless Steel Pipe, Grade B
ASTM A106	Seamless Carbon Steel Pipe for High Temperature Service
ASTM A108	Weld studs
ASTM A123	Zinc coatings (hot galvanized)
ASTM A167	Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet and Strip.
ASTM A193	Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A194	Carbon and Alloy Steel Nuts and Bolts for High-Pressure and High-Temperature Service
ASTM A240	Duplex 2101 stainless steel (designation S32101)
ASTM A242	High-strength low alloy structural steel
ASTM A276	Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A307	Low carbon steel bolts
ASTM A312	Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A325	High strength bolts
ASTM A354	Quenched and tempered alloy steel bolts (Grade BC)

ASTM A441	High-strength low alloy structural manganese vanadium steel
ASTM A496	ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A505	Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled
ASTM A514	High-Yield Strength Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A517	Standard Specification for Pressure Vessel Plates, Alloy Steel, High-Strength, Quenched and Tempered
ASTM A564	Hot-Rolled and Cold-Finished, Age Hardening Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A570	Hot-Rolled Carbon Steel Sheets and Strip, Structural Quality, Grades C, D and E
ASTM A572	High-strength low alloy structural steel
ASTM A588	High-strength low alloy structural steel
ASTM A607	Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High-Strength, Low-Alloy, Columbium and/or Vanadium
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement
ASTM A618	Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A706	Low Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM A970	Specification for Welded Headed Bars for Concrete Reinforcement
ASTM A992	Structural steel shapes
ASTM F1554	Steel anchor bolts, 36, 55, and 105-ksi Yield Strength

PRA Revision: None

Technical Report (TR) Revision: None