Before the

UNITED STATES NUCLEAR REGULATORY COMMISSION

Docket No. 50-466

Allens Creek Nuclear Generating Station Unit 1

Amendment 54 to the

PSAR

Houston Lighting & Power Company, applicant in the above captioned proceeding, hereby files Amendment 54 to the Preliminary Safety Analysis Report filed in connection with its application.

Amendment 54 consists of additional PSAR information updating the PSAR to make it consistent with Revision 2 of the Allens Creek Containment Structures Design Report.

Respectfully submitted

HOUSTON LIGHTING & POWER COMPANY

E. A. Turner
E. A. Turner
Vice President
Power Plant Construction
& Technical Services

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STATE OF TEXAS

COUNTY OF HARRIS

E. A. TURNER, being first duly sworn, deposes and says: That he is Vice President of HOUSTON LIGHTING & POWER COMPANY, an Applicant herein; that the foregoing amendment to the application has been prepared under his supervision and direction; that he knows the contents thereof; and that to the best of his knowledge and belief said documents and the facts contained therein are true and correct.

DATED: This 11th day Dec, 1979.

Signed: E A Turner
E. A. Turner

Subscribed and sworn to before me
this 11th day of Dec, 1979.

Rita P. Villanueva
Notary Public in and for the
County of Harris, State of Texas

My commission expires:
4-30-81

HOUSTON LIGHTING & POWER COMPANY
ALLENS CREEK NUCLEAR GENERATING STATION - UNIT NO. 1
PRELIMINARY SAFETY ANALYSIS REPORT
AMENDMENT NO. 54
INSTRUCTION SHEET

This amendment contains additional PSAR information updating the PSAR to make it consistent with Revision 2 of the CSDR. Revision 2 of the CSDR incorporates the latest containment load definition information from General Electric and documents a design change to the containment which makes the dome of the containment hemispherical instead of semi-ellipsoidal. All safety analysis depending on containment volume remain conservative.

The following page removals and insertions should be made to incorporate Amendment No. 54 into the PSAR.

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* All Figures whether labelled "Unit 1" or "Units 1 & 2" are to be considered applicable to Unit No. 1.

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* All Figures whether labelled "Unit 1" or "Units 1 & 2" are to be considered applicable to Unit No. 1.

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3.8 DESIGN OF CATEGORY I STRUCTURES

3.8.1 CONCRETE CONTAINMENT

The Mark III Containment Complex does not utilize a concrete Containment. The primary Containment will be a free standing steel vessel. The drywell is enclosed by the steel Containment Vessel which, in turn, is enclosed and protected by the Reactor Shield Building. The Reactor Shield Budiling will be designed as a Category I structure for earthquakes, tornado and external missile loading conditions. Due to the fact that the Reactor Shield Building is not classified as a Class I pressure vessel it will be discussed under Section 3.8.4, "Other Category I Structures." The steel Containment Vessel and the drywell will be covered under Section 3.8.2 and 3.8.3, respectively. 35 (U)

3.8.2 STEEL CONTAINMENT SYSTEM

3.8.2.1 Physical Description

3.8.2.1.1 General

The steel Containment Vessel (Containment), including all its penetrations, is a low leakage steel shell which is designed to withstand the effects of the postulated accidents and to confine the postulated resulting release of radioactive material. The functional requirements of the Containment vessel and the basis of the design pressures are discussed in detail in Section 6.2.1.

Features of the Containment vessel are shown in Figures 3.8-1 and 3.8-2.

The free standing steel Containment Vessel is a cylindrical pressure vessel with a hemispherical dome and a leaktight steel bottom. The bottom seal plate is welded both to an embedded grid in the mat and to the Containment vessel walls providing a leaktight bottom. The vessel internal diameter is 120 feet, and the total height is approximately 204 feet. The cylindrical portion of the vessel is adequately anchored to the building mat, but above this vessel is free standing with no physical links to the Shield Building of internal structures. An annular space is provided between the Containment and the Shield Building. 54 54

The lower portion of the vessel cylinder and a portion of the vessel bottom liner form two of the boundaries of the pressure Suppre ion Pool which is discussed in Section 3.8.3.1.

The containment shell provides vertical support for a number of intermediate platforms, the support brackets for which are designed with sliding bases to prevent any restraint in the radial and lateral directions. Figure 3.8-1 "Section B" shows the design details of the sliding bases. Lubrite type bearings, as manufactured by Merriman Incorporated or an approved alternate, will be an integral part of the sliding base. The maximum coefficient of friction is expected to be 0.15. The selection of slide bearings will also be based upon the Containment service environment (see Section 3.11 for temperature, humidity and radiation requirements) as 1 Q3.17

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well as loading conditions. Horizontal movements, both for thermal and seismic conditions will be provided after the final analysis is completed. 1 Q3.17

A 125 ton polar bridge crane will be supported directly by the Containment shell.

Two personnel access locks with double interlocked sealtight doors and one flanged and bolted sealtight equipment hatch will be provided for access into the Containment.

Containment mechanical, electrical and other penetrations as well as the design criteria for their internals are presented below. The nozzles for these penetrations will be designed and fabricated with the Containment.

3.8.2.1.2 Containment Penetrations

a) Design Bases

Containment penetrations will be designed to maintain containment itegrity during normal operation of the plant in the event of a LOCA. All Containment penetrations will be designed to meet the requirements of Class MC components of the ASME Boiler and Pressure Vessel Code, Section III. Penetrations will be designed in accordance with NRC General Design Criterion 53 of 10CFR50 Appendix A and in addition will be designed to meet the following considerations: 54

1) Ability to withstand the maximum pressure which could occur due to the postulated rupture of any pipe inside the Containment

2) Ability to withstand the jet forces associated with the flow from a postulated rupture of the pipe in the penetration and maintain the integrity of the Containment

3) Ability to accommodate thermal and mechanical stresses encountered in normal operation and other modes of operation and testing.

b) Electrical Penetrations

Containment electrical penetrations will be used to pass signal, control and power cables into and out of the Containment, annulus and Shield Building. 1

The penetration assemblies will be of the split-canister type or flange header plate type and will be designed to accommodate the primary containment nozzles. Upon insertion of the first section of the penetration assembly into the containment nozzle, a field weld will be performed and thus a pressure seal will be established between the steel vessel and the canister or header plate. Primary penetration assemblies will be designed to comply with IEEE-317-1976. 54

3.8.2.1.4 Boundaries

The boundaries for the steel containment consist of those defined in Paragraphs NA-3254 and NE-1130 of the ASME Code Section III, and the additional boundaries listed below: 35 (C)

a) The steel Containment shell and dome including the portion of the shell embedded in the concrete mat foundation but not including the associated anchorage steel

b) The attachment weld of the bottom liner plate to the steel Containment shell 35 (U)

c) The attachment welds of the crane girder, piping supports, walkway or platform supports, and other attachments to the shell or other pressure boundary of the steel Containment. 35 (C)

The bottom liner plate is outside of the boundaries for the steel Containment.

a) Boundaries of jurisdiction of the Containment Vessel Bottom Liner will be in accordance with the ASME Code, Section III, Division 2, Subsection CC, Article CC-1140 and will terminate at the weld which connects the liner plate to the containment vessel shell. 9

3.8.2.2 Applicable Codes, Standards and Specifications

The design, fabrication, erection, inspection and testing of the steel Containment will comply with the requirements of the following wwith exceptions as noted:

3.8.2.2.1 Codes, Standards and Specifications

a) American Society of Mechanical Engineers (ASME) Codes. 9

- Boiler and Pressure Vessel Code, Section II, "Material Specifications"
- Boiler and Pressure Vessel Code, Section III, "Nuclear Power Plant Components", Division 1, addenda through Summer 1974 and updates of NE-3133 through the Winter 1975 addenda. 54
- Boiler and Pressure Vessel Code, ASME Section III, Div 2, "Code for Concrete Reactor Vessels and Containments", issued in January 1975
- Boiler and Pressure Vessel Code, Section V, "Nondestructive Examination." 54
- Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications"

b) American Institute of Steel Construction (AISC):

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"Specification for the Design, Fabrication and Erection of Structural Steel or Buildings -1969, 7th Edition." and Supplements through No. 3 of June, 1974. 54

The Bottom Liner is classified Class CC in accordance with Sub-Article CC-1110, Section III, Division 2, of the ASME Code. 9, 35 (C)

3.8.2.2.3 Code Compliance

a) Containment

The steel cylindrical shell and dome of the steel Containment including all penetrations and attachments within the boundaries defined in Section 3.8.2.1.4, is designed and constructed in strict accordance with Subsection NE, Class MC Components, including the requirements for quality assurance of Article NA-4000, and inspection requirements of Article NA-5000 of Section III of the ASME Code.

The Bottom Liner of the Containment including attachments within the boundaries defined in Section 3.8.2.1.4, is designed and constructed in strict accordance with Subsection CC, Class CC Components, including the requirements for quality assurance of Article CA-4000, and inspection requirements of Article CA-5000 of Section III, Division 2 of the ASME Code. Furthermore, the suppression pool liner will be designed in accordance with the ASME Code, Section III, Division 1, Subsection NE to resist the SRV negative pressure, considering strength, buckling and low cycle fatigue. 9 54

b) Code Stamp

The steel Containment will not be ASME Code stamped. However, all other requirements of the Code applicable to Class MC containment vessels are complied with. The allowable stress limits are in accordance with Sub-Article NE-3131 (e) of Section III of the ASME Code. 35 (C)

The mat liner will not be ASME Code Stamped. However, all requirements of Section 3.8.2.2.3(a) will be complied with. 54

c) Exceptions

The following are exceptions to the requirements of Section III of the ASME Code for Class MC containment Vessels. 54

1) The design of the bottom steel liner (see Section 3.8.2.1.4) and the concrete mat foundation are not included in the scope of Section III, Division 1, of the ASME Code. 9

2) Buckling for SRV loads and post-accident flooding are not in the scope of ASME Section III, Division 1. 54

d) Attachments

Structural steel attachments beyond the boundaries established for the steel containment are designed and constructed according to the AISC Manual for Steel Construction, Seventh Edition, where applicable.

The allowable stress limits for other non-pressure retaining parts are in accordance with Sub-Article NE-3131 (e) of Section III of the ASME Code. 54

e) For the concrete mat foundation and the flat bottom liner plate anchorage, see Section 3.8.2.1.4 and Figures 3.8-2 and 3. 1

3.8.2.3 <u>Loads and Loads Combinations</u>

3.8.2.3.1 Loads and Symbols

The following loads will be considered in the design of the Containment Vessel Shell. Included in this list are all the loads specified in the ASME Code, Section III, Subsection NE-3110, 1974 Edition. All applicable loads below will be considered in the design. 1,9 Q3.18

a) <u>Pressure Loads</u>

P_a = Design Internal Pressure for a postulated design basis accident (DBA) = 15 psig as per Table 6.2-1A). For pressure under intermediate break accident (IBA) and small break accident (SBA), see Containment Structure Design Report (CSDR) Figures 3.3-2 and 3.3-5 respectively. 54

P_t = Structural Acceptance Test Pressure = 115 percent of P_a during DBA

P_e = External pressure on vessel due to the maximum external to internal pressure differential 35(D)

P_0 = Operating Pressure (positive, inside Containment due to negative pressure maintained in the annulus). During post-accident flooding will be adjusted accordingly

P_{bd} = Pressure effects due to SR valve blowdown (1,2,8 or 19 valves operation), additional to P_o. For detailed description and magnitudes of these loads, see Section 3.5 of Rev. 2 of the Containment Structures Design Report 54

P_{ps} = Pool swell loads of Containment Shell, vertical and horizontal, including reactions from structures and projections supported thereof. For detailed description and magnitudes of these loads, see Section 3.2.1 of CSDR. 54

P_{sc} = Steam condensation oscillation loads including the direct and the feedback effects. For detailed description and magnitude of these loads, see Section 3.2.2 of CSDR. 54

P_{ch} = Chugging loads, including the direct and the feedback effects. For detailed description and magniture of these loads, see Section 3.2.3 of CSDR. 54

(D)-Design

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b) Temperatures 35 (D)

T_a = Design (accident) temperature inside Containment. When coincident with P_a this temperature is 185^oF (Table 6.2-1A). It is adjusted accordingly when negative (accident) pressure occurs. For T_a under IBA and SBA, see Sections 6.2.1.3.1.3 and 6.2.1.3.1.4 respectively. 54

T_o = Operating Temperature (The range is 60 to 80 F inside Containment and 51 to 95 F in the annulus). During SRV blowdown the increased temperature in the suppression pool is included in T_o. During construction T_o is specified as the construction temperature.

c) Dead Loads

D = Dead loads; they shall include the following:

1) Weight of vessel shell, penetrations, hatches and locks.

2) The dead weight of the polar crane and its runway.

3) Weight of platforms, walkways, equipment, piping, ventilation duct, cable and trays, conduit, etc. These loads are generated either by direct attachment to the vessel, or through supporting structures. 35 (C)

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(D)-Design
(C)-Consistency

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3.8.2.3.2 Load Combinations

3.8.2.3.2.1 Containment Vessel Shell 9

The design of the Containment will include consideration of the load combinations listed below. Stress limits for these loading conditions are discussed in Section 3.8.2.6. 54

a) Construction and Test Conditions

1) $D + L^{(1)} + T^{(1)} + W^{(1)}$ 35 (C)

2) $D + L^{(2)} + T_o^{(2)} + P_t^{(3)} + F_n$ Vessel Test

3) $D + L^{(2)(4)} + T_o^{(2)} + P_o^{(2)} + F_n$ Crane Test

b) Normal Operating or Shutdown Conditions 35 (D)

4) $D + L + T_o + P_o + R_o + F_n$

5) $D + L + T_o^{(5)} + P_o + P_{bd} + R_o + F_n$ SRV blowdown 35 (D)

c) Severe Environment Loads

6) $D + L + T_o^{(5)} + P_o + P_{bd} + R_o + F_n + F_{eqo}$ SRV blowdown 9 Q1.33

7) $D + L^{(6)} + T_o^{(6)} + P_o^{(6)} + R_o^{(6)} + F_n + F_{eqo}$ Refueling 33

d) Extreme Environmental Loads 35 (D)

8) $D + L + T_o^{(5)} + P_o + P_{bd} + R_o + F_n + F_{eqs}$ SRV blowdown 44 Q130.24

e) Abnormal - Severe Environmental Loads

9) $D + L + T_a^{(7)} + P_a^{(7)} + P_{bd}^{(8)} + P_{ps}, P_{sc}$ or $P_{ch}^{(9)(13)} + F_n + F_{eqo}$ Pool swell Steam Condensation or chugging

10) $D + L + T_a^{(10)} + P_a^{(10)} + R_a + F_n^{(10)} + F_{eqo}$ Long Term LOCA

11) $D + L + T_a^{(11)(14)} + P_a^{(14)} + P_{bd}^{(12)} + P_{sc}$ or $P_{ch}^{(9)(13)} + R_a + F_n + F_{eqo}$ Intermediate break, ADS 54

12) $D + L + T_a^{(15)} + P_a^{(15)} + P_{bd}^{(8)} + P_{ch}^{(9)} + R_a + F_n^{(10)} + F_{eqo}$ Small break

13) $D + L + T_a + P_e + R_a + F_n + F_{eqo}$ Negative Pressure

14) $D + L + T_o + P_o + R_o + F_n + Y_j + F_{eqo}$ Accident at penetration sleeve

15) $D + L + T_o^{(6)} + P_o^{(6)} + R_o^{(6)} + F_{pa} + F_{eqo}$ Post-accident flooding

(C)-Consistency
(D)-Design

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f) Abnormal - Extreme Environmental Loads

16)	$D + L + T_a^{(7)} + P_a^{(7)} + P_{pd}^{(8)} + P_{ps}$, P_{sc} or $P_{ch}^{(9)(13)} + R_a + F_n + F_{eqs}$	Pool swell Steam condensation or chugging
17)	$D + L + T_a^{(10)} + P_a^{(10)} + R_a + F_n^{(10)} + F_{eqs}$	Long term LOCA
18)	$D + L + T_a^{(11)(14)} + P_a^{(14)} + P_{bd}^{(12)} + P_{sc}$ or $P_{ch}^{(9)(13)} + R_a + R_n + F_{eqs}$	Intermediate break, ADS
19)	$D + L + T_a^{(15)} + P_a^{(15)} + P_{bd}^{(18)} + P_{ch}^{(9)} + R_a + F_n^{(10)} \times F_{eqs}$	Small break
20)	$D + L + T_a + P_e + R_a + F_n + F_{eqs}$	Negative pressure
21)	$D + L + T_o + P_o + R_o + F_n + Y_j + F_{eqs}$	Accident at penetration sleeve

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Notes: (1) Temperature and live load (including snow), during construction. The wind load on the shell will be considered only if the shield building does not provide protection during containment erection. Snow and wind shall not be combined in the same loading equation.

(2) Ambient pressure, temperature and live load during test.

(3) Pressure test specified for the structural acceptance of the vessel. 35 (C)

(4) Use load factor 1.25 for the crane lifting load.

(5) T_o is adjusted accordingly during SRV blowdown.

(6) Use live load, the temperature, the pressure and the pipe reactions during shutdown, start-up, refueling or post-accident as the load combination might call for.

(7) These are pressure and temperature distribution during the first 100 seconds of the short term LOCA (Figures 6.2-5 and 6.2-6). 54

(8) Single SR valve blowdown only (First Actuation). 54

(9) It includes all local pressures in the suppression pool region plus reactions from pipes, structures and protuberances.

(10) The pressure, the temperature and the pool water level during the long term postulated design accident (later than 100 seconds after LOCA). The maximum values of P_a and F_n (water dump from upper pool during accident) may not be coincidental and therefore the worst feasible combination will be considered. 54

(11) The pool temperature increase due to the activation of Automatic Depressurization System (ADS) will be considered.

(12) Use pressure resulting from the blowdown of eight ADS valves.

(13) P_{ps}, P_{sc} and P_{ch} may occur sequentially while not simultaneously. 54

(14) These are pressure and temperature distribution during the intermediate break accident (IBA).

(15) These are pressure and temperature distribution during the small break accident (SBA)

Load Combinations (e) 9, 10 and (f) 16, 17 cover the design of the overall vessel for the accident fluid pressure cases, include the accident pressure accident temperature and accident fluid pressure on the vessel shell; the seismic loads on the shell and the penetrations, and the associated 54 35 (C)

(C)-Consistency

values of R_a (thermal load) on the penetrations. The design accident loads discussed above, result from a postulated pipe break inside the drywell. They would not occur simultaneously with the loads "Y_j" which are for a pipe breaking at a penetration. 35 (C)

54

The intent of load combinations (e) 14 and (f) 21 is to cover the design of local areas around penetrations for any pipe break postulated to occur at a penetration. In such a case, design accident loads (pressure, temperature, and fluid) would not be acting simultaneously on the overall vessel. The loads "Y" which would be acting at the penetration already include the thermal effects on the penetration of the postulated pipe rupture (see definition item (g) in Section 3.8.2.3.1). 35 (C)

Local areas will be designed by investigating the applicable loads combined as in the above listed loading cases. Local areas to be investigated include penetration nozzles and the surrounding shell, anchorage details, crane runway and floor framing brackets, and the dome knuckle. Investigations of these are discussed further in Section 3.8.2.4.

3.8.2.3.2.1 Bottom Liner

The containment bottom liner plate will be designed in accordance with the applicable rules listed in the ACI-ASME (ACI-359), Division 2 Code Issued in January 1975. It will also be designed in accordance with selected sections of ASME Code, Section III, Division 1, Subsection NE applicable to strength, buckling and low cycle fatigue for cases where SRV negative pressure occurs. The load combinations shown in Table 3.8-3 are applicable to the liner plate design except that load factors for all load cases shall be taken to equal to 1.0. 54

3.8.2.4 Design and Analysis Proccedures

The design and analysis of the Containment will be the responsibility of the selected containment vendor. The scope of the vendor's responsibility includes the design and analysis of the vessel shell and bottom liner, the vessel anchorage, the crane runway, dome platforms, intermediate floor support seats, personnel locks, equipment hatch, and penetration nozzles. The penetration internals discussed in Section 3.8.2.1.2 are not included.

The vessel vendor will be required to report fully on the actual completed design and analysis, and a summary of this will be available for the FSAR.

Containment Vessel design and analysis procedures will vary somewhat according to the selected vendor. However, the following discussion represents, in general, a typical example of the approaches utilized, and, in several areas, it represents specific requirements. 1 Q3.20

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The particular computer programs utilized for the design and analysis of the containment vessel is dependent on the selection of the containment vessel manufacturer. The following programs have been used in past practice and are indicative of the type to be used:

a) Shells of Revolution Program

This is based on the methods outlined in Reference 3.8-1 for overall containment vessel including the anchorage region of the Containment (Section 3.8.2.4.3). The program calculates stresses and displacements in the shell for static edge, surface and/or temperature loads with arbitrary distribution over the surface of the shell. The program numerically integrates the eight ordinary first order differential equations of thin shell theory derived by H. Reissner. This method may be utilized for the dome-cylinder transition region. 1 Q3.20

b) Stardyne II

A finite element program, especially used for stress concentration areas (penetrations).

c) Thermos

A proprietory program used for thermal analysis.

d) Proprietory Program for analysis of ring girders, the mathematics of which are based on the Hardy-Cross Column Analysis for rings (Reference 3.8-3). This program will be utilized for the crane runway girder (Section 3.8.2.4.6).

e) Several proprietory programs utilizing the mathematics of Welding Research Council Bulletin No. 107 for penetration analysis. (See Reference 3.8-2). 35 (C)

f) Proprietory Programs for seismic analysis of vessel appendages - utilizing a step-by-step matrix analysis.

3.8.2.4.1 Containment Shell and General Procedure

The Containment will be designed in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Subsection NE for Class MC Components. 54 The minimum thicknesses of the shell under internal pressure will be determined using the formulas of Section III, Subsection NE of the ASME Code, July 1974 edition (hereafter referred to as ASME, Section III). No thickness used in this vessel for internal pressure will be less than that required by the rules of Section III, Subsection NE. 9 35 (U)

The basic stress intensity limits of Paragraphs NE-3221.1, NE-3221.2, NE-3221.3 and NE-3222.2 will be satisfied for internal pressure loadings using S_m equal to the allowable stress, S, tabulated for the vessel 35(C) material at the design temperature in Appendix I of ASME Section III. 5

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In regions of substantial mechanical or thermal loads other than pressure, the vessel will be designed and analyzed using the requirements of Paragraph NE-3131(b) of Section III of the Code. 5

For external pressure, the vessel will be analyzed using the procedure outlined in ASME, Section III, Paragraph NE-3133. The cylinder is analyzed by considering the length of the cylinder between the point of embedment and the lower ring of the crane rail support. As outlined in Paragraph NE-3112(c) of ASME Section III, the design external pressure will not be increased by 25 percent as required by Paragraph UG-28(f) of ASME Section VIII, since vacuum service is not the primary function of the Containment. Q1-3.17

For instability effects resulting from SRV blowdown or post-accident flooding condition in combination with SSE and OBE respectively, the latest procedures accepted by the industry, such as those presented in Reference 3.8-4, will be used. 35 (D)

The resulting plate thicknesses required for internal and external pressure will be analyzed for the loads and load combinations listed in Section 3.8.2.3. This analysis will be made using the basic membrane equations for thin shells. The stress limits for each load combination are discussed in Section 3.8.2.6.

The containment shell will be analyzed for the responses due to the specified SSE and OBE ground acceleration in two horizontal directions and in one vertical direction acting simultaneously. 35 (D)

It will be assumed that any direct connections between the Containment and other structures, such as piping, have sufficient flexibility to preclude any coupling with the Containment. As described in Section 3.8.2.1, the intermediate floor supports will be seats with sliding bearing surfaces.

The seismic analysis of the vessel will include the local effects of the access locks vibrating as independent systems. The seismic effect of this independent vibration will be added vectorially to all other seismic effects. Access lock seismic design is discussed further in Section 3.8.2.4.4.

Additional discussion of the seismic analysis of the Containment as well as its interaction with other structures and components of the Reactor Building, is given in Section 3.7.

3.8.2.4.2 Top Head and Knuckle

The analysis used for the hemispherical dome will consider three stress cases: 54

a) Uniaxial compressive stress resultant

b) Biaxial equal compressive stress resultant

c) Biaxial unequal compressive stress resultant

The geometry of this head is such that circumferential compressive stress in the knuckle region of the head during the overload pressure test is not expected to be critical, and this region should be stable in this configuration without any further stiffening being required. 54

3.8.2.4.3 Anchorage Region

The Containment Vessel is assumed to be an independent, free-standing structure rigidly fixed at the base Elevation 116.17 feet.

The anchorage transition region will be analyzed for loads due to internal pressure, the specified thermal gradient, the Containment dead load and earthquake load. This analysis will utilize a Shells of Revolution Computer Program based on well accepted methods. (See Reference 3.8-1). The program will calculate the stresses and displacements in thin-walled elastic shells of revolution when subjected to static edge, surface and/or temperature loads with arbitrary distribution over the surface of the shell.

The temperature stresses will be analyzed at the point of embedment of the shell. This will be based on the vertical thermal gradients along the plate to be supplied to the vendor. It will be assumed that there is no temperature gradient across the thickness of the plate. The rules of ASME, Section III, Paragraph NE-3213 will govern the treatment of temperature stresses as either secondary or local.

The final details of the weld attachment of the floor liner plate to the containment shell will be established during the detailed design and analysis which will be performed by the selected containment vessel manufacturer. The relative position of the concrete and the anchorage ring precludes excessive shell deflection in the area of this weld. 9

The analytical method used for these studies are already described in Section 3.8.2.4.3. This analysis included the area of the floor liner plate adjacent to the vessel shell as a branch on the analytical model. The stresses in the liner plate and the relative deflections were found to be within acceptable limits.

3.8.2.4.4 Access Locks and Surrounding Shell

As part of the vessel seismic analysis, the vibration driving force on the access locks will be determined by accelerations derived from the specified response spectra curves. The three component earthquake will be considered in seismic analysis of the local effects of the access locks. The vibrating driving forces will be considered to be independent of the vibration modes of the Shield Building. 1 Q3.22

The shell stiffness in the region of the lock can be obtained for a radial load, circumferential moment and longitudinal moment. Using this stiffness of the shell, the fundamental period of vibration can be computed. From this the response acceleration of the lock can be found from the specified response spectra. The driving force of the lock will then be found by multiplying the mass of the lock by the response acceleration of the lock.

b) Provide a structure to support the upper pool

c) Channel steam release from a LOCA through the horizontal vents in the drywell for condensation in the Suppression Pool

d) Provide a support structure for work platforms, monorails, pipe supports, anchorages and restraints, etc., that are located in the annulus between the drywell and the steel Containment

e) Provide protection for the steel Containment from internal missiles and/or pipe whip.

The drywell will be a right circular cylinder 87 feet high with an inside
diameter of 73 feet and will contain a net free volume of approximately
280,000 cubic feet. The drywell will be designed as a Category I struc- 21
ture capable of withstanding an internal pressure of 30 psid (see Section 35
3.8.3.3 for additional details on loading conditions). Normal operating 17 (D)
drywell atmospheric temperature will be approximately 135 F with an acci-
dent maximum atmospheric temperature of 330 F. The surfaces of the drywell
in contact with Suppression Pool water will be steel lined.

Two structural materials are being considered for the construction of the 35
drywell. The upper section utilizes reinforced concrete for the construc-
tion of the 5 foot thick wall and 4 foot thick top slab. The top slab will
be stiffened by two 25 ft deep beams which will form the sides of the upper
pool.

The lower drywell scheme will consist of two concentric cylinders fabri-
cated of steel plate with longitudinal and vertical stiffeners provided as
required by the design. These cylinders will be embedded into the mat,
with embedments designed to withstand and transmit all loading effects.
The vent openings will be fabricated of steel plate and will form part of
the cylinders. The annular space between the cylinders will be filled with
concrete in the region above the pool level for shielding purpose. Nominal 54
reinforcement may be provided in the concrete fill, if composite action of
steel and concrete is required. A continuous circular ring plate or girder
will be provided at the top of the steel portion of the drywell, which will
be welded to both concentric cylinders. The cadwelds for the reinforcing
of the concrete portion above will be welded on this ring. The bottom
liner of the Containment will be seal welded to the inner and outer faces
of both cylinders. The outline of the drywell lower portion and the an-
chorage details are shown on Figure 3.8-3. 54

Access to Reactor Pressure Vessel through the drywell top slab will be pro- 35(C)
vided by the drywell head. Access through the drywell walls will be pro-
vided by a 12 1/2 ft diameter equipment hatch and a personnel lock at grade 54
level. The hatch will be provided to facilitate recirculation pump motor
removal. The standard personnel lock will permit entry into the drywell
when the reactor is at hot standby. The equipment hatch will also be used
for removal of

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2) American Institute of Steel Construction (AISC) "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings - February, 1969 Edition". 35(U)

3) AWS Structural Welding Code D1.1-75.

3.8.3.2.2 NRC Regulatory Guides

a) Regulatory Guide 1.10 - Mechanical (Cadweld) Splices in Reinforcing Bars of Category I Concrete Structures

b) Regulatory Guide 1.15 - Testing of Reinforcing Bars for Concrete Structures

c) Regulatory Guide 1.19 - Nondestructive Examination of Primary Containment Liner Welds

d) Regulatory Guide 1.31 - Control of Stainless Steel Welding 54

e) Regulatory Guide 1.55 - Concrete Placement in Category I Structures

f) Regulatory Guide 1.57 - Design Limits and Loading Combinations for Metal Primary Reactor Containment System Components.

3.8.3.2.3 Specifications

a) Material Specifications

Various ASTM Specifications, supplemented by the further requirements of ASME Section III, as noted in Section 3.8.3.6. 32

b) Surface Preparation

Steel Structure Painting Council (SSPC):

SSPC-SP-3	Power Tool Cleaning
SSPC-SP-6	Commercial Blasting Cleaning
SSPC-SP-8	Pickling
SSPC-SP-10	Near White Blasting Cleaning
SSPC-PA-1	Shop, Field and Maintenance Painting

c) Purchase Specifications

The purchase specifications will be prepared by the Architect-Engineer and will specify the requirements for materials, design criteria, fabrication, erection, inspection, and quality compliance. These specifications will reflect and expand on the requirements set forth in the Sections of 3.8.3 which follow.

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P_o = normal operating pressure (2.0 psig inside the drywell and 0.0 psig outside the drywell).

P_t = pressure used for acceptance test to verify structural integrity and/or compliance with maximum allowable leak rate specified for the component. For drywell pressure test, 34.5 psig shall be used.

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P_a = maximum differential positive (outward) accident pressure (30 psid) or maximum differential negative (inward) accident pressure (21 psid) for the drywell. Maximum negative accident pressure is not considered coincident with Pool Swell loads. For P_a under IBA and SBA, see Figures 3.3-1 and 3.3-4 of Rev. 2 of the Containment Structures Design Report respectively. 54

T_o = normal operating temperature (135°F inside the drywell and 80°F outside the drywell). During blowdown mode under normal operation, the temperature increase is also included in T_o. During construction, T_o is specified as construction temperature, and during post-accident flooding T_o is adjusted accordingly. 35(D)

T_a = accident temperatures associated with the accident pressure P_a and including T_o. (330°F is used for maximum air temperature in the drywell under DBA transient conditions as indicated in Figures 6.2-6 and 6.2-10 of Chapter 6 of this PSAR). For T_a under IBA and SBA, see Sections 6.2.1.3.1.3 and 6.2.1.3.1.4 respectively. 54

F_{eqo} = seismic loads generated by the Operating Basis Earthquake (OBE) specified for the site (Section 3.7 of this PSAR). During post accident flooding, the mass of water will be properly accounted for. The simultaneous occurrence of three dimensional earthquake motion is considered.

F_{eqs} = seismic loads generated by the Safe Shutdown Earthquake (SSE) specified for the site (Section 3.7 of this PSAR). The simultaneous occurrence of three dimensional earthquake motion is considered.

44 Q130. 24

R_o = piping loads during normal operating or shutdown conditions, and their related internal moments and forces as given by the reactions of piping systems subjected to normal operating thermal/hydraulic conditions (Chapter 4 and 5 of this PSAR). When steam relief valves are actuated R_o shall also include the blowdown reactions.

R_a = piping loads due to increased temperature resulting from the postulated design accidents, or their related internal moments and forces as given by related reactions of piping 44 Q130. 24

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systems subjected to the postulated accidental thermal/hydraulic conditions (Chapter 6 of this PSAR), and including R_o. 44 Q130.24

Y_r = equivalent static load on the structure generated by the reaction on the broken high-energy pipe during the postulated break, and including an appropriate dynamic factor to account for the dynamic nature of the load (Section 3.6). 3 Q3.23e

Y_j = jet impingement equivalent static load on a structure generated by the postulated break, and including an appropriate dynamic to account for the dynamic nature of the load (Section 3.6).

Y_m = missile impact equivalent static load on a structure generated by or during the postulated break, like pipe whipping, and including an appropriate dynamic factor to account for the dynamic nature of the load (Section 3.6).

P_{pd} = pressure loads due to Main Steam Safety Relief Valve (SRV) blowdown. During LOCA accident condition only one valve is assumed to open based on a single failure criteria. For detailed description and magnitude of these loads, see Section 3.5 of the Containment Structures Design Report (CSDR), Revision 2. 54

P_{ps} = pool swell loads, including pipe and other structure reactions resulting from these pressures. For detailed description and magnitude of these loads, see Section 3.2.1 of CSDR. 54

P_{sc} = steam condensation oscillation loads, including the direct and the feedback effects. For detailed description and magnitude of these loads, see Section 3.2.2 of CSDR. 54

P_{ch} = chugging loads, including the direct and the feedback effects. For detailed description and magnitude of these loads, see Section 3.2.3 of CSDR.

F_{pa} = hydrostatic pressure due to post-accident flooding of the containment to a level of 68'-6" above the bottom liner. 35(D)

b) Steel Internal Structures

The following loads will be considered in the design of the steel internal structures: 44 Q130.24

D = Dead loads shall include the following:

1) Weight of structure itself;

2) Weight of penetrations (including shielding), hatches and locks;

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3) Weight of platforms, walkways equipment, piping, ventilation duct, cable and trays, conduit, etc.

L = Live loads will include all or part of the following temporarily imposed loads: 44 Q130.24

1) Equipment laydown and live load on refueling on intermediate floors, including any construction loads (Refer to Section 3.8.3.3.2b).

2) Live load in equipment hatch.

3) Live load in access locks.

4) Monorail hoist loads.

P_o = normal operating pressure (2.0 psig inside the drywell and 0.0 psig outside the drywell). 17 Q2-3.37

T_o = normal operating temperature (135°F inside the drywell and 80°F outside the drywell). During blowdown the increased temperature in the pool is included in T_o. During construction T_o is specified as construction temperature and during post-accident flooding T_o is adjusted accordingly. Q2-3.38 35(D)

R_o = pipe reactions during normal operating or shutdown condition based on the most critical transient or steady state condition. When SR valves are actuated R_o include the blown reactions. 44 Q130.24

F_n = hydrostatic pressure due to normal water level in the suppression pool. The upper pool dump during accident will be appropriately accounted for.

P_t = pressure used for structural acceptance test (34.5 psig) 44 Q130.24

P_{bd} = pressure loads due to Main Steam Safety Relief Valve (SRV) blowdown. During DBA and SBA accident conditions, only one valve is assumed to open based on a single failure criteria. During IBA accident condition, P_{bd} represents the load induced by 8 ADS valves actuation. For detailed description and magnitude of these loads, see Section 3.5 of the Containment Structures Design Report (CSDR). 54

P_{ps} = pool swell loads, including pipe and other structures reactions resulting from these pressures. For detailed description and magnitude of these loads, see Section 3.2.1 of Rev. 2 of the Containment Structure Design Report.

P_{sc} = steam condensation oscillation loads, including the direct and the feedback effects. For detailed description and magnitude of these loads, see Section 3.2.2 of CSDR.

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P_{ch} = Chugging loads, including the direct and the feedback effects. For detailed description and magnitude of these loads, see Section 3.2.3 of CSDR. 54

P_a = maximum differential positive (outward) accident pressure (30 psid) or maximum differential negative (inward) accident pressure (21 psid) for drywell, maximum negative accident pressure is not considered coincident with Pool Swell loads. For P_a under IBA and SBA, see Figures 3.3-1 and 3.3-4 of CSDR respectively. 17 Q2-3.37 Q2-3.38 54

T_a = accident temperatures associated with the above accident pressures and including T_o. For T_a under DBA, see Figures 6.2-6 and 6.2-10. For T_a under IBA and SBA, see Sections 6.2.1.3.1.3 and 6.2.1.3.1.4 respectively. 54

R_a = pipe reactions under thermal condition generated by the postulated accident and including R_o. R_a should appropriately consider differences between positive and negative accident pressure cases. 44 Q130.24

F_{pa} = hydrostatic pressure due to post-accident flooding of the containment to a level of 68' - 6" above the bottom liner.

F_{eqo} = seismic loads generated by the operating basis earthquake. During post accident flooding, the mass of water will be properly accounted for.

F_{eqs} = seismic loads generated by the safe shutdown earthquake.

Y_r = equivalent static load on the structure generated by the reaction on the broken high-energy pipe during the postulated break, and including an appropriate dynamic factor to account for the dynamic nature of the load (Section 3.6).

Y_j = jet impingement equivalent static load on a structure generated by the postulated break, and including an appropriate dynamic to account for the dynamic nature of the load (Section 3.6). 17

Y_m = missile impact equivalent static load on a structure generated by or during the postulated break, like pipe whipping, and including an appropriate dynamic factor to account for the dynamic nature of the load (Section 3.6).

S = required section strength based on the elastic design methos and the allowable stresses defined in Part 1 of the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", February 12, 1969.

b) Steel Internal Structures

The design of the steel structures inside the Containment will include consideration of the load combinations listed below. Stress limits for these loading conditions are discussed in Section 3.8.3.5.

1) Checker plate or grating platforms, structure steel framing, RPV and Shield Wall Pedestal, Reactor Shield Wall, and Weir Wall 17 Q2-3.37

(a) Service Load Conditions

(1) $S = D + L + T_o$

(2) $S = D + L + F_{eqo} + F_n$

(3) $1.5S = D + L + T_o + R_o + P_o + F_n$

(4) $1.5S = D + L + T_o + R_o + P_o + F_n + P_{bd}$ 44 Q130.24

(5) $1.5S = D + L + T_o + R_o + P_o + F_n + F_{eqo}$

(6) $1.5S = D + L + T_o + R_o + P_o + F_n + F_{eqo} + P_{bd}$

(b) Factored Load Conditions

(1) $1.6S = D + L + T_o + R_o + P_o + F_n + F_{eqs}$

(2) $1.6S = D + L + T_o + R_o + P_o + F_n + F_{eqs} + P_{bd}$

(3) $1.6S = D + L + T_a + R_a + P_a + F_n$

(4) $1.6S = D + L + T_a + R_a + P_a + F_n + P_{ps}$ or P_{sc} or $P_{ch} + P_{bd} + Y_r + Y_j + Y_m$ 54

(5) $1.6S = D + L + T_a + R_a + P_a + F_n + F_{eqo}$

(6) $1.6S = D + L + T_a + R_a + P_a + F_n + P_{ps}$ or P_{sc} or $P_{ch} + F_{eqo} + Y_r + Y_j + Y_m$ 54

(7) $1.7S = D + L + T_a + R_a + P_a + F_n + F_{eqs}$

(8) $1.7S = D + L + T_a + R_a + P_a + F_n + P_{ps}$ or P_{sc} or $P_{ch} + P_{bd} + F_{eqs} + Y_r + Y_j + Y_m$ 54

(9) $1.6S = D + L + R_o + T_o + F_{eqo} + F_{pa}$ 44 Q130.24

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(c) Plastic Design Methods

For structural members subjected to pool swell loads, such as lower platforms (Ground and HCU) and quencher supports, plastic design method may be used. The applicable load combination for such cases are: 44 Q130.24

(10) $0.9Y = D + L + T_a + R_a + 1.25\,P_a + 1.25\,P_{ps}$ or P_{sc} or $P_{ch} + F_n + 1.25\,P_{bd} + F_{eqs} + Y_j + Y_r + Y_m$ 54

(11) $0.9Z = D + L + T_a + R_a + P_a + P_{ps}$, P_{sc} or $P_{ch} + P_{bd} + F_n + F_{eqs} + Y_j + Y_r + Y_m$ 54

2) Lower Drywell and Drywell Closure Head 17 Q2-3.37

(a) Service Loads

(1) Construction Condition 35(D)

a. $D + L + T_o$

(2) Test Condition

a. $D + L + T_o + P_t$ 44 Q130.24

(3) Normal Operating Condition

a. $D + L + T_o + P_o + R_o + F_n$

b. $D + L + T_o + P_o + R_o + F_n + P_{bd}$

(4) Severe Environmental Condition

a. $D + L + T_o + P_o + R_o + F_n + F_{eqo}$

b. $D + L + T_o + P_o + R_o + F_n + P_{bd} + F_{eqo}$

(b) Factored Loads

(1) Extreme Environmental Loads

a. $D + L + P_o + T_o + R_o + F_{eqs} + F_n$

b. $D + L + P_o + T_o + R_o + F_{eqs} + F_n + P_{bd}$

(2) Abnormal Loads

a. $D + L + P_a + T_a + R_a + F_n$ Long term LOCA 54

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b.	$D + L + P_a + T_a + R_a + P_{bd} + P_{ps}$, or P_{sc} or $P_{ch} + F_n + Y_r + Y_j$	Pool swell steam condensation or chugging 54
c.	$D + L + P_a + T_a + R_a + P_{bd} + P_{sc}$ or $P_{ch} + F_n$	Intermediate break, ADS
d.	$D + L + P_a + T_a + R_a + P_{bd} + P_{ch} + F_n$	Small break

(3) Abnormal/Severe Environmental

a.	$D + L + P_a + T_a + F_{eqo} + R_a + F_n$	Longterm LOCA
b.	$D + L + P_a + T_a + F_{eqo} + R_a + P_{bd} + F_n + P_{ps}, P_{sc}$ or $P_{ch} + Y_r + Y_j + Y_m$	Pool swell steam condensation or chugging
c.	$D + L + P_a + T_a + R_a + P_{bd} + P_{sc}$ or $P_{ch} + F_n + F_{eqo}$	Intermediate break ADS
d.	$D + L + P_a + T_a + R_a + P_{bd} + P_{ch} + F_n + F_{eqo}$	Small break

(4) Abnormal/Extreme Environmental

a.	$D + L + P_a + T_a + F_{eqs} + R_a + F_n$	Longterm LOCA
b.	$D + L + P_a + T_a + F_{eqs} + R_a + P_{bd} + F_n + P_{ps}, P_{sc}$ or $P_{ch} + Y_r + Y_J + Y_m$	Pool swell steam condensation or chugging
c.	$D + L + P_a + T_a + R_a + P_{bd} + P_{sc}$ or $P_{ch} + F_n + F_{eqs}$	Intermediate break, ADS
d.	$D + L + P_a + T_a + R_a + P_{bd} + P_{ch} + F_n + F_{eqs}$	Small break

(5) Post Accident Flooding with Earthquake

a. $D + L + R_o + T_o + F_{eqo} + F_{pa}$

Note - For the Drywell CLosure Head the hydrostatic pressure of the pool water above the head is substituted for the term F_n.

In the above combinations, thermal loads can be neglected when it can be shown that they are self-limiting and secondary in nature where the material is ductile.

For combinations 5, 6, 7, and 8 of (1) (b), in computing the required section strength, S, the plastic section modulus of steel shapes may be used. For load combinations of (1) (b) above involving F_{eqo} and/or F_{eqs} both cases of L having its full value or 44 Q 130.24

being completely absent will be checked for platforms and floor systems supported by steel floor framing. Separate live loads values will be assigned for concrete or grating and checker plate floors supported by steel framing. The operating condition floor live load will be based on minimum OSHA requirements since personnel will have limited access to these areas during operation. All spare parts, etc. will not be stored on these platforms. The shutdown condition live load will be based on equipment removal and/or repair considerations such as Recirculating Pump Motor removal. 35 (U)

The following live loads will be used for concrete or grating and checker plate floors supported by steel framing: 17

	Operating Condition	Shutdown Condition
EL 232.33'		
Steel beams	200 PSF	500 PSF
Grating & checker plate	100 PSF	100 PSF
EL 207.33'		
Steel beams	100 PSF	200 PSF
Grating & checker plate	100 PSF	100 PSF
EL 196.33'		
Steel beams	100 PSF	100 PSF
Grating & checker plate	100 PSF	100 PSF
EL 184.83'		
Steel beams	100 PSF	200 PSF*
Grating & checker plate	100 PSF	100 PSF

* Except 500 PSF for Standby Liquid Control Area

	Operating Condition	Shutdown Condition
EL 158.75'		
Steel beams	100 PSF	350 PSF
Grating & checker plate	100 PSF	100 PSF
Concrete Slab	100 PSF	350 PSF

2) Tension

Concrete tensile strength (membrane and/or flexure) shall not be relied upon to resist the external loads and moments or the forces and moments resulting from internal self-constraint.

3) Shear, Torsion, and Bearing

Refer to Article CC-3431.3 of the ACI-ASME Code. | 35(U)

4) Reinforcing Steel Stresses and Strains

Bar Tension

(a) Average tensile stress $0.5\ f_y$.

The values given in Item (a) above may be increased by 33 1/3 percent when temperature effects are combined with other loads. The 33 1/3 percent increase for stress allowable shall also apply to test conditions which include the temporary pressure load. | 3 Q3.23e | 54

5) Axial Compression

(a) For load resisting purposes the stress shall not exceed $0.5\ f_y$. | 3 Q3.23e

(b) The stress may exceed that given in Item (a) for compatibility with the concrete but this stress may not be used for load resistance.

c) Concrete Temperature

1) The following temperature limitations are for normal operation or any other long-term period. The temperatures shall not exceed 150 F, except for local areas which are allowed to have increased temperatures not exceeding 200 F. | 54

2) The following temperature limitations are for accident or any other short-term period. The temperatures shall not exceed 350 F for the interior surface. However, local areas are allowed to reach 650 F from steam and/or water jets in the event of pipe failure.

d) Design for flexure, axial and shear loads

1) Assumptions for factored loads

(a) The strength design of members for flexure and axial loads shall be based on the assumptions given in this section, and on satisfaction of the applicable conditions of equilibrium of forces and compatibility of strains.

(b) Strain in the reinforcing steel and concrete shall be assumed directly proportional to the distance from the neutral axis. 3 Q3.23e

3.8.3.7.1.1 High Pressure Structural Proof Test

This test will be started after the temperature inside and outside the drywell has been maintained at 60 F or higher for the previous 24 hours. During this test, the temperature inside and outside the drywell shall be maintained above 60 F.

A temporary bank of air compressors will be used to pressurize the drywell. The initial step in the test will be to raise the drywell pressure to 10 $\pm$ 1 psig and hold for at least one hour. During this period, the drywell and containment pressure and temperature will be monitored along with the air flow rate from the compressors into the drywell. The leak rate will be determined in a gross manner using the air inflow information. A walk thru gross visual and noise inspection will be made on the exposed exterior surfaces of the drywell. Particular attention will be paid to discontinuities such as the air lock, equipment hatch, and steam and feedwater line penetrations.

During the second step, the drywell pressure will be raised to 20 $\pm$ 1 psig, and the one-hour hold, measurements, and inspections will be performed as described for the 10-psig hold period.

The final step will be to raise the drywell pressure to 115 percent of its design value or 34.5 psig. The pressure shall be maintained with $\pm$ 1 psig of this value for at least one hour while the drywell pressure and temperature and air inflow is monitored and the visual inspection completed. 54

The structural acceptance criteria is no visual evidence of gross structural failure as determined by the ability of the structure to meet the subsequent drywell leak rate tests.

In the event that the drywell is a prototype drywell,* it will be provided with instrumentation to measure strains and radial deflections as follows:

1. Strain Measurements

Strain gauges will be placed at or near the inner and outer sufaces of the drywell wall at two azimuths as follows: 32

No. of Elevations	Locations
1	Vent region in the steel portion of the cylindrical drywell wall

* Prototype drywell. A prototype drywell is defined as one that incorporates a new or unusual design feature (which, as determined by analysis, causes the drywell to respond structurally in a significantly different manner than previous designs), in part or in full, that has not yet been confirmed by a test on a prototype drywell with appropriate instrumentation.

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No. of Elevations	Location
1	Mid-height of the drywell wall above the steel section where the drywell wall is of reinforced concrete construction.

Strain gauges will not be provided at the mid-plane or neutral axis of the wall because they provide limited information for the low strain levels that are predicted.

2. Deflection Measurements

Instrumentation will be provided to obtain measurements of radial deflections of the drywell wall at three azimuths as follows:

No. of Elevations	Location	
1	Vent region in the steel portion of the cylindrical drywell wall	32
1	Midheight of drywell wall	
1	Top of drywell wall	

The measurement locations selected for the test shall include points of varying stiffness characteristics such that an overall representative deflection pattern can be obtained.

In the event that the drywell is a prototype drywell, a detailed description of the instrumentation, measurement locations, measurement tolerances, and predicted responses will be provided twelve months before the test is scheduled to be performed. 35(C)

If, however, the drywell is not a prototype drywell and if the strains and deflections measured on the drywell which is an acceptable prototype correlate satisfactorily with analytical predictions, then neither strain nor radial deflection-measuring instrumentation will be provided on drywell and the testing described above which is applicable solely to prototype drywells will not be performed on the ACNGS unit. 35(C) 35(C)

3.8.3.7.1.2 High Pressure Leak Rate Test 30

Immediately following the high pressure structural proof test, the drywell pressurization sources will be shutdown and reduce the drywell pressure to its design value of 30 psig. The change in drywell pressure and temperature will be monitored for the next 30 minutes. 54

The drywell pressure and temperature decay information wyll be used to establish that the drywell leak rate is less than the allowable value. The drywell air flow rate from the one-hour structural test holding period will be used as a gross check on the drywell leak rate. Figure 3.8-18 shoes the expected pressure decay rate for the drywell from the 30 psig starting point.

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a) Reactor Shield Building (RSB)

b) Reactor Auxiliary Building (RAB)

c) Fuel Handling Building (FHB)

d) Diesel Generator Building (DGB)

e) Control Center Building (CCB)

f) Ultimate Heat Sink Intake Structure Complex (UHS)

g) Diesel Fuel Oil Storage Tank Building 39(U) 35(C)

Figure 1.2-2, Plot Plan shows the arrangement of these Sections.

For design of foundation mats refer to Section 3.8.5.

3.8.4.1 Description of the Structures

3.8.4.1.1 Reactor Shield Building (RSB)

The Reactor Shield Building (see GA drawings, Section 1.2) will be a reinforced concrete dome-cylinder structure with cast-in-place monolithic walls which represents the shield of the Mark III Reactor Building protecting the steel containment. It will be a semi-leaktight structure consisting of a 130.0 foot (ID) cylindrical shell with 3.0 foot walls and a 2.5 foot thick shallow domed roof. The structure will have an overall height of approximately 210.0 feet and will be separated from the steel Containment by a 5.0 foot gap at the cylindrical section and a 4.0 foot gap at the center of the dome. 35(C) 54 54

The Shield Building will be designed for normal structural loading including ventilation pressure differentials, wind, tornadoes, tornado generated missiles and earthquake. The ventilation system will be designed to maintain the pressure inside the annulus within design limits. 35(C)

Access to the inside of the Containment through the Shield Building will be provided by two personnel locks approximately 9 feet 0 inches diameter. The equipment access opening will also be provided of sufficient size to allow for the removal of various equipment.

The Reactor Building will be supported on an independent reinforced concrete mat. Waterproofing will be provided for the exterior portion of the Shield Building below grade.

3.8.4.1.2 Reactor Auxiliary Building (RAB) 7 35 (C)

The Reactor Auxiliary Building will be approximately 207 feet long by 123 feet wide adjacent to and partially "wrapping around" the Shield Building. It will house residual heat removal equipment, high and low-pressure core sprays equipment, associated electrical, heating and ventilating equipment, and the elevator for access to the upper elevations 35 (C) 35 (C)

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of the Containment Building. 35(C)

The Auxiliary Building will have a tunnel to house the main steam and feedwater lines which run from the Reactor Building to the Turbine Building. The tunnel will be approximately 21 feet high by 36 feet wide after leaving 35(C)

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A uniform normal live load of 30 psf will be considered for the shield building dome and 65 psf will be used for the roofs of the other Category I structures. A minimum uniform live load of 100 psf will be considered for floors, stairs, and platforms not subject to vehicle traffic nor used for equipment laydown. Loads for areas subject to such use will be established as appropriate for the particular area. 5

Live loads shall not be used in establishing inertia forces for seismic calculations.

c) Soil Pressure (H) 3

The static soil pressure to be used in the design will be established as described in Section 2.5.4.10.3. Q3.24

d) Water Loads (B) 3 Q3.24

The structures will be designed for the surface water or groundwater elevation under normal environmental conditions. Wave action will be considered in the design of the Ultimate Heat Sink Intake Structure. Refer to Section 3.4.3. 35(C)

e) Crane Lifting Loads (C) 3

These loads consist of wheel reactions on the structures due to a rated lifting load, positioned in such a way as to give maximum loading on structural members considered. Included will also be the vertical, lateral and longitudinal impact loads due to crane operation.

f) Thermal Load (T_o) 54

Thermal effects and loads during normal operating or shutdown conditions will be based on the most critical transient or steady state condition. 3 Q3.24

The following temperatures will be used:

1) Shield Building Annulus Space 35(C)

Maximum temperature of 95 F, normal operating condition (Summer) 35(U)
Minimum temperature of 51 F, normal operating condition (Winter)

2) Ambient Temperatures for Category I Structures, including Shield Building 35(C)

Maximum 7 day mean 90 F (Summer) 35(U)
Minimum 7 day mean 32 F (Winter)

3) As-built concrete temperature is 70°F

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g) Reaction Forces (R_o) 3 Q3.24

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The pipe reactions during normal operating or shutdown conditions will be based on the most critical transient or steady state condition. 3 Q3.24

h) Safety Relief Valve Blowdown Feedback Effect (P_{bd})

These are the loads generated via the feedback effect of Safety Relief Valve (SRV) actuation during normal plant operating conditions or loss-of-coolant accident conditions. While actuation of 1, 2 or 19 SRVs will be postulated under normal conditions, only the 8-ADS valves will be assumed to activate during Intermediate Break Accidents (IBA) and one valve is assumed to inadverdently open during Design Basis Accidents (DBA) and Small Break Accidents (SBA). For a detailed description of these loads, see Section 3.5 of Containment Structures Design Report (CSDR). 54

3.8.4.3.1.2 Severe Environmental Loads

Severe environmental loads are those loads that could infrequently be encountered during the plant life. Included in this category are: 3 Q3.24

a) Wind Loads (W)

These are the loads generated by the design wind specified in Section 3.3.1.

b) Seismic Load (F_{eqo})

These are the loads generated by the Operating Basis Earthquake. The seismic loads will be computed through dynamic analyses, as described in Section 3.7. 5 Q1-3.3

c) Ice Load (Ultimate Heat Sink Intake Structure)

The possibility of ice flooding at the intake structure is negligible, as discussed in Section 2.4.7.

d) Soil Pressure (H'_o)

Category I structures are surrounded by Class -I engineered backfill. The soil-structure interaction model for dynamic analysis discussed in PSAR Section 3.7.1.6 includes this backfill around the structures. The results of the soil-structure interaction dynamic analysis will provide the dynamic soil pressures acting on structures walls. The soil pressure Ho is the lateral earth pressure under Operating Base Earthquake conditions in excess of the static soil pressure H. 35(D)

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b) Thermal Load (T_a)

These are the thermal loads under thermal conditions generated by the postulated break and including T_o.

c) Reaction Forces (R_a)

These are the pipe reactions udner thermal conditions generated by the postulated oreak and including R_o.

d) Pipe Loads (Y_r)

These are the equivalent static loads on the structure generated by the reaction on the broken high-energy pipe during the postulated break, and including an appropriate dynamic factor to account for the dynamic nature of the load.

e) Jet Impingement (Y_j)

These are the jet impingement equivalent static loads on a structure generated by the postulated break and including an appropriate dynamic factor to account for the dynamic nature of the load.

f) Missile Load (Y_m)

This load is the missile impact equivalent static load on a structure, such as those generated by an equipment failure or pipe whipping during a postulated break, and an appropriate dynamic factor to account for the dynamic nature of the load. 35(C)

g) Pool Swell Feedback Effect (P_{ps})

This is the feedback effect resulting from the LOCA air clearing and pool swell loads.

h) Steam Condensation Feedback Effect (P_{sc})

This is the feedback effect resulting from the LOCA steam condensation oscillation loading. 54

i) Chugging Feedback Effect (P_{ch}).

This is the feedback effect resulting from the LOCA chugging load.

In determining an appropriate equivalent static load for Yr, Yj, and Ym, elasto-plastic behavior may be assumed with appropriate ductility ratios, provided deflections are not excessive and will not result in loss of function of any safety related system. 35(C)

3.8.4.3.1.5 Other Notations 35(C)

3.8.4.3.1.5.1 Concrete Structures 35(D)

U = Required ultimate strength to resist design loads or their related internal moments and forces as defined by the ACI-349-76 Code, Section 9.2. 35(U)

3.8.4.3.1.5.2 Steel Structures

S = Required section strength based on the elastic design methods and the allowable stresses defined in Part 1 of the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," February 12, 1969. 5

3.8.4.3.2 Loading Combinations

3.8.4.3.2.1 Concrete Structures

3.8.4.3.2.1.1 Service Load Conditions

For Service Load Conditions, which include loads encountered during normal plant operation and shutdown and severe environmental loads, the following load combinations will be considered: 35(C)

$$U = 1.4D + 17L + 1/4B + 1.7H + 1.7C^{*} + 1.7P_{bd}^{**}$$
$$U = 1.4D + 17L + 1.4B + 1.7H + 1.9 F_{eqo} + H_o + 1.7 P_{bd}^{**}$$
$$U = 1.4D + 1.7L + 1.4B + 1.7H + 1.7W + 1.7 P_{bd}^{**}$$

35 (D) 54

If thermal stresses due to T_o and R_o are present, the following combinations should be considered: 35(C)

$$U = 0.75 (1.4D + 1.7L + 1.4B + 1.7H + 1.7 T_o + 1.7 R_o + 1.7C^{*} 1.7P_{bd}^{**})$$
$$U = 0.75 (1.4D + 1.7L + 1.4B + 1.7H + 1.7 T_o + 1.7 R_o + 1.9 F_{eqo} + 1.9 H'_o)$$
$$U = 0.75 (1.4D) + 1.7L + 1.4B + 1.7H + 1.7 T_o + 1.7 R_o + 1.7W + 1.7 P_{bd}^{**}$$

35 (D) 54

For all load combinations above, both cases of L, H, H'_o, P_{bd}, and C having their full value or being completely absent shall be considered. The following load combinations shall also be considered. 35(C)

$$U = 1.2D + 1.2B + 1.9 F_{eqo}$$
$$U = 1.2D + 1.2B + 1.7W$$

35(D)

3.8.4.3.2.1.2 Factored Load Conditions

For factored load conditions, which represent extreme environmental, abnormal, abnormal/severe environmental and abnormal/extreme environmental conditions, the strength design method will be used and the following load combinations will be considered: 35(C)

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1) $U = D + L + H + H'_s + T_o + R_o + F_{eqs} + B + C^* + P_{bd}^{**}$
2) $U = D + L + H + T_o + R_o + W_t + B + P_{bd}^{**}$
3) $U = D + L + H + T_a + R_a + 1.5\,P_a + B + 1.5\,(P_{ps}^{**}, P_{sc}^{**} \text{ or } P_{ch}^{**}) + 1.25\,P_{bd}^{**}$
4) $U = D + L + H + 1.25\,H'_o + T_a + R_a + 1.25\,P_a + Y_r + Y_j + Y_m + 1.25\,F_{eqo} + B + 1.25\,(P_{ps}^{**}, P_{sc}^{**}, \text{or } P_{ch}^{**}) + P_{bd}$ 54
5) $U = D + L + H'_s + T_a + R_a + P_a + Y_r + Y_j + Y_m + H + F_{eqs} + B + P_{ps}^{**}, P_{sc}^{**} \text{ or } P_{ch}^{**} + P_{bd}^{**}$
6) $U = D + L + H + T_o + R_o + B' + P_{bd}^{**}$

* Crane Load "C" applies only to Fuel Handling Building. 35(C)

** Loads due to feedback effects apply to Shield Building and those adjacent structures which are significantly affected as indicated in the soil-structure interaction model analysis. 54

In load combinations (3), (4) and (5) above, the maximum values of P_a, T_a, R_a, Y_j, Y_r and Y_m will be used unless a time history analysis is performed to justify otherwise. 35 (C) Furthermore, only feedback effect due to single SRV actuation has to be considered in these three load combinations. 54 Load Combinations (2), (4) and (5) shall be satisfied first without the tornado missile load in (2) and without Y_r, Y_j and Y_m in (4) and (5). When considering these concentrated loads, local section strength capacities may be exceeded provided there will be no loss of function of any safety-related system. 3 Q3.24

Both cases of L, H, H'_o, H'_s, P_{bd}, and C having their full values or being completely absent will be considered. 54

3.8.4.3.2.2 Steel Structures 44 Q130.15

a) Service Load Conditions

1) $S = D + L + C^* + P_{bd}^{**}$

2) $S = D + L + F_{eqo} + P_{bd}^{**}$

3) $S = D + L + W + P_{bd}^{**}$ 54

If thermal stresses due to T_o and R_o are present and are secondary and self-limiting in nature, the following combinations should also be satisfied:

1a) $1.5\,S = D + L + T_o + R_o + C^* + P_{bd}^{**}$

2a) $1.5\,S = D + L + T_o + R_o + F_{eqo} + P_{bd}^{**}$ 54

3a) $1.5\,S = D + L + T_o + R_o + W + P_{bd}^{**}$

Both cases of L and P_{bd} having its full value or being completely absent.

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3 Q3.24

b) Factored Load Conditions

1) $1.6\ S = D + L + T_o + R_o + F_{eqs} + C^* + P_{bd}^{**}$ 54

2) $1.6S = D + L + T_o + R_o + W_t + P_{bd}^{**}$

3) $1.6\ S = D + L + T_a + R_a + P_a + P_{ps}^{**}, P_{sc}^{**}$ or $P_{ch}^{**} + P_{bd}^{**}$

4) $1.6\ S = D + L + T_a + 1.0\ P_a + 1.0 + (Y_j + Y_r + Y_m) + 1.0\ Feqo + P_{ps}^{**}, P_{sc}^{**}$ or $P_{ch}^{**} + P_{bd}^{**} + R_a$ 35 (D)

5) $1.7\ S = D + L + T_a + R_a + P_a + 1.0\ (Y_r + Y_m + Y_j) + F_{eqs} + P_{ps}^{**}, P_{sc}^{**}$ or $P_{ch}^{**} + P_{bd}^{**}$

* The term C applies to the Fuel Handling Building only. 5

** Loads due to feedback effects apply to Shield Building only. 54

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Y_m = Loads generated by the missile impact during the postulated break. 5 Q1-9.29

F_{pa} = Hydrostatic pressure due to post-accident flooding of the steel containment or its related moments and forces.

B = Buoyancy force due to Probable Maximum Flood 44 Q130.24

P_{bd} = Pressure loads due 1, 2, 8 or 19 Main Steam Safety Relief Valve (SRV) blowdown under normal plant operating or accident conditions. 54

P_{ps} = Pool swell loads, including pipe and other structure reactions resulting from the pressure. 35(U)

P_{sc} = Steam condensation oscillation loads, including the direct and the feedback effects. 54

P_{ch} = Chugging loads, including the direct and the feedback effects.

For a more exact definition of the above loads, refer to Section 3.8.3.3.1 a)

P_t = Containment Vessel structural acceptance test pressure, as described in Section 3.8.2.3.1(a) and 3.8.2.8(a)

c) Other Category I Buildings

The definitions and symbols applicable to the Category I buildings other than the Reactor Building are as specified in Section 3.8.4.3.1.

3.8.5.3.2 Loading Combinations

a) Reactor Building Mat

The load combinations to be used in the design of the Reactor Building mat are as shown in Table 3.8-3. Furthermore, the following load combination will be considered under Extreme Environmental category to include the effect due to Probable Maximum Flood. 54 44 Q130.24

1) $1.0D + 1.0L + 1.0P_o + 1.0T_o + 1.0R_o + 1.0B$

b) Other Category I Building

The load combinations to be used in the design of Category I building mats are as indicated in Sections 3.8.4.3.2.1.1.2 and 3.8.4.3.2.1.2.1.

c) In addition to the load combinations referenced above, the following load combinations are utilized to check all Category I building foundations against sliding and overturning due to earthquakes, winds and tornadoes, and against floatation due to floods. 35(D)

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1) $D + H' + F_{eqo}$

2) $D + H + W$

3) $D + H'' + F_{eqs}$ 35 (D)

4) $D + H + W_t$

5) $D + B$

where, H is the static soil pressure load, H' and H" are the lateral earth pressures under OBE and SSE respectively, and B is the buoyancy force. The flood level to be used for determining the buoyancy force is discussed in Section 3.4.2.

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For the above load combinations, the minimum factors of safety will not be less than the following:

Load Combination	Minimum Factors of Safety Overturning	Sliding	Floatation
1) --------------	1.5	1.5	-
2) --------------	1.5	1.5	-
3) --------------	1.1	1.1	-
4) --------------	1.1	1.1	-
5) --------------	-	-	1.1

35(D)

45 (D)

3.8.5.3.3 Soil Bearing

The soil bearing pressures developed and factors of safety against bearing failure calculated from the loading combinations specified in Section 3.8.5.3.2 will be within the limits described in Section 2.5.4.10.1.

3.8.5.3.4 Settlement

A discussion of the expected gross and differential settlements is presented in Section 2.5.4.10.

All Category I structures are separated from each other and differential settlement between structures will not impose loads on the structures.

3.8.5.4 Design and Analysis Procedures

3.8.5.4.1 Analytical Techniques

3.8.5.4.1.1 Dynamic Analysis

Lumped mass models of structures including their foundations will be made as described in Section 3.7.2.1.1.1. Equivalent static forces will be obtained at the assumed mass locations including the foundation.

3.8.5.4.1.2 Static Analysis

The static analysis of all Category I foundations will be performed by conventional stiffness/flexibility computerized methods using proven industry accepted computer programs such as NASTRAN, STARDYNE, EAC/EASE, and ANSYS. 35(U)

3.8.5.4.2 Design Procedures

The design methods for the reinforced concrete foundations covered by this section shall be as follows: 5,17

a) Reactor Building: as described in Section 3.8.3.4.1

b) Other Category I Buildings: as described in Section 3.8.4.4

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TABLE 3.8-1

STRESS LIMITS FOR CONTAINMENT VESSEL

Load Combination	Stress Criterion Category		Primary Stresses: Gen. Memb. P_m	Primary Stresses: Local Memb. P_L	Primary Stresses: Bend + Local Memb. $P_B + P_L$	Primary and Secondary	Peak Stresses	Buckling	
Construction and Test	Construction Overpressure Test		0.9 Sy	1.25 Sy	1.25 Sy	3 S_m	Consider for Fatigue Analysis	125% of Allowables given by NE-3133	54
Normal and Severe	Operating or Shutdown with or without OBE		S_m	1.5 S_m	1.5 S_m	3 S_m	Consider for Fatigue Analysis	See Table 3.8-2	
Normal Extreme	Operating with SSE	Not integral and Continuous	S_m	1.5 S_m	1.5$_m$	N/A	N/A	See Table 3.8-2	5 Q1-3.20 Q1-9.29
		Integral and Continuous	The greater of 1.2 S_m or Sy	The greater of 1.8 S_m or 1.5 Sy	The greater of 1.8 S_m or 1.5 Sy	N/A	N/A	See Table 3.8-2	35(C)
Abnormal Severe	Accident with OBE		S_m	1.5 S_m	1.5 S_m	N/A	N/A	See Table 3.8-2	
	Post Accident Flood with OBE		1.5 S_m	The greater of 1.8 S_m or 1.5 Sy	The greater of 1.8 S_m or 1.5 Sy	N/A	N/A	See Table 3.8-2	
Abnormal Extreme	Accident with SSE	Not integral and Continuous	S_m	1.5 S_m	1.5 S_m	N/A	N/A	See Table 3.8-2	
		Integeral and Continuous	The greater of 1.2 S_m or Sy	The greater of 1.8 S_m or 1.5 Sy	The greater of 1.8 S_m or 1.5 Sy	N/A	N/A	See Table 3.8-2	

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TABLE 3.8-1 (Cont'd)

Load Combination	Stress Criterion Category		Primary Stresses: Gen. Memb. P_m	Primary Stresses: Local Memb. P_L	Primary Stresses: Bend + Local Memb. $P_B + P_L$	Primary and Secondary	Peak Stresses	Buckling	
	Accident with SSE and Rupture Jet or Missile Loads	Not integral and Continuous	The greater of 1.2 S_m or Sy	The greater of 1.8 S_m or 1.5 Sy	The greater of 1.8 S_m or 1.5 Sy	N/A	N/A	See Table 3.8-2	Q1-3.20 Q1-9.29
		Integral and Continuous	85% of Stress Intensity Limits of Appendix F			N/A	N/A	85% of Allow. given by F 1325	35(C)

Note: The stress symbols used in this table conform to the definitions given in ASME Section III Div. 1 Subsection NE 3000. 54

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TABLE 3.8-3

UPPER (CONCRETE) DRYWELL AND REACTOR BUILDING MAT 54

LOAD COMBINATIONS AND LOAD FACTORS (1) 35

Category	D	L(2)	P_o	P_t	P_a	T_o	T_a	F_{eqo}	F_{eqs}	W(7)	W_t(7)
Service:											
Test	1.0	1.0		1.0		1.0					
Construction	1.0	1.0				1.0				1.0	
Normal	1.0	1.0	1.0			1.0					
	1.0	1.0	1.0			1.0					
Severe Environmental	1.0	1.0	1.0			1.0		1.0	or	1.0	
	1.0	1.0	1.0			1.0		1.0	or	1.0	
Factored:											
Extreme Environmental	1.0	1.0	1.0			1.0			1.0	or	1.0
	1.0	1.0	1.0			1.0			1.0	or	1.0
Abnormal	1.0	1.0			1.5		1.0				
	1.0	1.0			1.5		1.0				
	1.0	1.0			1.5		1.0				
Abnormal/Severe	1.0	1.0			1.25		1.0	1.25	or	1.25	
Environmental	1.0	1.0			1.25		1.0	1.25	or	1.25	
	1.0	1.0			1.25		1.0	1.25	or	1.25	
	1.0	1.0				1.0		1.0			
Abnormal/Extreme	1.0	1.0			1.0		1.0		1.0		
Environmental	1.0	1.0			1.0		1.0		1.0		
	1.0	1.0			1.0		1.0		1.0		

Category	R_o	R_a	Y_r	Y_m	Y_j	P_{bd}	P_{sc}	P_{ps}(8)	P_{ch}	F_{pa}	Remarks
Service:											
Test											
Construction											
Normal	1.0										
	1.0					1.0					SRV, (3)
Severe Environmental	1.0										
	1.0					1.0					SRV, (3)
Factored:											
Extreme Environmental	1.0										
	1.0					1.0					SRV, (3)
Abnormal		1.0	1.0	1.0	1.0	1.25		1.5			Short Term LOCA, (4), (5)
		1.0				1.25		1.5			(6)
		1.0									Long Term LOCA
Abnormal/Severe		1.0	1.0	1.0	1.0	1.0		1.25			Short Term LOCA, (4), (5)
Environmental		1.0				1.0		1.25			(6)
		1.0									Long Term LOCA
	1.0									1.0	Post Accident Flooding
Abnormal/Extreme		1.0	1.0	1.0	1.0	1.0		1.0			Short Term LOCA, (4), (5)
Environmental		1.0				1.0		1.0			(6)
		1.0									Long Term LOCA

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TABLE 3.8-3 (Cont'd)

NOTES:

(1) Refer to Section 3.8.3.3.1 for symbols and numerical values.

(2) Includes all temporary construction loading during and after construction of the Drywell. Both cases of L having its full value or being completely absent will be considered.

(3) Due to 1, 2 or 19 SRV operation only, the thermal effects and pipe reactions will be treated as T_o & R_o under normal operation. 35

(4) The maximum values of P_a, T_a, R_a, Y_r, Y_j and Y_m will be applied simultaneously, unless a time-history analysis is performed to justify otherwise. Local stresses due to Y_r, Y_j, and Y_m may exceed the allowable provided there is no loss of function.

(5) Due to short term LOCA with 1 SRV operation only, the thermal effects and pipe reactions due to SRV discharge will be treated as T_a and R_a for accident condition. The pool swell load (Pps), the steam condensation oscillation load (P_{sc}), the chugging load (P_{ch}), the accident pressure (P_a) and their corresponding accident temperature (T_a) will be combined in accordance with their actual time dependent mutual occurrence. Both cases of Drywell wall under outward and inward pressures will be investigated.

(6) Due to Small Break Accident (SBA) with 1 SRV actuation and Intermediate Break Accident (IBA) with 8- valve ADS operation, the thermal effect and pipe reaction loads due to SRV actuation will be included in T_a and R_a. 54

(7) Applies to Reactor Building mat design only.

(8) While P_{ps} applies only to Design Basis Accident (DBA) short term cases, P_{sc} applies to both DBA and IBA, and P_{ch} applies to all three accidents (DBA, IBA and SBA); however, these three loads will not occur simultaneously.

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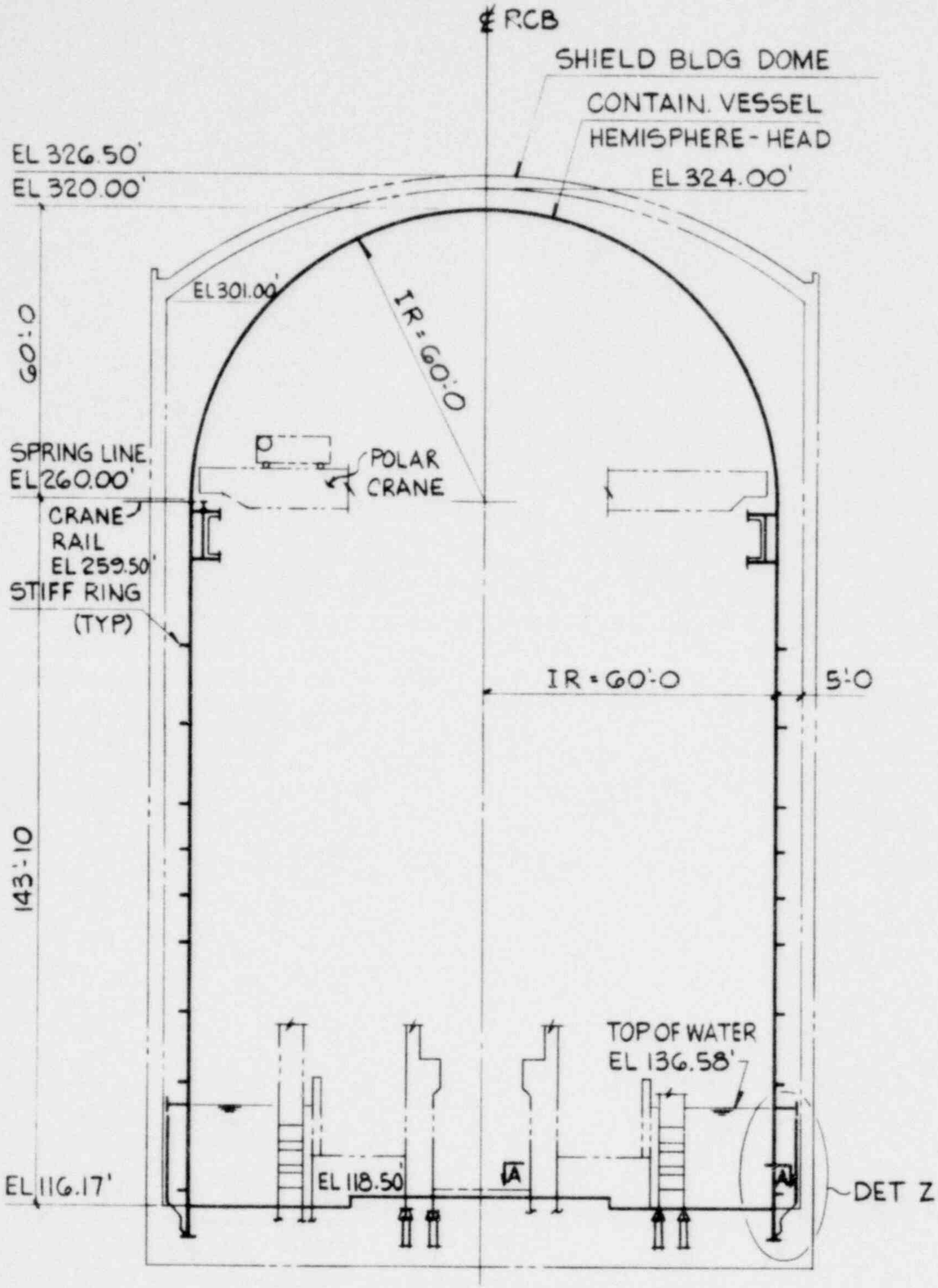
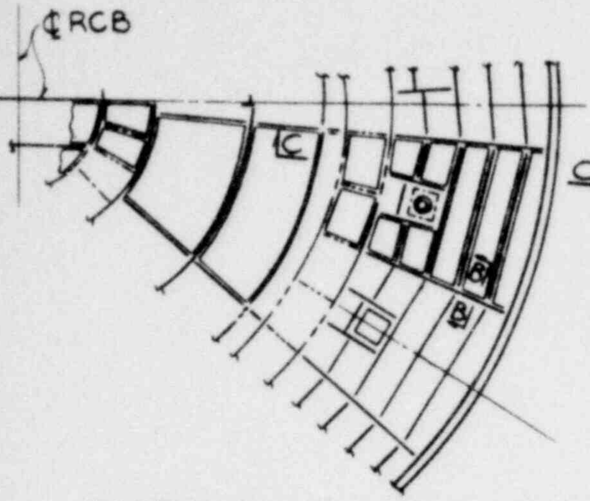
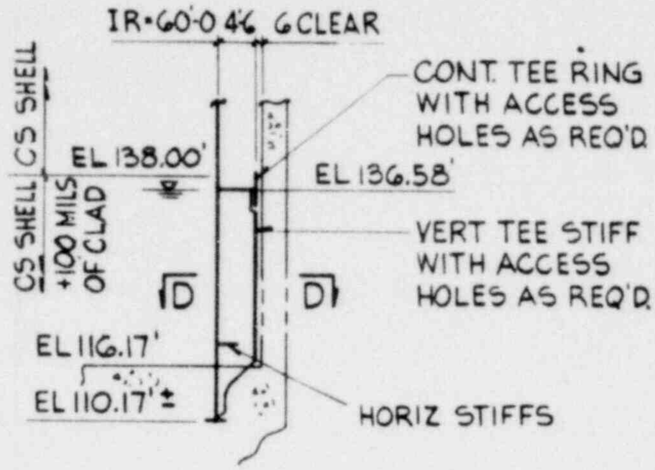


TYPICAL CONTAIN. VESSEL SECTION
1" = 30'-0

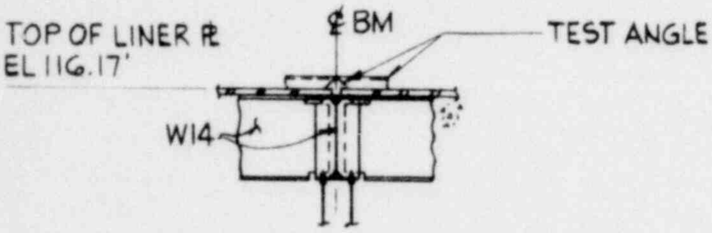
1636 177



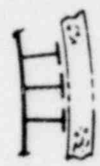
PART PLAN OF BOTTOM LINER
SECT A
NTS



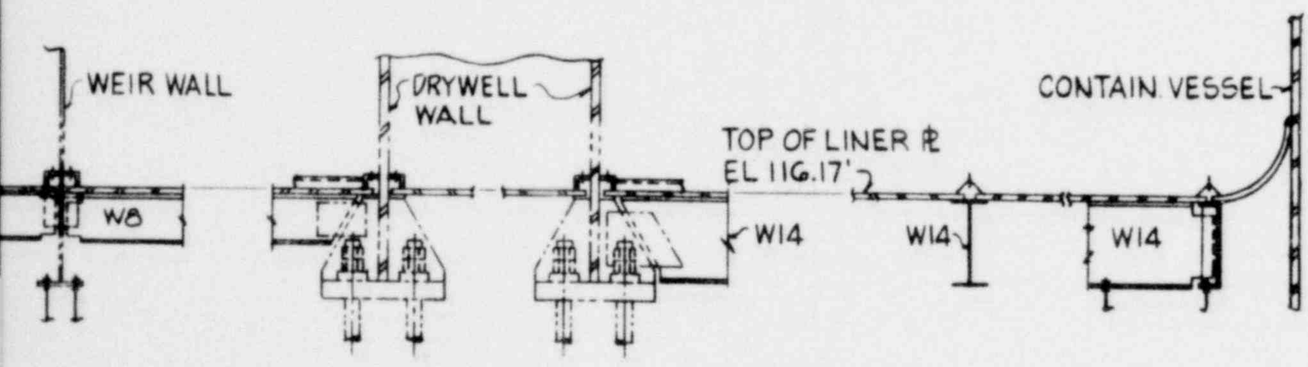
DET Z
1" = 20'-0



SECT B
NTS



SECT D
1" = 20'-0



SECT C
NTS

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Allens Creek Nuclear Generating Station
Unit 1

CONTAINMENT VESSEL
STRUCTURAL FEATURES

FIGURE 3.8-1

Figure 3.8-2 has been deleted

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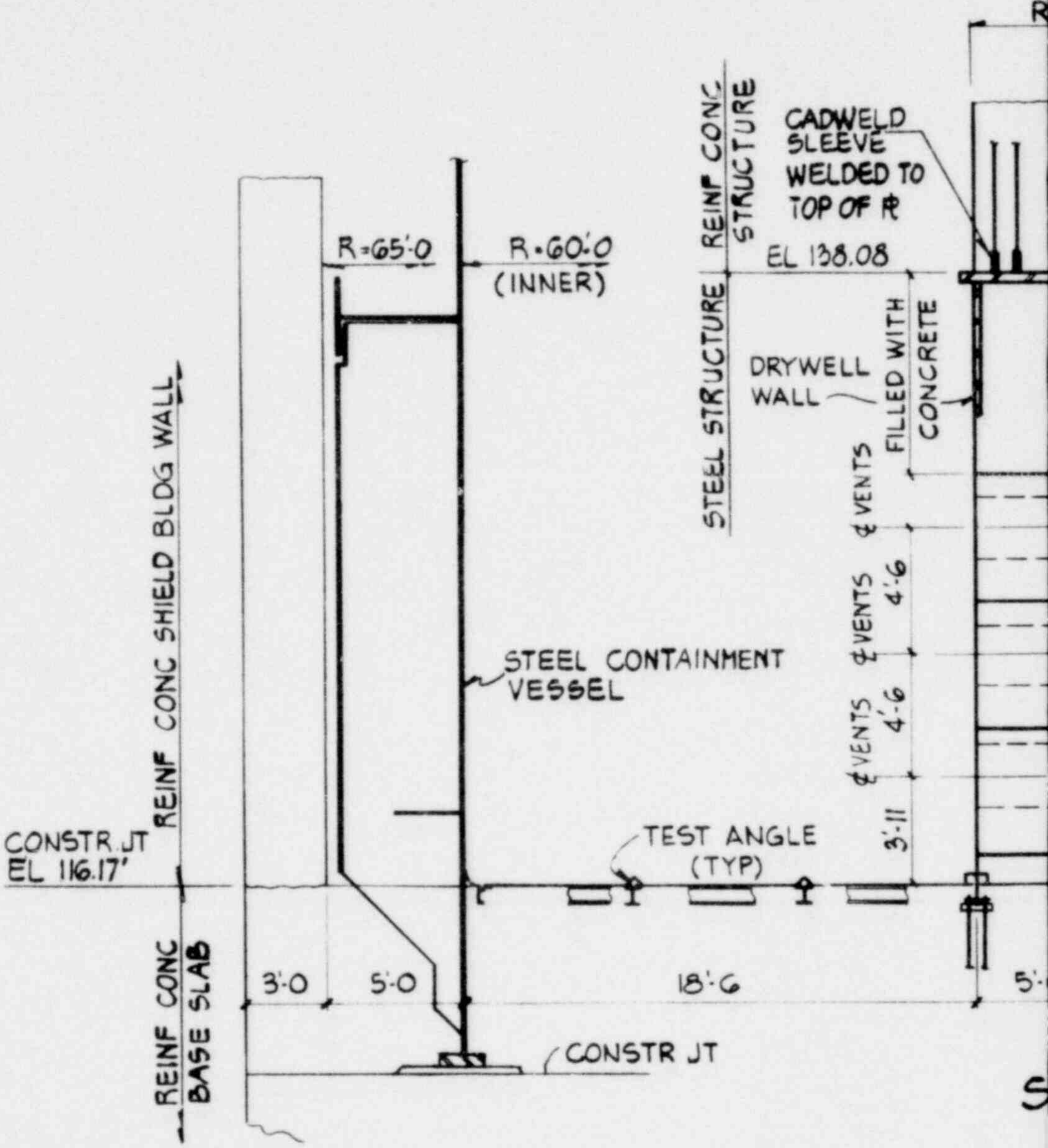
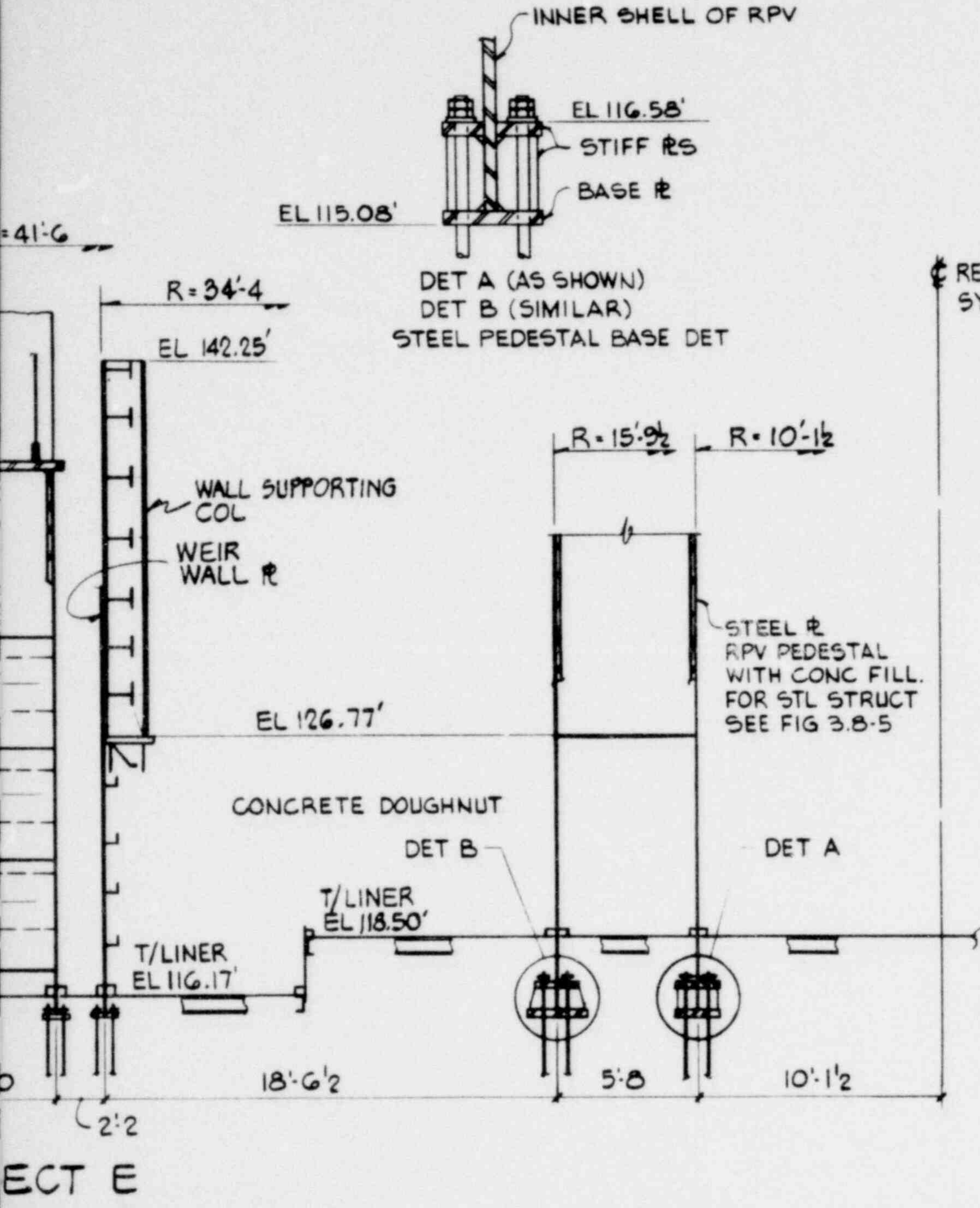


CADWELD SLEEVE WELDED TO TOP OF ℞
REINF CONC STRUCTURE
STEEL STRUCTURE
EL 138.08
R=65'-0
R=60'-0 (INNER)
DRYWELL WALL
FILLED WITH CONCRETE
¢ VENTS
4'-6
4'-6
3'-11
REINF CONC SHIELD BLDG WALL
STEEL CONTAINMENT VESSEL
CONSTR JT EL 116.17'
TEST ANGLE (TYP)
REINF CONC BASE SLAB
3'-0
5'-0
18'-6
CONSTR JT

1636 180



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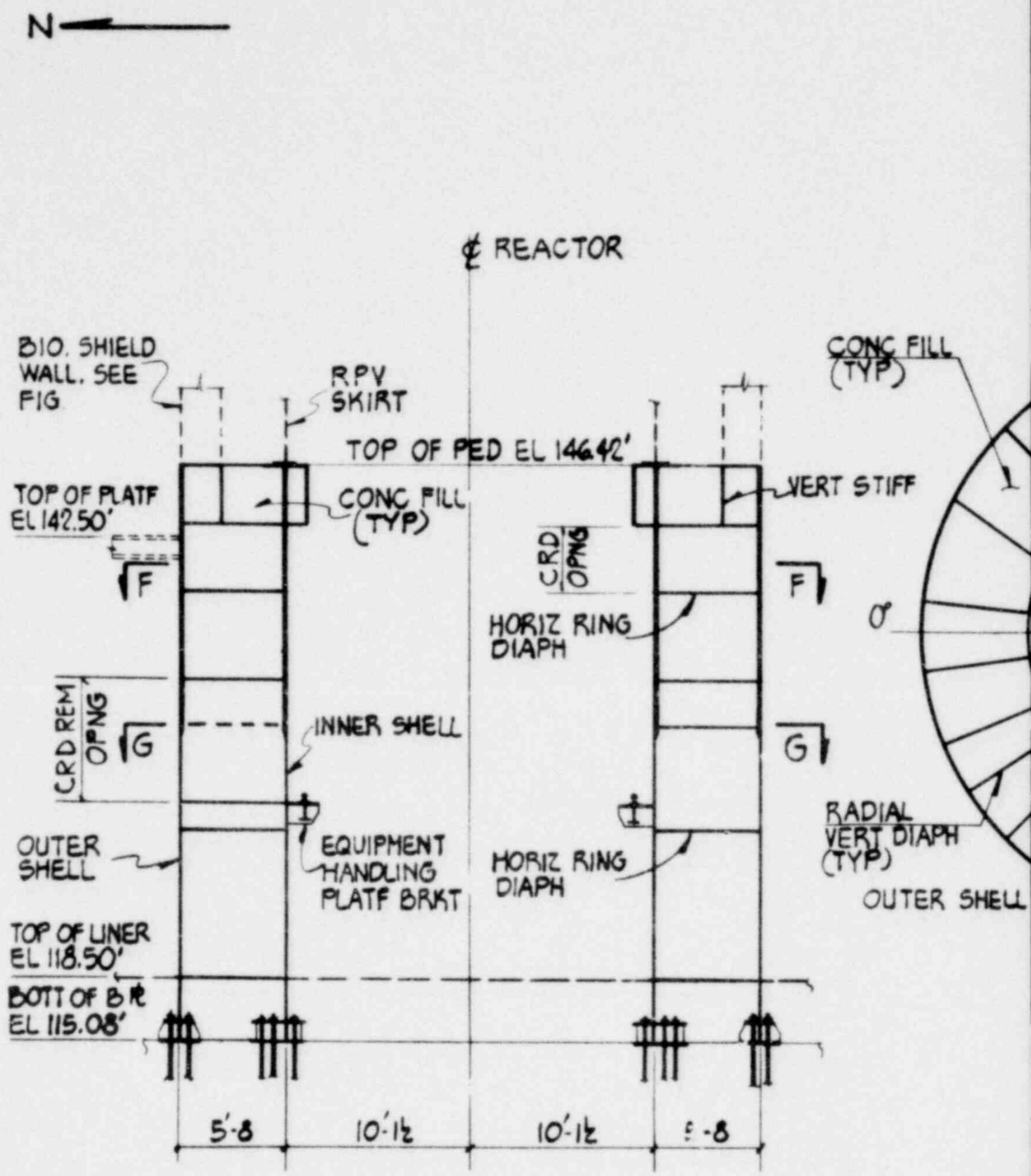
Allens Creek Nuclear Generating Station
Unit 1

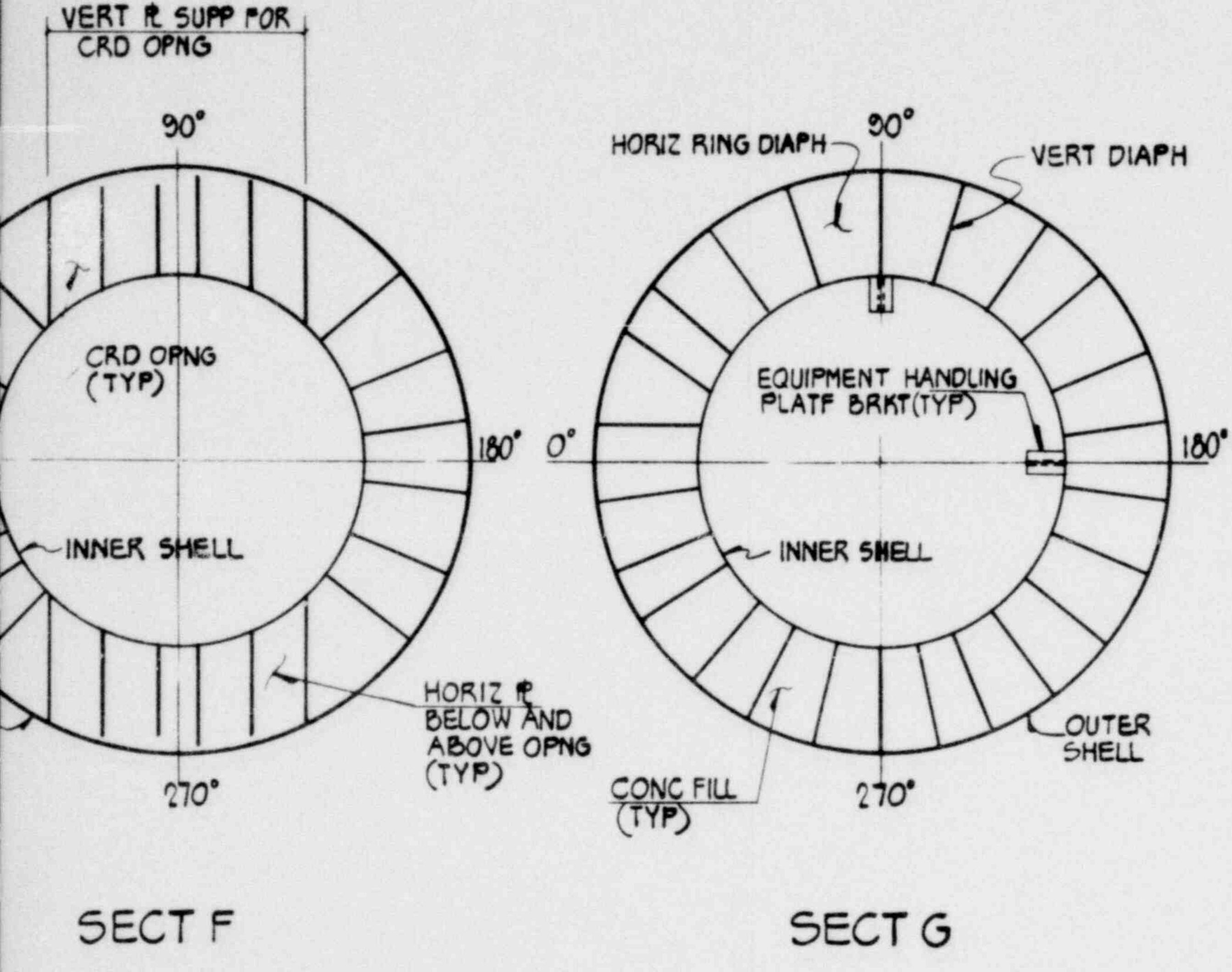
REACTOR CONTAINMENT BUILDING
INTERNAL STRUCTURES BASE DETAILS

FIGURE 3.8-3



STEEL RPV PEDESTAL

1636 182



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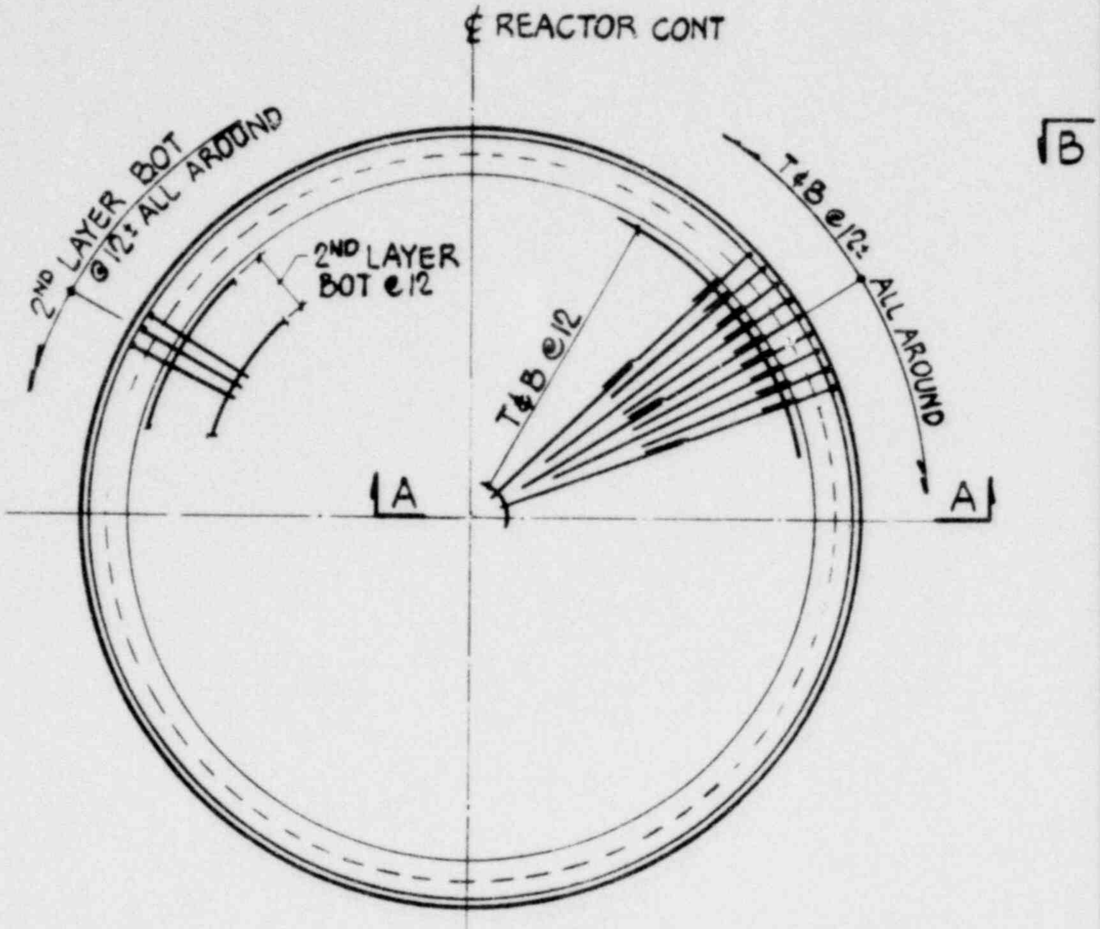
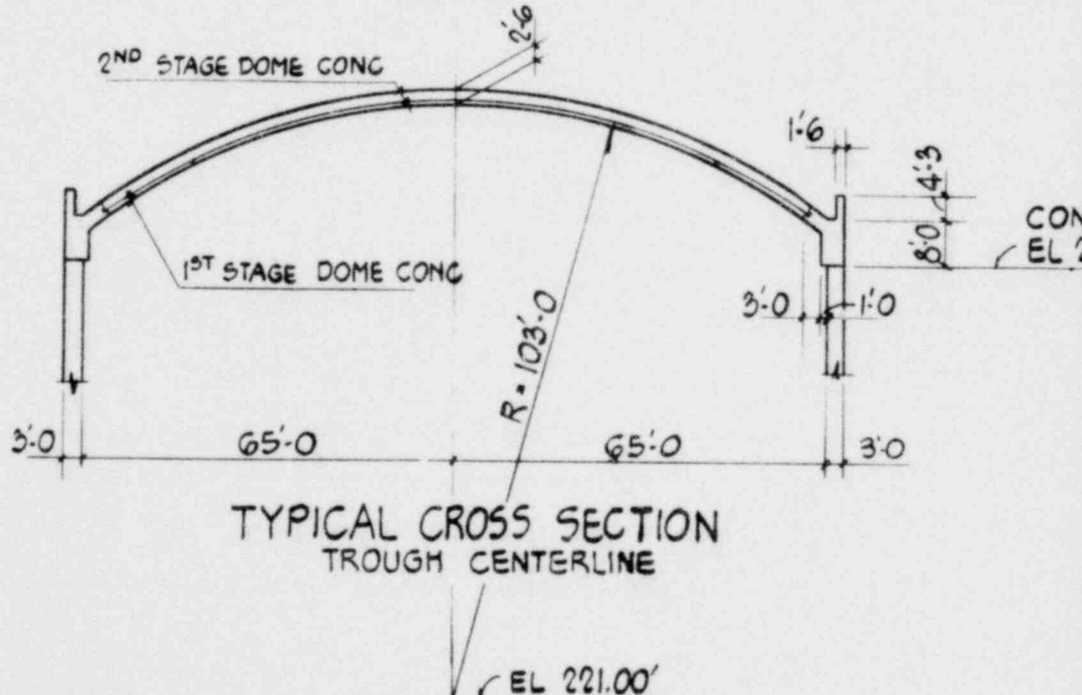
HOUSTON LIGHTING & POWER COMPANY
Allens Creek Nuclear Generating Station
Unit 1

REACTOR CONTAINMENT BUILDING
STEEL PLATE RPV PEDESTAL

FIGURE 3.8-5

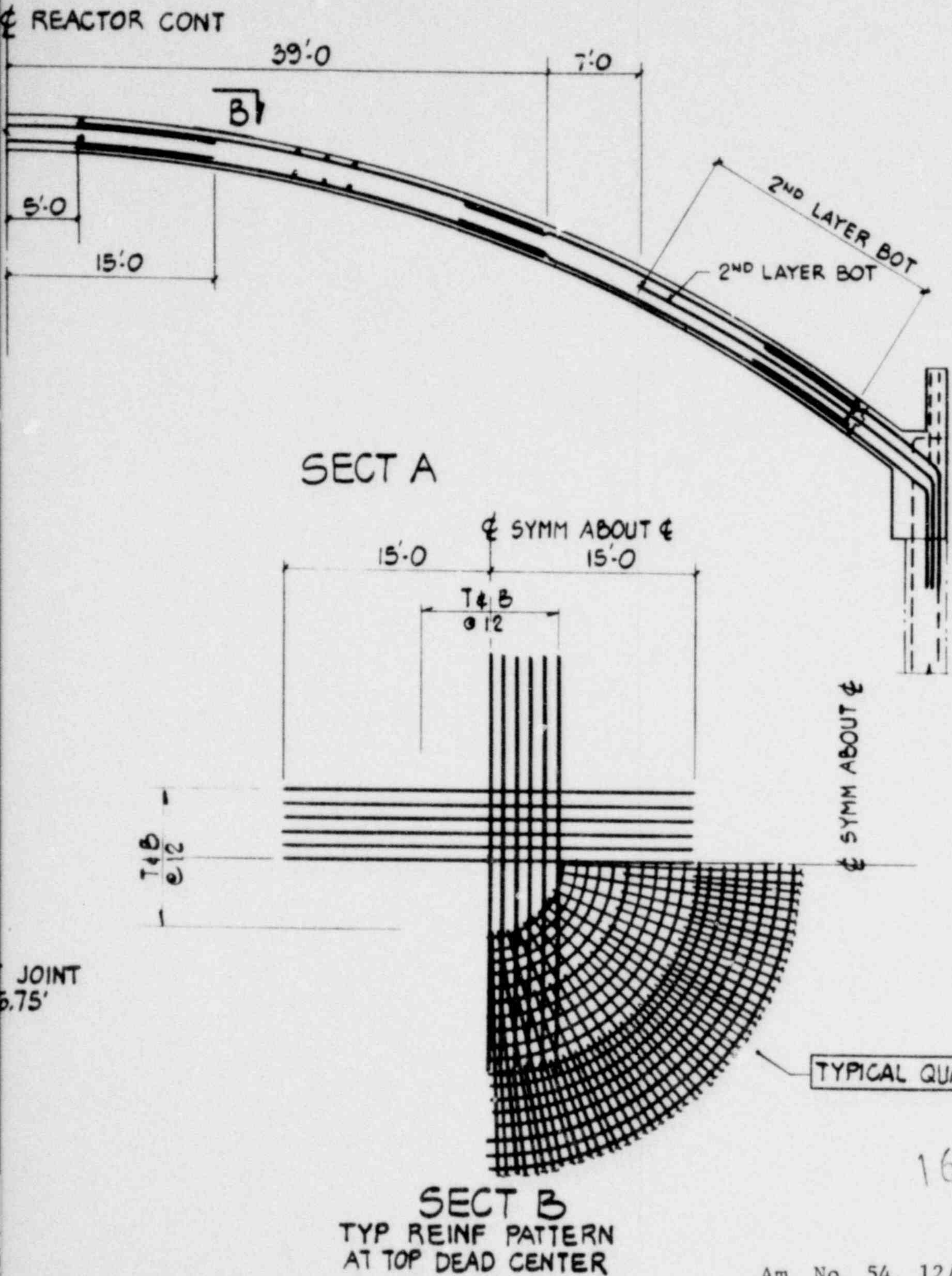


PLAN



TYPICAL CROSS SECTION
TROUGH CENTERLINE

1636 184



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HOUSTON LIGHTING & POWER COMPANY
Allens Creek Nuclear Generating Station
Unit 1

REACTOR CONTAINMENT BUILDING
DOME – M&R

FIGURE 3.8-11

3.9.2.2 Design Loading Combinations

The design loading combinations considered in the design of ASME Code Class 2 and 3 components are categorized as Normal, Upset, Emergency or Faulted plant conditions in Table 3.9-2. Additional loading combinations for piping in the suppression pool area, however, are presented in Chapter 7 of Rev. 2 of the Containment Structures Design Report. Applicable stress limits for piping, vessels, tanks, pumps and valves are given for each condition in Table 3.9-3. 54

3.9.2.3 Design Stress Limits

Stress limits given in Table 3.9-3 are based on elastic deformation for all conditions.

3.9.2.4 Analytical and Empirical Methods for Design of Pumps and Valves

The design stress limits given in Table 3.9-3 for ASME Class 2 or 3 pumps and valves are selected to prevent excessive deformation which could impair the operability of the components. Manufacturers shall be required, in the component specification, to submit test procedures and or analytical methods to demonstrate that components will function as designed and in accordance with the criteria specified in Section III of the ASME Code. The valve and pump operability assurance program is given in Appendix 3.9.B. 3 Q3-32

3.9.2.5 Design and Installation Criteria, Pressure-Relieving Devices

Safety valves and relief valves with free discharge will be analyzed in accordance with ASME Section III code case (now in preparation).

Safety valves and relief valves with an enclosed discharge will be analyzed by methods which suitably account for the time-history of loads acting immediately following valve opening (first few milliseconds). The dynamic response of the piping to these loads will also be analyzed. Stresses resulting from relief valve opening will, when combined with other upset loads, meet the limits in ASME Section III for upset conditions. 35 (G)

The analyses account for the actual fact that all valves discharge outwardly away from the reactor vessel. The simultaneous discharge creates maximum energy into the piping system at one time and lower mode excitation will dominate. Thus maximum responses will result.

The fluid induced forcing functions are calculated using one-dimensional equations for the conservation of mass, momentum and energy. The fluid is assumed to be an ideal gas. These forcing functions, once calculated, are applied at locations along the piping system where change in fluid flow direction occurs. Applying these functions to the structural system model, a dynamic time history is performed, to calculate structural response of the piping. Therefore, a dynamic amplification factor is inherently accounted for in the analyses. 3 Q3-33

For Class 2 and 3 piping, the moment due to F (including the dynamic load factor) will be included in the M_R term of equation 9 of Section Q1-1-9

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NC-3652 of the Winter 1972 addenda of ASME Section III to calculate stresses at the header-valve inlet nozzle junction. Q1-

Fabrication and installation of the valve inlet nozzle to the header will be in full compliance with the applicable provisions of ASME Section III, Class 2 and 3 for branch connections. Stresses in these pipes, including the effects of valve discharge thrust, will be maintained within code limits. Q 1-9 3

For any pipe run having more than one safety/relief valve; the most severe combination of relief valves discharging simultaneously, including all valves on one side of the system, will be considered in determining pipe stresses as described in Sections 3.9.2.1 and 5.2.1. 3 Q3 .33

35

For closed systems where the fluid is discharging from a safety-relieving device to another vessel or chamber, the dynamic interaction forces of the total system including the attached discharge piping will be considered. The effects of this loading will be included in the M_R term of equation 9 of Section NC-3652 of the Winter 1972 addenda to ASME Section III. 3 42 (C)

Pressure relieving devices will be constructed, located and installed so that they are readily accessible for inspection and repair and so that they cannot be readily rendered inoperative. Safety or relief valves are set to relieve at a pressure not exceeding the maximum allowable working pressure of the vessel at the operating temperature.

3.9.2.6 Stress Levels for Category I Components

Stress analysis is used to determine structural adequacy of pressure components of the reactor coolant pressure boundary under the operating conditions of normal, upset, emergency and faulted. 35 (G)

Significant discontinuities are considered such as nozzles, flanges, etc. In addition to the design calculations required by the ASME III code, stress analysis is performed by methods outlined in the code appendices or by other methods applicable to the design condition through reference to analogous codes or other published literature.

Examples of methods and results of significant areas of consideration are given for major components in the FSAR.

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(C)-Consistency
(G)-GESSAR