

RAS 14253

05/28/06 16:35:08



APPLICANT'S EXHIBIT 39

GE Nuclear Energy

990-2174

DOCKETED  
USNRC

October 1, 2007 (10:45am)

December 11, 1992

OFFICE OF SECRETARY  
RULEMAKINGS AND  
ADJUDICATIONS STAFF

DEC 14 2007  
U.S. NUCLEAR REGULATORY COMMISSION

In the Matter of AMERGEN ENERGY CO., LLC

Docket No. 99-0219 Official Exhibit No. 39

OFFERED by Applicant/Licensee Intervenor \_\_\_\_\_

NRQ Staff \_\_\_\_\_ Other \_\_\_\_\_

IDENTIFIED on 12/14 Witness/Panel N/A

Action Taken: ADMITTED REJECTED WITHDRAWN

Reporter/Clerk DW

To: Dr. Stephen Tumminelli  
Manager, Engineering Mechanics  
GPU Nuclear Corporation  
1 Upper Pond Road  
Parsippany, NJ 07054

Subject: Sandbed Local Thinning and Raising the Fixity Height Analyses (Line Items 1 and 2 in Contract # PC-0391407)

Dear Dr. Tumminelli:

The attached letter report documents the results of subject analyses. The original purchase order called for the analyses to be conducted on a spherical panel model rather than on the full pie slice model. However, the results are more useful when conducted on the full pie slice model since in that case no interpretation is required regarding the relationship between the spherical panel results and the pie slice model results. The pie slice model we have used in these studies has the refined mesh in the sandbed region.

A 3.5" PC Disk containing three ANSYS input files (0.636" case, 0.536" case and 1 foot wall case) is also enclosed with this letter. The detailed calculations have been filed in Chapter 10 of our Design Record File No. 00664.

This transmittal completes the scope of work identified in the subject PO. If you have any questions on the above item, please give me a call.

Sincerely,

H.S. Mehta, Principal Engineer  
Materials Monitoring & Structural Analysis Services  
Mail Code 747; Phone (408) 925-5029

Attachment: Letter Report

cc: D.K. Henrie (w/o Attach.)  
J.M. Miller (w/o Attach.)  
S. Ranganath (w/o Attach.)

HSMOC-57.wp

Template=SECY-028

SECY-02



APPLICANT'S EXHIBIT 39

GE Nuclear Energy

990-2174

DEC 14 1992

U.S. NUCLEAR REGULATORY COMMISSION

December 11, 1992

To: Dr. Stephen Tumminelli  
Manager, Engineering Mechanics  
GPU Nuclear Corporation  
1 Upper Pond Road  
Parsippany, NJ 07054

In the Matter of \_\_\_\_\_  
Docket No. \_\_\_\_\_ Official Exhibit No. \_\_\_\_\_  
OFFERED by: Applicant/Licensee/Intervenor \_\_\_\_\_  
NRC Staff \_\_\_\_\_  
IDENTIFIED on \_\_\_\_\_ witness panel \_\_\_\_\_  
Action Taken: ADMITTED REJECTED WITHDRAWN  
Reporter/Clerk \_\_\_\_\_

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cc: D.K. Henrie (w/o Attach.)  
J.M. Miller (w/o Attach.)  
S. Ranganath (w/o Attach.)

HSMOC-57.wp

## LETTER REPORT ON ADDITIONAL SANDBED REGION ANALYSES

### 1.0 SCOPE AND BACKGROUND

Structural Analyses of the Oyster Creek drywell assuming a degraded thickness of 0.736 inch in the sandbed region (and sand removed) were documented in GENE Report Numbers 9-3 and 9-4. A separate purchase order was issued (Contract # PC-0391407) to perform additional analyses. The PO listed the additional analyses under two categories: Line Item 001 and Line Item 002. This letter report documents the results of these analyses.

The additional analyses are the following:

- (1) Investigate the effect on the buckling behavior of drywell from postulated local thinning in the sandbed region beyond the uniform projected thickness of 0.736" used in the above mentioned reports (Line Item 001).
- (2) Determine the change in the drywell buckling margins when the fixity point at the bottom of the sandbed is moved upwards by  $\approx 1$  foot to simulate placement of concrete (Line Item 002).

The original PO called for the Line Item 001 analyses to be conducted on a spherical panel. The relative changes in the buckling load factors were to be assumed to be the same for the global pie slice model. However, the mesh refinement activity on the global pie slice model and the availability of work station, has given us the capability to conduct the same analyses on the global pie slice model itself, thus eliminating the uncertainties regarding the correlation between the panel model and the pie slice model.

All of the results reported in this report are based on the pie slice model with a refined mesh in the sandbed region.

### 2.0 LINE ITEM 001

Figure 1a shows the local thickness reductions modeled in the pie slice model. A locally thinned region of  $\approx 6" \times 12"$  is modeled. The thickness of this region is 0.636" in one

case and 0.536" in the other case. The transition to the sandbed projected thickness of 0.736" occurs over a distance of 12" (4 elements).

The various thicknesses indicated in Figure 1a were incorporated in the pie slice model by defining new real constants for the elements involved. The buckling analyses conducted as a result of mesh refinement indicated that the refueling loading condition is the governing case from the point of view of ASME Code margins. Therefore, the stress and buckling analyses were conducted using the refueling condition loadings. The center of the thinned area was located close to the calculated maximum displacement point in the refueling condition buckling analyses with uniform thickness of 0.736 inch. Figure 1b shows the location of the thinned area in the pie slice model.

### 2.1 0.536 Inch Thickness Case

Figures 2 through 5 show the membrane meridional and circumferential stress distributions from the refueling condition loads. As expected, the tensile circumferential stress ( $S_x$  in element coordinate system) and the compressive meridional stress ( $S_y$  in element coordinate system) magnitudes in the thinned region are larger than those at the other edge of the model where the thickness is 0.736 inch. However, this is a local effect and the average meridional stress and the average circumferential stress is not expected to change significantly.

Figures 6 and 7 show the first buckling mode with the symmetric boundary conditions at both the edges of the model (sym-sym). This mode is clearly associated with the thinned region. The load factor value is 5.562. The second mode with the same boundary conditions is also associated with the thinned region. Figure 8 shows the buckled shape. The load factor value is 5.872.

Next, buckling analyses were conducted with the symmetric boundary conditions specified at the thinned edge and the asymmetric boundary conditions at the other edge (sym-asym). The load factor of the first mode for this case was 5.58. Figure 9 shows the buckling mode shape. It is clearly associated with the thinned region. Figure 10 shows the buckled mode shape with asymmetric boundary conditions at the both edges (asym-asym). As expected, the load factor for this case is considerably higher (7.037).

Thus, the load factor value of 5.562 is the lowest value obtained. The load factor for the same loading case (refueling condition) with a uniform thickness of 0.736" was 6.141. Thus, the load factor is predicted to change from 6.141 to 5.562 with the postulated thinning to 0.536".

## 2.2 0.636 Inch Thickness Case

Figures 11 through 14 show the membrane meridional and circumferential stress distributions from the refueling condition loads. As expected, the tensile circumferential stress ( $S_x$  in element coordinate system) and the compressive meridional stress ( $S_y$  in element coordinate system) magnitudes in the thinned region are larger than those at the other edge of the model where the thickness is 0.736 inch. However, this is a local effect and the average meridional stress and the average circumferential stress is not expected to change significantly.

Figures 15 and 16 show the first buckling mode with the symmetric boundary conditions at both the edges of the model (sym-sym). This mode is clearly associated with the thinned region. The load factor value is 5.91.

Next, buckling analysis was conducted with the symmetric boundary conditions specified at the thinned edge and the asymmetric boundary conditions at the other edge. The load factor of the first mode for this case was 5.945. Figure 17 shows the buckling mode shape. It is clearly associated with the thinned region. Based on the results of 0.536" case, the load factor for asym-asym case is expected to be considerably higher.

Thus, the load factor value of 5.91 is the lowest value obtained. The load factor for the same loading case (refueling condition) with a uniform thickness of 0.736" was 6.141. Thus, the load factor is predicted to change from 6.141 to 5.91 with the postulated thinning to 0.636".

## 2.3 Summary

The load factors for the postulated 0.536" and 0.636" thinning cases are 5.562 and 5.91, respectively. These values can be compared to 6.141 obtained for the case with a uniform sandbed thickness of 0.736 inch.

### 3.0 LINE ITEM 002

The objective of this task was to determine the change in the drywell buckling margins when the fixity point at the bottom of the sandbed is moved upwards by  $\approx 1$  foot to simulate placement of concrete. The elements in the sandbed region are approximately 3-inch square. Thus the nodes associated with the bottom four row of elements (nodes 1027 through 1271, Figure 18) were fixed in all directions.

The buckling analyses conducted as a result of mesh refinement indicated that the refueling loading condition is the governing case from the point of view of ASME Code margins. Therefore, the stress and buckling analyses were conducted using the refueling condition loadings. Figure 19 through 22 show the membrane meridional and circumferential stress distributions from the refueling condition loads. Figure 23 shows the calculated average values of meridional and circumferential stresses that are used in the buckling margin evaluation.

Figure 24 shows the first buckling mode with sym-sym boundary conditions. The load factor for this mode is 6.739. The load factor with asym-sym boundary conditions is 6.887 and the mode shape shown in Figure 25. It is clear that the sym-sym boundary condition gives the least load factor. Figure 26 shows the buckling margin calculation. It is seen that the buckling margin is 5.3% compared to 0% margin in the base case calculation.

To summarize, the load factor changes to 6.739 for the refueling condition when the fixity point at the bottom of the sandbed is moved upwards by  $\approx 1$  foot. This results in an excess margin of 5.3% above that required by the Code.



### Calculation Sheet

Subject <i>Oyster Creek DRYWELL</i>		Calc. No.	Rev. No.	Sheet No. of
Originator <i>M. Yekta</i>	Date <i>11/23/92</i>	Reviewed by		Date

## Proposed Local Thinning in the Refined Global Pic Slice

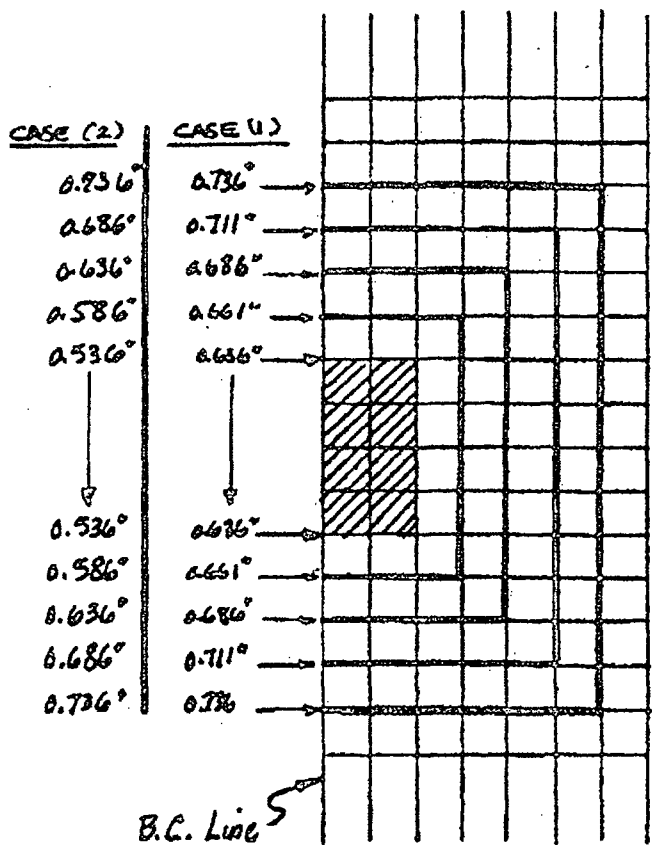
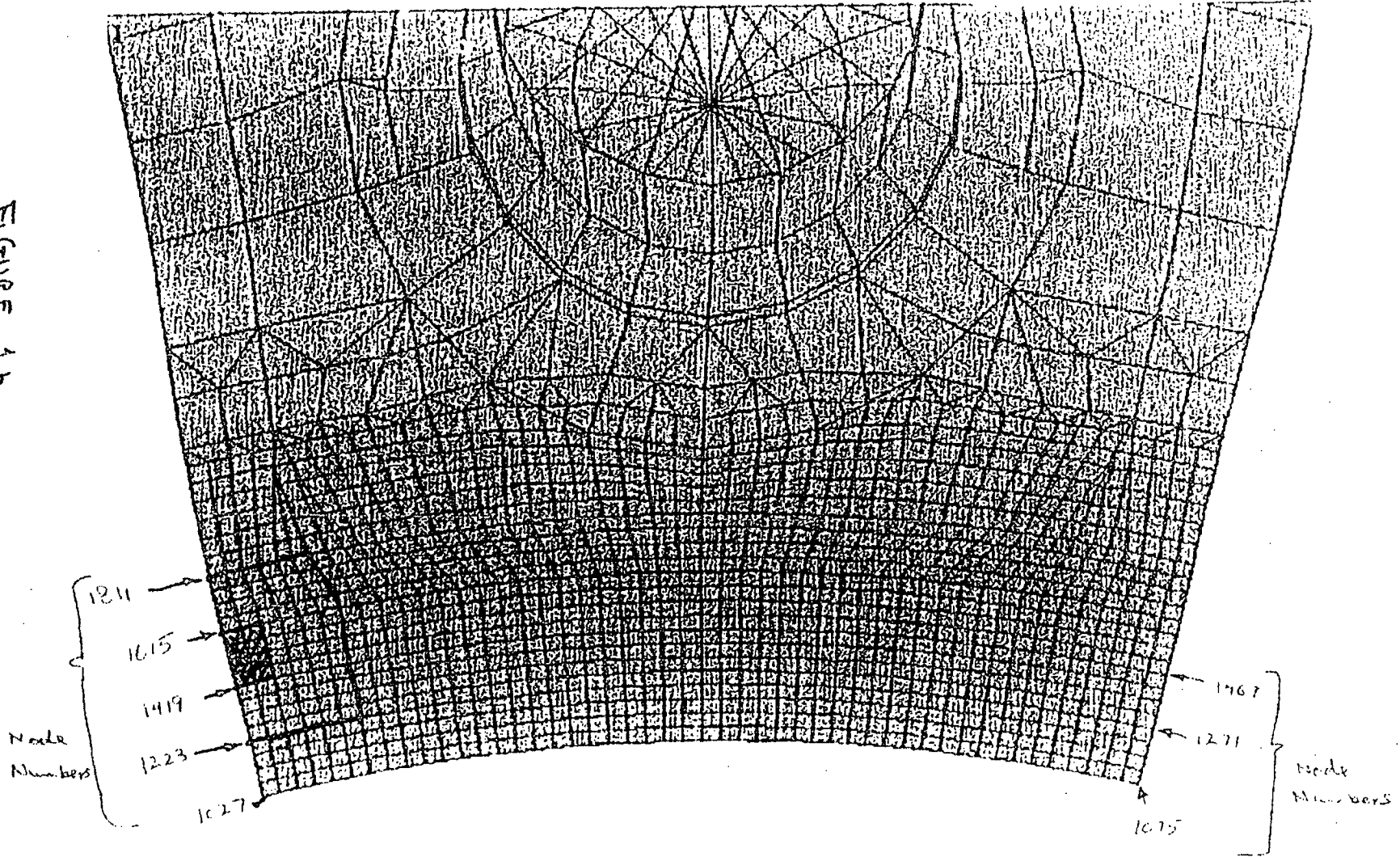


FIGURE 1a

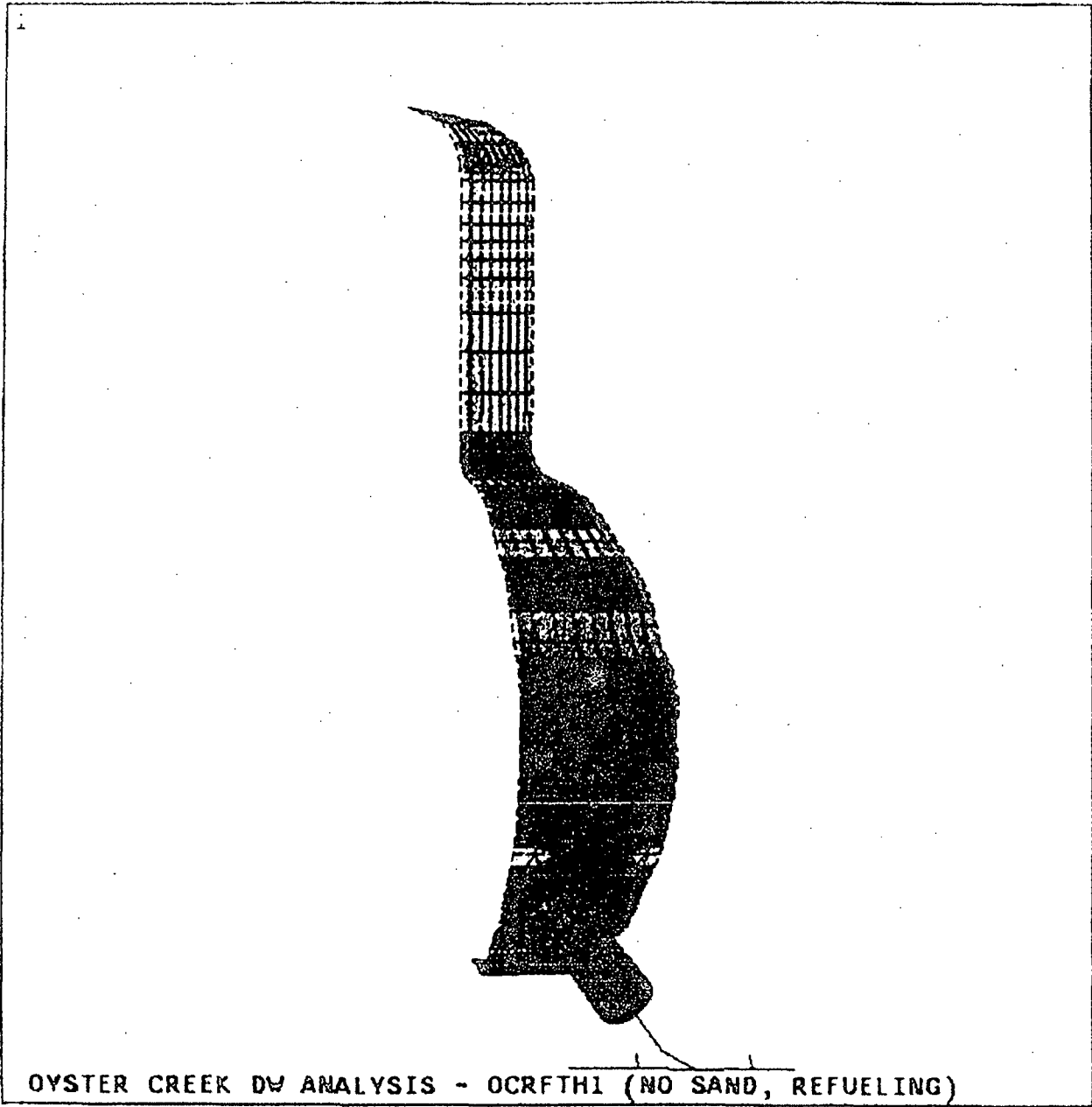
FIGURE 4b



980-2174



FIGURE 2



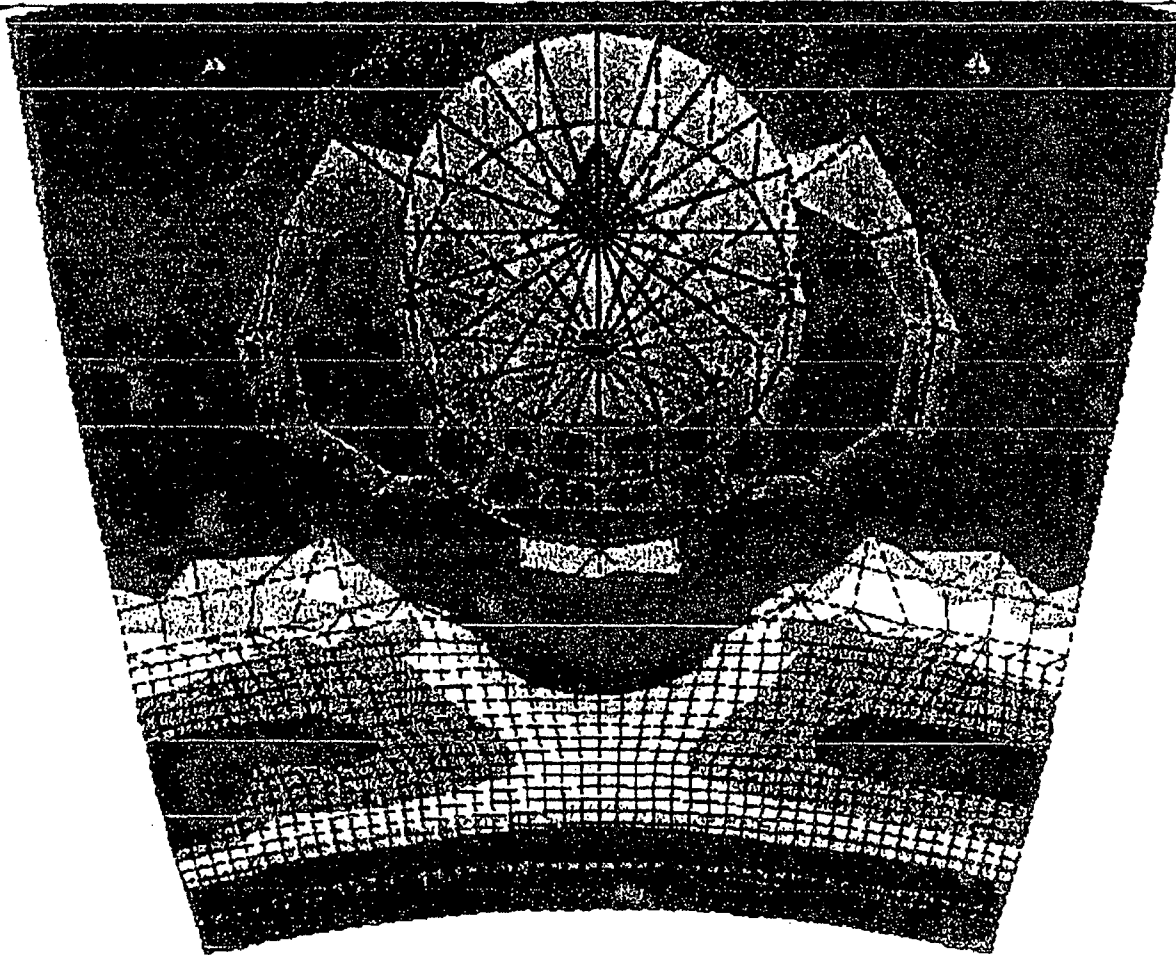
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SMN =-3561  
SMX =7614

XV =1  
YV =-0.8  
DIST=718.786  
XF =303.031  
ZF =639.498  
ANGZ=-90  
CENTROID HIDDEN

████████	-3561
████████	-2319
████████	-1078
████████	163.887
████████	1406
████████	2647
████████	3889
████████	5131
████████	6372
████████	7614

42 00-063

FIGURE 3



ANSYS 4.4A1  
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17:43:35  
POST1 STRESS  
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ITER=1  
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MIDDLE  
ELEM CS  
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SMM =-3561  
SMX =7614

XV -1  
ZV =-1  
\*DIST=121.539  
\*XF =46.39  
\*YF =-1.382  
\*ZF =382.857

ANGZ=-90  
CENTROID HIDDEN

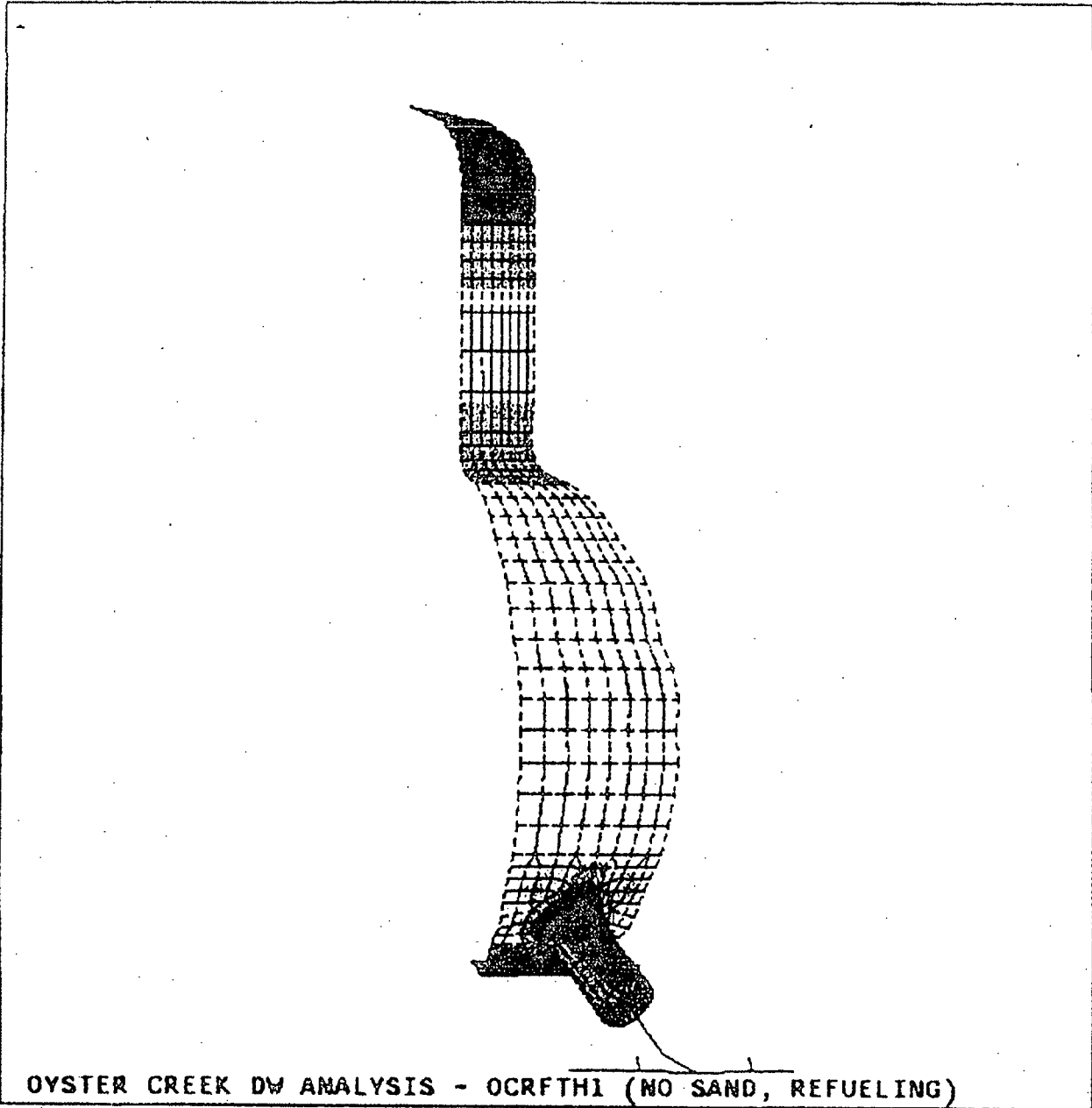
■	-3561
■	-2319
■	-1078
■	163.887
■	1406
■	2647
■	3889
■	5131
■	6372
■	7614

OYSTER CREEK DW ANALYSIS - OCRFTH1 (NO SAND, REFUELING)

02/29/92 16:25:36

930-2174

FIGURE 4

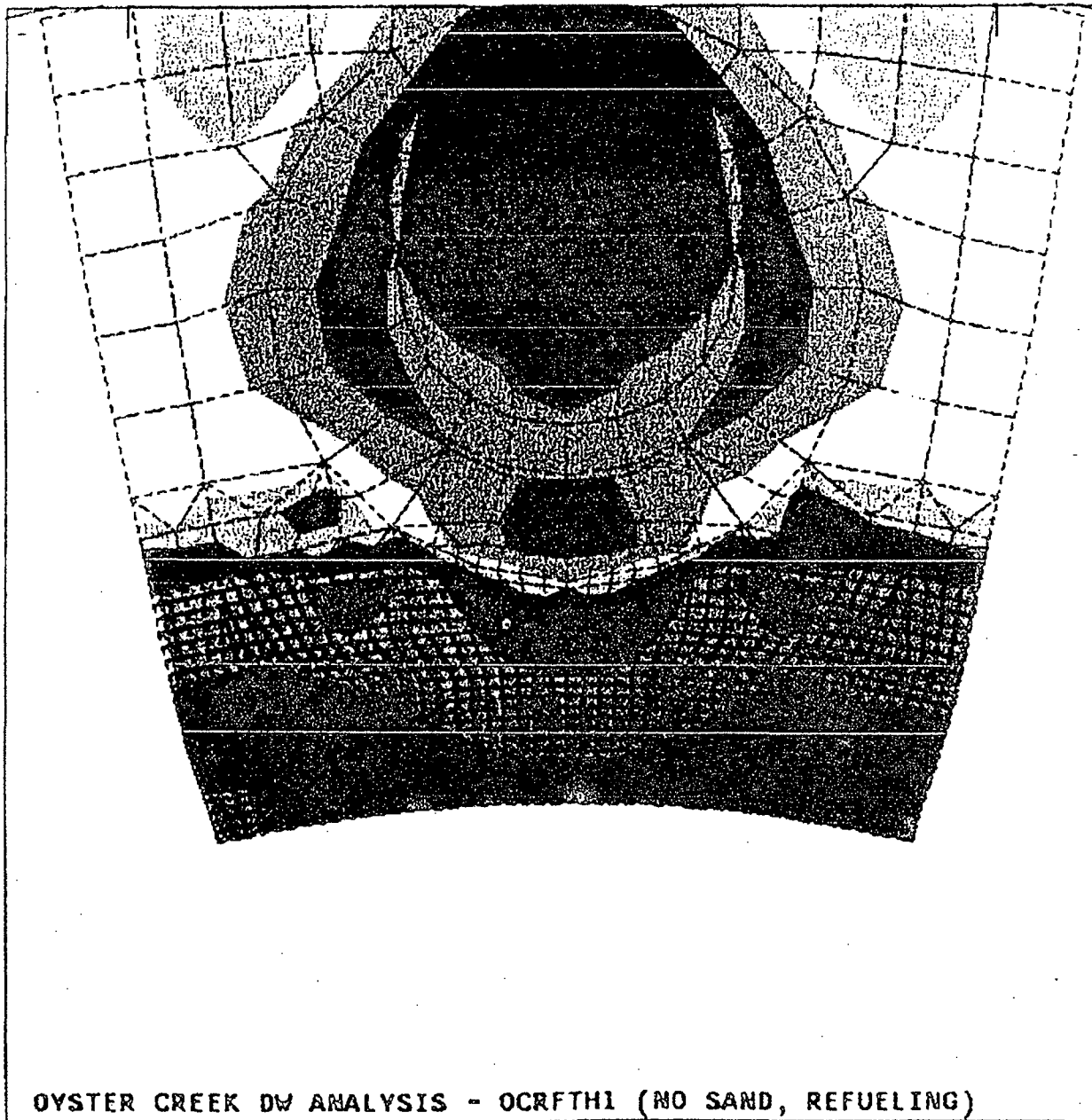


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MIDDLE  
ELEM CS  
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SMN =-9943  
SMX =701.049  
  
XV =1  
YV =-0.8  
DIST=718.786  
XF =303.031  
ZF =639.498  
ANGZ=-90  
CENTROID.HIDDEN  
-9943  
-8760  
-7577  
-6395  
-5212  
-4030  
-2847  
-1664  
-481.591  
701.049

418.036

5/26/95 11:28:10

FIGURE 5



ANSYS 4.4A1  
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 17:43:49  
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 STEP=1  
 ITER=1  
 SY (AVG)  
 MIDDLE  
 ELEM CS  
 DMX =0.222715  
 SMN =-9943  
 SMX =701.049

XV =1  
 ZV =-1  
 \*DIST=121.539  
 \*XF =46.39  
 \*YF =-1.382  
 \*ZF =382.857  
 ANGZ=-90  
 CENTROID HIDDEN

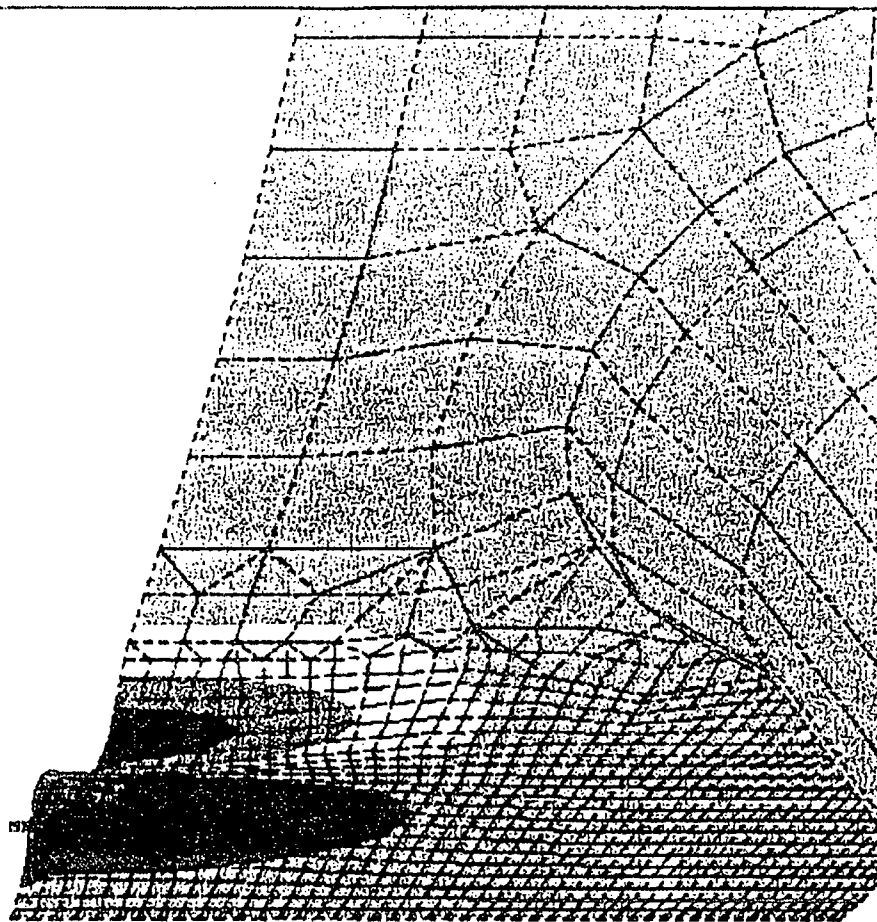
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████████	-8760
████████	-7577
████████	-6395
████████	-5212
████████	-4030
████████	-2847
████████	-1664
████████	-481.591
████████	701.049

OYSTER CREEK DW ANALYSIS - OCRFTH1 (NO SAND, REFUELING)

980-2174

31/20/92 14:23:06

FIGURE 6



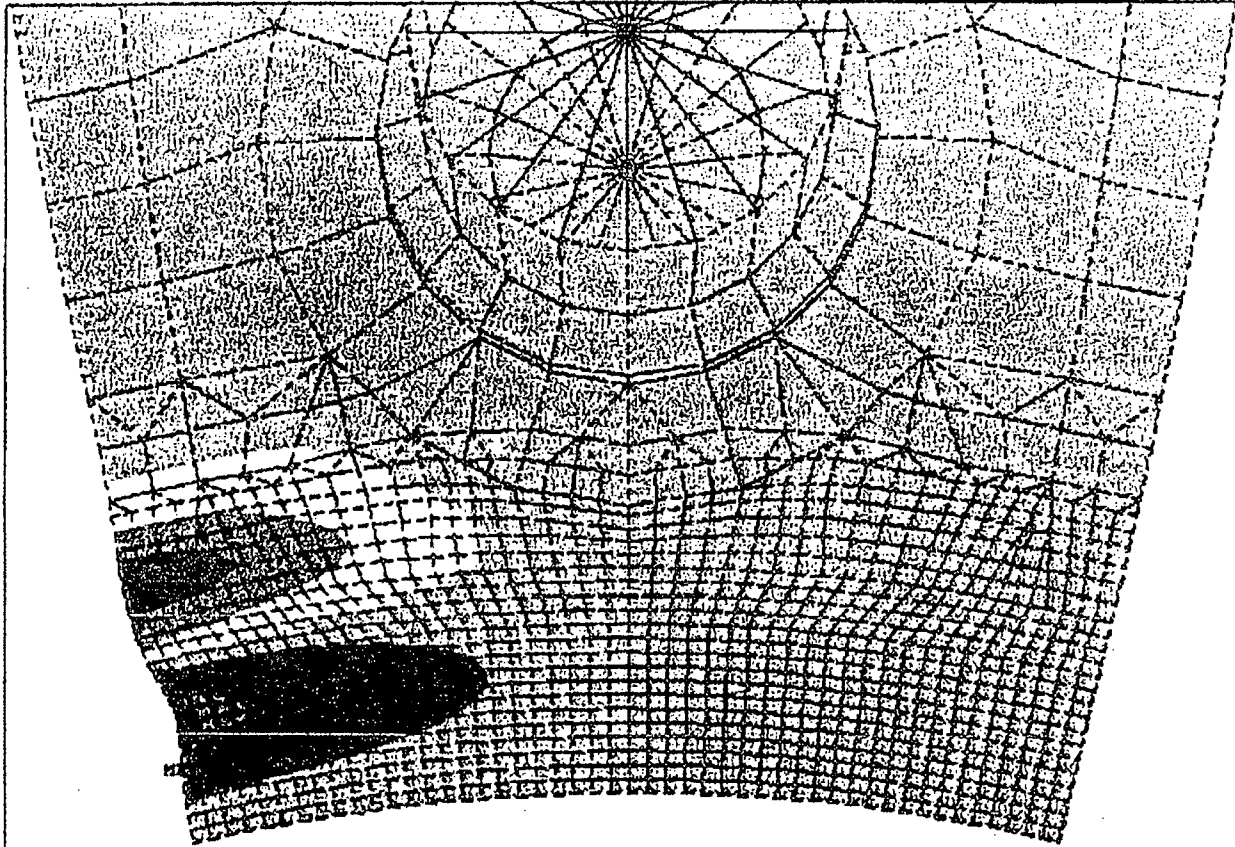
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SMN =-0.006072  
SMX =0.00345  
  
XV =1  
YV =-0.8  
\*DIST=89.401  
\*XF =262.142  
\*YF =-51.111  
\*ZF =148.214  
ANGZ=-90  
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-0.005014  
-0.003956  
-0.002898  
-0.00184  
-0.782E-03  
0.276E-03  
0.001334  
0.002392  
0.00345

OYSTER CREEK DRYWELL ANALYSIS - OCRF05BSS (NO SAND, REFUELING)

480.2174

02/20/93 1:05:08

FIGURE 7

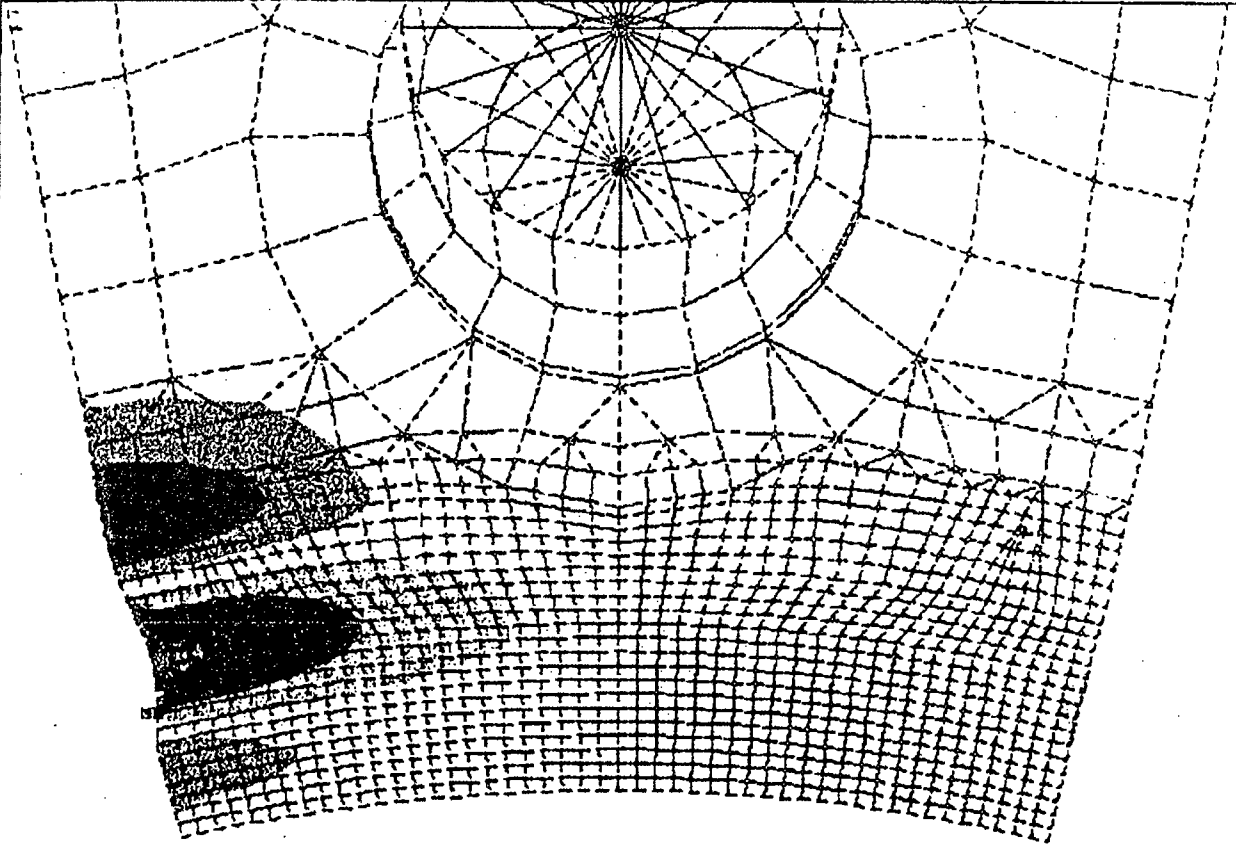


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ITER=1  
FACT=5.562  
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D NODAL  
DMX =0.006073  
SMN =-0.006072  
SMX =0.00345  
  
XV -1  
ZV --1  
\*DIST=110.004  
\*XF -29.455  
\*YF =0.460954  
\*ZF =-365.922  
ANGZ=-90  
CENTROID HIDDEN  
-0.006072  
-0.005014  
-0.003956  
-0.002898  
-0.00184  
-0.782E-03  
0.276E-03  
0.001334  
0.002392  
0.00345

OYSTER CREEK DRYWELL ANALYSIS - OCRF05BSS (NO SAND, REFUELING)

hcr.03h

FIGURE 8



ANSYS 4.4A1  
 DEC 10 1992  
 8:10:04  
 POST1 STRESS  
 STEP=1  
 ITER=2  
 FACT=5.872  
 UX  
 D NODAL  
 DMX =-0.006414  
 SMN =-0.006414  
 SMX =0.002261

XV =1  
 ZV =-1  
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 \*XF =-29.455  
 \*YF =-0.460954  
 \*ZF =-365.922  
 ANGZ=-90

CENTROID HIDDEN

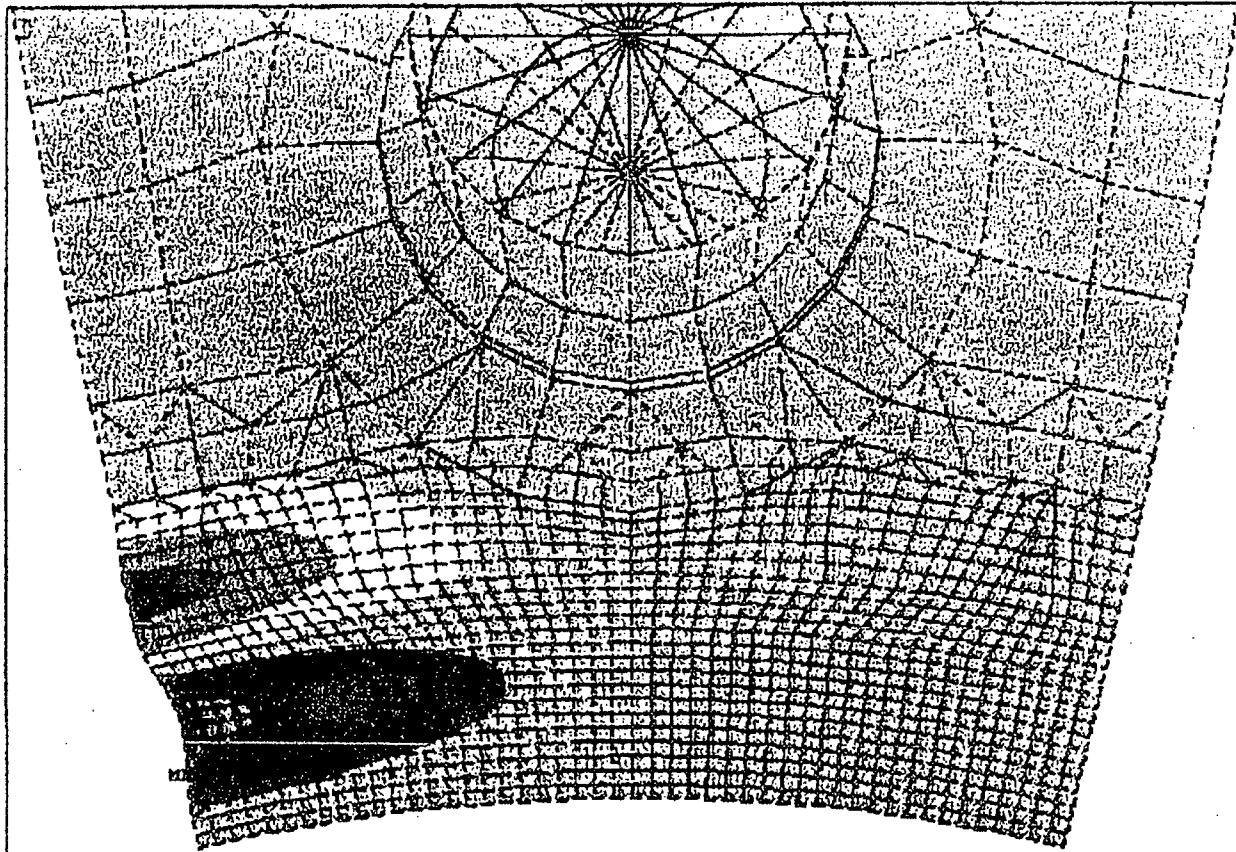
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████████	0.001297
████████	0.002261

12/20/92 16:25:06

980-2174

OCRF05BSS  
 OYSTER CREEK DRYWELL ANALYSIS - ~~OCRF05BSS~~ (NO SAND, REFUELING)











FIGURE 9



ANSYS 4.4A1  
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ITER=1  
FACT=5.58  
UX  
D NODAL  
DMX =0.005974  
SMN =-0.005972  
SMX =0.003682

XV =1  
ZV =-1  
°DIST=110.004  
°XF =29.455  
°YF =0.460954  
°ZF =-365.922  
ANGZ=-90

CENTROID HIDDEN

	-0.005972
	-0.0049
	-0.003827
	-0.002754
	-0.001681
	-0.609E-03
	0.464E-03
	0.001537
	0.00261
	0.003682

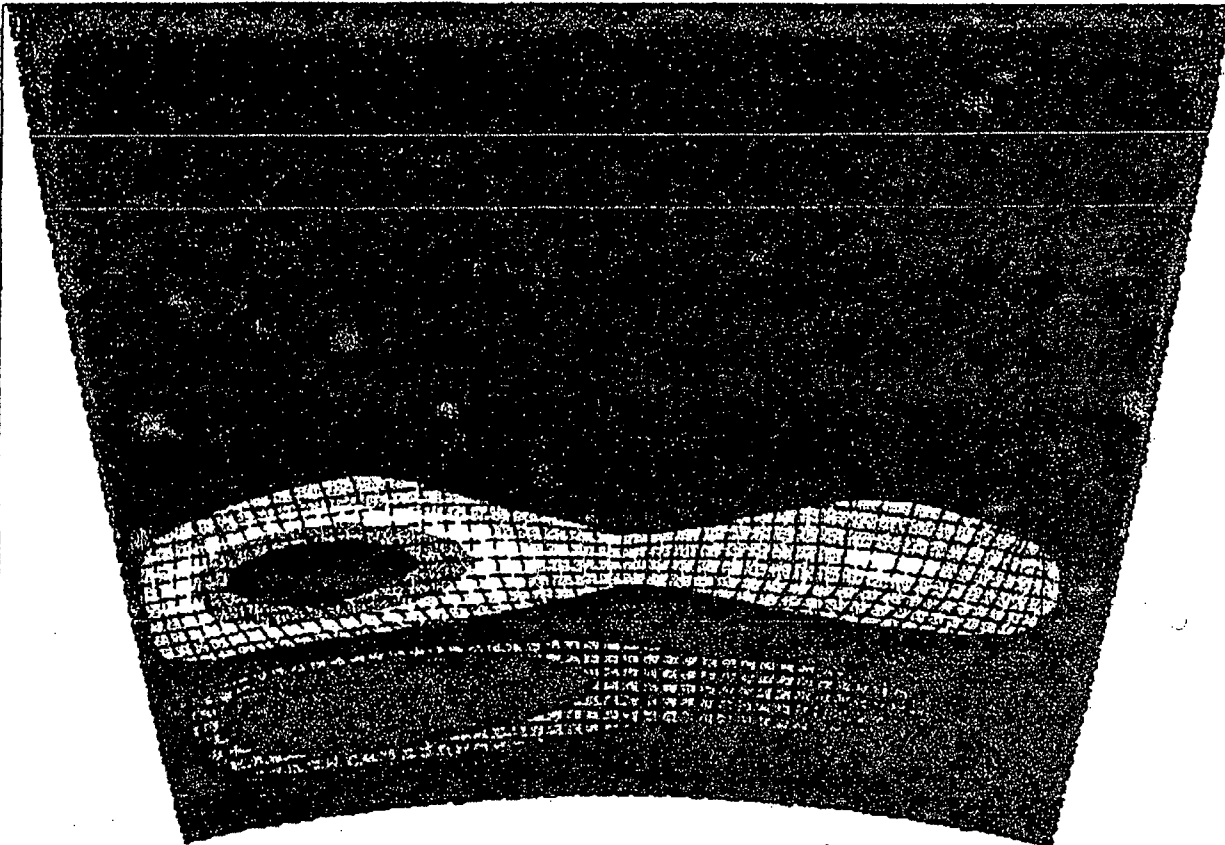
OYSTER CREEK DV ANALYSIS - OCRF05AS (NO SAND, REFUELING)

03/28/96 16:23:05

450-2/74



FIGURE 10

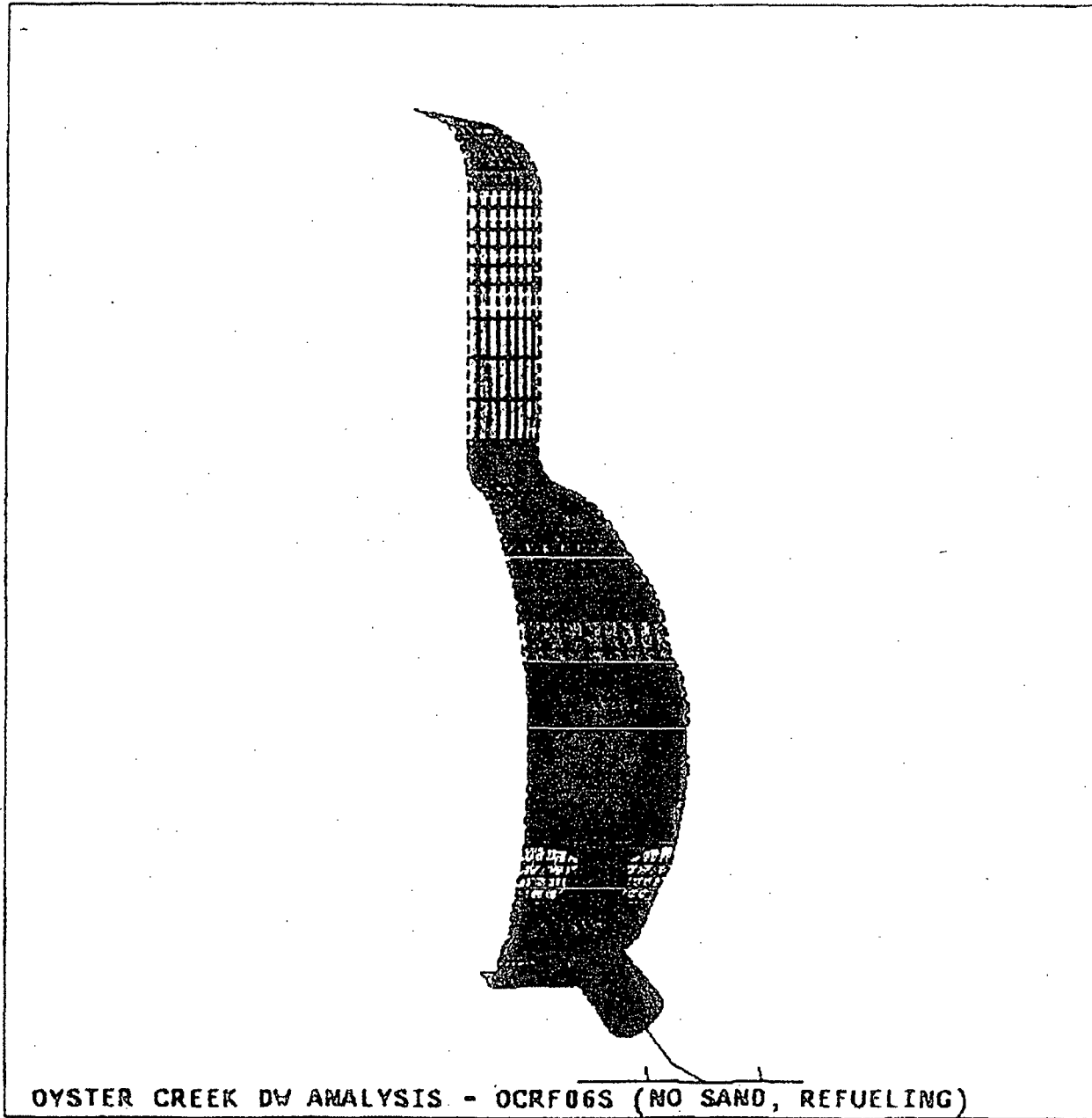


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SMN =-0.002088  
SMX =0.002164  
  
XV =1  
ZV =-1  
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\*XF =-29.455  
\*YF =0.460954  
\*ZF =-365.922  
ANGZ=-90  
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0.747E-03  
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0.001691  
0.002164

OYSTER CREEK DW ANALYSIS - OCRF05AA (NO SAND, REFUELING)

990-2174

FIGURE 11



ANSYS 4.4A1  
DEC 10 1992  
8:18:30  
POST1 STRESS  
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SMX =6950

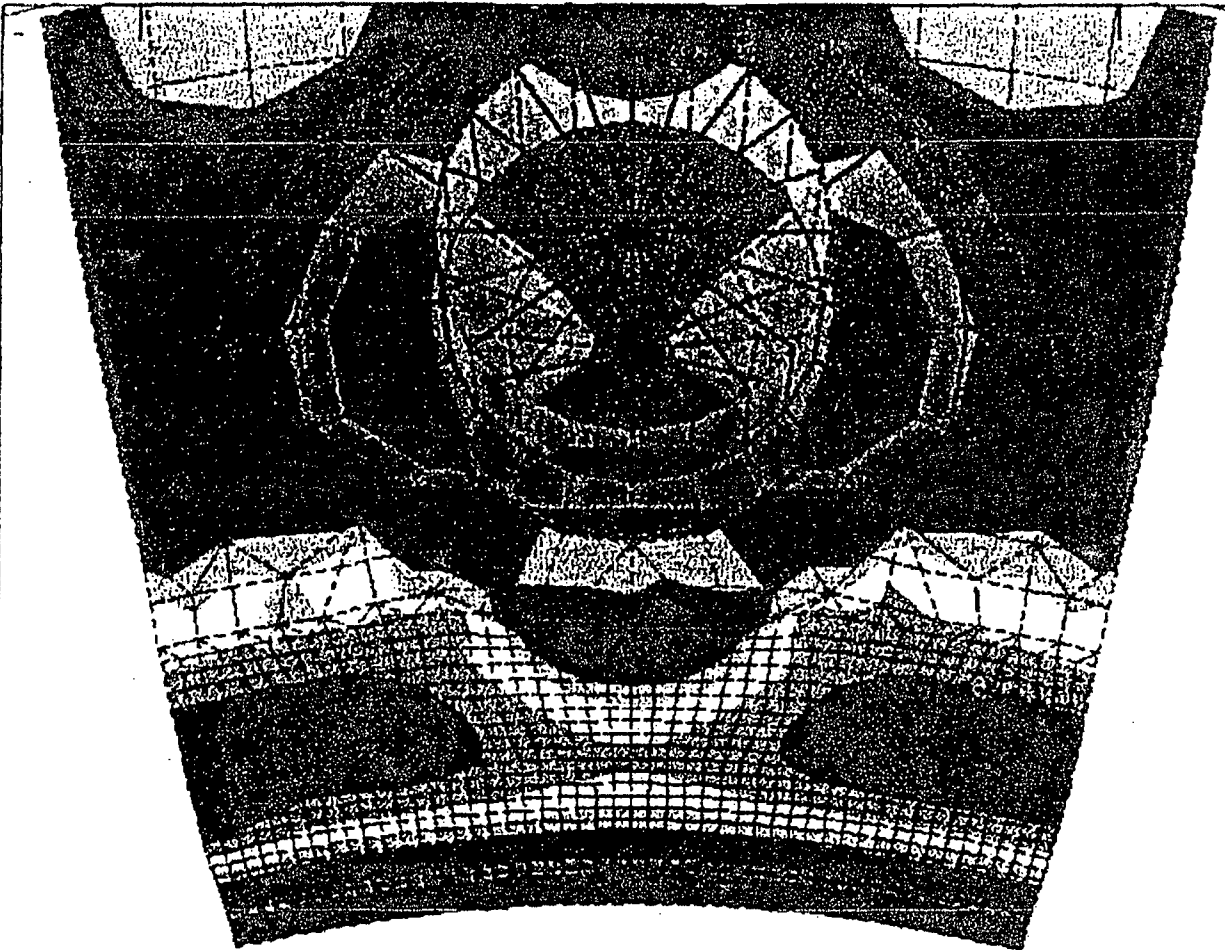
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YV =-0.8  
DIST=718.786  
XF =303.031  
ZF =639.498  
ANGZ=-90  
CENTROID HIDDEN

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█	-2387
█	-1220
█	-52.809
█	1114
█	2281
█	3448
█	4615
█	5783
█	6950

03/26/98 14:25:08

490-2174

FIGURE 12



ANSYS 4.4A1  
DEC 10 1992  
8:21:15  
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ITER-1  
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ELEM CS  
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SMN =-3554  
SMX =6950

XV =1  
ZV =-1  
\*DIST=121.539  
\*XF =46.39  
\*YF =-1.382  
\*ZF =382.857

ANGZ=-90

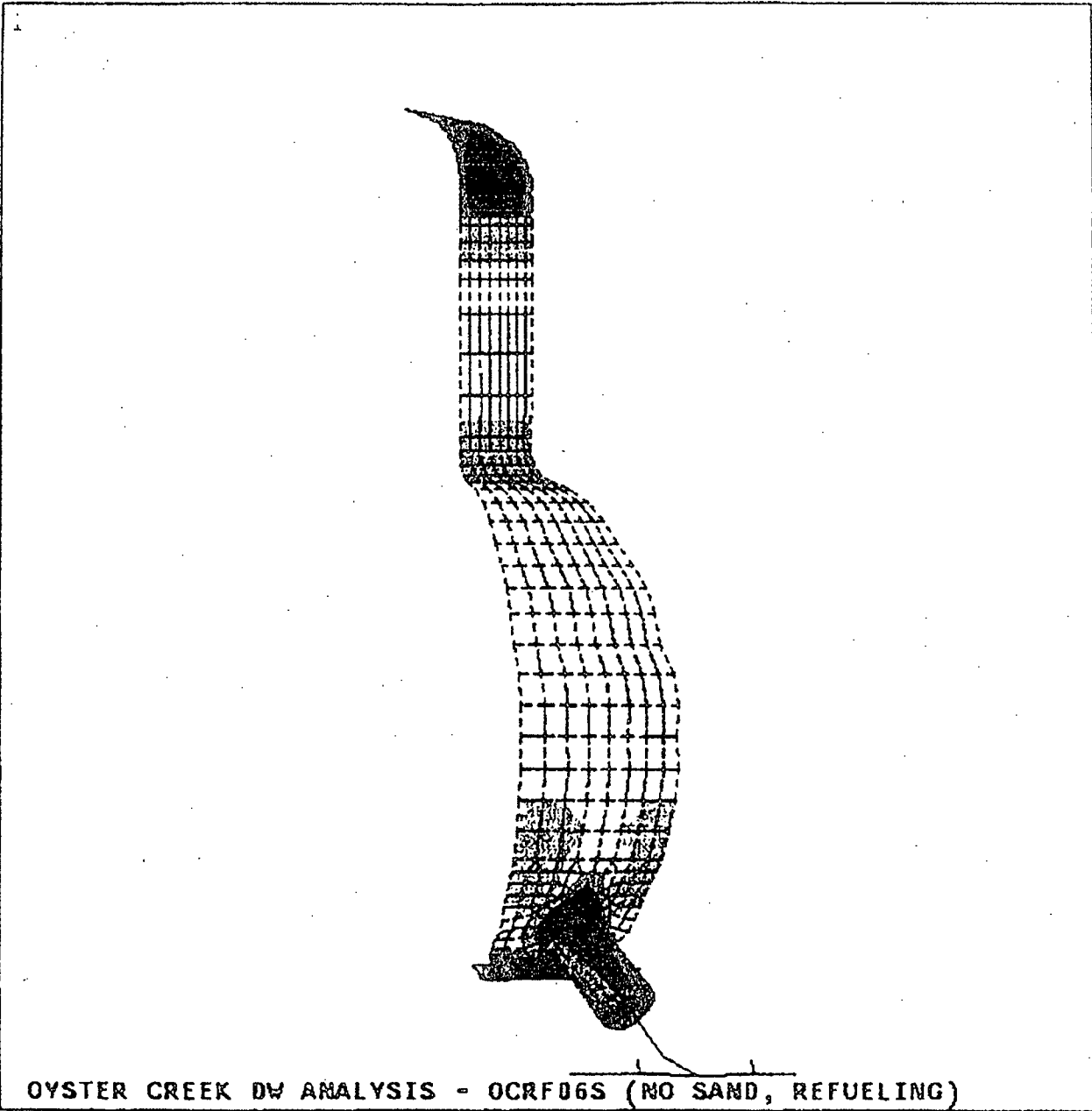
CENTROID HIDDEN

■	-3554
■	-2387
■	-1220
■	-52.809
■	1114
■	2281
■	3448
■	4615
■	5783
■	6950

OYSTER CREEK DW ANALYSIS - OCRF06S (NO SAND, REFUELING)

996-2174

FIGURE 13



ANSYS 4.4A1  
DEC 10 1992  
8:18:45  
POST1 STRESS  
STEP-1  
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SY (AVG)  
MIDDLE  
ELEM CS  
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SMN =-8767  
SMX =694.653

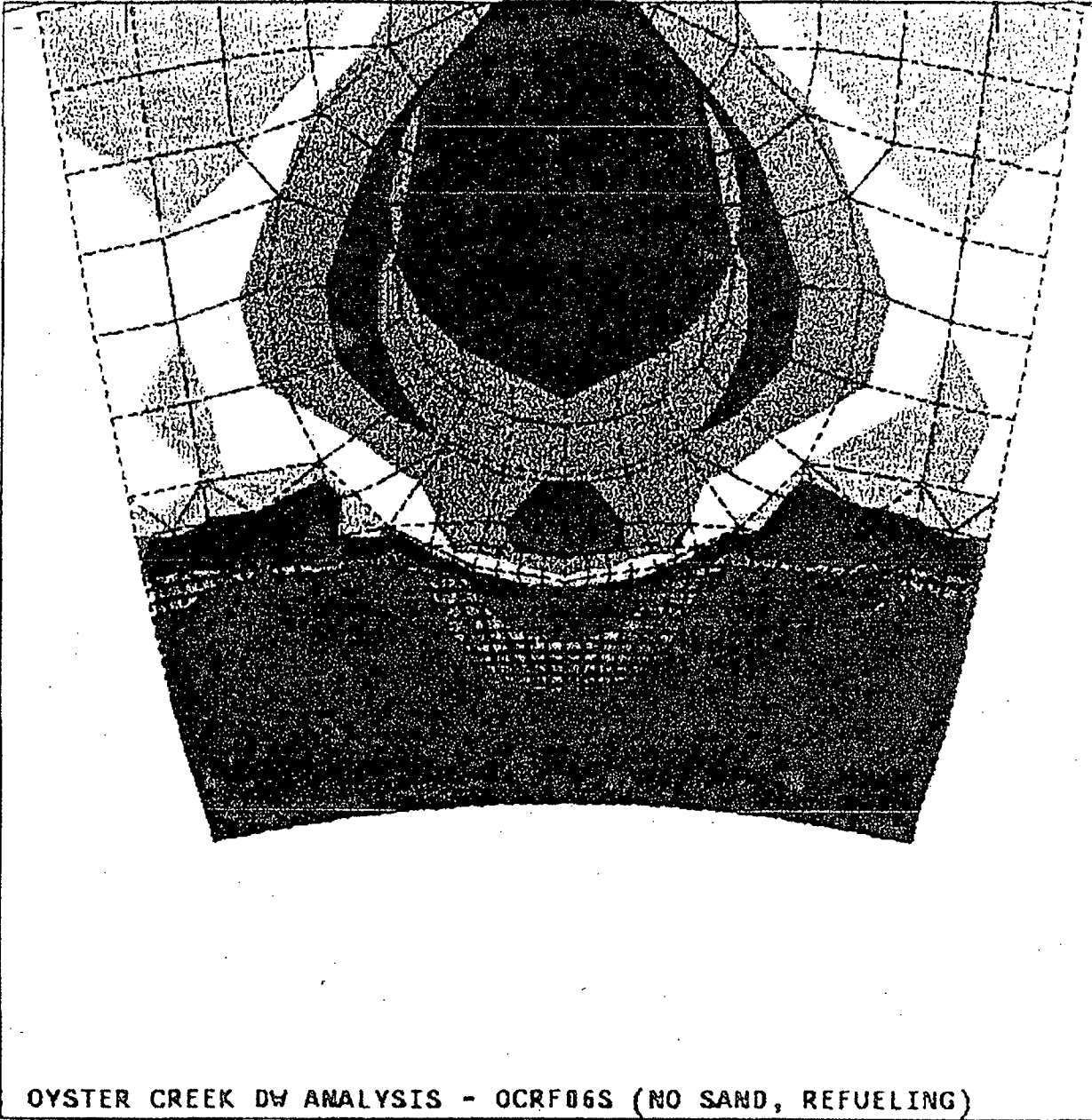
XV =1  
YV =-0.8  
DIST=718.786  
XF =303.031  
ZF =639.498  
ANGZ=-90  
CENTROID HIDDEN

████████	-8767
████████	-7716
████████	-6664
████████	-5613
████████	-4562
████████	-3511
████████	-2459
████████	-1408
████████	-356.637
████████	694.653

993-2174

05/20/92 1:51:50

FIGURE 14

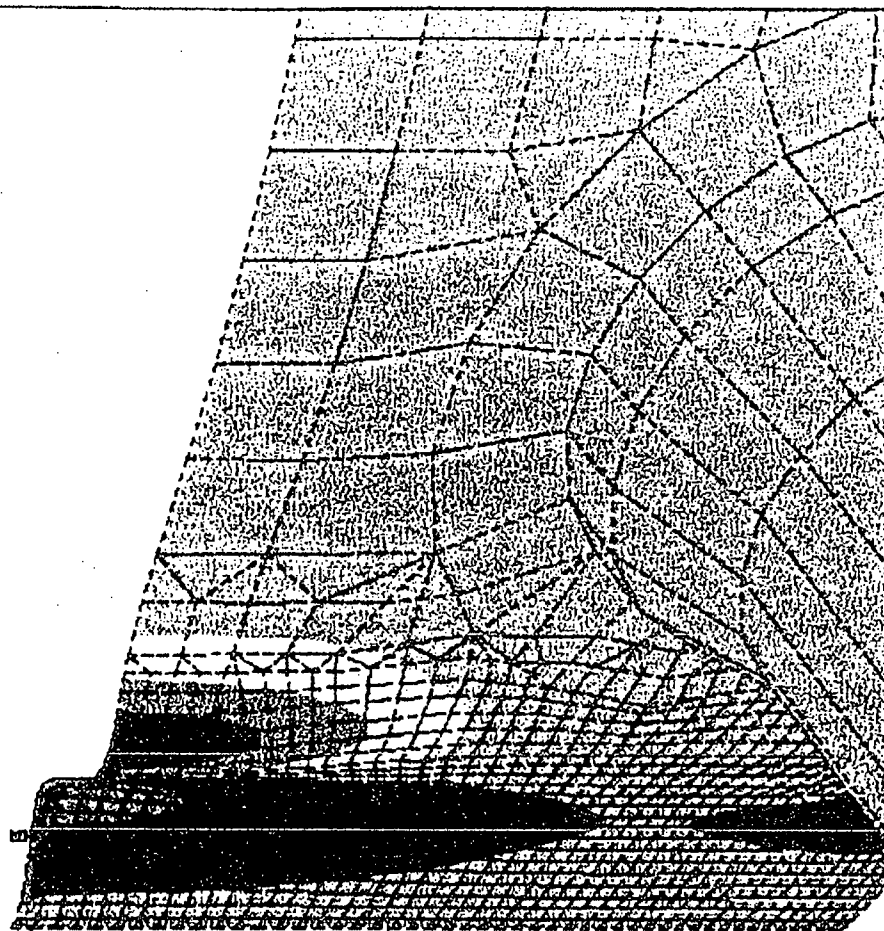


ANSYS 4.4A1  
DEC 10 1992  
8:21:30  
POST1 STRESS  
STEP=1  
ITER=1  
SY (AVG)  
MIDDLE  
ELEM CS  
DMX =0.222456  
SMN =-8767  
SMX =694.653

XV -1  
ZV --1  
\*DIST=121.539  
\*XF -46.39  
\*YF --1.382  
\*ZF =382.857  
ANGZ--90  
CENTROID HIDDEN  
-8767  
-7716  
-6664  
-5613  
-4562  
-3511  
-2459  
-1408  
-356.637  
694.653

990-2174

FIGURE 15



ANSYS 4.4A1  
 DEC 10 1992  
 10:36:45  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 FACT=5.91  
 UX  
 D NODAL  
 DMX =-0.005175  
 SMN =-0.005174  
 SMX =-0.00326

XV =-1  
 YV =-0.8  
 DIST=89.401  
 XF =-262.142  
 YF =-51.111  
 ZF =-148.214  
 ANGZ=-90

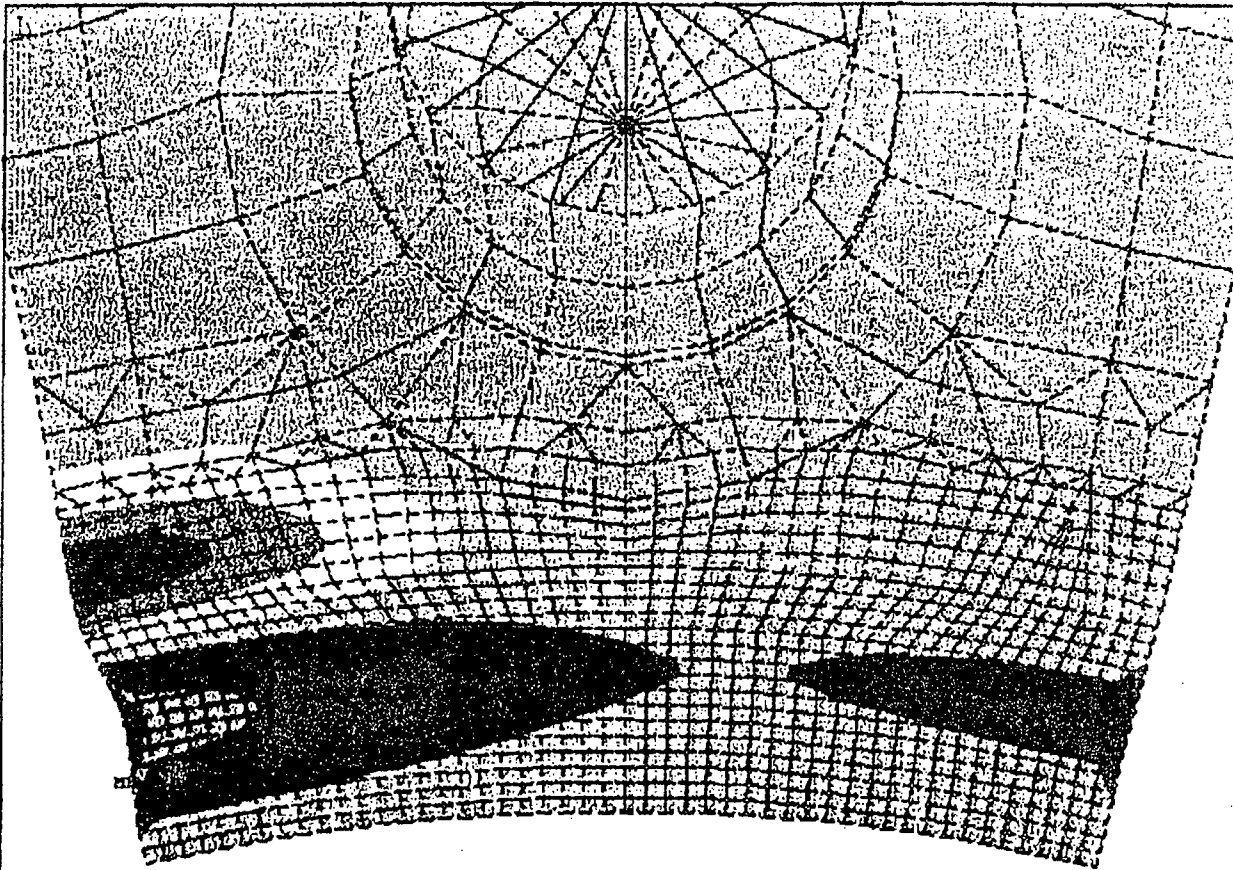
CENTROID HIDDEN

[Dark Gray Box]	-0.005174
[Medium-Dark Gray Box]	-0.004237
[Medium Gray Box]	-0.0033
[Light Gray Box]	-0.002362
[White Box]	-0.001425
[Dark Gray Box]	-0.488E-03
[White Box]	0.449E-03
[Light Gray Box]	0.001386
[Medium Gray Box]	0.002323
[Dark Gray Box]	0.00326

OYTER CREEK DRYWELL ANALYSIS - OCRF06BSS (NO SAND, REFUELING)

430-2074

FIGURE 16



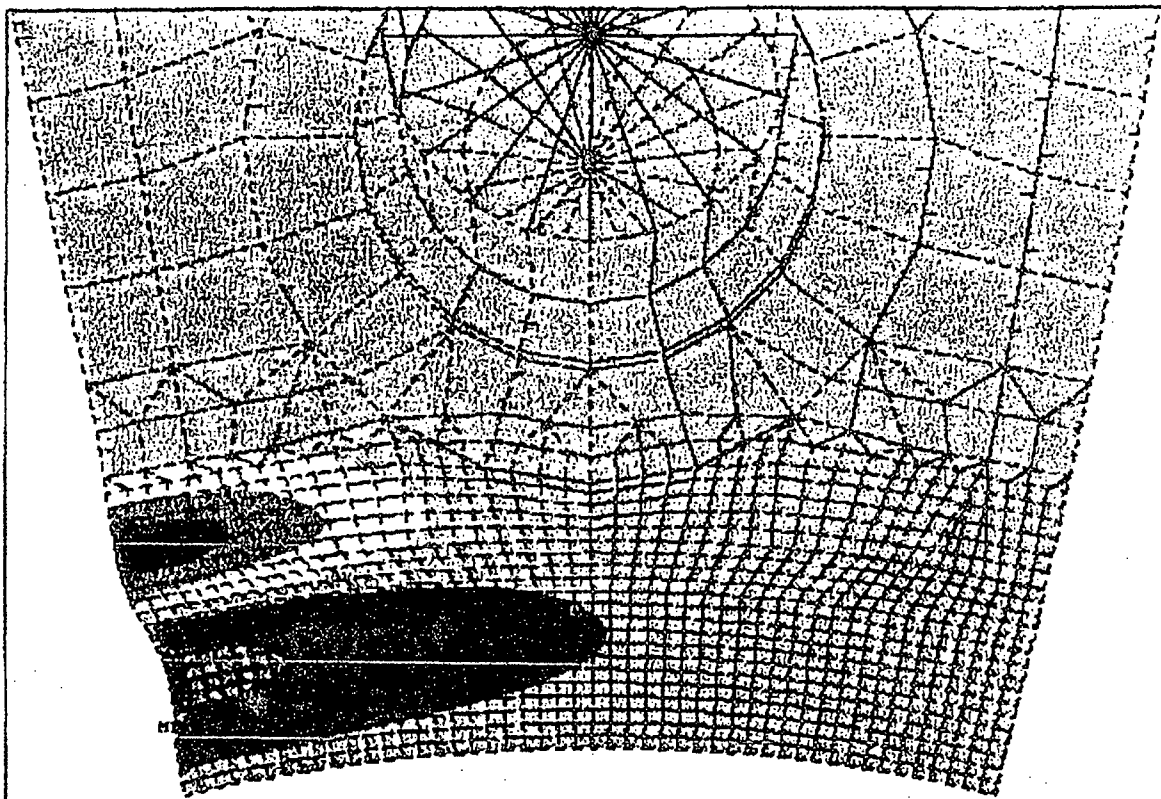
ANSYS 4.4A1  
DEC 10 1992  
10:37:56  
POST1 STRESS  
STEP=1  
ITER=1  
FACT=5.91  
UX  
D NODAL  
DMX =-0.005175  
SMN =-0.005174  
SMX =0.00326  
  
XV =-1  
ZV =-1  
\*DIST=100.004  
\*XF =-29.455  
\*YF =-0.460954  
\*ZF =-365.922  
ANGZ=-90  
CENTROID HIDDEN  
-0.005174  
-0.004237  
-0.0033  
-0.002362  
-0.001425  
-0.488E-03  
0.449E-03  
0.001386  
0.002323  
0.00326

OYTER CREEK DRYWELL ANALYSIS - OCRF06BSS (NO SAND, REFUELING)

990 - 2174

01/20/98 16:23:03

FIGURE 17



ANSYS 4.4A1  
DEC 10 1992  
16:48:07  
POST1 STRESS  
STEP=1  
ITER=1  
FACT=5.945  
UX  
D NODAL  
DMX =-0.005178  
SMN =-0.005177  
SMX =0.003584

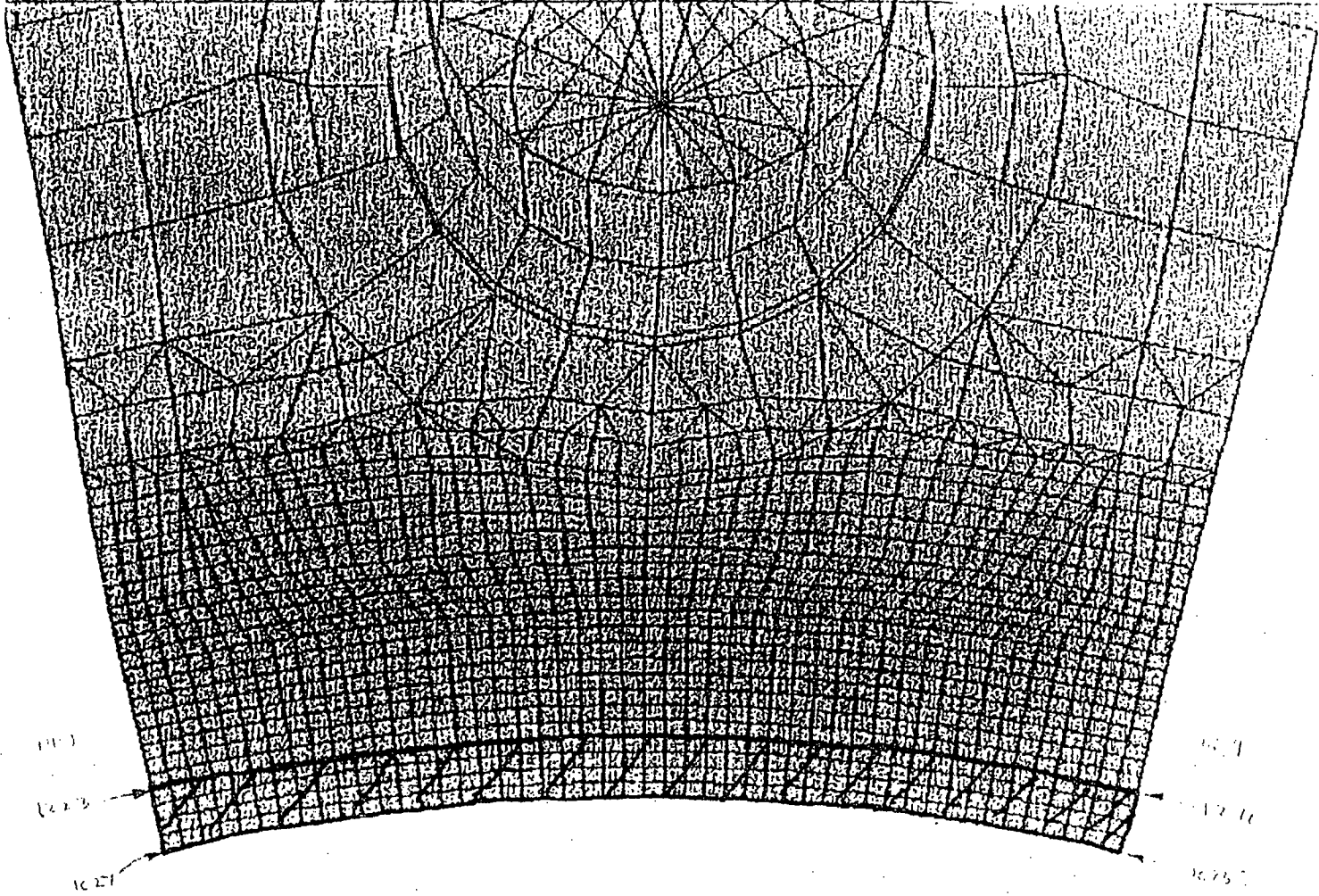
XV =1  
ZV =-1  
\*DIST=110.004  
\*XF =29.455  
\*YF =0.460954  
\*ZF =365.922  
ANGZ=-90  
CENTROID HIDDEN  
-0.005177  
-0.004203  
-0.00323  
-0.002256  
-0.001283  
-0.310E-03  
0.664E-03  
0.001637  
0.002611  
0.003584

OYSTER CREEK DW ANALYSIS - DCRF06AS (NO SAND, REFUELING)

985-2174



FIGURE 18



13.21  
12.22  
11.11

10.10  
9.09  
8.08

990 - 2174

FIGURE 19



OYSTER CREEK DRYWELL ANALYSIS - OYCRIS (NO SAND, REFUELING)

ANSYS 4.4A1  
DEC 7 1992  
12:44:31  
POST1 STRESS  
STEP=1  
ITER=1  
SX (AVG)  
MIDDLE  
ELEM CS  
DMX =0.211959  
SMN =-3547  
SMX =6041

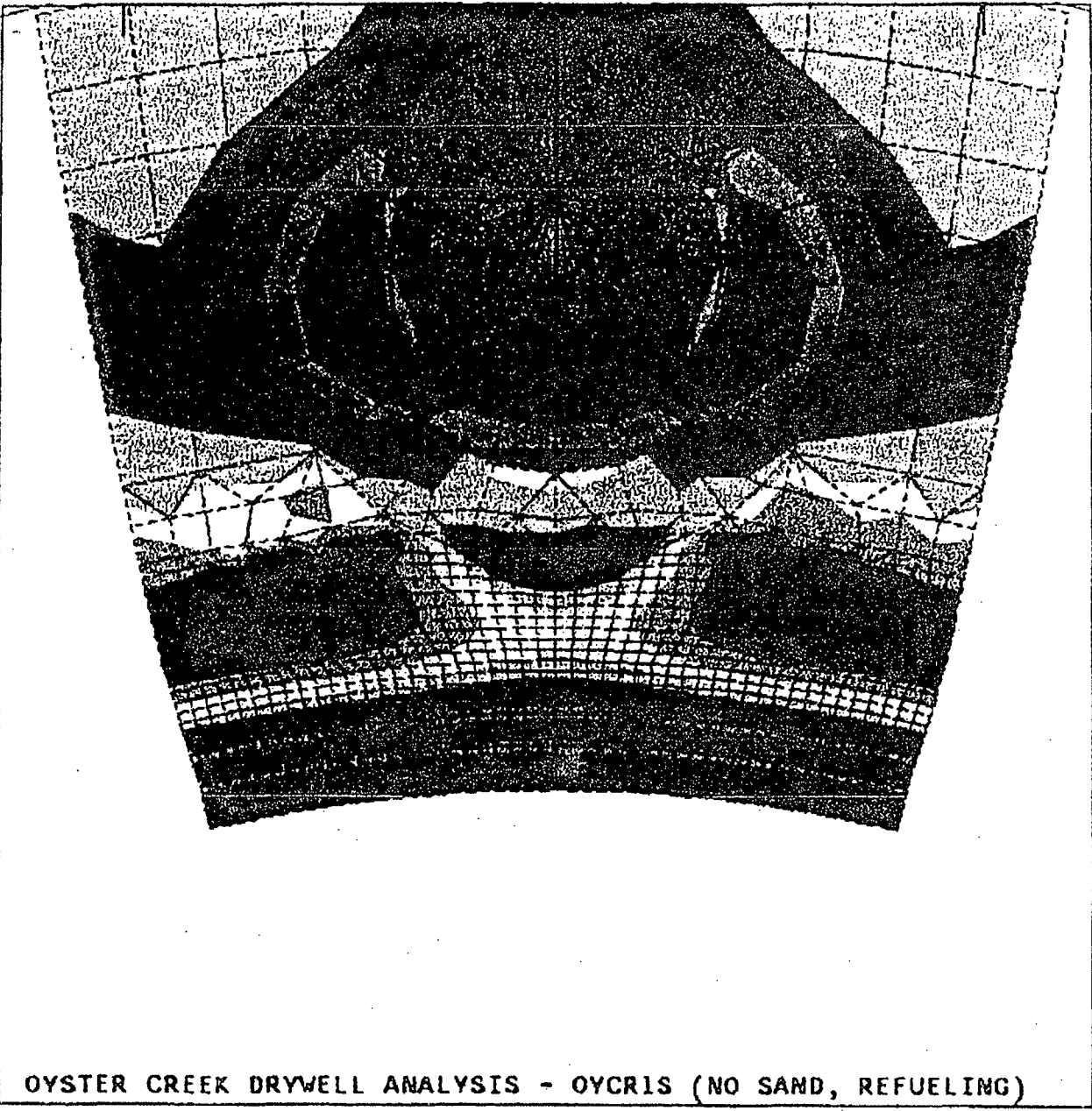
XV =1  
YV =-0.8  
DIST=718.786  
XF =-303.031  
ZF =639.498  
ANGZ=-90  
CENTROID HIDDEN

[Dark pattern]	-3547
[Dark pattern]	-2482
[Dark pattern]	-1416
[Dark pattern]	-350.884
[Dark pattern]	714.437
[Dark pattern]	1780
[Dark pattern]	2845
[Light pattern]	3910
[Dark pattern]	4976
[Dark pattern]	6041

03/20/78 14:12:10

946-2174

FIGURE 20

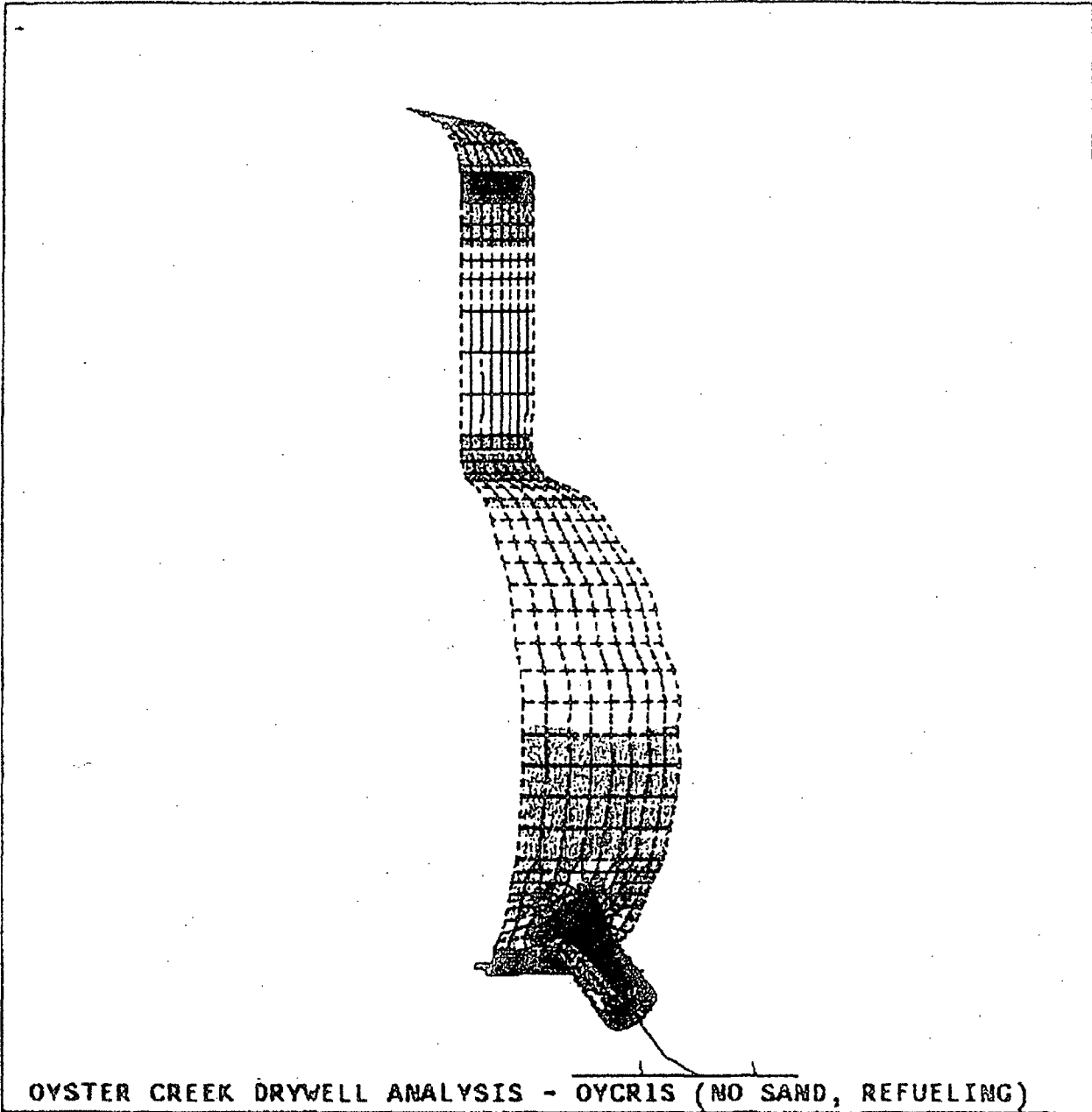


ANSYS 4.4A1  
DEC 7 1992  
12:33:33  
POST1 STRESS  
STEP=1  
ITER=1  
SX (AVG)  
MIDDLE  
ELEM CS  
DMX =0.211959  
SMN =-3547  
SMX =6041

XV =1  
ZV =-1  
\*DIST=121.539  
\*XF =46.39  
\*YF =-1.382  
\*ZF =-382.857  
ANGZ=-90  
CENTROID HIDDEN  
-3547  
-2482  
-1416  
-350.884  
714.437  
1780  
2845  
3910  
4976  
6041

980-2174

FIGURE 21



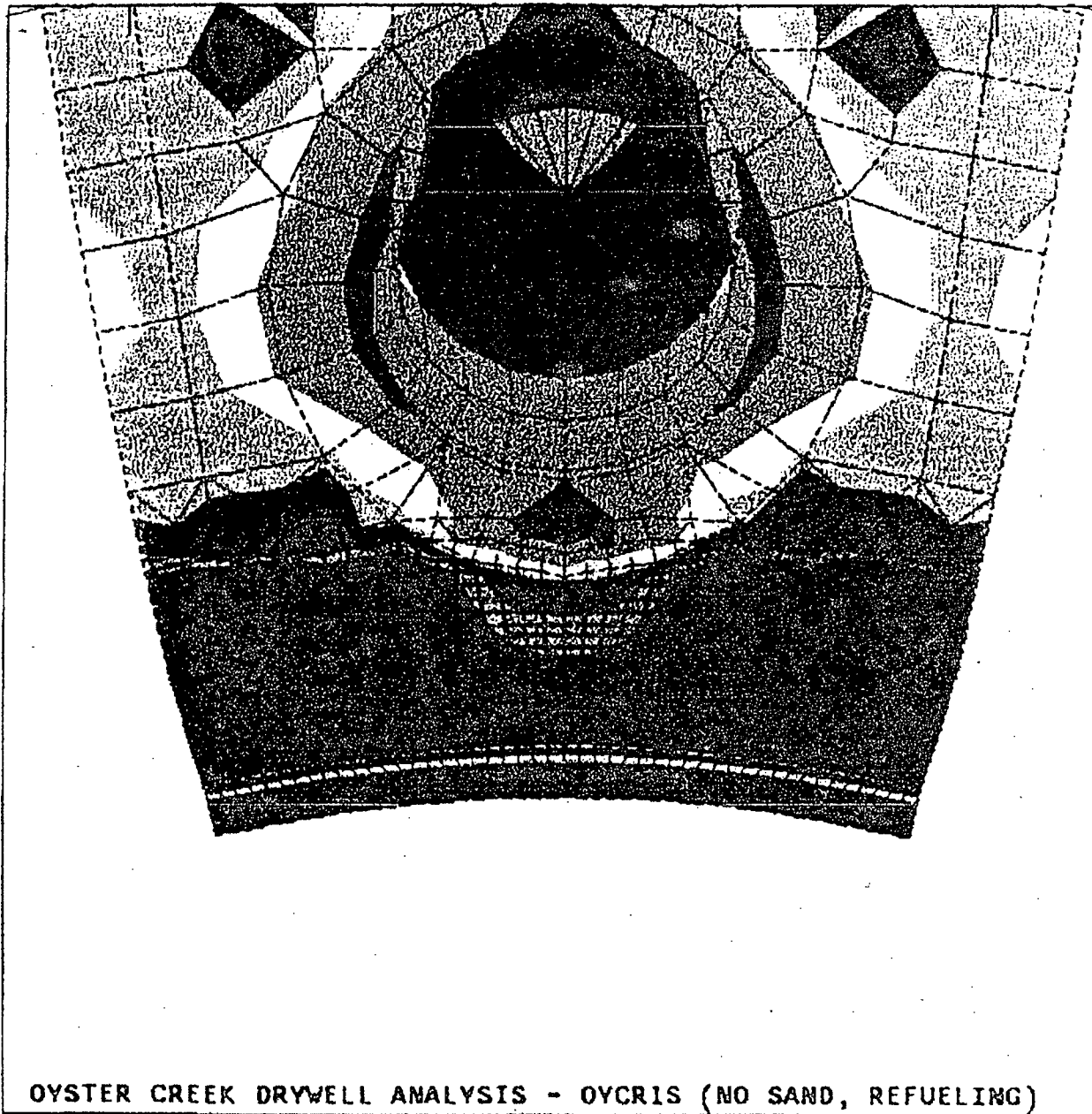
```
ANSYS 4.4A1
DEC 7 1992
12:44:44
POST1 STRESS
STEP=1
ITER=1
SY (AVG)
MIDDLE
ELEM CS
DMX =0.211959
SMN =-7956
SMX =766.953

XV =1
YV =-0.8
DIST=718.786
XF =303.031
ZF =639.498
ANGZ=-90
CENTROID HIDDEN
-7956
-6987
-6018
-5049
-4079
-3110
-2141
-1172
-202.301
766.953
```

990-2179

03/20/05 14:28:08

FIGURE 22



ANSYS 4.4A1  
DEC 7 1992  
12:34:18  
POST1 STRESS  
STEP=1  
ITER=1  
SY (AVG)  
MIDDLE  
ELEM CS  
DMX =0.211959  
SMN =-7956  
SMX =766.953

XV =1  
ZV =-1  
\*DIST=121.539  
\*XF =46.39  
\*YF =-1.382  
\*ZF =-382.857  
ANGZ=-90  
CENTROID HIDDEN  
-7956  
-6987  
-6018  
-5049  
-4079  
-3110  
-2141  
-1172  
-202.301  
766.953

OYSTER CREEK DRYWELL ANALYSIS - OYCRIS (NO SAND, REFUELING)

440-2174

996-2174

APPLIED MERIDIONAL AND CIRCUMFERENTIAL STRESSES - REFUELING CONDITION  
ONE FOOT INCREASE IN FIXITY CASE; STRESS RUN: OCRFRLSB.OUT

AVERAGE APPLIED MERIDIONAL STRESS:

The average meridional stress is defined as the average stress across the elevation including nodes 1419 through 1467. Stresses at nodes 1419 and 1467 are weighted only one half as much as the other nodes because they lie on the edge of the modeled 1/10th section of the drywell and thus represent only 1/2 of the area represented by the other nodes.

Nodes	# of Nodes	Meridional Stress (ksi)	# of Nodes
			x
			Meridional
			Stress (ksi)
1419-1467	1	-7.726	-7.726
1423-1463	2	-7.738	-15.476
1427-1459	2	-7.760	-15.520
1431-1455	2	-7.682	-15.364
1435-1451	2	-7.394	-14.788
1439-1447	2	-7.014	-14.028
1443	1	-6.834	-6.834
Total:			-89.736
			12
Average Meridional Stress:			-7.478 (ksi)

AVERAGE APPLIED CIRCUMFERENTIAL STRESS:

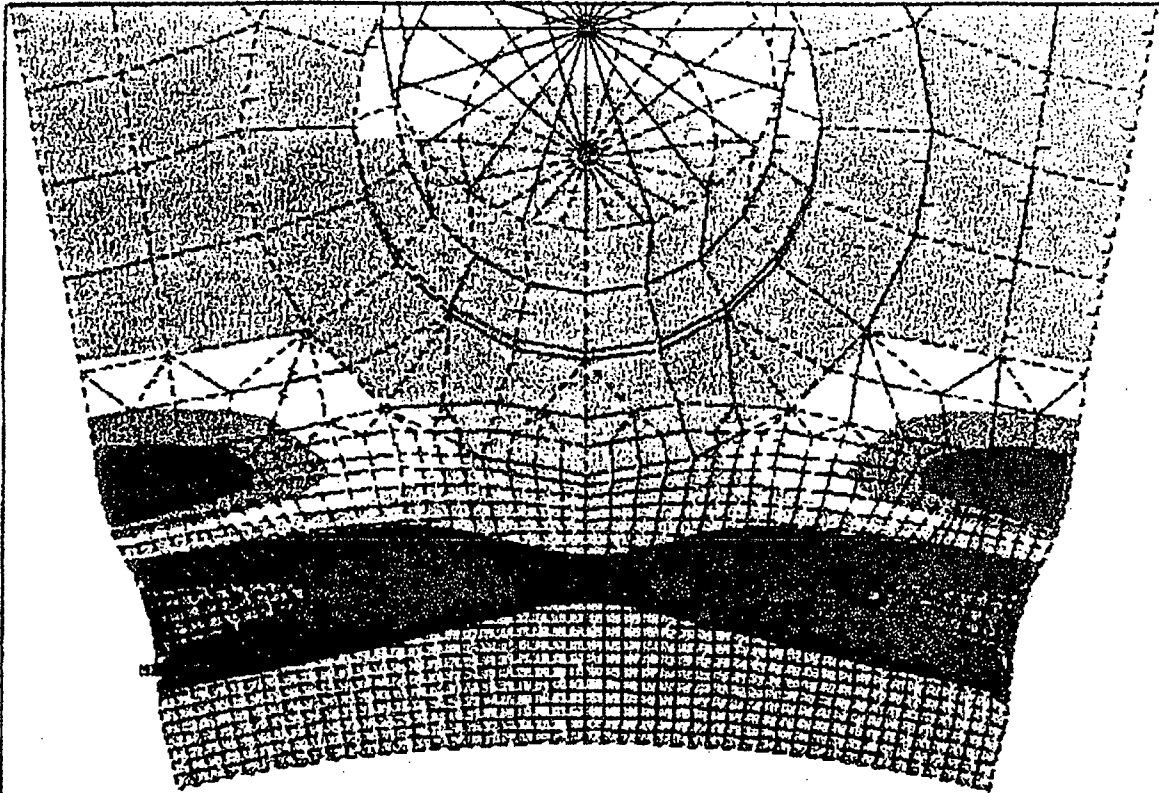
The circumferential stress is averaged along the vertical line from node 1223 to node 2058.

Nodes	# of Nodes	Circumferential Stress (ksi)	# of Nodes
			x
			Circumferential
			Stress (ksi)
1223	0	-1.175	0.000
1419	1	0.505	0.505
1615	1	4.165	4.165
1811	1	5.846	5.846
2058	1	5.024	5.024
Total:			15.54
			4
Average Circumferential Stress:			3.885 (ksi)

OCRFST06.WK1

FIGURE 23

FIGURE 24

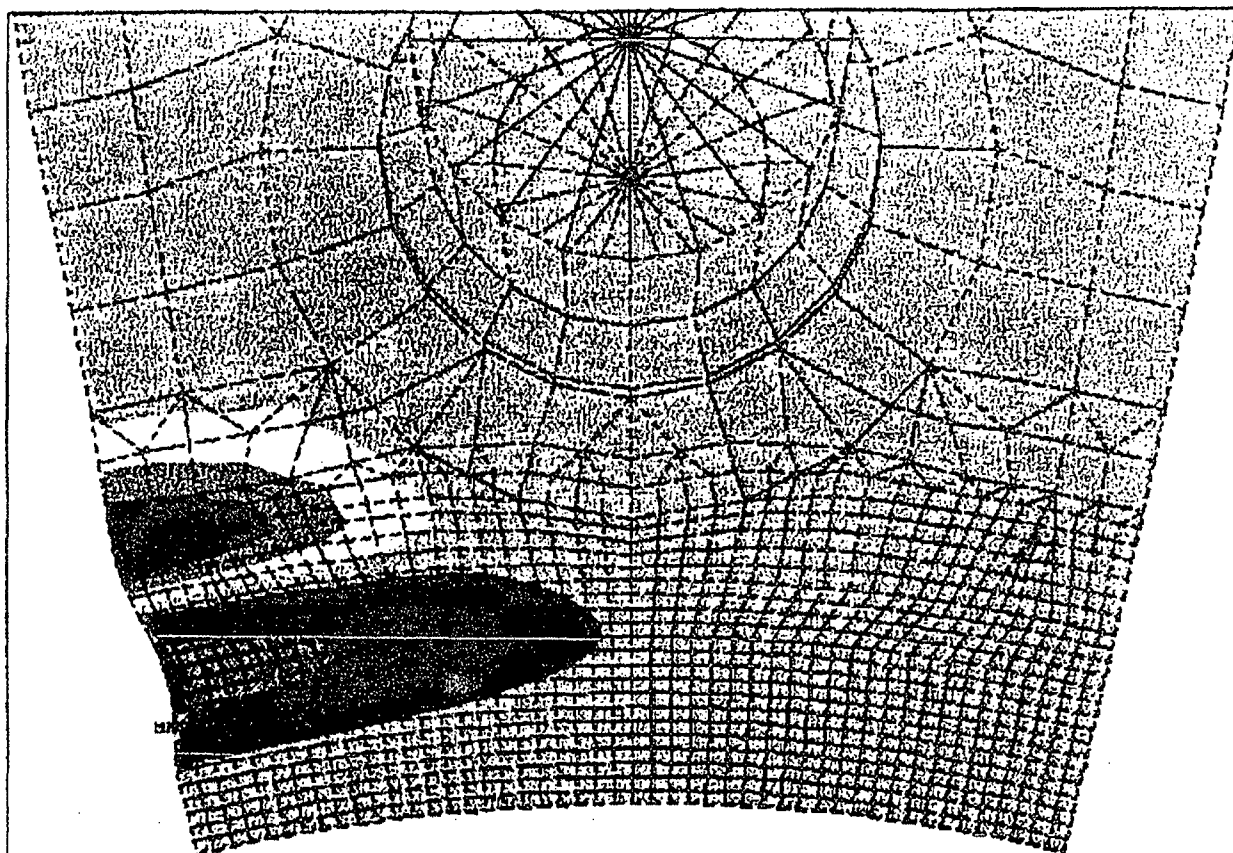


ANSYS 4.4A1  
DEC 8 1992  
6:15:38  
POST1 STRESS  
STEP=1  
ITER=1  
FACT=6.739  
UX  
D NODAL  
DMX =0.003681  
SMN =-0.00368  
SMX =0.001848  
  
XV =1  
ZV =-1  
\*DIST=110.004  
\*XF =29.455  
\*YF =0.460954  
\*ZF =365.922  
ANGZ=-90  
CENTROID HIDDEN  
-0.00368  
-0.003065  
-0.002451  
-0.001837  
-0.001223  
-0.609E-03  
0.567E-05  
0.620E-03  
0.001234  
0.001848

OYSTER CREEK DRYWELL ANALYSIS - ocrfs-s (NO SAND, REFUELING)

440-2174

FIGURE 25



ANSYS 4.4A1  
DEC 9 1992  
11:35:17  
POST1 STRESS  
STEP=1  
ITER=1  
FACT=6.887  
UX  
D NODAL  
DMX =0.005136  
SMN =-0.005134  
SMX =0.003244

XV =1  
ZV =-1  
\*DIST=110.004  
\*XF =29.455  
\*YF =0.460954  
\*ZF =365.922  
ANGZ=-90

CENTROID HIDDEN

■	-0.005134
■	-0.004203
■	-0.003273
■	-0.002342
■	-0.001411
■	-0.480E-03
■	0.451E-03
■	0.001382
■	0.002313
■	0.003244

OYSTER CREEK DRYWELL ANALYSIS (ASYM-SYMM) - (NO SAND, REFUELING)

990-2174



CALCULATION OF ALLOWABLE BUCKLING STRESSES - REFUELING CASE, NO SAND  
 ONE FOOT INCREASE IN FIXITY CASE; STRESS RUN OCRFRLS.OUT,  
 BUCKLING RUN OYCRSBBK.OUT

ITEM	PARAMETER	UNITS	VALUE	LOAD FACTOR
*** DRYWELL GEOMETRY AND MATERIALS				
1	Sphere Radius, R	(in.)	420	
2	Sphere Thickness, t	(in.)	0.736	
3	Material Yield Strength, Sy	(ksi)	38	
4	Material Modulus of Elasticity, E	(ksi)	29600	
5	Factor of Safety, FS	-	2	
*** BUCKLING ANALYSIS RESULTS				
6	Theoretical Elastic Instability Stress, Ste	(ksi)	50.394	6.739
*** STRESS ANALYSIS RESULTS				
7	Applied Meridional Compressive Stress, Sm	(ksi)	7.478	
8	Applied Circumferential Tensile Stress, Sc	(ksi)	3.885	
*** CAPACITY REDUCTION FACTOR CALCULATION				
9	Capacity Reduction Factor, ALPHA <sub>i</sub>	-	0.207	
10	Circumferential Stress Equivalent Pressure, Peq	(psi)	13.616	
11	'X' Parameter, X= (Peq/4E) (d/t)^2	-	0.075	
12	Delta C (From Figure - )	-	0.064	
13	Modified Capacity Reduction Factor, ALPHA <sub>i,mod</sub>	-	0.313	
14	Reduced Elastic Instability Stress, Se	(ksi)	15.753	2.107
*** PLASTICITY REDUCTION FACTOR CALCULATION				
15	Yield Stress Ratio, DELTA=Se/Sy	-	0.415	
16	Plasticity Reduction Factor, NU <sub>i</sub>	-	1.000	
17	Inelastic Instability Stress, Si = NU <sub>i</sub> x Se	(ksi)	15.753	2.107
*** ALLOWABLE COMPRESSIVE STRESS CALCULATION				
18	Allowable Compressive Stress, Sall = Si/FS	(ksi)	7.877	1.053
19	Compressive Stress Margin, M=(Sall/Sm -1) x 100%	(%)	5.3	

FIGURE 26

940-2174