CRITERIA BFN 50 C 7100

ATTACHMENT F

BROWNS FERRY NUCLEAR PLANT

DETAILED

Design Criteria

For

STRUCTURAL ACCEPTANCE OF DRYWELL ACCESS PLATFORMS

NOTE: This Attachment incorporates and replaces BFN-50-790 Rev. 0

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1.0 INTRODUCTION

1.1 Description

The drywell access platforms include two main platforms, one at elevation 584 feet 11 inches, and one at elevation 563 feet 2 inches. The flooring is standard grating, with 1-1/2-inch by 3/16-inch load bars. The grating and support steel extend from the reactor pedestal to the drywell shell at elevation 563 feet 2 inches and from the sacrificial shield wall to the drywell shell at elevation 584 feet 11 inches.

The platforms are supported by 24-inch-deep, wide-flange beams radiating from the reactor pedestal and sacrificial shield wall to the drywell shell. The radial support beams for elevation 584 feet 11 inches are field-welded to header beams in the sacrificial shield wall. The radial support beams for elevation 563 feet 2 inches are field-bolted to embedded plates in the outside face of the reactor pedestal. All radial beams are supported by beam seats welded to the drywell shell. Lubrite pads under the radial beams allow drywell shell expansion. Shear bars welded to the bottom flange of the radial beams on both sides of the beam seat prevent lateral movement of the beams. Intermediate grating support beams at 6 feet 6 inches maximum spacing are framed between the radial beams. Additional support beams are framed between both the radial and grating support beams for equipment, HVAC, cable tray, and piping system load attachments.

1.2 Purpose

The purpose of this criteria is to establish the requirements for the designer to assure uniformity in design during the evaluation of the drywell access platforms and to obtain a safe and complete design considering all appropriate loading combinations. This criteria defines the loads and load combinations for use in this evaluation and also the associated allowable stresses and uplift evaluation requirements.

1.3 Scope

1.3.1 The requirements of this document shall apply only to the structural steel inside the drywell at elevation 584 feet 11 inches and elevation 563 feet 2 inches as denoted on TVA drawings 48N442 and 48N443, including miscellaneous steel for these elevations as denoted on TVA drawings 48N1015-series, 48N1016-series, and 48N1028.

1.3.2 In the event of conflicting requirements between this document and any reference material, this document shall govern. However, the civil project engineer shall be notified of the difference.

2.0 DESIGN SPECIFICATIONS

For this structural design or reevaluation, the 1978 AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings shall be used.

3.0 LOADS AND LOADING COMBINATIONS

3.1 Loading Definitions

3.1.1 D - Deadload, including structural steel, permanent equipment, and attached systems, e.g., piping, HVAC, cable trays, etc, shall be a minimum of 40 psf.

3.1.2 L_o - Outage and maintenance loads, including any moveable equipment loads and other loads which vary with intensity and occurrence during an outage, i.e., these loads will not be present while the plant is operating. An L_o of 100 psf applied to the loadable open areas shall be evaluated as a baseline outage and maintenance live load for the initial analysis using this criteria. As concentrated live loads due to outage or maintenance procedures are identified, these loads shall be evaluated against the baseline case. If the results of the concentrated loads exceed the baseline case, the concentrated loads must be evaluated per this criteria. The cooler live load shall be 1.5 kips per foot of beam; where applicable.

3.1.3 L - Live loads while the plant is operating, including any loads which vary with intensity and occurrence and are not otherwise accounted for. For the purpose of the initial evaluation using this criteria, L will be assumed zero.

3.1.4 E - Loads due to effects of OBE on structural steel and permanent floor-mounted equipment. This excludes support loads from attached piping, HVAC ducts, and cable trays (these loads are defined in Section 3.1.8).

3.1.5 E' - Loads due to effects of SSE on structural steel and permanent floor-mounted equipment. This excludes support loads from attached piping, HVAC ducts, and cable trays (these loads are defined in Section 3.1.8).

3.1.6 Y_r - Equivalent static load on the structural due to a pipe whip reaction from existing pipe rupture restraints attached to the drywell steel.

Note: The application of pipe rupture loads only at those locations where mitigation exists is consistent with the baseline approach to pipe rupture design inside the drywell. Only those locations where GE and/or TVA negotiated pipe rupture mitigation as part of the original design need be considered.

3.1.7 RFE - Restraint of free end displacement loads, e.g., thermal reactions from attached piping systems based on the most critical condition.* RFE loads can be subdivided as follows:

3.1.7.1 RFE_{ul} - RFE reactions which contribute to uplift.

3.1.7.2 RFE_s - All other RFE reactions, i.e., reactions which do not contribute to uplift.

*If reduced conservatism is needed, RFE loads may be divided into upset, emergency, and faulted conditions corresponding to the associated dynamic loading conditions.

3.1.8 DYNB, DYNC, and DYND - Reaction of attached systems, e.g., piping, HVAC, cable trays, etc., due to upset (service level B), emergency (service level C), and faulted (service level D) dynamic events, respectively. Note: Not all attached systems are analyzed for the faulted condition; therefore, some reaction points on the floor steel will only have upset and emergency loading.

3.1.8.1 Dynamic Reaction Phasing

Dynamic reactions from attached systems are transmitted to the floor steel through rigid restraints and snubbers. Based on the location and orientation of these restraints, different assumptions can be made regarding the phasing of these dynamic loads. These assumptions can be grouped into three general categories as follows:

Group A - Phasing Known

When two or more dynamic restraints act together to restrain a particular motion or mode of vibration of an attached system, in-phase reaction loads can be assumed. For example, reactions resulting from a matched pair of vertical snubbers on a piping system would fall into this group.

Group B - Random Phasing

When a dynamic restraint acts independently to restrain a particular motion or mode of vibration of an attached system, this reaction can be considered randomly phased with other dynamic reactions.

Group C - Worst Case Phasing

When two or more dynamic restraints act to restrain a particular location of an attached system in more than

one direction, a phasing relationship for these restraints cannot be assumed. For example, two snubbers which restrain essentially the same point on a piping system and whose lines of action are skewed to each other would fall into this group. The results of these reactions must be summed absolutely to determine an enveloping condition.

If further justification or additional analysis can show a phasing relationship between group C restraint loads, these restraints can be treated as group A restraints.

3.1.8.2 Procedure for Determining DYNB, DYNC, and DYND

3.1.8.2.1 As a minimum, the following procedure shall be used to determine the dynamic reaction load cases.

A. Assign each dynamic reaction to one of the groups defined above. This will require engineering judgment. Justification for these groupings should be included as part of the analysis report as required by section 4.0 of this criteria.

B. Group A reactions should be arranged into load sets per the phasing sssumed. Each load set should be evaluated separately with the results of each evaluation constituting a dynamic load step.

C. Each group B reaction should be evaluated separately with the results of each evaluation constituting a dynamic load step.

D. Group C reactions should be arranged into load sets per their potential for phasing. Each reaction in the load set should be evaluated separately. The absolute summation of the results of each reaction in the load set will constitute a dynamic load step.

E. Combine all dynamic load steps using the square root of the sum of the squares (SRSS) method to form DYNB, DYNC, or DYND.

3.1.8.2.2 Figure 3.1.7 provides a summary of this procedure.

3.1.9 DYBD - Larger of DYNB or DYND. To determine DYBD, screen each DYNB load step against the corresponding DYND load step. (Note that in some instances no DYND load step exists. In these cases, use the DYNB load step.) Combine the screened load steps using the SRSS method to form DYBD.

3.1.10 DYCD - larger of DYNC or DYND. Use the procedure outlined in 3.1.9 above substituting DYNC for DYNB.

3.1.11 T_o - Thermal effects and loads during startup, normal operating, or shutdown conditions, based on the most critical transient or steady-state condition.

3.1.12 T_a - Thermal loads under thermal conditions generated by the postulated pipe break accident and including T_o.

3.2 Loading Combinations

As stated in section 1.1, all radial platform support beams are supported on one end by beam seats welded to the drywell shell. Since the beam seats do not have holddown capability, the potential for lifting off the beam seats as well as the beam stress must be evaluated. Tables 3.2.1 and 3.2.2 detail the loading combinations which must be addressed in these two evaluations.

4.0 DESIGN AND ANALYSIS PROCEDURES

The design and analysis procedures utilized for the drywell steel structures, including assumptions on boundary conditions and expected behavior under loads, shall be in accordance with the AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings," 8th Edition.

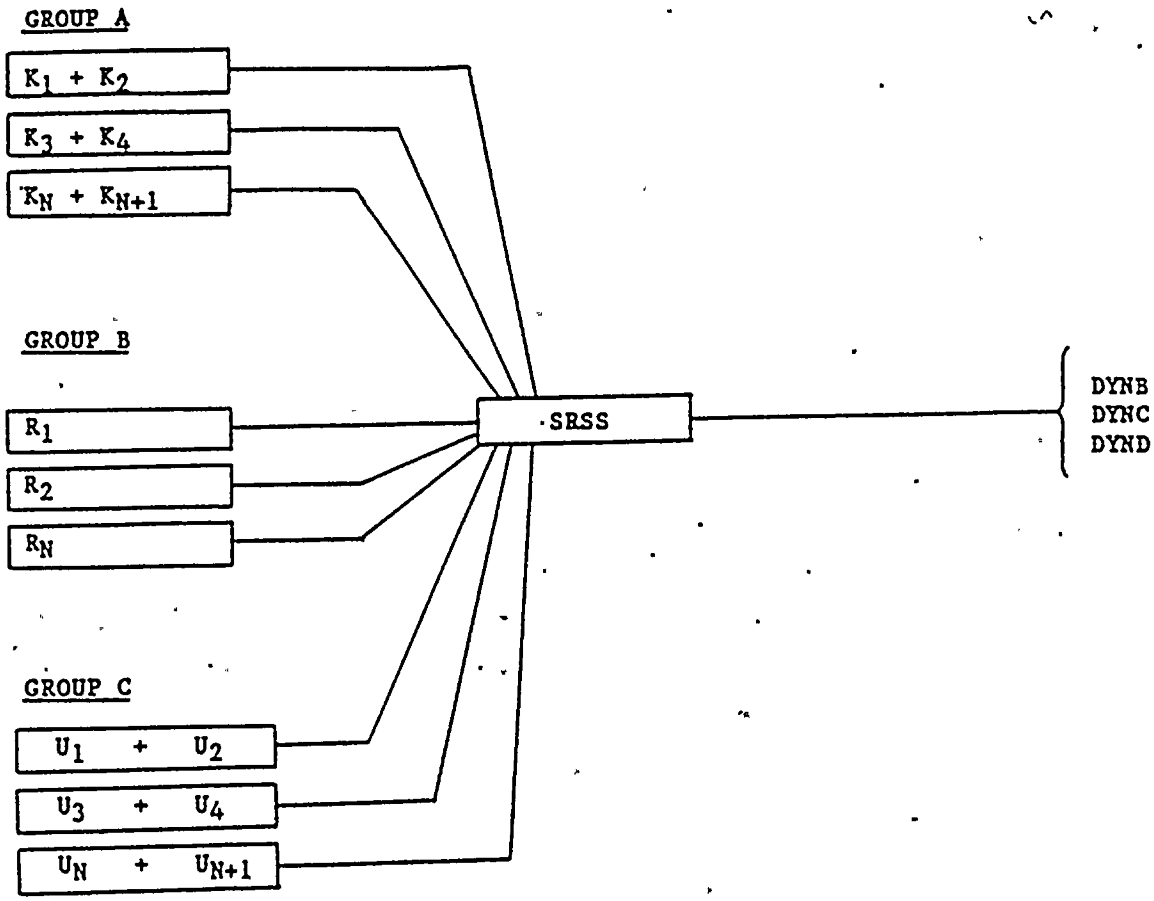
A summary of analysis procedures as well as justification for assumptions should be documented in the form of an analysis report. This analysis report should be issued as an OE calculation.

5.0 REFERENCES

5.1 Design Criteria BFN-50-D707, Revision 2, Analysis of As-Built Piping Systems.

5.2 Design Criteria BFN-50-D706, Revision 1, The Torus Integrity Long-Term Program.

5.3 TVA drawings 48N442, 48N443, 48N1015-series, 48N1016-series, and 48N1028.



Ki = Individual group A reaction

Ri = Individual group B reaction

Ui = Individual group C reaction

Figure 3.1.7

Combination of Dynamic Reactions from Attached Systems

TABLE 3.2.1

LOADING COMBINATIONS FOR STRESS EVALUATION

	Combination	Allowable Stress(1)
A.	$D + L_o$	1.0 S
B.	$D + L + E + DYNB$	1.0 S
C.	$D + L_o + E + DYNB$	1.0 S
D.	$D + L + E + DYNB + T_o + RFE_s$	1.5 S
E.	$D + L_o + E' + DYNC$	1.6 S
F.	$D + L + E' + DYNC + T_o + RFE_s$	1.6 S
G.	$D + L + DYND + T_a + RFE_s$	1.6 S
H.	$D + L + E + DYBD + T_a + RFE_s + Y_r$(2)	1.6 S
I.	$D + L + E' + DYCD + T_a + RFE_s + Y_r$(2)	1.7 S

Notes:

(1) S - For structural steel, S is the required section strength based on elastic design methods and the allowble stresses defined in Part 1 of the AISC "Specification for the Design and Fabrication, and Erection of Structural Steel for Buildings."

The one-third increase in allowable stresses due to the seismic or wind loadings is not permitted.

(2) Only one pipe whip reaction should be considered at any given time; however, all postulated breaks for which pipe rupture mitigation structures exist and are attached to drywell steel must be considered.

TABLE 3.2.2

LOADING COMBINATIONS FOR UPLIFT EVALUATION[1]

Combination	Static Loading	Dynamic Loading
A	$.9D + T_o + RFE_{ul}$	--
B	$.9D$	DYNB + E
C	$.9D + T_o + RFE_{ul}$	DYNB + E
D	$.9D$	DYNC + E'
E	$.9D + T_o + RFE_{ul}$	DYNC + E'
F	$.9D + T_a + RFE_{ul}$	DYND + E + Y_r
G	$.9D + T_a + RFE_{ul}$	DYND + E' + Y_r

Note:

(1) In each combination, it must be shown that the magnitude of the beam seat reaction due to static loading is greater than the reaction due to dynamic loading, unless an adequate tiedown exists or the magnitude of uplift is within acceptable limits. Those acceptable uplift limits will be defined on a case-by-case basis and included in this criteria if the need arises.

BFN-50-C-7100 DISCREPANCIES

1. C/R CEB-JMH-1060 (JFG 1013) statement that building will be designed to remain elastic under DBE appears to conflict with Table 4.2-33 which permits strength design instead of working stress design.

2. FSAR Section 12.2.2.7.3 states in 2 locations (TLM 1205 and 1206) that the ASME B&PV Code, Section III, Class B Vessels, 1968 edition was used, whereas Attachment D to BFN-50-C-7100 specifies the 1965 edition.

3. Source document for Section 3.1.1.D of BFN-50-C-7100 Attachment F for dead load was not consistent with FSAR Section 12.2.2.7.1; however, it was incorporated by G/C. Also source document for Attachment F, Section 3.1.2 did not address cooler live load as provided in FSAR Section 12.2.2.7.1. It has also been added by G/C.

4. Table 4.2-14 of C-7100 (formerly FSAR Table 12.2-16) conflicts with Table 3.2.1 of Attachment F. This must be resolved in Revision 1 of C-7100.

5. FSAR Section 12.2.2.7.1 (page 12.2-31) states that seismic load factors are applied to dead loads and live loads. Attachment F (source document BFN-50-709) implies seismic accelerations are only applied to dead loads.

6. Attachment F (formerly BFN-50-790) provides design criteria for uplift evaluations but makes no mention of tie-down columns as referenced in FSAR Section 12.2.2.7.1 (p. 12.2-31). This discrepancy is noted; however, the general design requirements in Attachment F should be adequate without any reference to tie-down columns which may not even be required.

7. The one hour rainfall of 2.12 inches in Section 3.3 of C-7100 conflicts with the 14 inches cited in Attachment E, Section 4.2.5, for the Volume Reduction and Solidification Structure.

8. FSAR Section 12.2.4.2 states that anchor bars for the chimney foundation shall consider ground saturated to El. 561.0 which corresponds to the maximum probable flood elevation. This conflicts with C/R CG-1023 which states that the MPF is El. 562-0.

9. The secondary containment internal positive design pressure of 7 inches of water as called out in GECRNR1055 (B45860618882) and incorporated into Attachment D does not agree with FSAR Section 14.4.4.3 which specifies a value of 2 inches of water.