MISSISSIPPI POWER & LIGHT COMPANY
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P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

October 14, 1983

NUCLEAR PRODUCTION DEPARTMENT

U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and ~~50-417~~
License No. NPF-13
File: 0260/C-197.0/L-334.0
Transmittal of Responses to Informal NRC-SEB Concerns on the Containment SIT
AECM-83/0669

On July 6, 1983, a conference call was held between representatives of MP&L, Bechtel, and the NRC Structural Engineering Branch to discuss NRC concerns pertaining to the Grand Gulf Nuclear Station - Unit 1 (GGNS) Containment Structural Integrity Test (SIT). The NRC expressed concerns about (1) the basis for the GGNS containment being tested as a nonprototype containment; and 2) the SIT descriptions in FSAR subsection 3.8.1.7 and the "GGNS Unit 1 Primary Containment Structural Integrity Test Report," dated January 1982. MP&L responses to these concerns are provided as attachments.

Additionally, MP&L maintains that the GGNS-1 SIT was performed in compliance with the provisions of Regulatory Guide 1.18, Revision 1, and Article CC-6000 of the ASME Boiler and Pressure Vessel Code, Section III, Division 2, 1980 Edition, except as noted in FSAR Appendix 3A.

Should you require additional information, please contact us.

Yours truly,

for L. F. Dale
Manager of Nuclear Services

MLC/JGC:rg

Attachments

cc: See next page

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MISSISSIPPI POWER & LIGHT COMPANY

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Containment Design Comparison

NRC Concern:

The FSAR states in subsection 3.8.1.7.1 that the containment SIT test procedure will be based on the containment being a nonprototype structure. Provide a comparison of the Grand Gulf containment design to similar containments.

Response:

The Grand Gulf Nuclear Station (GGNS) Structural Integrity Test (SIT) is based on the containment being a nonprototype structure. The SIT procedure complies with the requirements of NRC Regulatory Guide 1.18, except as noted in FSAR Appendix 3A.

The Grand Gulf containment is a conventionally reinforced concrete structure. It does not incorporate any new or unusual design features as defined in Regulatory Guide 1.18, Appendix A, which would require it to be considered a prototype containment. A summary of Appendix A to Regulatory Guide 1.18 is given below.

> "A concrete primary reactor containment is considered a prototype if it is the first design to incorporate any of the following features:
>
> a. A dome with a shape other than hemispherical;
>
> b. An opening larger than 0.2D[3];
>
> c. Two openings with a diameter greater than 0.15D that are separated by a distance less than 0.2D;
>
> d. A connection of the cylindrical wall to the bottom slab or to the dome by a sliding joint, a hinge, or a combination of hinge and sliding joint;
>
> e. A pattern of main reinforcing other than vertical straight bars and horizontal hoops;
>
> f. An intermediate interior floor connected to the wall; or
>
> g. Any other structural design feature that may decrease the safety margins from those of a containment confirmed by an acceptance test.

[3]D = internal diameter of the cylindrical part of the containment."

The GGNS containment consists of a flat circular foundation mat, right circular cylinder, and hemispherical dome with major dimensions as shown in GGNS FSAR Figure 3.8-1 (attached). The inside diameter (D) of the circular cylinder is 124'-0". The largest opening, and the only opening greater than 0.15D, is the 19 foot (0.153D) diameter equipment hatch. Sliding or hinged joints are not used to connect the cylinder wall to the bottom slab or the dome. No intermediate interior floors are fixed to the wall. The main reinforcing in the wall consists of inside and outside layers of hoop reinforcement, inside and outside vertical reinforcement, and diagonal reinforcement placed in two directions to form a helix with an angle of approximately 45 degrees from the vertical axis of the shell.

This design is similar to many other conventionally reinforced concrete containments. Table 1 (attached) lists several examples of plants using this type of containment. The variations noted in containment dimensions are due to differences in design loads and/or design preferences.

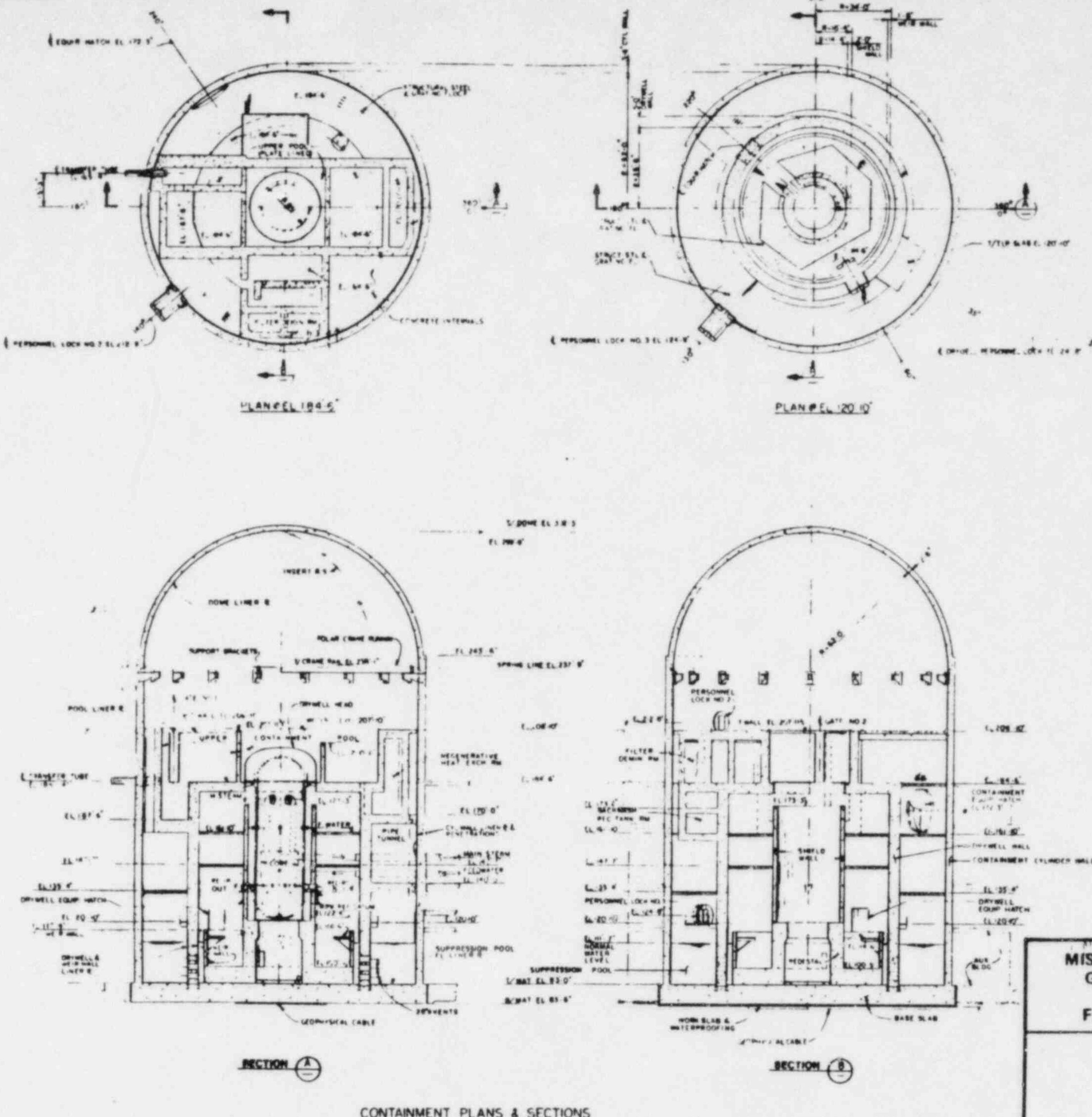
The Salem Nuclear Generating Station, Unit 1, is a prototype conventionally reinforced concrete containment similar to GGNS. Its containment consists of a flat concrete base mat at the wall to mat interface, right circular cylinder, and hemispherical dome with major dimensions as shown in Salem FSAR Figure 3.8-1 (attached). The inside diameter (D) of the circular cylinder is 140 feet. The largest opening is the 19 foot diameter (0.136D) equipment hatch. No openings exceed 0.15D. Sliding or hinged joints are not used to connect the cylinder wall to the bottom slab or the dome. No intermediate interior floors are fixed to the wall. The main reinforcing in the wall consists of inside and outside layers of hoop reinforcement, inside and outside vertical reinforcement, and diagonal reinforcement placed in two directions to form a helix with an angle of approximately 45 degrees from the vertical axis of the shell. The Salem SIT is in accordance with the prototype test requirements of Regulatory Guide 1.18, as detailed in the Salem FSAR, subsection 6.2.1.2. Strain data was obtained based on a SIT air pressure of 54 psig (115 percent of design pressure) as compared to the GGNS SIT air pressure of 17.25 psig.

As described above, the Salem design is similar to Grand Gulf. Based on this similarity in design, the successful prototype testing of Salem and the successful nonprototype testing of Grand Gulf, it can be concluded that the GGNS Unit 1 containment meets the requirements of Regulatory Guide 1.18, Revision 1, for SIT testing.

TABLE 1

REINFORCED CONCRETE CONTAINMENTS

Name of Nuclear Unit	Design Parameters: Inside Diameter (ft)	Design Parameters: Internal Design Pressure (psi)
Grand Gulf 1&2	124	15
Connecticut Yankee	135	40
Indian Point 2&3	135	47
Salem 1&2	140	47
Diablo Canyon 1&2	140	47
Surry 1&2	126	45
Maine Yankee	135	55
Donald C. Cook 1&2	115	12
Beaver Valley 1&2	126	45
North Anna 1&2	126	45
Harris 1&2	130	45
Millstone 3	140	45
Comanche Peak 1&2	135	50
Seabrook 1&2	140	51
WPPSS 1	150	46.4

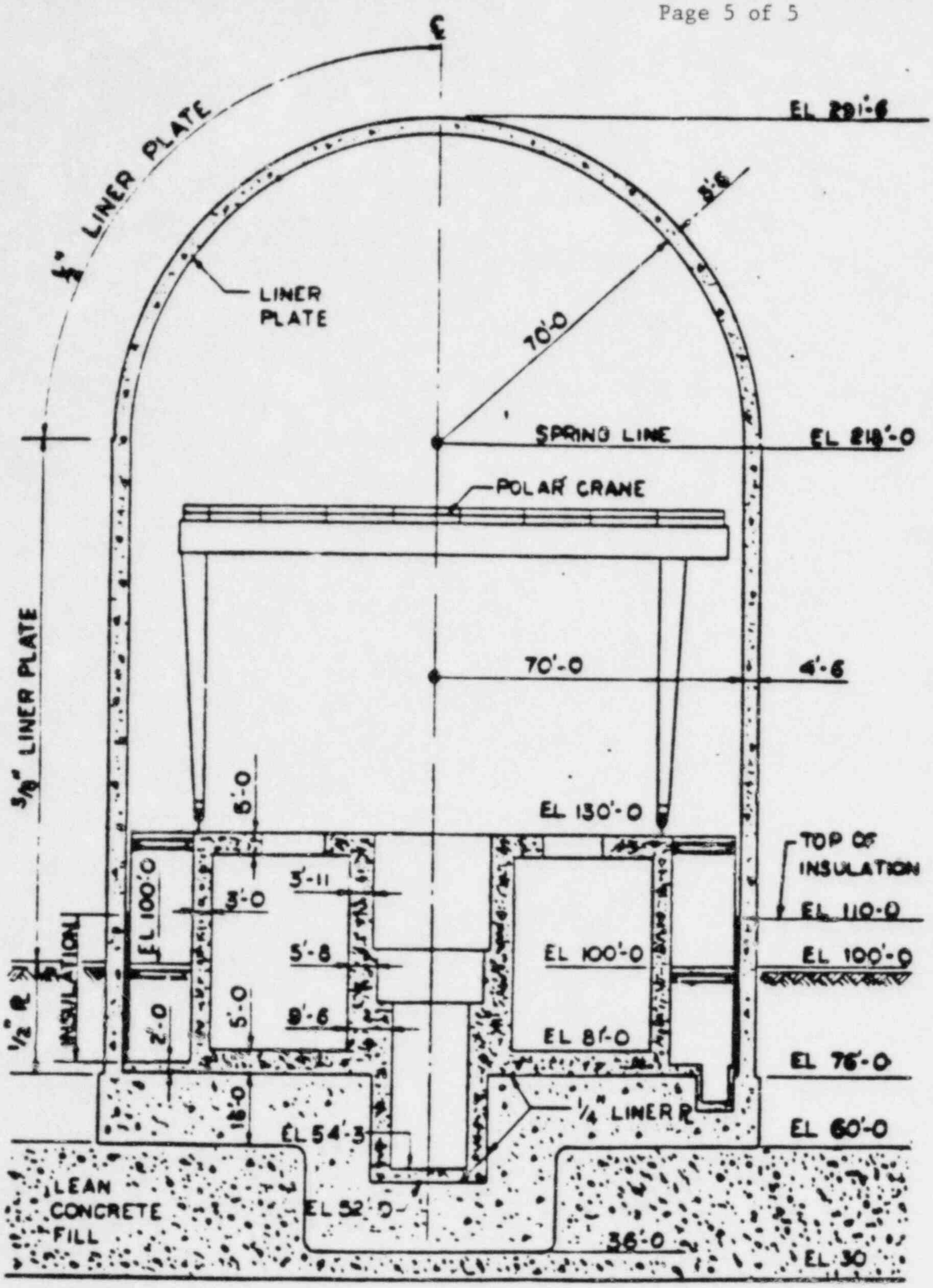


MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

CONTAINMENT
GENERAL ARRANGEMENT

FIGURE 3.8-1

Amend. 52 12/81



Revision 0
July 22, 1982

PUBLIC SERVICE ELECTRIC AND GAS COMPANY SALEM NUCLEAR GENERATING STATION	Containment Building Cross Section	
	Updated FSAR	Figure 3.8-1

Extensometer Location Clarification

NRC Concern:

Table 4-1, "Extensometer Locations," of the Grand Gulf Nuclear Station (GGNS) Unit 1 Primary Containment Structural Integrity Test (SIT) Report, issued in January 1982, shows extensometers H-13, H-14, and H-15 at azimuths 210°, 270°, and 150°, respectively, at El. 230'-0". The table also shows that six extensometers were located at both El. 103'-0" and El. 167'-0". However, Section C.2 of Regulatory Guide 1.18, Revision 1, "Structural Acceptance Test for Concrete Primary Reactor Containments," requires that radial deflections be measured at three points along six meridians. The containment SIT performed does not meet this criteria since El. 230'-0" only measured radial deflections at three meridians.

Response:

The test method at El. 230'-0" used to measure radial deflections consisted of placing extensometers at azimuths 210°, 270°, and 150° and connecting them to their "fixed" reference points at azimuths 30°, 90°, and 330°, respectively. The azimuth diametrically opposed to the extensometer location was used as the reference point because there are no internal structures suitable for use as reference points at this elevation. The radial displacement at each azimuth was assumed to be equal to one-half of the measured change in diameter. Therefore, the displacements at azimuths 30° and 210°, 90° and 270°, and 150° and 330° are one-half of the measured differential displacements between each respective pair of azimuths. Tables 4-1, 5-13, 5-14, and 5-15 and Figure 5-1 of the GGNS Unit 1 containment SIT report have been revised to clarify the measurement locations and test results. The revised pages are attached.

MISSISSIPPI POWER AND LIGHT COMPANY

GRAND GULF NUCLEAR STATION
UNIT 1

PRIMARY CONTAINMENT
STRUCTURAL INTEGRITY TEST REPORT

Bechtel Power Corporation
San Francisco, California
July 1983 (Rev. 1)

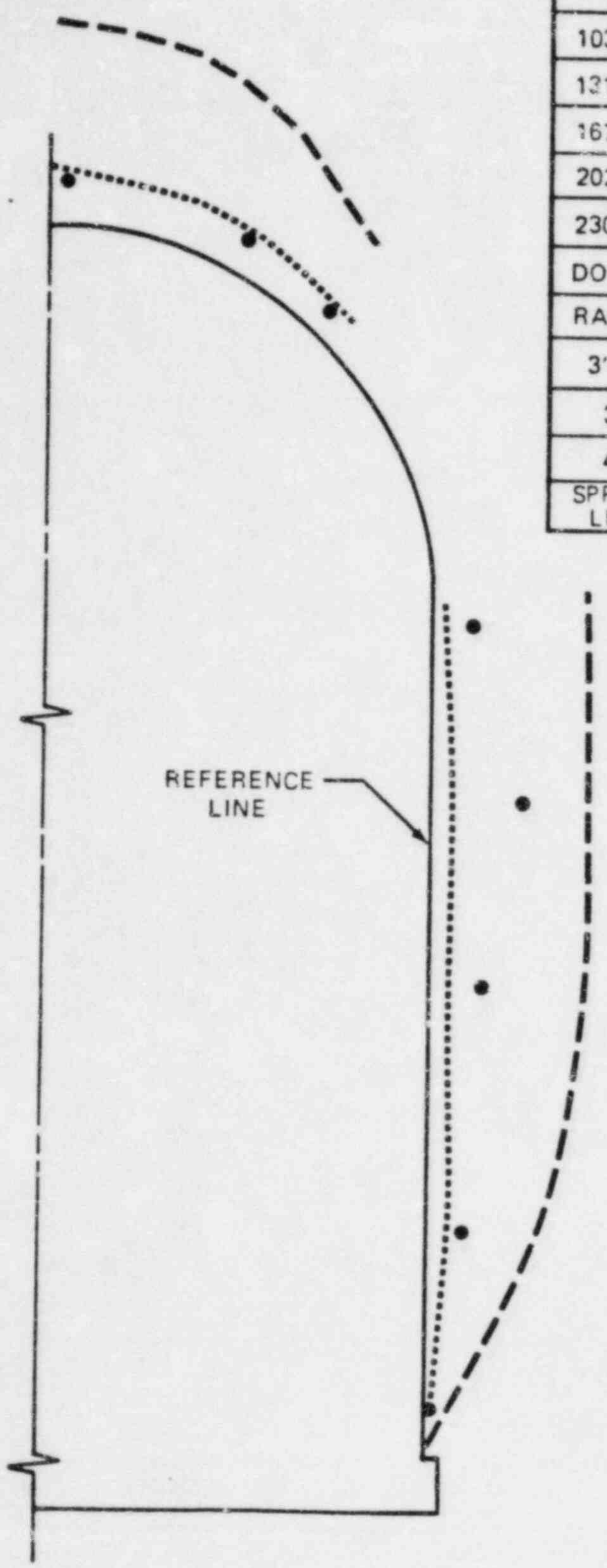
TABLE 4-1
EXTENSOMETER LOCATIONS

Table	Extensometer	Elevation Radials (H) and Hatch (E) or Radius Verticals (V) and Dome (D)	Azimuth
A-2	H-1	EL. 103'-0"	30°
A-3	H-2	EL. 103'-0"	90°
A-4	H-3	EL. 103'-0"	150°
A-5	H-4	EL. 103'-0"	210°
A-6	H-5	EL. 103'-0"	270°
A-7	H-6	EL. 103'-0"	330°
A-8	H-7	EL. 167'-0"	30°
A-9	H-8	EL. 167'-0"	90°
A-10	H-9	EL. 167'-0"	150°
A-11	H-10	EL. 167'-0"	211°-08'
A-12	H-11	EL. 167'-0"	270°
A-13	H-12	EL. 167'-0"	330°
A-14	H-13	EL. 230'-0"	210° (30°)*
A-15	H-14	EL. 230'-0"	270° (90°)*
A-16	H-15	EL. 230'-0"	150° (330°)*
A-17	H-16	EL. 131'-0"	30°
A-18	H-17	EL. 131'-0"	150°
A-19	H-18	EL. 131'-0"	270°
A-20	H-19	EL. 202'-0"	30°
A-21	H-20	EL. 202'-0"	150°
A-22	H-21	EL. 202'-0"	270°
A-23	D-1	R 3'-1"	165°-30'
A-24	D-2	R 31'-0"	75°
A-25	D-3	R 45'-0"	75°
A-26	V-1	R 61'-8"	46°
A-27	V-3	R 61'-8"	225°
A-28	V-4	R 61'-8"	315°
A-29	E-1	EL. 198'-6"	240°
A-30	E-2	EL. 191'-2-1/2"	240°
A-31	E-3	EL. 182'-9"	240°
A-32	E-4	EL. 161'-9"	240°
A-33	E-5	EL. 153'-10-1/2"	240°
A-34	E-6	EL. 146'-6"	240°
A-35	E-7	EL. 172'-6"	217°-47'
A-36	E-8	EL. 172'-3"	223°-14'
A-37	E-9	EL. 172'-6"	230°-14'
A-38	E-10	EL. 168'-2"	247°-07'
A-39	E-11	EL. 172'-7-1/4"	259°
A-40	E-12	EL. 172'-0"	264°

* Extensometers H-13, H-14, and H-15 measure differential displacements between six attachment points on the containment wall (i.e., between Azimuth 210° and 30°, 270° and 90°, and 150° and 330° respectively).

DEFLECTIONS (INCHES)

WALL						
EL	MIN	MAX	AVG	PRED 1	PRED 2	
103'-6"	.024	.044	.034	.08	.01	
131'-0"	.056	.082	.071	.38	.05	
167'-0"	.084	.283	.178	.42	.05	
202'-0"	.201	.271	.226	.42	.05	
230'-0" 3	.092	.1245	.107	.39	.04	1
DOME						
RADIUS	–	–	DEFL	PRED 1	PRED 2	
3'-1"	–	–	.114	.54	.15	
31'	–	–	.112	.51	.15	
45'	–	–	.107	.46	.14	
SPRING LINE	.027	.034	.031	.20	.08	



0 .20 .40 .60

SCALE – INCHES 1

CRACKED ANALYSIS DISPLACEMENT

ELASTIC ANALYSIS DISPLACEMENT

MEASURED VALUE

NOTES:

1. PREDICTED DISPLACEMENT FROM CRACKED ANALYSIS.
2. PREDICTED DISPLACEMENT FROM ELASTIC ANALYSIS.
3. MIN, MAX AND AVG DEFLECTIONS AT EL. 230' ARE EQUAL TO HALF OF MEASURED DIAMETRIC DISPLACEMENTS. 1

FIGURE 5-1

CONTAINMENT STRUCTURE AVERAGE DEFLECTIONS AT 17.25 PSIG – WALL AND DOME

TABLE 5-13
SUMMARY OF DATA FOR TRANSDUCER H-13

1

Date	Time	(Psig) Pressure	Displacement (diametric) (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.011
1/1	0930	10.0	0.026
1/1	1041	12.6	0.043
1/1	1246	15.0	0.125
1/1	1349	17.3	0.185
1/1	1630	17.3	0.210
1/1	2000	15.1	0.210
1/1	2249	12.5	0.198
1/2	0153	9.8	0.173
1/2	1458	5.1	0.130
1/2	1802	2.5	0.110
1/2	2114	0	0.088

TABLE 5-14
SUMMARY OF DATA FOR TRANSDUCER H-14

1

Date	Time	(Psig) Pressure	Displacement (diametric) (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.006
1/1	0343	5.0	0.013
1/1	0622	7.5	0.023
1/1	0930	10.0	0.039
1/1	1041	12.6	0.057
1/1	1246	15.0	0.154
1/1	1349	17.3	*
1/1	1630	17.3	0.249
1/1	2000	15.1	0.244
1/1	2249	12.5	*
1/2	0153	9.8	0.197
1/2	1458	5.1	0.147
1/2	1802	2.5	0.124
1/2	2114	0	0.102

*Invalid Reading - Out of Scale

TABLE 5-15
SUMMARY OF DATA FOR TRANSDUCER H-15

1

Date	Time	(Psig) Pressure	Displacement (diametric) (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.009
1/1	0622	7.5	0.017
1/1	0930	10.0	0.029
1/1	1041	12.6	0.040
1/1	1246	15.0	0.108
1/1	1349	17.3	0.165
1/1	1630	17.3	0.184
1/1	2000	15.1	0.184
1/1	2249	12.5	0.171
1/2	0153	9.8	0.150
1/2	1458	5.1	0.112
1/2	1802	2.5	0.097
1/2	2114	0	0.080

TABLE 5-16
SUMMARY OF DATA FOR TRANSDUCER H-16

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.009
1/1	0622	7.5	0.014
1/1	0930	10.0	0.019
1/1	1041	12.6	0.024
1/1	1246	15.0	0.044
1/1	1349	17.3	0.051
1/1	1630	17.3	0.056
1/1	2000	15.1	0.055
1/1	2249	12.5	0.051
1/2	0153	9.8	0.046
1/2	1458	5.1	0.037
1/2	1802	2.5	0.032
1/2	2114	0	0.026

Missing FSAR Figure

FSAR Figure 3.18-121, "Containment Structural Integrity Test Instrumentation and Crack Mapping Locations," is referenced in subsection 3.8.1.7. However, the figure was not provided in Amendment 51 to the FSAR.

Response:

Figure 3.8-121 was inadvertently omitted from Amendment 51 due to an administrative oversight. However, Figure 3.8-121 is being deleted from the FSAR. New Figures 3.8-123, 3.8-124, 3.8-125, and 3.8-126 will be added to replace Figure 3.8-121. Also, new Figure 3.8-122 was added to present the time versus pressure plot during the SIT. Additional changes to subsection 3.8.1.7 to reflect the final results of the containment SIT are also planned. A draft of these changes is attached. These changes are currently scheduled for incorporation in the FSAR in Amendment 57.

5. Compressive Strength (ASTM C 31-69, tested in accordance with ASTM C 39-72): Standard 6- by 12-inch concrete test cylinders will be molded and tested at 7, and 28 or 91 days from each 100 cubic yards, or a minimum of one set per day for each class of concrete. 25

Correlation tests for air content, slump, and temperature of concrete shall be made at the end of the last piece of conveying equipment for the first batch produced each day and for each 200 cubic yards or fraction over 100 cubic yards placed of each class of concrete. 25

b. Concrete Cylinders

A strength test is the average of the strengths of the two specimens from each sample tested at 28 or 91 days. Only one cylinder shall be made and tested at 7 days. The provisions of ACI 318-71, Paragraph 4.3.3, shall apply in determining the satisfactory strength level of the concrete tested at 28 or 91 days.

PRELIMINARY

3.8.1.6.6 Splices of Reinforcement

a. Provisions of ACI 318-71, Sections 7.5, 7.6, and 7.7, will be met for all reinforcing bar splices. Splices are designed to develop the specified minimum yield strength.

b. All mechanical splices for reinforcing bars are made by Cadweld process, using clamping devices, sleeves, charges, etc., as specified by the Cadweld Splice Instruction Sheets for B and T series connections. C series materials are not permitted.

Qualification of operators, visual inspection, tensile testing, tensile test frequency, and procedure for substandard tensile test results are in accordance with the Cadweld instruction sheets, and will comply with NRC Regulatory Guide 1.10, Revision 1, dated 1/2/73.

3.8.1.7 <u>Testing and Inservice Surveillance Requirements</u>

3.8.1.7.1 Structural Integrity Pressure Test (Unit 1)

Following construction, the containment was proof-tested at 115 percent of the design pressure. During this test, deflection and concrete crack measurements were made to determine 57

that the actual structural response was within the limits predicted by the design analyses.

A test procedure was issued prior to the Structural Integrity Test and was based on the containment being a non-prototype structure. This procedure was in compliance with the requirements of NRC Regulatory Guide 1.18, to the extent noted in Appendix 3A.

The containment was pressurized pneumatically in four pressure increments from atmospheric pressure to the maximum test pressure of 17.25 psig, as shown in Figure 3.8-122. Normal operational water volumes were present, and the drywell structure was vented through the drywell personnel lock. Pressurization and depressurization were halted at 5.0, 10.0, 15.0, 17.25, 15.0, 10.0, and 5.0 psig to allow acquisition of the required structural integrity test data, i.e., deflection and crack patterns. At these plateaus, the pressure was maintained for a minimum of 1 hour to determine if indicated displacements lagged the actual pressurization/depressurization cycle. In addition, deflection data were recorded at each 2.5 psig change in pressure.

Gross structural deformations were measured using taut invar wire extensometers that spanned between points on the containment wall, dome, and springline and fixed points within the structure. The extensometers were located to measure radial displacements along typical wall sections and around the lower equipment hatch, vertical displacement of the dome relative to the operating floor, and vertical displacement of the springline relative to the foundation slab. The layout of the extensometer system is shown in Figures 3.8-123 through 3.8-125. 57

Concrete crack patterns were mapped in the areas shown in Figure 3.8-126.

The lengths and widths (measured by optical comparator) of all visible cracks within these areas were recorded at specified pressure levels.

A detailed description of the SIT test is given in the "Final Report On Primary Reactor Containment Structural Integrity Test Performed At The Grand Gulf Nuclear Station Unit 1 for Mississippi Power and Light Company," dated January 1982.

A summary discussion of the results of the SIT test is given in the following paragraphs.

PRELIMINARY

A. Radial and Vertical Deflections

Tables 3.8-41 through 3.8-43 provide the radial and vertical deflections observed during the test at each displacement transducer location, and the corresponding predicted values. The actual vertical and radial deflections were below the maximum predicted values for all locations.

The response of the containment to the maximum test pressure of 17.25 psig is illustrated in Figure 3.8-127, which shows the measured radial and vertical deflections of the cylinder wall and the measured vertical deflection of the dome. Also shown are the predicted deflections based on both elastic and cracked section analyses. The measured vertical deflections of the dome and wall are less than the elastic analysis prediction. This demonstrates that the membrane stresses in the dome and the vertical membrane stress in the cylinder wall were not sufficient to cause significant tensile cracking. Also, the modulus of elasticity used in elastic deflection prediction calculations was based on the specified concrete compressive strength rather than the actual strength, which is higher, as demonstrated by concrete cylinder break tests. Higher concrete strength, and, consequently, higher modulus of elasticity, will result in deflections lower than the predicted, as observed from the actual vertical deflection measurements. 57

The radial deflection of the wall is between the elastic and cracked wall section case predictions. This demonstrates that hoop stress caused tensile cracking but did not develop the complete cracked section used as a model in the cracked section analysis.

The wall radial deflections listed and plotted in Figure 3.8-127 show averages of the measurements made on several azimuths at each elevation. The individual measurements made at each elevation show a variation from azimuth to azimuth, which can be attributed to the containment shell not being constructed perfectly axisymmetric. On the dome, the measured deflections show a smooth trend. The measured wall vertical deflection listed in Figure 3.8-127 is the average of the measurements at extensometers V_1, V_3, and V_4 (V_2 malfunctioned). The individual measurements are tightly grouped, as indicated in Table 3.8-41, demonstrating a uniform vertical elongation of the cylindrical portion of the containment.

PRELIMINARY

Figure 3.8-128 also shows the measured radial growth of the wall in the vicinity of the equipment hatch. The deflections measured along the horizontal center plane of the hatch are approximately symmetrical about the vertical center line. Measurements along the vertical center plane of the hatch show that the outward movement in the vicinity of the hatch increased with elevation. This behavior is typical for a large opening located close to the containment base mat.

Measurements of 24-hour residual deflections showed an 85 percent recovery of the maximum recorded vertical deflection at the dome apex (extensometer D_1), an 88 percent recovery of the average maximum vertical deflections recorded at the springline (extensometers V_1, V_3, V_4), and a 72 percent recovery of the average maximum radial deflections recorded at the elevation that exhibited the maximum average peak radial deflection (extensometers H_{19}, H_{20}, H_{21}).

Recovery values are based on an average of the 24-hour residual deflections recorded at the appropriate extensometers, as tabulated in the "Primary Containment Structural Integrity Test Report" dated January 1982. In all cases, the deflection recovery within 24 hours after complete depressurization, at the points of maximum recorded deflection for the dome vertical direction and for the cylinder wall radial and vertical directions, was greater than 70 percent. 57

B. Containment Concrete Cracking

The surface concrete crack mapping areas on the containment wall are shown in Figure 3.8-126. A variety of surface cracks with widths less than 0.010 inch were observed immediately prior to pressurization.

Concrete crack widths in the various surveillance areas did not change in measured width by more than 0.010 inch. This is consistent with the low deflections recorded and does not adversely affect the integrity of the containment structure.

During the subsequent ILRT pressurization cycle to 12.5 psig, cracks that appeared in Crack Mapping Area 2 were monitored. Those cracks enlarged slightly from the zero pressure recovery value and returned to hairline width not accurately measurable with the optical comparators. Growth during the ILRT pressurization cycle was estimated at 0.002 inch at the locations observed.

PRELIMINARY

C. Summary and Conclusions

The deflections met the acceptance criteria set in the Grand Gulf test procedure.

The containment structural integrity test provided proof of the structure's ability to contain the internal design pressure and provided measurement of structural response to changes in internal pressure. Test measurements for the containment included gross structural deformations and concrete crack growth.

The structure withstood the internal pressures with no observable indications of structural distress. All measured structural deformations were less than the maximum predicted values, and all recovery deflections at the points of maximum average deflection recovered more than 70 percent of their maximum deflection. No cracks with widths equal to or exceeding 0.010 inch were observed in the crack mapping areas prior to pressurization. Changes in concrete cracks did not change in measured width by more than 0.010 inch during pressurization, and those cracks that developed during pressurization closed to below measurable values at zero pressure. 57

The results of the structural integrity test provide direct experimental evidence that the containment structure can contain the internal design pressure with sufficient margin of safety and that the gross response to pressure is predictable.

PRELIMINARY

TABLE 3.8-41

VERTICAL DEFLECTIONS OF CONTAINMENT
CONTAINMENT SIT

EXTENSO-METER	AZIMUTH (DEGREES)	RADIAL LOCATION FROM CONTAINMENT CENTERLINE	DEFLECTION (INCHES) Predicted[1]	Predicted[2]	Actual
D_1	165°-30'	3'-1"	0.1482	0.541	0.114
D_2	75	31'-0"	0.145	0.507	0.112
D_3	75	45'-0"	0.139	0.463	0.081
V_1	46	61'-8"	0.079	0.197	0.027
V_3	225	61'-8"	0.079	0.197	0.031
V_4	315	61'-8"	0.079	0.197	0.034

57

[1]Based on uncracked analysis.
[2]Based on cracked analysis.

PRELIMINARY

Attachment 3 to AECM-83/0669
Page 7 of 17

TABLE 3.8-42

RADIAL DEFLECTIONS OF CONTAINMENT
CONTAINMENT SIT

EXTENSO-METER	ELEVATION	AZIMUTH (DEGREES)	DEFLECTION (INCHES) Predicted[1]	Predicted[2]	Actual
H_1	103'0"	30	0.0104	0.080	0.029
H_2	103'0"	90	0.0104	0.080	0.031
H_3	103'0"	150	0.0104	0.080	0.024
H_4	103'0"	210	0.0104	0.080	0.039
H_5	103'0"	270	0.0104	0.080	0.036
H_6	103'0"	330	0.0104	0.080	0.044
H_{16}	131'0"	30	0.0502	0.380	0.056
H_{17}	131'0"	150	0.0502	0.380	0.082
H_{18}	131'0"	270	0.0502	0.380	0.074
H_7	167'0"	30	0.0477	0.420	0.101
H_8	167'0"	90	0.0477	0.420	0.283
H_9	167'0"	150	0.0477	0.420	0.263
H_{10}	167'0"	211°-08'	0.0477	0.420	0.166
H_{11}	167'0"	270	0.0477	0.420	0.168
H_{12}	167'0"	330	0.0477	0.420	0.084
H_{19}	202'0"	30	0.0484	0.420	0.201
H_{20}	202'0"	150	0.0484	0.420	0.271
H_{21}	202'0"	270	0.0484	0.420	0.206
H_{13} *	230'0"	210 (30)	0.0402	0.390	0.105
H_{14} *	230'0"	270 (90)	0.0402	0.390	0.1245
H_{15} *	230'0"	150 (330)	0.0402	0.390	0.092

[1]Based on uncracked analysis
[2]Based on cracked analysis
*Extensometers H-13, H-14, and H-15 measure differential displacements between six points on the containment wall (i.e., between azimuths 210° and 30°, 270° and 90°, and 150° and 330°, respectively). The deflections indicated for these extensometers are one-half of the measured diametric displacements.

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TABLE 3.8-43

RADIAL DEFLECTIONS OF CONTAINMENT AT EQUIPMENT HATCH
CONTAINMENT SIT

EXTENSO-METER	ELEVATION	AZIMUTH (DEGREES)	DEFLECTION (INCHES) Predicted[1]	Predicted[2]	Actual
E_1	198'-6"	240	0.0477	0.420	0.233
E_2	191'-2½"	240	0.0477	0.420	0.258
E_3	182'-9"	240	0.0477	0.420	0.232
E_4	161'-9"	240	0.0477	0.420	0.213
E_5	153'-10½"	240	0.0477	0.420	0.187
E_6	146'-6"	240	0.0477	0.420	0.167
E_7	172'-6"	217°-47'	0.0477	0.420	0.200
E_8	172'-3"	223°-14'	0.0477	0.420	0.210
E_9	172'-6"	230°-14'	0.0477	0.420	0.235
E_{10}	168'-2"	247°-07'	0.0477	0.420	0.205
E_{11}	172'-7¼"	259	0.0477	0.420	0.173
E_{12}	172'0"	264	0.0477	0.420	0.170

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[1]Based on uncracked analysis.
[2]Based on cracked analysis.

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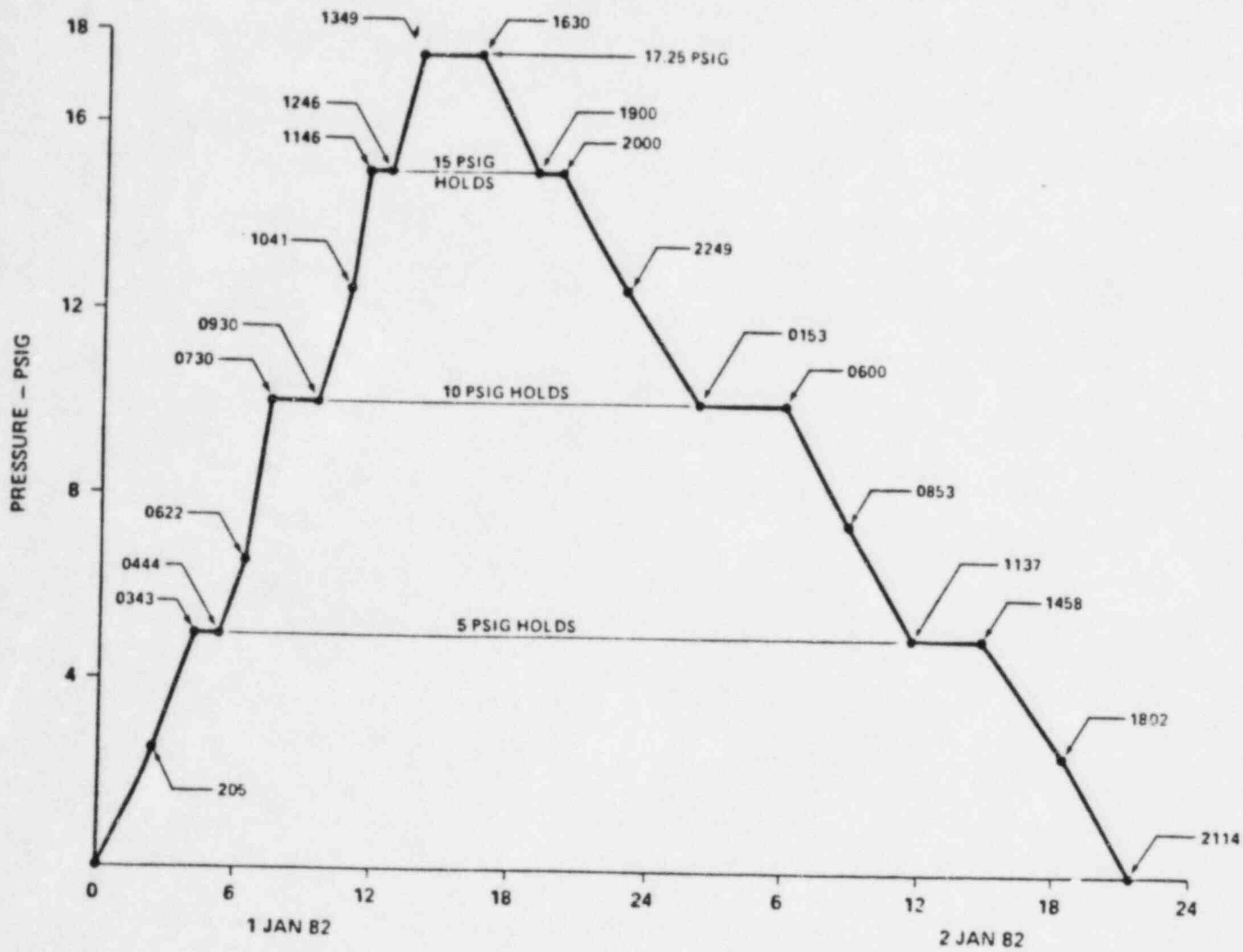
Figure 3.8-121 is deleted.

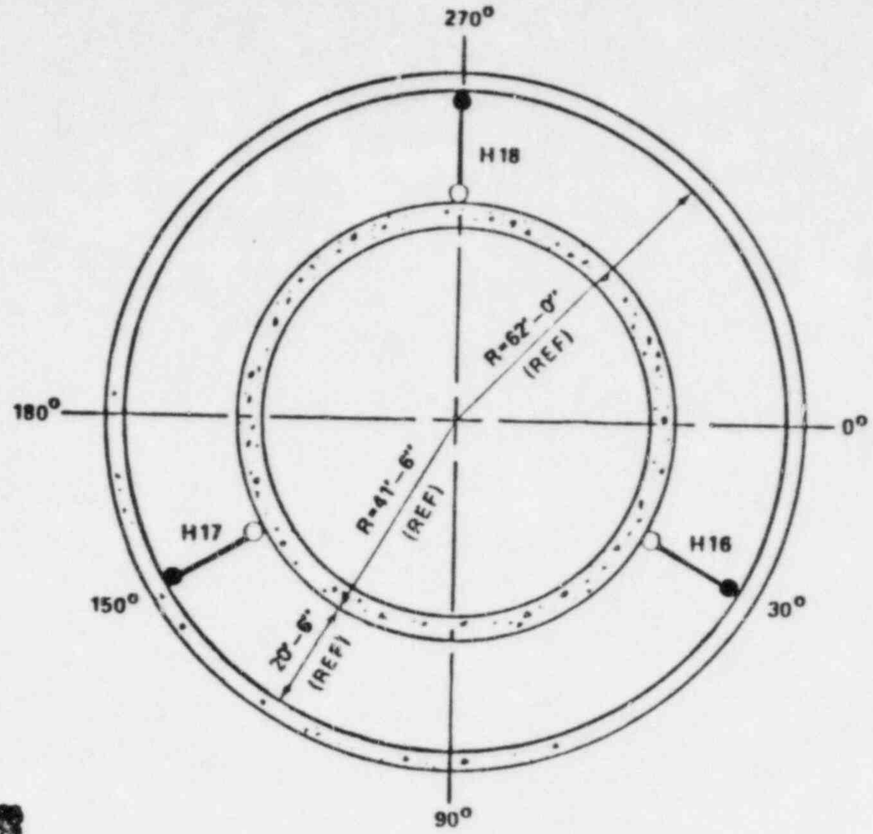
PRELIMINARY



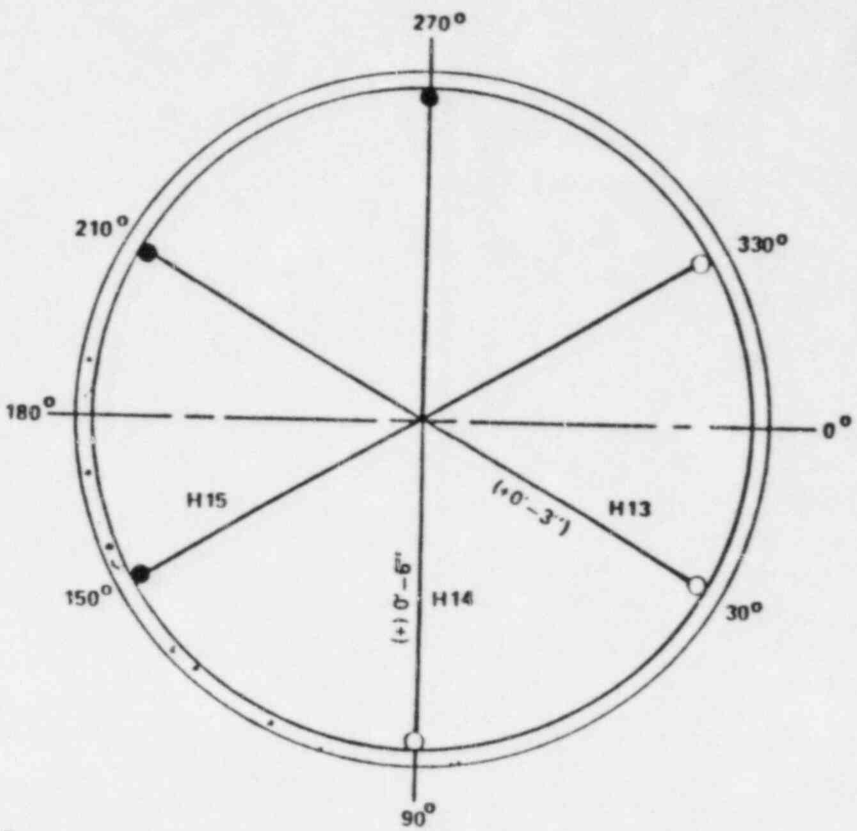
PRELIMINARY

MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
UNIT 1 SIT PRESSURE CYCLE FIGURE 3.8-122

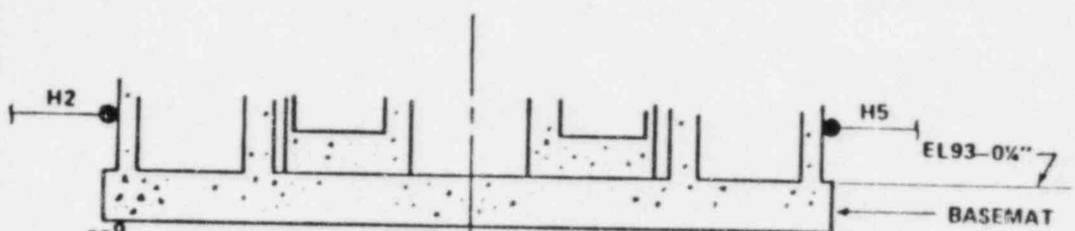
Amend. 57



ELEVATION 131'-0"



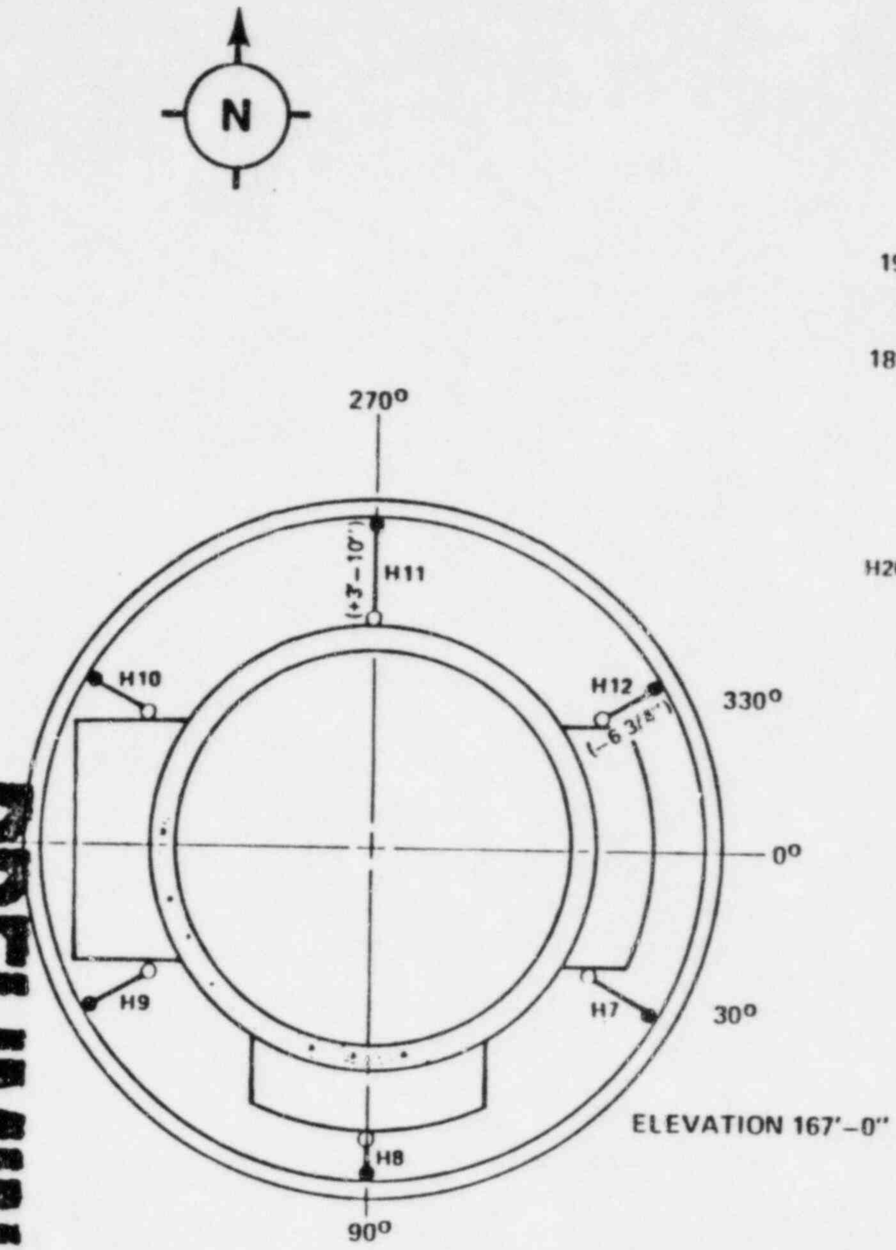
ELEVATION 230'-0"

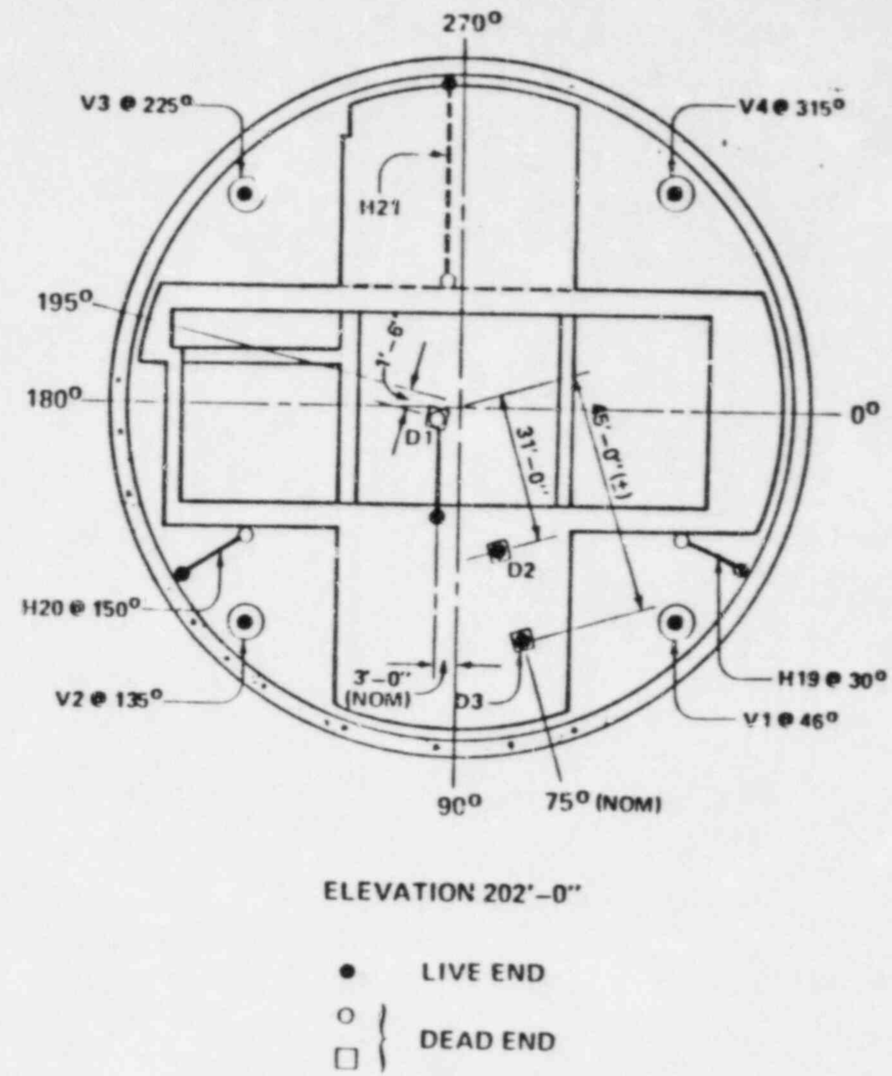


ELEVATION 103'-6" (OUTSIDE CONTAINMENT)
6 EXTENSOMETERS AT 30°, 90°, 150°, 210°, 270°, 330°.

MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNITS 1 & 2 FINAL SAFETY ANALYSIS REPORT
UNIT 1 TAUT WIRE EXTENSOMETER LOCATIONS – RADIALS AT ELEVATIONS 103'-6", 131', AND 230' FIGURE 3.8-123

Amend. 57





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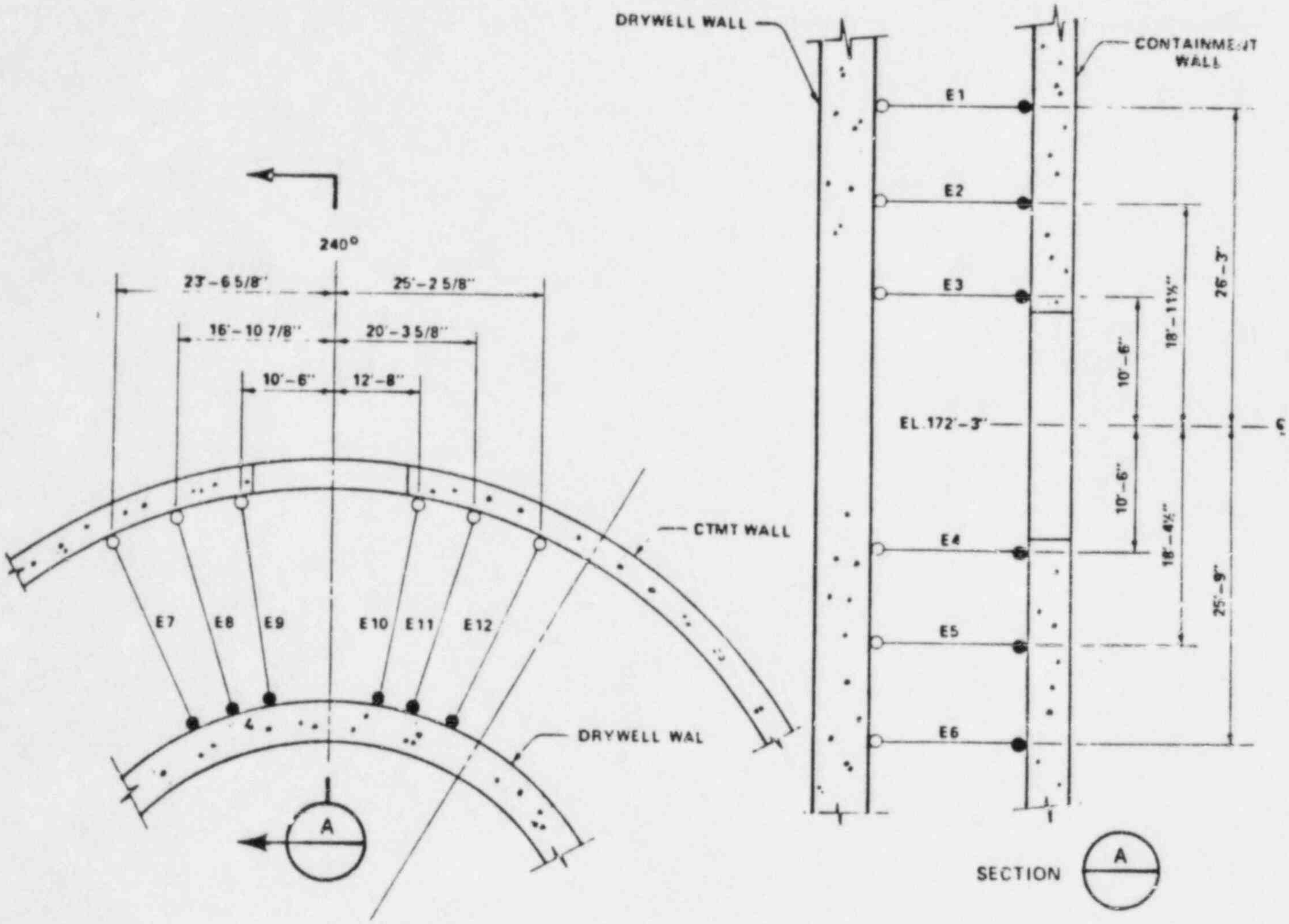
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

UNIT 1 TAUT WIRE EXTENSOMETER LOCATIONS – RADIALS AT ELEVATIONS 167' AND 202', DOMES, AND VERTICALS

FIGURE 3.8-124

Amend. 57



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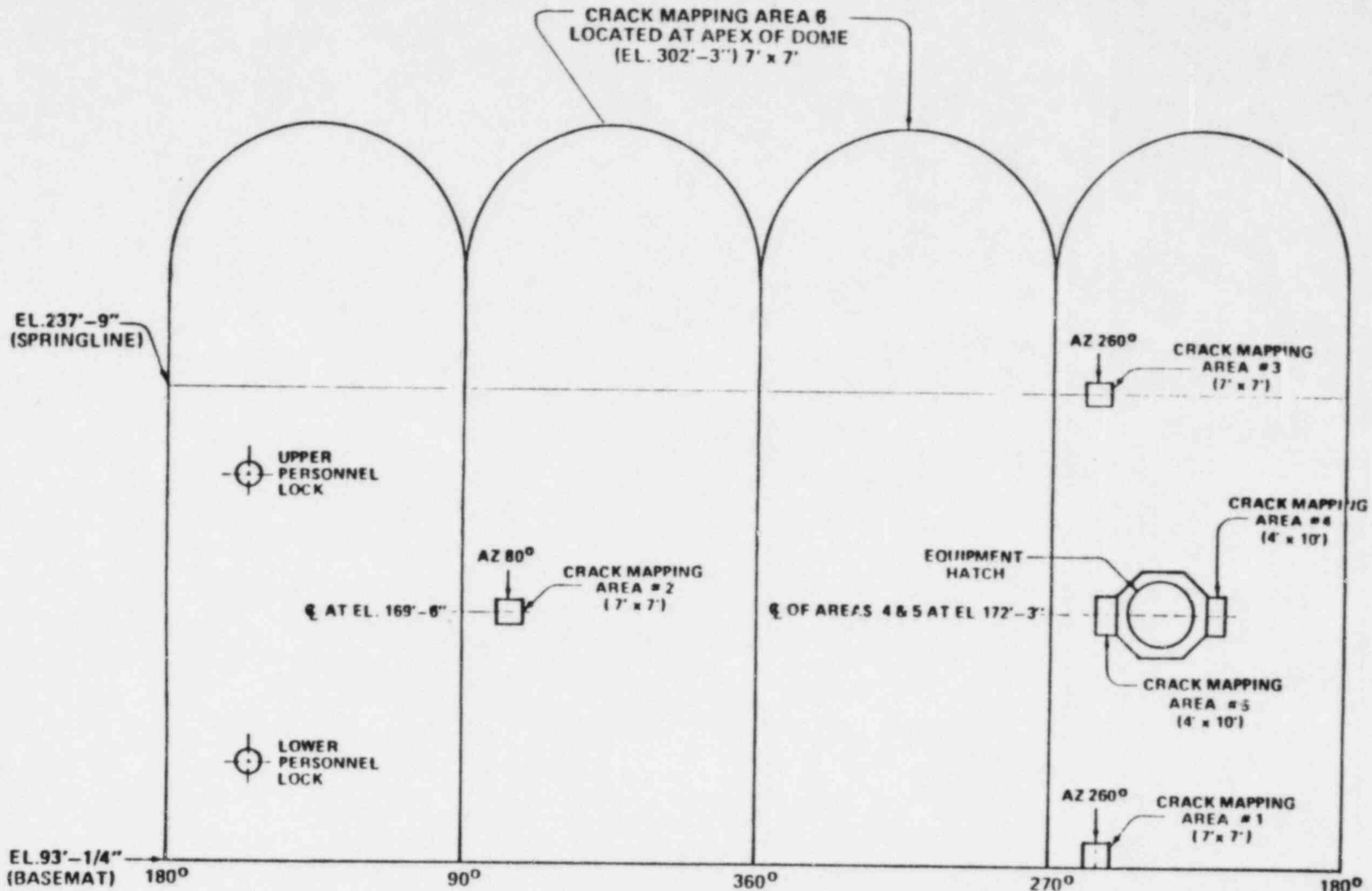
MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

UNIT 1 TAUT WIRE EXTENSOMETER LOCATIONS – EQUIPMENT HATCH

FIGURE 3.8-125

Amend. 57



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MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

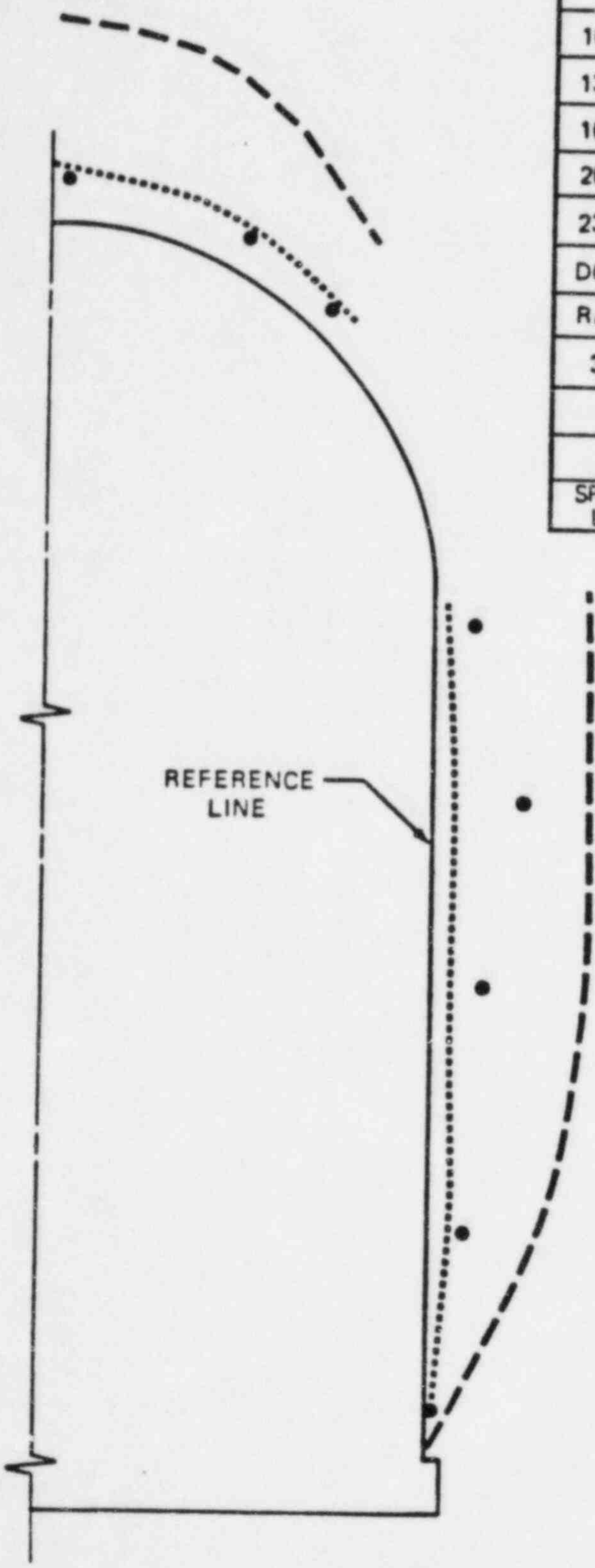
UNIT 1
CONCRETE CRACK MAPPING AREAS

FIGURE 3.8-126

Amend. 57

DEFLECTIONS (INCHES)

WALL					
EL	MIN	MAX	AVG	PRED [1]	PRED [2]
103'-6"	.024	.044	.034	.08	.01
131'-0"	.056	.082	.071	.38	.05
167'-0"	.084	.283	.178	.42	.05
202'-0"	.201	.271	.226	.42	.05
230'-0" [3]	.092	.1245	.107	.39	.04
DOME					
RADIUS	–	–	DEFL	PRED [1]	PRED [2]
3'-1"	–	–	.114	.54	.15
31'	–	–	.112	.51	.15
45'	–	–	.107	.46	.14
SPRING LINE	.027	.034	.031	.20	.08



0 .20 .40 .60

SCALE – INCHES

— — — — CRACKED ANALYSIS DISPLACEMENT

.... ELASTIC ANALYSIS DISPLACEMENT

● MEASURED VALUE

NOTES:

1. PREDICTED DISPLACEMENT FROM CRACKED ANALYSIS.
2. PREDICTED DISPLACEMENT FROM ELASTIC ANALYSIS.
3. MIN. MAX AND AVG DEFLECTIONS AT EL. 230' ARE EQUAL TO HALF OF MEASURED DIAMETRIC DISPLACEMENTS.

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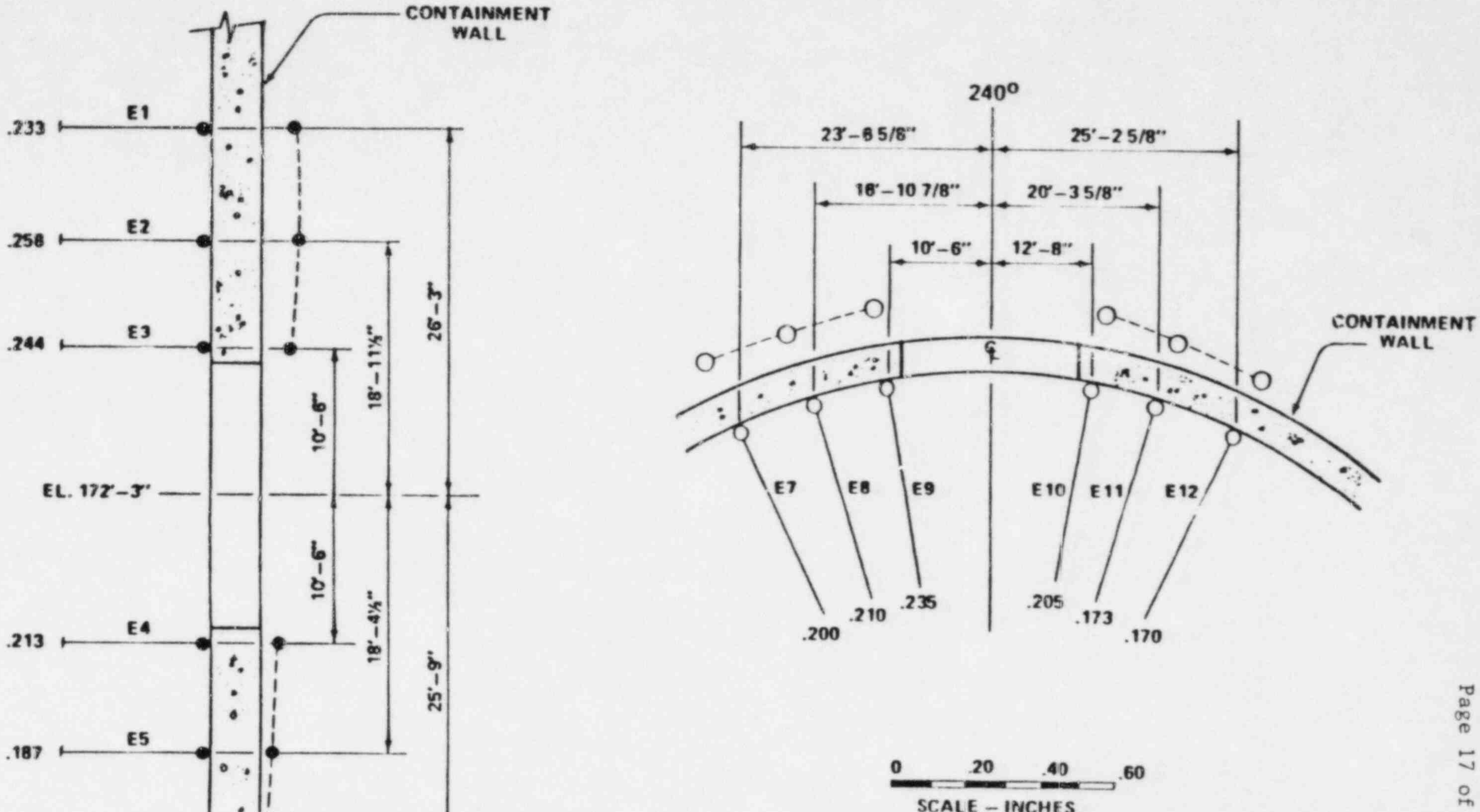
MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

UNIT 1 CONTAINMENT STRUCTURE
AVERAGE DEFLECTIONS AT 17.25 PSIG–
WALL AND DOME

FIGURE 3.8-127



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MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

UNIT 1 CONTAINMENT STRUCTURE DEFLECTIONS AT 17.25 PSIG–EQUIPMENT HATCH RADIAL

FIGURE 3.8-128

Amend. 57