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SUBJECT: Responds to 900709 request for addl info re structural integrity & documents info discussed at 901213 meeting at ABB Impell.Rept of containment structure integrity encl.

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January 28, 1991

U.S. Nuclear Regulatory Commission
Document Control Desk
Attn: Allen R. Johnson
Project Directorate I-3
Washington, D.C. 20555

Subject: Report on Structural Integrity
R. E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Johnson:

This letter is in response to the NRC's request for additional information, dated July 9, 1990. It also documents the information discussed during our meeting at the ABB Impell offices on December 13, 1990.

As described in the enclosed report and its attachments, the actions that RG&E has taken with respect to:

- removal of groundwater around the containment periphery,
- reanalysis of the containment structure which provides high assurance that the containment design functions can be fully met, with margins.

We trust this information is fully responsive to the NRC staff's request.

Very truly yours,

Robert C. Mecredy

Robert C. Mecredy

LAS/200

xc: Mr. Allen R. Johnson (Mail Stop 14D1)
Project Directorate I-3
Washington, D.C. 20555

U.S. Nuclear Regulatory Commission
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475 Allendale Road
King of Prussia, PA 19406

Ginna Senior Resident Inspector

Cert No P249194222
A001 1/1

[illegible]

REPORT OF THE INTEGRITY OF THE
R.E. GINNA NUCLEAR POWER PLANT
CONTAINMENT STRUCTURE

I. INTRODUCTION

On June 27, 1990 members of the USNRC staff performed an inspection of the exterior containment structure of RG&E's R.E. Ginna Nuclear Power plant. At that inspection, a number of concerns were raised by the NRC concerning the integrity of the Containment structure. In particular, the concerns focused on the intrusion of groundwater and its presence on the cylinder to foundation ring beam connection of the Containment structure. As a matter of documentation, RG&E communicated its understanding of those concerns in a letter dated August 28, 1990 from R. C. Mecredy (RG&E) to A. Johnson (NRC).

This document is RG&E's response to those concerns and presents the steps that RG&E has taken to address the issues.

II. INVESTIGATION

After the June inspection, RG&E began an investigation first to determine the source of water in the area and second to remove the standing water at the joint.

Most of the Containment foundation is accessible from the sub basement of the Intermediate Building. This area is an area open for inspection with little groundwater intrusion visible. On the east side of the Containment, a sheet pile wall was originally constructed to retain the backfill soil material so that access to the Containment interior at the equipment hatch at El. 271' was possible. An inspection of the annular space between the Containment structure and sheet piling determined that a visible flow of groundwater was leaking through the sheet piling. It was evident that the original design had anticipated an inflow of groundwater from this area because a diversion curb and collection sump system was installed during initial construction. RG&E determined in its investigation that this curb system was damaged and not performing its design intent.

As a result of its inspections, RG&E was able to determine the most significant source of water flowing into the sub basement. The annular space between the Containment and sheet piling extends from the ring beam at

El. 232' up to grade at El. 270'. At grade a concrete slab had been constructed where entrance into the Containment through the equipment hatch is made annually (See Attachments 1 & 2). Because of seismic considerations, a four inch gap between the slab and Containment wall exists. Original documents show that this gap was to be filled with a caulking material. RG&E found that the condition of the existing material was ineffective in preventing water from passing through the joint. As a result, any rainwater that fell on the Containment dome and wall in this area would run down the side of the structure and flow directly into the sub basement.

III. PHYSICAL RESOLUTION

Having identified these sources of water RG&E took the following steps:

1. the annular area at the Containment base was cleaned of debris and standing water;

2. the curb/sump system was restored to perform its original design function;

3. the joint between the Containment wall and slab at grade was cleaned and new caulking material installed;

4. the existing inspection procedure will be upgraded to define reporting requirements if standing water is present in the annular space.

As a result of these actions, there is currently no standing water on the subject structural joint and the curb/sump system is performing its function.

IV. ANALYTICAL STUDY

To address the other issues in RG&E's August 28, 1990 letter not pertaining to the physical condition of the area, a detailed analytical study was performed.

The analysis utilized two detailed finite element analyses models (See Attachments 3 & 4).

The first model consisted of an axisymmetric solid model of the Containment shell and foundation structures. The model simulated the structural characteristics of the cylindrical wall from the foundation up to the apex of the dome and included the neoprene pads, the tension tie rods, the foundation slab/ring girder, the prestressed tendons, the rock anchors, and the supporting bedrock. The model was con-

structed in a way such that any adverse conditions at the foundation structure/bedrock interface could be investigated.

The second model was a three dimensional finite element shell model. It modeled one half (180°) of the Containment cylinder and tension ties with appropriate boundary conditions at the base from 0 to 180 degrees. The model was constructed to permit variation of boundary conditions at the cylinder/ring girder interface.

As part of the analytical approach and as a means of confirming the accuracy of the chosen finite element mesh, the results of the models were checked against closed formed solutions for shells with various boundary conditions.

The details of these models were presented to your staff at the December 13, 1990 meeting held at Impell's office in Boston.

V. SEISMIC STUDY

Part of RG&E's investigation consisted of a review of the original design bases for the seismic analysis of the Containment structure.

The original analysis consisted of treating a single degree of freedom spring/mass system, determining a fundamental frequency for the cantilever mode, and using the corresponding acceleration from the Housner Spectra. That acceleration was determined to be 0.44g. However, the peak of the spectra of 0.46g was used as an equivalent static loading for the design.

More detailed seismic analysis of the Containment were performed as part of the Systematic Evaluation Program (SEP) in 1980. The Containment was analyzed as a lumped mass model. The results of that analysis determined that the existing design met or exceeded then existing (1980) criteria. As part of RG&E's current investigation, a dynamic modal analysis of the finite element shell model was performed. Close correlation with the SEP analysis was found to exist. Therefore, analyses done in 1980 and now in 1990 have confirmed that the design parameters used for the original design of the Containment, bound those values determined by today's methods and criteria.

IV. RESULTS OF THE ANALYSIS

The results of the axisymmetric solid model were reviewed to determine the behavior of the Containment structure and its foundation. Dead load, pre-stress, and LOCA pressure loads were applied and combined as defined in the UFSAR.

The results show that there is no evidence of any detrimental tensile stresses present, either in the Containment structure or the supporting bedrock. Lack of tensile stresses sufficient to cause cracking of the concrete foundation supports RG&E's opinion that the foundation structure is not cracked and that the source of water in the annular area is not from beneath the building.

The finite element shell model was used to perform parametric studies on the behavior of the Containment for various conditions at the cylinder/ring beam interface. These analyses were performed to address the concerns of sliding or no sliding, partial fixity, function of the tension rods and function of the bellows.

Attachment 5 defines all the load conditions and boundary combinations that were analyzed.

The Containment structure has been analyzed for four load conditions: dead load, pre-stress load, seismic load and internal pressure. Each of these loads establish distinct stress conditions in the structure. Dead load and tendon pre-stress create vertical axial compressive (meridional) stress in the Containment shell. The behavior of the Containment from seismic loads is essentially the response of a cantilever beam under lateral loading. As the structure responds as a cantilever, axial compressive and tensile stresses are created. No bending stresses are created in the shell from seismic loadings.

The response of the Containment to internal pressure is somewhat more complicated. Under internal pressure the shell is expanding in all directions, creating tensile stress in both the meridional and hoop (horizontal) directions. However, the tension rods restrain the outward expansion of the cylinder at its base. The combined effect of this restraint and internal pressure create bending moments in the cylinder. Therefore, the critical section in the Containment is where the combined effects of axial load plus bending are present. In particular, this critical section for the Ginna Containment occurs in the shell at a point that is ten feet above the base. The findings of these current analyses are also in agreement with the original design basis which also indicate this to be the critical location.

With respect to sliding, the behavior of the Containment under combined loads was also determined. Under an internal pressure, the cylinder at the base expands (slides) outward and stresses the tension bars creating a very small gap between the containment wall and the two foot base slab. When seismic is applied, because of the presence of the neoprene, the Containment, as a whole, moves horizontally.

This movement, although quite small, is sufficient to exceed the outward expansion from pressure. The combined effect is that the cylinder moving from seismic will bear against the top two feet of the foundation base slab on the inside and create additional displacements on the other side of the cylinder.

As can be seen on Attachment 5 many variations of the boundary conditions were examined. For the tension rods in particular, it was determined that the maximum stress occurs when the base is totally restrained from translation and rotation. Even for that postulated extreme condition, the stresses in the tension bars remained below yield for the worst load combination. For those conditions which simulate the original design basis (pinned), the stresses in the bars are approximately 60% of yield for the worst load combination.

As stated above, the critical section for the design of the containment shell is ten feet above the base. Attachment 6, which is Table 3.8-5 of the UFSAR, is a tabulation of stress resultants and couples in the containment structure. The parametric studies that have been performed have compared the current output values with those of Table 3.8-5. For all cases, the results have shown no more than a 10% increase from the original design values.

As part of this investigation, RG&E considered a worst case seismic scenario. That is, total loss of the tension bars and the cylinder free to slide. Under that condition the cylinder contacts the upper two feet of the foundation slab on one side and displaces away from it on the opposite side. The transfer of force is achieved by action of the horizontal (hoop) steel in the Containment wall. High stresses occur in a very localized area near the base of the cylinder. Although cracking of the concrete and yielding of the reinforcing steel will occur, sufficient reinforcement in the hoop direction exists in the structure to limit localized overstress to 10% of the height of the vessel after load redistribution due to yielding.

To address the concern on the bellows the same postulated extreme condition described above was used. For this condition, the maximum displacement at the base is 1/2 inch. Review of the geometry of the tendon details implies that the centerline of the tendon bundle must be at the centerline of the conduit/bellows. In that case the outermost wire of the tendon bundle is 9/16 inch away from the inside of the bellows. Therefore, the tendon wire would not contact the bellows. In the extremely low probability that the outermost tendon wire is in contact with the bellows, there are sufficient gaps between the tendon wires such that a one half inch displacement would not damage the wire.

SUMMARY

RG&E believes that it has determined the actual sources of groundwater intrusion and has taken measures to control the intrusion. Since the physical work has been completed no standing water is present on the foundation joint.

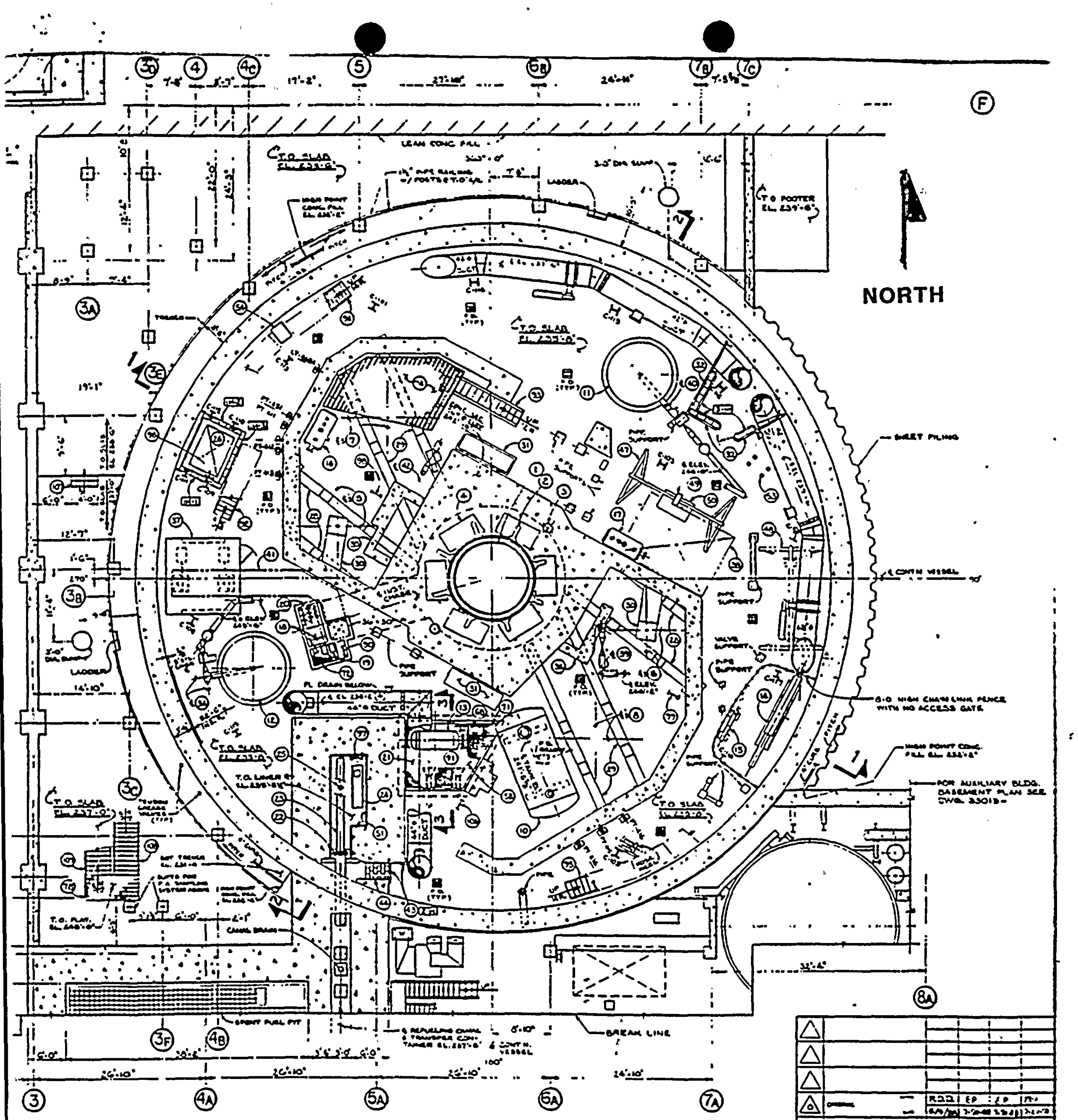
The condition of the annular space is checked daily for standing water. The existing inspection procedure is being upgraded to assure reporting of standing water to the Technical Engineering group of the plant.

The behavior of the cylinder/ring beam has been extenstively analyzed. Our conclusion is that it is insensitive to possible variations of the structural boundary conditions.

The parametric studies show no more than a 10% increase in the value of stress at the critical section of the containment shell due to the worst possible combination of boundary conditions, when compared to the original design.

RG&E has concluded that the containment shell/foundation mat is sound and that it will perform its design function under all postulated loadings.

LAS/199



PLAN ABOVE BASEMENT FLOOR

T.O. SLAB EL. 235'-8"

NOTES:

SEE DWG. 33013-2110 FOR DESCRIPTIONS OF EQUIPMENT & STRUCTURES

ATTACHMENT 1

LIMITED CONSTRUCTION: AS NOTED

PRELIMINARY NOT FOR CONSTRUCTION

BIDDING PURPOSES

DATE | RELEASED FOR | ENGR.

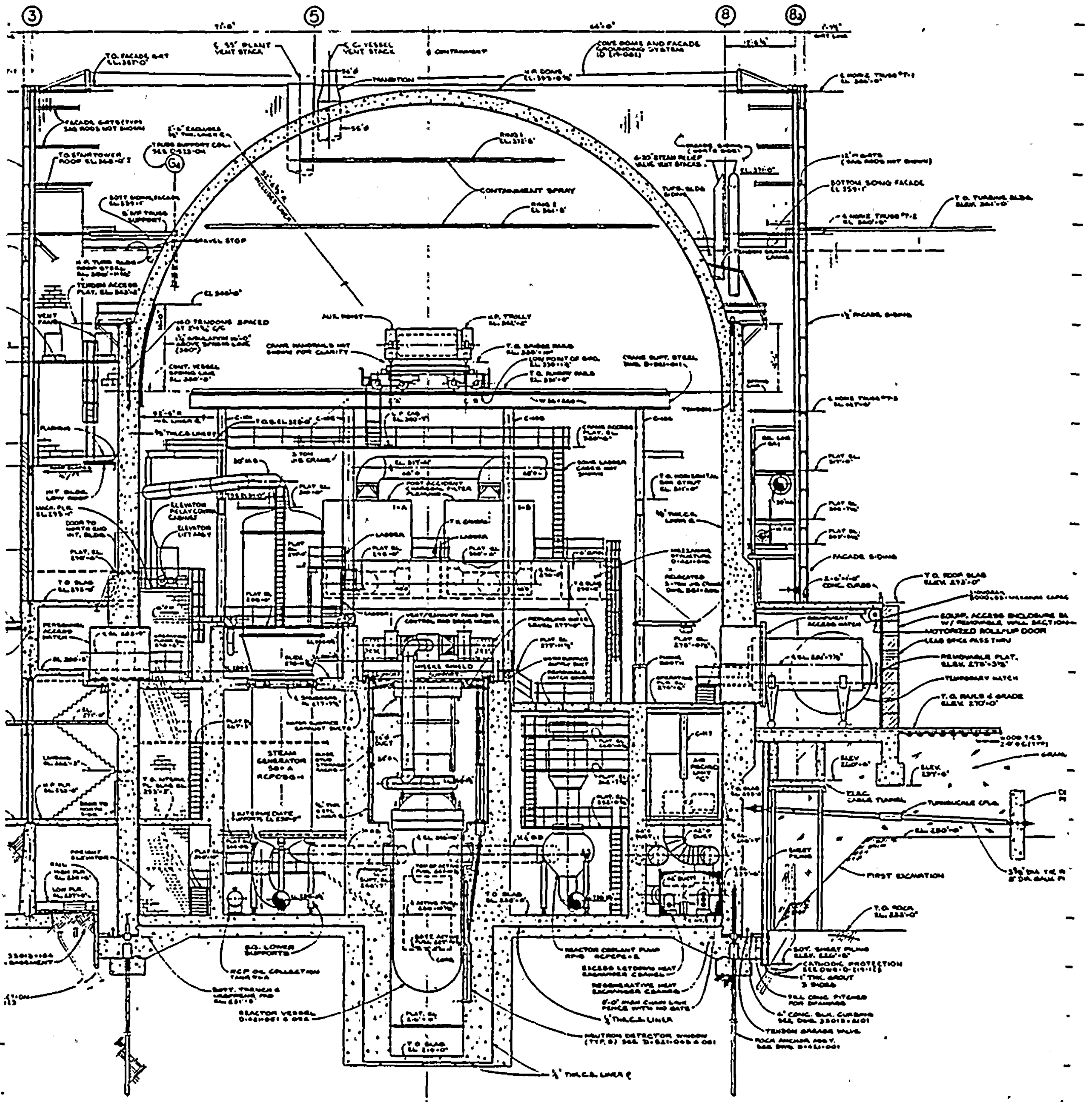
GINNA STATION

SCALE 1/8" = 1'-0"

PLANT ARRANGEMENT

CONT. STRUCT. & INTERMEDIATE BLDG.

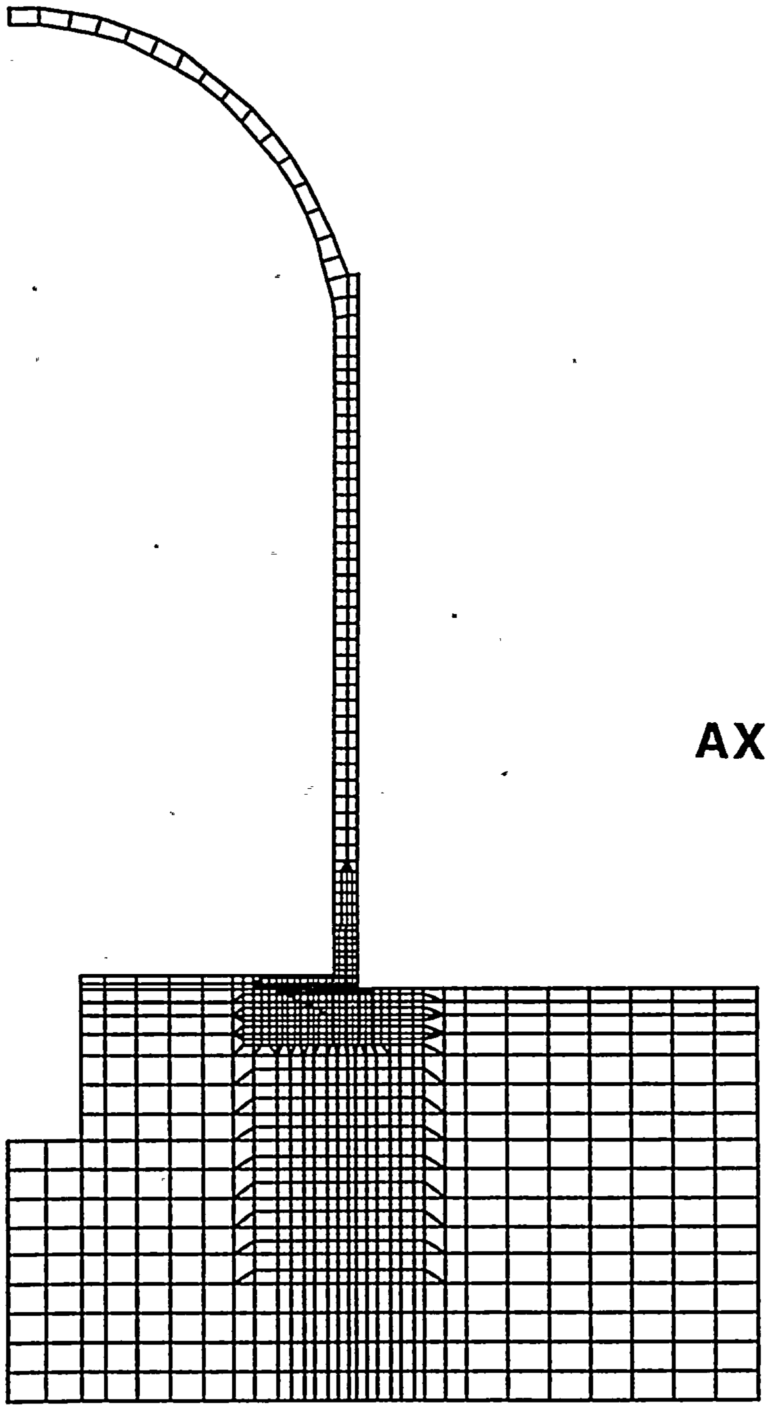
PLAN - BASEMENT FLOOR EL. 235'-8"



SECTION 1-1

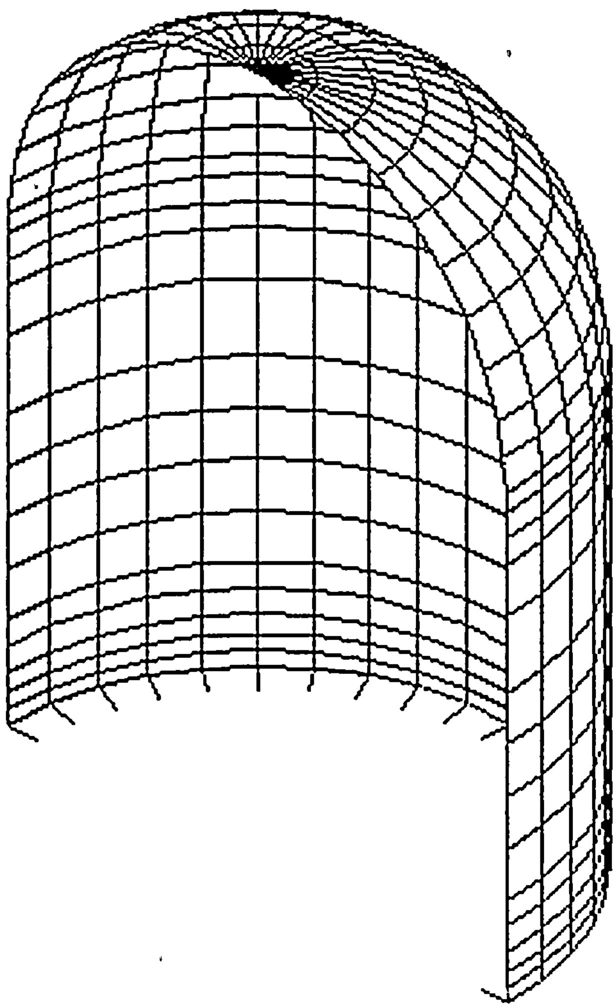
NOTES:
1) THIS DRAWING TO BE WORKED IN CONJUNCTION WITH DRAWINGS 33013-2101, 33013-2105, 33013-2113, 33013-2121 AND 33013-2122

ATTACHMENT 2



AXISYMMETRIC MODEL

ATTACHMENT 3



SOLID 180° MODEL

ATTACHMENT 4

Case Reference Chart - Shell Model

File Name	Load Cases	Base Boundary Conditions			Material Properties	
					Modulus	
		Tension Rods	Rotational [ft-lbs/ft]	Radial	Meridional [psi]	Circumferencial [psi]
RGEA01	D,PS,P,2E	Inactive	Free	Fixed	4.10E+06	4.10E+06
RGEA02	D,PS,P,2E	Inactive	Free	Fixed	4.10E+06	4.10E+06
RGEA03	D,PS,P,2E	Active	Free	Free	4.10E+06	4.10E+06
RGEA04	D,PS,P,2E	Inactive	Free	Fixed	4.10E+06	3#18@9"
RGEA05	D,PS,P,2E	Inactive	Free	Fixed	4.10E+06	3#18@9"
RGEA06	D,PS,P,2E	Active	Free	Free	4.10E+06	3#18@9"
RGEA07	D,PS,P,2E	Active	Free	Free	4.10E+06	4.10E+06
RGEA14	D,PS,P,2E	Inactive	Free	Fixed	4.10E+06	Rebar Varies
RGEA08	D,PS,P,2E	Active	Free	Free	4.10E+06	Rebar Varies
RGEA09	D,PS,P,2E	Active	3.00E+01	Free	4.10E+06	Rebar Varies
RGEA10	D,PS,P,2E	Active	9.00E+01	Free	4.10E+06	Rebar Varies
RGEA11	D,PS,P,2E	Active	3.00E+02	Free	4.10E+06	Rebar Varies
RGEA12	D,PS,P,2E	Active	Fixed	Free	4.10E+06	Rebar Varies
RGEA15	D,PS,P,2E	Inactive	3.00E+01	Fixed	4.10E+06	Rebar Varies
RGEA16	D,PS,P,2E	Inactive	9.00E+01	Fixed	4.10E+06	Rebar Varies
RGEA17	D,PS,P,2E	Inactive	3.00E+02	Fixed	4.10E+06	Rebar Varies
RGEA18	D,PS,P,2E	Inactive	Fixed	Fixed	4.10E+06	Rebar Varies
RGEA20	D,PS,P,2E	Active	Free	(90-180°)Fxd.	4.10E+06	4.10E+06
RGEA21	D,PS,P,2E	Inactive	Free	(72-180°)Fxd.	4.10E+06	4.10E+06
RGEA22	D,PS,P,2E	Inactive	Free	(72-180°)Fxd.	4.10E+06	Rebar Varies

ATTACHMENT 5

Table 3.8-5

CONTAINMENT STRUCTURE STRESSES

Loading: Dead Load

#1

Location in Feet Up From Base/Element No.		Stress Resultants Meridional N ϕ	Stress Resultants Hoop N θ	Stress Couples Meridional M ϕ	Stress Couples Hoop M θ	Meridional Shear V ϕ	Radial Displacement δ R
Base	0	-70.9	0	0	0	0	0
	3	-69.4	0	0	0	0	0
	6	-67.8	0	0	0	0	0
	10	-65.2	0	0	0	0	0
	15	-63.3	0	0	0	0	0
	20	-60.5	0	0	0	0	0
	30	-55.7	0	0	0	0	0
	40	-50.5	0	0	0	0	0
	60	-40.3	0	0	0	0	0
	75	-32.7	0	0	0	0	0
	85	-27.6	0	0	0	0	0
	90	-25.0	0	0.0	0	0	0
	95	-22.5	0	+20.0	0	0	0
Springline	99	-20.4	+20.4	+27.8	0	0	0
	102	-19.4	+18.3	+31.0	0	0	0
	105	-18.5	+16.2	+32.3	0	0	0
Dome Anchor	108	-17.5	+14.1	+31.0	0	0	0
	-111	-16.8	+12.2	+26.5	0	0	0
	111	-16.8	+12.2	+28.0	0	0	0
	+111	-16.8	+12.2	-1.5	0	0	0
	114	-16.1	+10.5	0.0	0	0	0
	117	-15.4	+8.7	0.0	0	0	0
	123	-14.3	+5.5	0.0	0	0	0
	130	-13.2	+2.2	0.0	0	0	0
	Apex	-10.2	-10.2	0.0	0.0	0.0	0.0

Table 3.8-5

CONTAINMENT STRUCTURE STRESSES (Continued)

Loading: Final Prestress
#2 636 k/tendon

$$N = \frac{160x636}{x108.5} = 299 \text{ k/in.}$$

Location in Feet Up From Base/Element No.		Stress Resultants Meridional N φ	Stress Resultants Hoop N θ	Stress Coules Meridional M φ	Stress Coules Hoop M θ	Meridional Shear V φ	Radial Displacement δ R
Base	0	-299.0	0	0	0	0	0
	3	-299.0	0	0	0	0	0
	6	-299.0	0	0	0	0	0
	10	-299.0	0	0	0	0	0
	15	-299.0	0	0	0	0	0
	20	-299.0	0	0	0	0	0
	30	-299.0	0	0	0	0	0
	40	-299.0	0	0	0	0	0
	60	-299.0	0	0	0	0	0
	75	-299.0	0	0	0	0	0
	85	-299.0	0	0	0	0	0
	90	-299.0	0	0	0	0	0
	95	-299.0	0	0	0	0	0
Springline	99	-299.0	0	0	0	0	0
	102	-299.0	0	0	0	0	0
	105	-299.0	0	0	0	0	0
Dome Anchor	108	-299.0	0	0	0	0	0
	-111	-299.0	0	0	0	0	0
	111	-299.0	0	0	0	0	0
	+111	0	0	0	0	0	0
	114	0	0	0	0	0	0
	117	0	0	0	0	0	0
	123	0	0	0	0	0	0
	130	0	0	0	0	0	0
	Apex	0	0	0	0	0	0

Table 3.8-5

CONTAINMENT STRUCTURE STRESSES (Continued)

Loading: Operating temperature - Winter

#3

$$N\theta = kry = 116.5\ (651)\ \frac{12}{1000}\ y = 912\ y'c\ k/ft \qquad \delta r = -0.143$$

Location in Feet Up From Base/Element No.		Stress Resultants: Meridional $N\phi$	Stress Resultants: Hoop $N\theta$	Stress Couples: Meridional $M\phi$	Stress Couples: Hoop $M\theta$	Meridional Shear $V\phi$	Radial Displacement δR
Base	0	0.0	+130.2	0.0	99.5	-6.6	0.000
	3	0.0	+95.6	-9.7	99.5	-0.3	-.038
	6	0.0	+65.0	-3.6	99.5	4.0	-.075
	10	0.0	+27.3	+19.8	99.5	7.2	-.113
	15	0.0	0.0	+59.7	99.5	8.4	-.143
	20	0.0	-14.6	+100.2	99.5	7.6	-.159
	30	0.0	-19.2	+160.4	99.5	4.3	-.164
	40	0.0	+11.8	+188.0	99.5	1.5	-.156
	60	0.0	0.0	+192.3	99.5	-0.4	-.144
	75	0.0	0.0	+185.6	99.5	0.0	-.142
	85	0.0	0.0	+186.0	99.5	0.0	-.143
	90	0.0	+20.0	+149.1	99.5	+0.8	-.121
	95	0.0	+34.6	+157.3	99.5	+3.1	-.105
Springline	99	0.0	+48.3	+173.8	+99.5	+5.9	-.090
	102	0.0	-24.8	+28.1	28.2	-1.0	-.093
	105	0.0	-12.1	+31.9	28.2	+1.0	-.072
Dome Anchor	108	0.0	-3.7	+31.8	28.2	+1.2	-.058
	-111	0.0	0.0	+28.2	28.2	0.0	-.052
	111	0.0	0.0	+28.2	28.2	0.0	-.052
	+111	0.0	0.0	+28.2	28.2	0.0	-.052
	114	0.0	0.0	+28.2	28.2	0.0	-.052
	117	0.0	0.0	+28.2	28.2	0.0	-.052
	123	0.0	0.0	+28.2	28.2	0.0	-.052
	130	0.0	0.0	+28.2	28.2	0.0	-.052
	Apex	0.0	0.0	+28.2	28.2	0.0	-.052

Table 3.8-5

CONTAINMENT STRUCTURE STRESSES (Continued)

Loading: Operating temperature - Summer

#4

Location in Feet Up From Base/Element No.		Stress Resultants Meridional $N\phi$	Stress Resultants Hoop $N\theta$	Stress Couples Meridional $M\phi$	Stress Couples Hoop $M\theta$	Meridional Shear $V\phi$	Radial Displacement δR
Base	0	0.0	-130.2	0.0	0.0	+6.6	0.000
	3	0.0	-38.3	+16.1	0.0	+4.2	+.101
	6	0.0	-30.1	+25.9	0.0	+2.4	+.110
	10	0.0	-19.1	+31.6	0.0	+0.6	+.122
	15	0.0	-15.5	+30.9	0.0	-0.7	+.126
	20	0.0	-2.7	+25.7	0.0	-1.3	+.140
	30	0.0	+2.7	+12.5	0.0	-1.2	+.146
	40	0.0	+2.7	+3.3	0.0	-0.6	+.146
	60	0.0	0.0	-1.4	0.0	0.0	+.143
	75	0.0	0.0	0.0	0.0	0.0	+.143
	85	0.0	0.0	0.0	0.0	0.0	+.143
	90	0.0	0.0	0.0	0.0	0.0	+.143
	95	0.0	0.0	0.0	0.0	0.0	+.143
Springline	99	0.0	0.0	0.0	0.0	0.0	+.143
	102	0.0	0.0	0.0	0.0	0.0	+.143
	105	0.0	0.0	0.0	0.0	0.0	+.143
Dome Anchor	108	0.0	0.0	0.0	0.0	0.0	+.143
	-111	0.0	0.0	0.0	0.0	0.0	+.143
	111	0.0	0.0	0.0	0.0	0.0	+.143
	+111	0.0	0.0	0.0	0.0	0.0	+.143
	114	0.0	0.0	0.0	0.0	0.0	+.143
	117	0.0	0.0	0.0	0.0	0.0	+.143
	123	0.0	0.0	0.0	0.0	0.0	+.143
	130	0.0	0.0	0.0	0.0	0.0	+.143
	Apex	0.0	0.0	0.0	0.0	0.0	+.143

Table 3.8-5

CONTAINMENT STRUCTURE STRESSES (Continued)

Loading: Internal Pressure p = 60 psig δR_D = 0.383 in.

#5

δR = 0.492 in.

Location in Feet Up From Base/Element No.		Stress Resultants Meridional $N\phi$	Stress Resultants Hoop $N\theta$	Stress Couples Meridional $M\phi$	Stress Couples Hoop $M\theta$	Meridional Shear $V\phi$	Radial Displacement δR
Base	0	227.0	+79.6	-30.0	0.0	+55.3	.009
	3	227.0	+127.4	+106.0	0.0	+36.2	.149
	6	227.0	+199.4	+190.6	0.0	+20.9	.226
	10	227.0	+282.2	+243.0	0.0	+6.2	.314
	15	227.0	+363.1	+243.6	0.0	-4.8	.401
	20	227.0	+418.8	+205.7	0.0	-9.7	.460
	30	227.0	+469.0	+102.8	0.0	-9.5	.514
	40	227.0	+473.2	+28.9	0.0	-5.2	.518
	60	227.0	+454.2	+10.8	0.0	0.0	.498
	75	227.0	+454.0	-7.1	0.0	0.0	.492
	85	227.0	+438.0	-3.9	0.0	0.0	.480
	90	227.0	+428.0	+34.7	0.0	-0.4	.470
	95	227.0	+354.0	+7.7	0.0	-12.8	.388
Springline	99	227.0	+322.0	-60.5	0.0	-21.6	.353
	102	227.0	+210.0	-126.7	0.0	-18.2	.346
	105	0.0	+182.0	-199.1	0.0	-25.0	.301
Dome Anchor	108	0.0	+229.0	+19.8	0.0	+3.1	.368
	-111	0.0	+243.0	+10.3	0.0	+3.3	.402
	111	227.0	+243.0	+10.3	0.0	+3.3	.402
	+111	227.0	+243.0	+10.3	0.0	+3.3	.402
	114	227.0	+243.0	+4.3	0.0	+2.0	.402
	117	227.0	+238.0	+0.2	0.0	+0.8	.393
	123	227.0	+230.0	0.0	0.0	0.0	.388
	130	227.0	227.0	0.0	0.0	0.0	.383
	Apex	227.0	227.0	0.0	0.0	0.0	.383

Table 3.8-5

CONTAINMENT STRUCTURE STRESSES (Continued)

Loading: Accident Temperature p = 60 psig, T = 286°F

#6

Location in Feet Up From Base/Element No.		Stress Resultants Meridional N ϕ	Stress Resultants Hoop N θ	Stress Couples Meridional M ϕ	Stress Couples Hoop M θ	Meridional Shear V ϕ	Radial Displacement δR
Base	0	8.0	-1.5	0.0	0.0	1.2	0.000
	3	8.0	-0.6	2.5	0.0	-0.8	.001
	6	8.0	+1.2	4.3	0.0	0.5	.003
	10	8.0	+3.0	5.5	0.0	0.1	.005
	15	8.0	+5.0	5.5	0.0	-0.1	.007
	20	8.0	+6.0	4.6	0.0	-0.2	.008
	30	8.0	+6.7	2.3	0.0	-0.2	.009
	40	8.0	+6.7	0.6	0.0	-0.1	.009
	60	8.0	+6.7	-0.2	0.0	0.0	.009
	75	8.0	+6.7	0.0	0.0	0.0	.009
	85	8.0	+25.8	-80.0	0.0	0.0	.030
	90	8.0	+54.1	-85.7	0.0	+0.9	.061
	95	8.0	+102.4	-66.8	0.0	+6.8	.114
Springline	99	8.0	+120.7	-28.4	0.0	+13.7	.134
	102	8.0	+54.0	-0.3	0.0	-5.6	.179
	105	8.0	+84.4	+8.7	0.0	-1.0	.229
Dome Anchor	108	8.0	+103.7	+8.2	0.0	+0.9	.261
	-111	111.0	111.0	+5.0	0.0	+1.1	.273
	111	111.0	111.0	0.0	0.0	0.0	.273
	+111	111.0	111.0	0.0	0.0	0.0	.273
	114	111.0	111.0	0.0	0.0	0.0	.273
	117	111.0	111.0	0.0	0.0	0.0	.273
	123	111.0	111.0	0.0	0.0	0.0	.273
	130	111.0	111.0	0.0	0.0	0.0	.273
	Apex	111.0	111.0	0.0	0.0	0.0	.273