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Your ref: Docket No. 52-006
Our ref: DCP_NRC_003071

October 21, 2010

Subject: AP1000 Response to Request for Additional Information (SRP 3)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 3. 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 RAI(s):

RAI-SRP3.8.3-SEB1-05 R4
RAI-SRP3.8.3-SEB1-07 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,

R. F. Ziesing
Director, U.S. Licensing

/Enclosure

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

D063
NRD

cc:	D. Jaffe	-	U.S. NRC	1E
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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-SRP3.8.3-SEB1-05
Revision: 4

Question: (Revision 0)

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.

Additional Question: (Revision 3)

The staff reviewed the Westinghouse response to RAI-SRP3.8.3-SEB1-05 Rev. 2, transmitted in their letter dated July 2, 2010. The response addressed the concerns, related to the removal of Tier 2* information for the DCD and definition of new Tier 2* criteria for critical sections, except for one item. On Page 5 of 37 of the response, in the last sentence of the second bullet of the proposed new criteria in Subsection 3.8.3.5.8, the reference to "Table 3H-3" should be revised to "Table 3H.5-3." Since this new Tier 2* criteria are utilized in several locations in the DCD, this correction should be made at all of the other locations as well.

Question: (Revision 4)

During discussions between the NRC staff and Westinghouse on October 14, 2010 the staff observed that the Tier 2* change criteria added to Subsection 3.8.3.5.8 is inconsistent with the rules for Tier 2* material included in Part 52 Appendix D. Westinghouse will remove that criteria from the DCD and address the concern about designating calculation results Tier 2* in another manner.

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.~~ This DCD revision is reversed in Revision 4 of this response.

Additional Westinghouse Response: (Revision 3)

The reference to Table 3H.5-3 in 3.8.3.5.8 is corrected. In the previous revision the reference was to Table 3H-3.

A similar correction to Subsection 3H.1 is included in the response to RAI-SRP3.8.4-SEB1-03

Additional Westinghouse Response: (Revision 4)

Westinghouse understands that the change criteria included with Revision 1 of this response are inconsistent with the rules of Part 52 Appendix D for Tier 2*. The change criteria will be removed from DCD changes planned for Revision 18 of the DCD.

The Tier 2* change criteria which was included as DCD mark-up for Subsection 3.8.3.5.8 in Revision 2 and 3 of this response was added to address the information included in critical section tables which is copied from calculation and analytical results and is subject to minor changes when analyses are rerun. This issue will be addressed by removing the Tier 2*

designation from values from tables that are analytical and calculation results. These values will remain in the DCD as Tier 2 information. Design parameters such as reinforcement provide is designated as Tier 2* information. In some cases values designated as Tier 2* include a tolerance with the tolerance designated as Tier 2* information. The tolerance included is consistent with ASTM-6, "Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling" and ASTM A480, "Standard Specification for General Requirements for Flat-Rolled Stainless and Heat- Resisting Steel Plate, Sheet, and Strip". Changes to tables previously included in this RAI response are provided below.

Discussions about the designation of Tier 2* information have also demonstrated a lack of clarity about the designation of information in figures as Tier 2*. These figures include information at more detail that the information that is intended to be captures as Tier 2*. Mark-ups of DCD text are provided below to clarify the Tier 2* information in DCD module figures designated as Tier 2*. In addition The Table in the Introduction to the DCD that tabulates the Tier 2* information is revised to be consistent with the additional information provided to clarify the Tier 2* designation.

Design Control Document (DCD) Revision: (Revision 0, 1, 2, and 4)

Revise Table 1-1 in the DCD Introduction to clarify the Tier 2* material in figures related to module design as follows:

Item	Expiration at First Full Power	Tier 2 Reference
Design Summary of Critical Sections Inside Containment	Yes	3.8.3.5.8.1 3.8.3.5.8.2 3.8.3.5.8.3 Table 3.8.3-3 Table 3.8.3-4 Table 3.8.3-5 Table 3.8.3-6 Table 3.8.4-1 Figure 3.8.3-1
Minimum Size of Angles and Channels		Figure 3.8.3-2
Spacing of Faceplates, trusses, channels, and headed studs. Mechanical connectors. Use of anchors, studs, and bars.		Figure 3.8.3-8 Figure 3.8.3-14
Spacing of faceplates and trusses		Figure 3.8.3-15 Figure 3.8.3-17 Figure 3.8.3-18

Revise the fourth paragraph of Subsection 3.8.3.1 as follows:

Walls and floors are concrete filled steel plate structural modules. The walls are supported on the mass concrete containment internal structures basemat with the steel surface plate extending down to the concrete floor on each side of the wall. The steel surface plates of the structural modules provide reinforcement in the concrete. The structural modules are anchored to the base concrete by mechanical connections welded to the steel plate ~~or by lap splices where the reinforcement overlaps shear studs on the steel plate~~ as shown in Figure 3.8.3-8. Figure 3.8.3-1 shows the location of the structural modules. Figures 3.8.3-2 and 3.8.3-15 show the typical structural configuration of the wall modules. The information in Figure 3.8.3-2 that is Tier 2 * is the minimum size of the angles and channels used to fabricate the modules. The information in Figure 3.8.3-15 that is Tier 2* is the maximum design spacing between the face plates and the maximum design spacing between the trusses used to fabricate the modules. A typical floor module is shown in Figure 3.8.3-3 and also in Figure 3.8.3-16 combined with the liner module. These structural modules are structural elements built up with welded steel structural shapes and plates. Concrete is used where required for shielding, but reinforcing steel is not normally used.

Revise the second paragraph of 3.8.3.1.3 as follows:

Structural wall modules consist of steel faceplates connected by steel trusses. The primary purpose of the trusses is to stiffen and hold together the faceplates during handling, erection, and concrete placement. The nominal thickness of the steel faceplates is 0.5 inch. The nominal spacing of the trusses is 30 inches. Shear studs are welded to the inside faces of the steel faceplates. Face plates are welded to adjacent plates with full penetration welds so that the weld is at least as strong as the plate. Plates on each face of the wall module extend down to the elevation of the adjacent floor. Since the floors in the rooms each side of the wall module are at different elevations, one of the plates extends further than the other. This portion is designated on Figure 3.8.3-1 as "CA Structure Module with Single Surface Plate." A typical configuration is shown in Figure 3.8.3-8. The module functions as a wall above the upper floor level (elevation 103′-0″ in Figure 3.8.3-8). The information in Figure 3.8.3-8 that is considered to be Tier 2* information is the maximum design spacing of the faceplates, trusses, channels in the trusses and headed studs. On Sheet 2 of Figure 3.8.3-8 the use of mechanical connectors and the development length requirement for the mechanical connectors is considered to be Tier 2 * information. On Sheet 3 of Figure 3.8.3-8 the use of angles to stiffen the module, the use of studs to anchor the module, and the use of deformed bars to connect the module to the mass concrete are considered to be Tier 2* information. The single plate below this elevation is designed to transfer the reactions at the base of the wall into the base mat. This plate also acts as face reinforcement for the basemat. Basemat reinforcement dowels are provided at the bottom of the single plate as shown in Figure 3.8.3-8.

~~Revise~~ The revision of DCD Tier 2, Section 3.8.3.5.8, "Design Summary of Critical Sections," included in Revision 2 of this response is reversed as shown below by a strikeout of the material previously added. ~~as follows: (Revision 2)~~ Material added to 3.8.3.5.8 will not be included in DCD Revision 18.

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.5-3 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: Reference to Technical Report APP-GW-GLR-045 is removed in Revision 4 of this response.

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: Reference to Technical Report APP-GW-GLR-045 is removed in Revision 4 of this response.

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: Reference to Technical Report APP-GW-GLR-045 is removed in Revision 4 of this response.

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: Reference to Technical Report APP-GW-GLR-045 is removed in Revision 4 of this response.

~~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 -.0.0 +0.1]**
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 -.0.0 +0.1]**
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 -.0.0 +0.1]**

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~~ 0.100 inches (Max.)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
Maximum principal stress for load combinations including thermal:	23.37 ksi
[Yield stress at temperature:	*~~565~~.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	23.37 ksi
Allowable stress intensity range for load combinations including thermal:	~~1~~130.0 ksi (Minimum)

~~(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:	~~0.02~~0.100 inches (Maximum)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
Maximum principal stress for load combinations including thermal:	28.0 ksi
[Yield stress at temperature:	*~~5~~65.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	28.0 ksi
Allowable stress intensity range for load combinations including thermal:	1~~+~~30.0 ksi Minimum

~~(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~~0.30 inches (Max.)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
Maximum principal stress for load combinations including thermal:	28.1 ksi
[Yield stress at temperature:	*~~56~~5.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	35.26 ksi
Allowable stress intensity range for load combinations including thermal:	1~~1~~30.0 ksi (Minimum)

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~~(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~~0.100 inches (Maximum)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
Maximum principal stress for load combinations including thermal:	23.0 ksi
[Yield stress at temperature:	*36.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	23.0 ksi
Allowable stress intensity range for load combinations including thermal:	72.0 ksi (Minimum)

~~(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.~~

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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 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)	-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:	~~0.040~~.100 inches (Maximum)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
Maximum principal stress for load combinations including thermal:	25.7 ksi
[Yield stress at temperature:	*36.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	25.7 ksi
Allowable stress intensity range for load combinations including thermal:	72.0 ksi (Minimum)

~~(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.~~

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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 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)	-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:	~~0.040~~.100 inches (Maximum)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
Maximum principal stress for load combinations including thermal:	43.1 ksi
[Yield stress at temperature:	*36.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	52.6 ksi
Allowable stress intensity range for load combinations including thermal:	72.0 ksi (Minimum)

~~(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:	~~0.040~~.100 inches (Maximum)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
[Maximum principal stress for load combinations including thermal:	23.4 ksi
Yield stress at temperature:	*36.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	23.4 ksi
Allowable stress intensity range for load combinations including thermal:	72.0 ksi (Minimum)

}

~~(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.*~~

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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″~~1*(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~~ 0.100 inches (Maximum)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
Maximum principal stress for load combinations including thermal:	22.8 ksi
[Yield stress at temperature:	*36.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	22.8 ksi
Allowable stress intensity range for load combinations including thermal:	72.0 ksi (Minimum)

(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.*~~

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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~~0.10 inches (Max.)
[Plate thickness provided:	*0.50 inches -0.01 +0.10]**
Maximum principal stress for load combinations including thermal:	32.3 ksi
[Yield stress at temperature:	*36.0 ksi (Minimum)]**
Maximum stress intensity range for load combinations including thermal:	32.4 ksi
Allowable stress intensity range for load combinations including thermal:	72.0 ksi (Minimum)

~~(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

Revise Figure 3.8.3-8 as shown in the attached mark-up (Page 35).

Changes to figure include: Weld Details are removed. References to AP1000 drawings are removed. Note for weld stud spacing is corrected to read as follows:

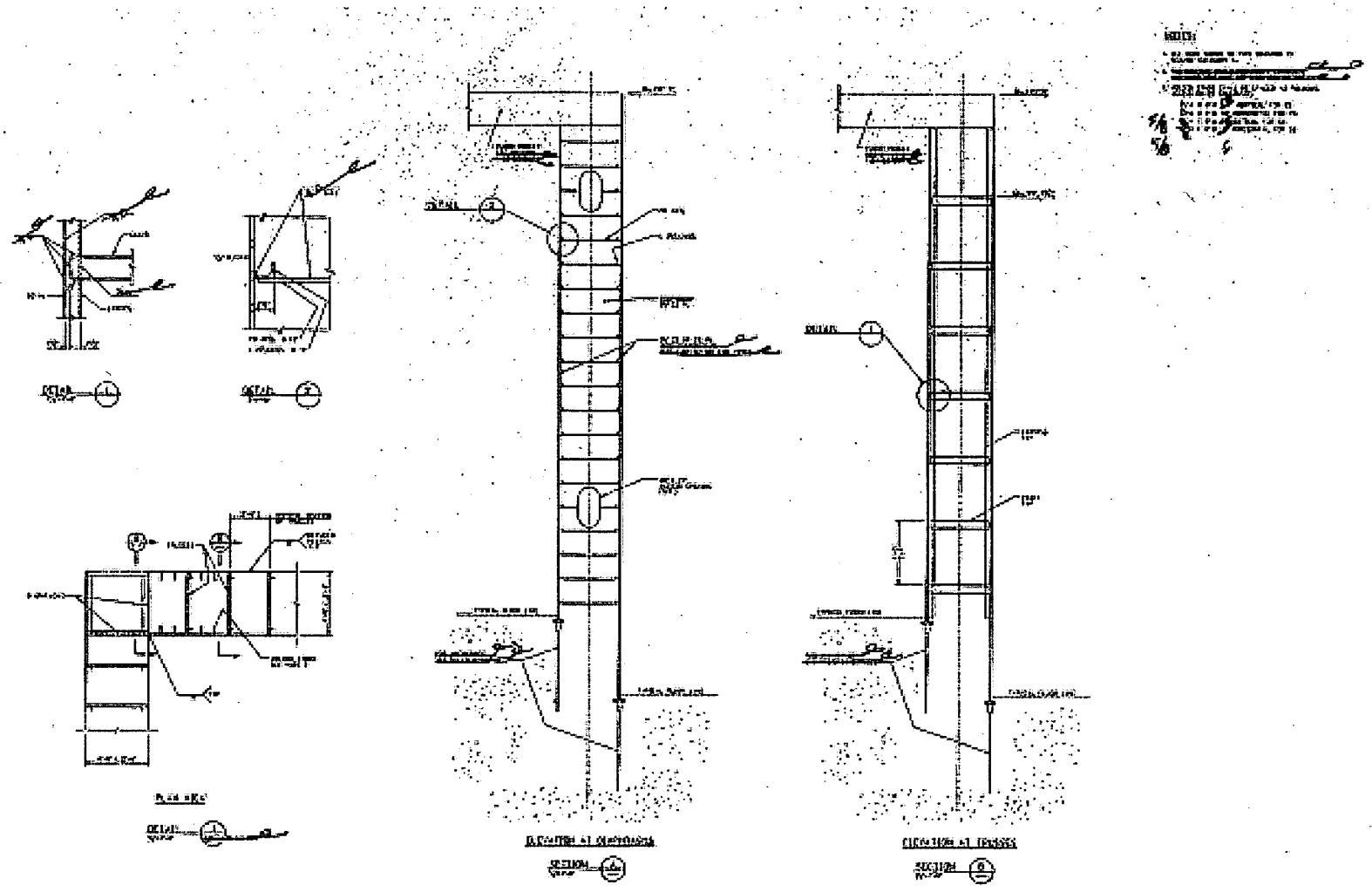
¾ dia. X 6" @ 10"~~9.6"~~ VERTICAL FOR CS
¾ dia. X 6" @ 10" HORIZONTAL FOR CS
~~¾~~⅝ dia. X 6" @ 6"~~8"~~ VERTICAL FOR SS
~~¾~~⅝ dia. X 6" @ 6"~~10"~~ HORIZONTAL FOR SS

Revise Figure 3.8.3-15 as shown in the attached mark-up (Page 36).

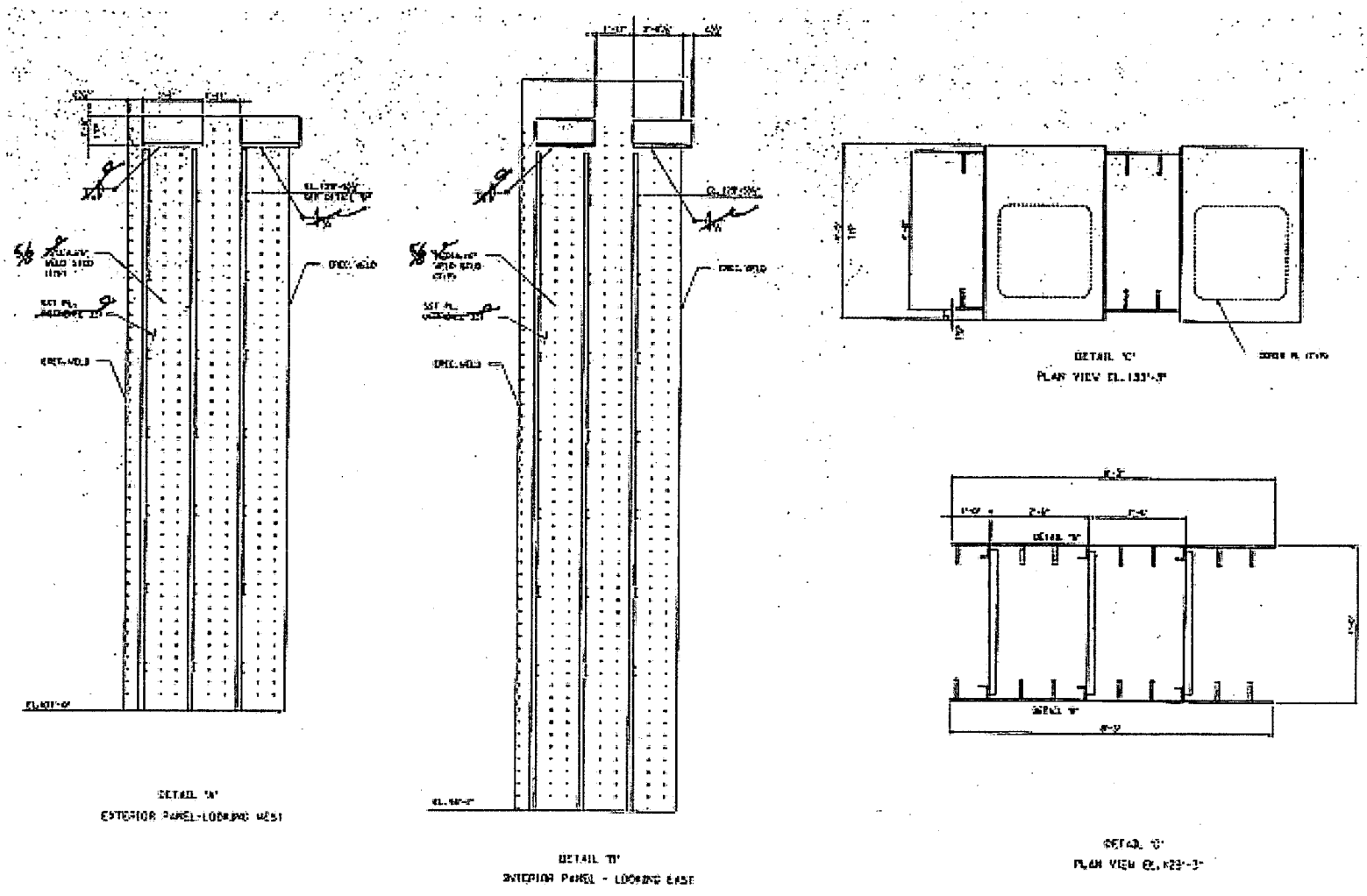
Changes to figure include: Weld details are removed. Reference to Nitronic 33 is removed. Diameter of Weld Stud is changed from ¾ inch diameter to ⅝ inch diameter.

PRA Revision: None

Technical Report (TR) Revision: None



Westinghouse



AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP-3.8.3-SEB1-07
Revision: 2

Question:

DCD Rev. 16 Tables 3.8.3-3 through 3.8.3-7 have been revised from the prior version of the DCD, which were identified as Tier 2*. The revised tables removed information which provided the required plate thicknesses and stress results which permit comparison to the plate thicknesses provided and allowable stress limits. Westinghouse is requested to provide the same equivalent information in DCD Rev. 16 for these tables as was provided in the prior DCD.

Also, DCD Rev. 16, Table 3.8.3-7 replaced specific AISC interaction ratio values in the prior DCD with a notation that it is now less than 1.0 at all entries of the table. This is not enough information for NRC to review. Therefore, Westinghouse is likewise requested to present the actual interaction ratios as was done in 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.

Question: (Revision 2)

During discussions between the NRC staff and Westinghouse on October 14, 2010 the staff observed that the Tier 2* change criteria added to Subsection 3.8.5.4.4 is inconsistent with the rules for Tier 2* material included in Part 52 Appendix D. Westinghouse will remove that criteria from the DCD and address the concern about designating calculation results as Tier 2* in another manner.

Westinghouse Response: (Revision 0)

These changes were communicated to the NRC in Technical Report APP-GW-GLR-045 (TR57) Revision 1, Chapter 5.0 "DCD Mark Up" (November 2007). These changes were also discussed in a review and audit meeting in Pittsburgh.

APP-GW-GLR-045 Rev 1 had flagged the removal of the design load summary tables in DCD Subsection 3.8.3 and 3.8.4 and the tables of member forces and moments in Appendix 3H.

The information in the tables represented the results of detailed calculations and analyses. These results change slightly as the design is finalized. Small changes in modeling and updates to software also have a minor effect on the results in the Tables. For these reasons it was considered appropriate to allow for changes in the design by removing these results in the DCD.

Subsection 3.8.3, 3.8.4, and Appendix 3H provide information on the criteria, design configuration, and concrete reinforcement. This should provide the appropriate parameters and design information for NRC review. Attempting to lock in the design implementation by

including the results of design load calculations over specifies the design. Note: detailed results of the analyses of the critical structures are made available for NRC audit and review.

The level of detail represented by the design summary tables and table of member forces and moments in DCD Revision 15 exceeded the level of detail suggested in the guidance of Regulatory Guide 1.70 and Standard Review Plan Section 3.8.4. Based on the reasons cited above Westinghouse is not including the required plate thicknesses, and stress results, and actual interaction ratios in the DCD.

Additional Westinghouse Response: (Revision 1)

This response addresses the information contained in DCD Section 3.8. Revised Tier 2 Tables 3.8.3-3 through 3.8.3-6 are provided in RAI-SRP-3.8.3-SEB1-05 R1. Tier 2 Table 3.8.3-7 is revised below.

Additional Westinghouse Response: (Revision 2)

Westinghouse understands that the change criteria included with Revision 1 of this response are inconsistent with the rules of Part 52 Appendix D for Tier 2*. The change criteria will be removed from DCD changes planned for Revision 18 of the DCD.

The Tier 2* change criteria which was included as DCD mark-up for Subsection 3.8.5.4.4 in Revision 1 of this response was added to address the information included in critical section tables which is copied from calculation and analytical results and is subject to minor changes when analyses are rerun. This issue will be addressed by removing the Tier 2* designation from values from tables that are analytical and calculation results. These values will remain in the DCD as Tier 2 information. Design parameters such as reinforcement provided are designated as Tier 2* information. In some cases values designated as Tier 2* include a tolerance. The tolerance is also designated as Tier 2* information.

Design Control Document (DCD) Revision:

~~Revise~~ The change to DCD Tier 2, Section 3.8.5.4.4, "Design Summary of Critical Sections," ~~as follows:~~ shown in Revision 1 of this response will not be included in DCD Revision 18.

3.8.5.4.4 Design Summary of Critical Sections

(First paragraph unchanged)

~~[Changes in the values in the critical section Table 3.8.5-3 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 or concrete strength. Changes in the values that are designated as Tier 2* must be reported to the NRC if the change results in a required reinforcement increase greater than the larger of 20% of the required reinforcement value in the table, or a change in the required reinforcement equal to 10% of the provided reinforcement.]*~~

Update Table 3.8.5-3, "Definition of Critical Locations and Thicknesses for Nuclear Island Basemat," as follows: Revision 1 of response revised the Note for Tier 2* material. Revision 2 of the response restored the previous note and clarified and revised the designation of what is Tier 2*

Table 3.8.5-3

DEFINITION OF CRITICAL LOCATIONS AND THICKNESSES FOR NUCLEAR ISLAND BASEMAT(1)* (a)

Wall or Section Description	Applicable Column Lines	Applicable Elevation Level or Elevation Level Range	*[Concrete Thickness(2)*	Reinforcement Required Vertical (in^2/ft^2)(3)	Reinforcement Required Horizontal (in^2/ft)(3)	*[Reinforcement Provided Vertical (Minimum) (in^2/ft^2)(4)]**	*[Reinforcement Provided Horizontal (Minimum) (in^2/ft)(4)]**
Auxiliary Building Basemat							
Auxiliary Basemat Area	Column line K to L and from Col. Line 11	From level 0 to 1	*6'-0"*	**Shear Reinforcement** 0.23	**Bottom Reinforcement** 1.6 (East-West Direction) **Top Reinforcement** 1.5 (East-West Direction)	*[**Shear Reinforcement** 0.25]**	*[**Bottom Reinforcement** 2.25 (East-West Direction) **Top Reinforcement** 2.25 (East-West Direction)]**
Auxiliary Basemat Area	Column line 1 to 2 and from Column Line K-2 to N wall	From level 0 to 1	*6'-0"]**	**Shear Reinforcement** 0.47	**Bottom Reinforcement at column line 2** 2.25 (North-South Direction) **Top Reinforcement at mid-span** 2.25 (North-South Direction)	*[**Shear Reinforcement** 0.50]**	*[**Bottom Reinforcement** 2.255 (North-South Direction) **Top Reinforcement** 3.25 (North-South Direction)]**

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. These thicknesses have a construction tolerance of +1 inch, -3/4 inch.]**

3. These concrete reinforcement values represent the minimum reinforcement required for structural requirements except for designed openings, penetrations, sumps or elevator pits.

*[4. These concrete reinforcement values represent the provided reinforcement for structural requirements except for designed openings, penetrations, sumps or elevator pits.]**

~~(2) See Section 3.8.5.4.4 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 3.8.3-7, "Design Summary Of Steel Wall Of IRWST," as follows:

Table 3.8.3-7

DESIGN SUMMARY OF STEEL WALL OF IRWST

Mechanical Loads Only AISC Interaction Ratio			
Section Location and Element Number	**T Section**	**L Section**	**Load Combination**
TYPICAL COLUMN AT MIDDLE OF WALL			
Top (139701)	~~<1.00~~.13	~~<1.00~~.64	*[D+F+L_o -|ADS|- E_s (LC#5)* ~~D+F_n+L_n+R_e]*~~
	~~<1.0~~	~~<1.0~~	~~D+F_r+L_r]*~~
Mid-height (139699)	~~<1.00~~.33	~~<1.00~~.33	*[D+F+L_o -|ADS|- E_s (LC#5)* ~~D+F_n+L_n+R_e]*~~
	~~<1.00~~.21	~~<1.00~~.34	*[D+F+L_o +|ADS|+E_s (LC#4)* ~~D+F_r+L_r]*~~
Bottom (139690)	~~<1.00~~.69	~~<1.00~~.09	*[D+F+L_o -|ADS|- E_s (LC#5)]** ~~D+F_n+L_n+R_e]*~~
	~~<1.0~~	~~<1.0~~	~~D+F_r+L_r]*~~
ENVELOPE OF ALL LOCATIONS AND LOAD COMBINATIONS			
	~~<1.00~~.94	~~<1.00~~.94	*[D+F+ADS (LC#3)]**

Mechanical Plus Thermal Loads Ratio of Stress to AISC or ASME (2 * Sy = 80 ksi)				
Section Location and Element Number	**Flange of T Section**	**Flange of L Section**	**Plate**	**Load Combination**
TYPICAL COLUMN AT MIDDLE OF WALL				
Top (139701)	~~<1.00~~.13 AISC	~~<1.00~~.60 AISC	~~<1.00~~.07 AISC	*[D+F+L_o -|ADS|+T_0-E_s (LC#7)]** ~~D+F_n+L_n+ADS_2+E_s+Pa_5+R_a+T_a~~
	0.07 AISC	0.061 AISC	0.47 AISC	*[D+F+L_o +|ADS|+T_0+E_s (LC#6)]**
Mid-height (139699)	~~<1.00~~.32 AISC	~~<1.00~~.87 AISC	~~<1.00~~.11 AISC	*[D+F+L_o -|ADS|+T_0-E_s (LC#7)]** ~~D+F_n+L_n+ADS_2+E_s+Pa_5+R_a+T_a~~

Bottom (139690)	~~<1.00~~.92 ASME	~~<1.00~~.49 AISC	~~<1.00~~.06	*[D+F+L_o +|ADS|+T_0+E_s (LC#6)]** ~~)D+F_a+L_a+ADS_2+E_s+Pa_s+R_a+T_a~~
	0.28 ASME	0.67 ASME	0.23 ASME	*[D+F+L_o -|ADS|+T_0-E_s (LC#7)]**
ENVELOPE OF ALL LOCATIONS AND LOAD COMBINATIONS				
–	~~<1.00~~.92 ASME	~~<1.00~~.74 ASME	~~<1.00~~.81 ASME	*[D+F+L_o +|ADS|+T_0+E_s (LC#6)]**

Note:
Results of the evaluation of mechanical and thermal loads are shown against the AISC allowables when the stresses are less than yield. Portions of the steel wall at the end of the wall exceed yield due to the restraint provided by the adjacent concrete. These areas are evaluated against the ASME allowables as described in subsection 3.8.3.5.3.4.
*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

PRA Revision:
None

Technical Report (TR) Revision:
None