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APPENDIX 5E

GILBERT ASSOCIATES, INC., PRELIMINARY REPORT

TO

METROPOLITAN EDISON COMPANY

ON

STRUCTURAL INTEGRITY TESTING
OF THE REACTOR BUILDING STRUCTURE

FOR

THREE MILE ISLAND NUCLEAR STATION
UNIT 1

This Report Contains:

24 pages of text

7 tables

22 figures

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November 5, 1969

GAI REPORT NO. 1710

PRELIMINARY REPORT ON
STRUCTURAL INTEGRITY TESTING OF REACTOR
BUILDING STRUCTURE FOR

THREE MILE ISLAND NUCLEAR STATION
UNIT 1

METROPOLITAN EDISON COMPANY

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1. PURPOSE

The purpose of this report is to present pertinent information on the design and materials of the Reactor Building; and to outline the instrumentation to be used for the measurements and observations to be made on the Reactor Building of the Three Mile Island Nuclear Station, Unit No. 1, during the Structural Integrity test. This test is to ascertain the response of the structure when subjected to a maximum internal pressure of 63.3 psig which is 15 percent in excess of 55 psig (the design pressure due to the maximum hypothetical accident).

2. DESCRIPTION OF CONTAINMENT STRUCTURE

2.1 LOCATION

The Three Mile Island Nuclear Station, Unit No. 1 is located on Three Mile Island, near the east shore of the Susquehanna River in Londonderry Township, Dauphin County, Pennsylvania. The site is located approximately 11 miles SE of Harrisburg, Pennsylvania.

2.2 GEOMETRY AND PRINCIPAL ELEMENTS

The Reactor Building is a reinforced concrete structure composed of a cylindrical wall with a flat foundation mat and a shallow dome roof. The foundation slab is reinforced with conventional mild-steel reinforcing. The cylindrical walls are prestressed with a post-tensioning system in the vertical and horizontal directions. The dome roof is prestressed utilizing a three way post tensioning system. The inside surface of the Reactor Building is lined with a carbon steel liner to ensure a high degree of tightness during operating and accident conditions. Nominal liner plate thickness is 3/8 inch for the cylinder and dome and 1/4 inch for the base.

The foundation mat is bearing on sound rock and is 9 feet thick with a 2 feet thick concrete slab above the bottom liner plate. The cylinder portion has an inside diameter of 130 feet, wall thickness of 3 feet 6 inch, and a height of 156 ft. from top of foundation slab to the spring line. The shallow dome roof has a large radius of 10 feet, a transition radius of 20 feet 6 inch and a thickness of 3 feet. The Reactor Building Cross Section is shown in Figure 1.

Two large openings are provided for access into the containment structure: one is of a 22 feet 4 inches inside diameter opening for the equipment access hatch, the other is a 9 feet 6 inches inside diameter opening for the personnel lock. Penetrations for the main steam, feedwater, purge air, other mechanical process pipe and electrical cables are also provided in the cylinder wall. Drawings and description of the containment structure are provided in the Final Safety Analysis Report.

2.3 MATERIALS

2.3.1 Liner

The basic liner plate conforms to ASTM A283-67, Grade C with a minimum yield point of 30,000 psi. Non-accessible liner seams are covered with A36 steel test channels to permit leak testing. Penetration sleeves through the containment barrier consist

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normally of material conforming to ASTM A-333, Grade 1 or to ASTM A-516 Grade 60 modified to ASTM A-300.

2.3.2 Mild Steel Reinforcement

The mild steel reinforcement in the cylinder, dome, and reinforcement in the mat conforms to ASTM A 615-68, Grade 40. The reinforcing steel provides capacity in bending and shear only for the typical cylindrical wall and dome roof. The mat reinforcing steel provides capacity in tension, bending, and shear.

Special large size bars were spliced by the Cadweld process using splices designed to develop the ultimate strength of the bar. All bars of size number 11 or smaller were lap spliced, except for some rebars in the ring girder.

To support the 2009 SGR Project, a Containment Opening was made in the Reactor Building concrete wall and liner plate at the 290° azimuth, and directly above the existing Equipment Hatch to gain building access for rigging and handling of the steam generators. In order to restore the concrete opening, new rebar was spliced to existing No. 11 and No. 8 rebar using BarSplice BPI XI swaged couplers, which consisted of a cold-swaged sleeve installed using a portable hydraulic press and a pair of swaging dies. As an acceptable design equivalent to cadweld splicing of rebar, these mechanical splice devices complied with ASME Section III, Div. 2, Subsection CC to be capable of developing not less than 125% of the specified yield strength of the bars in question. For areas where mechanical splices could not be used, direct-butt fusion welded splices were employed. Welded splices were welded and inspected in accordance with AWS D1.4-1998, Structural Welding Code - Reinforcing Steel. A new vertical rebar configuration and additional horizontal rebar was added to the outside face of the Containment Opening in order to meet design acceptance criteria due to post-construction loading. Additionally, a new interior rebar mat was installed adjacent to the liner plate within the Containment Opening to carry the bending loads associated with post-tensioning of tendons on the inside face.

2.3.3 Concrete

The concrete mix used in the cylinder, dome, and mat was designed to develop 5,000 psi compressive strength in 28 days and included the use of admixtures for air entrainment and water reduction.

2.3.4 Tendons

The prestressing system used for the Reactor Building is the BBRV system utilizing a maximum of 169 1/4 in. diameter wires. These wires conform to ASTM A-421 with a minimum ultimate strength of 240,000 psi and incorporate the use of BBRV bottom head system for end anchorages. The tendons are encased in galvanized steel conduits.

The tendons and included anchorages are coated with a temporary corrosion inhibitor for protection prior to bulk-filling the conduit.

2.4 DESIGN

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The methods used for the design of the structure, including assumptions on the interaction of steel liner and concrete shell, are described in the Final Safety Analysis Report.

2.5 CONSTRUCTION METHODS

In order to describe the basis for establishing "as-built" conditions, only special construction procedures are enumerated. The containment liner in the cylinder and dome is erected independent of the placement of the concrete shell. Survey control was used to ascertain actual liner and concrete shell dimensions during construction.

Flexural reinforcement is located on the outside face relative to the horizontal wall tendons and on the inside face relative to the liner. Concrete forms are tied on approximately 5 feet centers to the liner. Minimum concrete cover requirements are shown on the drawings.

The dome tendon conduits are pre-bent and cut to the total length required for the tendons from one trumplate assembly to the other. The vertical wall tendon conduits are terminated at the anchor plates in top of the ring girder. Dome concrete was not placed until after tendon conduits, trumpets, anchor plates, and reinforcing bars were installed. The anchor plates are located and installed relative to the tendon conduits; and the necessary pockets were provided in the vertical side of the ring girder. The dome tendon conduits and reinforcing steel are blocked from the liner and located relative to the theoretical location and not the liner.

The tendons are stressed after the cylinder wall and dome concrete has been placed and cured. The vertical tendons are stressed first. The stressing operation starts at four positions along the circumference of the cylinder. The sequence of stressing the vertical tendons is approximately symmetrical with respect to the cylindrical wall circumference. After completion of the vertical tendons, the dome and horizontal wall tendons are installed and stressed in a sequence so as to minimize stress concentration in the shell.

3. TEST REQUIREMENTS

3.1 PRELIMINARY SAFETY ANALYSIS REPORT

The Preliminary Safety Analysis Report, Section 5.0 and Appendix 5F, Reactor Building Instrumentation, provided background information on initial commitments to the AEC on the subject of instrumentation and measurements to be made during the structural proof test.

4. TEST PROCEDURES

4.1 GENERAL DESCRIPTION

After completion of the construction of the entire containment vessel, a structural integrity test will be performed where a pneumatic pressure at 63.3 psig (115 percent of the design pressure of 55 psig) will be maintained for a minimum of one hour. The pressurization of the vessel will be performed so as to permit readings and measurements more fully described hereafter to be made during the initial pressurization at 0 psig, 30 psig, 45 psig, 55 psig, at final test pressure of 63.3 psig, and thereafter

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during depressurization at 55 psig, 45 psig, 30 psig, and 0 psig. Except for the maximum pressure level (63.3 psig), the vessel pressure will always be stopped at 0.1 psi above the level at which the measurements will be made, and the pressure will then be slowly reduced to the specified value and held for 60 minutes to permit an adjustment of strains within the structure. Observations will be made and data taken after the 60 minute hold.

Because the structure is so large, displacement measurements can be made with sufficient precision to serve as confirmation of previously calculated response. The test program further includes, in addition to displacement measurements, a continuous visual examination for concrete cracks of the Reactor Building exterior concrete surfaces, that can be observed from existing or temporary platforms, with special attention given to pertinent locations such as major discontinuities. An ideal schedule has been determined as an aid in planning a detailed procedure for the Structural Integrity Test. A description of the instrumentation used to measure response is included in Section 5 of this report. Predicted displacements developed for an internal pressure of 63.3 psig, which is the pressure for the structural proof test, is included in Section 7 of this report. Strain values obtained, however, will be analyzed to determine magnitude and direction of principal strains.

Maximum cracks widths are described in Section 7.

4.2 PREPARATION

The installation of all targets, LVDT'S, white wash for crack pattern areas, tapes, strain gages, junction boxes, cables, read-out instruments, support structures, and platforms must be completed prior to initiating pressurization of the vessel. The location for instrumentation is shown in Table 1.

The strain gages for reinforcing bars are waterproofed and protected to permit encasement in the concrete. It is recognized that prior to the test, when each strain gage is being checked out, malfunction of gages may occur. Therefore, in order to avoid having to remove concrete to regain access to the gage, two gages have been installed at each specified location. One gage has been installed, wired, waterproofed, and protected directly to the main reinforcing steel in the shell outer surface.

The other gage "dummy gage," has been wired, waterproofed, and protected to a No. 4, 3 feet long reinforcing bar, and installed adjacent to the first gage.

Prior to the start of the structural integrity test, the inside air temperature will be controlled so that the air temperature reaches a steady-state condition two to three days before the start of the structural integrity test.

The outside air temperature will vary, but due to the relatively short period of time involved in the structural integrity test, it is expected that the fluctuation of the outside air temperature will not affect the temperature in the concrete shell.

In order to verify the above, both inside and outside air temperature readings will be taken and recorded at least twice daily for two weeks prior to the start of the structural integrity test and at each pressure level shown on Figure 2 during the structural integrity test.

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After completion of the structural integrity test, the temperature data will be reviewed.

4.3 DURING TEST

All acquired data and general observations will be transmitted to the control center. Data will be tabulated on the sheets typically shown in Tables 2 through 7 and will be graphically shown on Figures 12 through 22 to ensure immediate comparison with predicted results.

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4.4 FOLLOWING TEST

All acquired data plus interpretations of the results will be incorporated in this report. If the test data include any displacements which are in excess of the predicted extremes, such discrepancies will be resolved by means of including a review of the design, evaluation of measurement errors, material variability, and possibly exploration of the structure.

The test data obtained during the structural integrity test will be interpreted and compared with the analytical values. The analytical values have been obtained using the same method of analysis as was used for the design of the containment structure. If the test values do not show good agreement with the analytical values, the discrepancies will be resolved or the design safety margin will be reviewed.

5. INSTRUMENTATION

The behavior of the containment vessel will be observed during the structural proof test by making strain and displacement measurements. In addition, crack spacing and width will be observed.

5.1 GENERAL DESCRIPTION

The type of instruments used are shown on Figures 3, 4, 5, and 6. These are:

Displacement Measurements

- a. Jig Transits with scales and targets
- b. Levels
- c. Invar tapes
- d. LVDT (Displacement Transducers)

Strain Measurements

- a. Strain gages
- b. Rosette strain gages

5.1.1 Displacement Measurements:

Cylinder displacements will be measured at:

Three locations using jig transits and several scales at each location

Three locations using precision levels and rods

Three locations using Invar tapes and precision levels

One location using Invar tape and LVDT (Linear Variable Displacement Transducers)

Forty-one locations using LVDT'S

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a. Jig Transits

Three jig transits (one at each of the 3 azimuths) will be permanently set up and sheltered on the roof of auxiliary building, control building, and intermediate building. Two scales will be attached on the ring girder at each azimuth; the remaining scales are attached to the cylinder wall: four at one azimuth, three at another azimuth, and two at the third azimuth. Bare targets will be attached directly to the concrete roof structure at each of the three azimuths. Relative radial displacement will be determined at each scale location by aligning the transit with the base target and by plunging the scope up from the base target to each scale. Variations in the scale readings from the original reading will indicate the amount of displacement.

b. Precision Levels

Vertical displacements of the mat at Elevation 279 feet 0 in. outside the Reactor Building will be measured utilizing precision levels. Three levels will be needed, one at each azimuth, and will be located above grade. The levels will not be placed within 40 feet of the Reactor Building. This location should eliminate possible minute ground movements during pressurization of the vessel. A precise surveyors rod (at each azimuth) will be attached to the mat at Elevation 279 feet 0 inches.

c. Invar Tapes

Vertical displacements of the cylinder at the top of the ring girder, for side wall elongation and average tendon strain, will be determined using three Invar tapes (or equal) at three azimuths. The tapes will be mounted at the ledge (top of the ring girder) and will extend down to grade level, where weights will tension the tapes. The weights will be dampened in 10 gallon drums of oil. The tapes must be protected against oscillation due to wind. A scale attached to the tape will be read, with the same precision levels described under Item b, to indicate relative elongation.

The fourth Invar tape will be attached to the apex of the reactor building liner and extend down to the operating floor. Weight will tension the tape and will be dampened in a 10 gallons drum of water. An LVDT will be attached to the tape and vertical dome displacements read at the control center.

d. LVDT

Radial displacements will be measured with the LVDT'S at three azimuths (12 LVDT'S total) at the base of the cylinder wall.

LVDT'S will be utilized at 28 locations attached to the concrete surface around the equipment access opening to measure horizontal and vertical displacements. Along the horizontal axis, eight horizontal and eight vertical displacements will be obtained to a point forty four feet from the centerline of the hole. Along the vertical axis, six horizontal and six vertical displacements will be obtained to a

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point thirty one feet and six inches above the centerline of the equipment access opening.

Rigid support structures for the 40 LVDT'S will be built, properly braced and protected due to changes in weather.

e. Instrument Accuracy

Displacement measurement accuracies will be as follows: The jig transit with an optical micrometer will have a resolution of 0.001 inch and an accuracy of 0.005 to 0.010 inch. The LVDT'S and associated instrumentation will have a resolution of better than 0.001 inch and an accuracy of 0.002 to 0.005 inch.

5.1.2 Strain Measurements:

a. Reinforcing Bar Strain Gages

A total of 74 reinforcing bars will be instrumented for strain measurement; 28 at locations similar to LVDT displacement measurements around the equipment access opening, and 46 at locations above and below the ledge.

b. Liner Rosette Strain Gages

The liner will be instrumented with rectangular rosettes at six locations to indicate general strain in regions unaffected by geometric discontinuities and at 42 locations around three typical penetrations. Fourteen rosettes will be used at each penetration.

c. Strain Gage Accuracy

The strain gages on reinforcing bars and associated instrumentation will have a resolution of 0.4 microinch per inch strain and an accuracy of two to three microinches per inch. The strain gages on the steel liner will have a resolution of one microinch per inch and an accuracy of approximately five microinches.

5.1.3 Concrete Crack Measurement:

The accessible portions of the Reactor Building will be visually inspected for cracks and crack patterns from both the ground and the available scaffolding at the time of the test. Any observed cracks greater than 0.005 inch width shall be charted.

Approximately 1450 square feet of the outside surface of the containment vessel will be whitewashed for detailed measurement of spacing and width of cracks to confirm the magnitude of the local strains are not excessive. The whitewash areas are as follows: an area of approximately six foot width of the structure at the dome-to-cylinder transition extending six feet above and below the ledge and including ring girder area; three areas of approximately 6 feet width of the ring girder extending from elevation 439 feet 0 inches to elevation 451 feet 0 inches; and an area six feet by six feet on the cylinder at elevation 360 feet 0 inches; and an area six feet by ten feet at the base of cylinder wall. In addition, an area approximately 28 feet by 32 feet at one upper quadrant of the equipment access opening will be whitewashed.

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A one foot by one foot grid system will be laid out over the entire whitewashed area. Platforms will be provided for access and protective covers will be provided against adverse weather. All cracks shall be plotted for each pressure level when pressurizing, and at 0 psig after completion of the pressure test; but only those cracks with measurements greater than 0.005 inch shall be recorded on the plots. Optical instruments shall be used for measurement of crack widths.

5.1.4 Tendon Anchorage Zone Inspection

The results of the structural integrity test for the Robert E. Ginna Nuclear Power Station, which are presented in "Structural Integrity Test of Reactor Containment Structure" prepared for Westinghouse Electric Corporation, Atomic Power Division, and for Rochester Gas and Electric Corporation by Gilbert Associates, Inc. (GAI Report No. 1720 includes strains obtained from load cells installed under the tendon button heads and strain gages installed on the tendon bearing plates for four vertical tendons. Although the results obtained from both the load cells and strain gages were in general agreement with the predicted behavior, the results did not appreciably aid in the evaluation of the behavior of the containment structure. This was due to the fact that the strains which were recorded were due only to the increase in tendon force resulting from the pressure loading. This increase amounts to only a small percentage of the total force in the tendon.

The tendons installed in the containment structure of the Three Mile Island Nuclear Station Unit 1 will behave in a manner similar to the tendons installed in the containment structure of the Robert E. Ginna Nuclear Power Station. Specifically, the increase in tendon force due to the pressure loading amounts to only about five percent of the original tendon force for the hoop and dome tendons and 2 1/2 percent for the vertical tendons. Because of the above and, also because of the testing of the post-tensioning system as described in Appendix 5B, tendon load cells and bearing plate strain gages will not be installed on the containment structure.

The tendon anchorage zone inspection will include the following:

- a. A visual inspection of the concrete in the area of accessible anchorage zones both prior to the start of the structural integrity test and at each pressure level shown on Figure 2 during the structural integrity test.
- b. One tendon anchorage zone for vertical tendons V-81 and V-82 and dome tendons 327, 328, and 329 are included in white-wash area No. 120, "Wall and Dome Junction," shown on Figure 8. These anchorage zones will be examined at each pressure level when pressurizing and at 0 psig after completion of the pressure test.

Any unusual observations will be recorded on Table 7, "Tendon Anchorage Observations" and evaluated.

6 AS BUILT CONDITIONS

A survey of the "as built" conditions of the reactor building shell will be performed after completion of the construction. Radial distances from the established centerpoint of the containment vessel to the inside face of the liner plate will be measured at various elevations and azimuths prior to the test. The centerpoint was established prior to the erection of the liner plate and shell concrete.

7 CALCULATED RESPONSE

7.1 GENERAL DESCRIPTION

Displacements of the reactor building under pressure have been computed at several points on the vessel. A graph for each of these points (a total of 62) shows the limiting displacement at a pressure equal to 63.3 psig. The displacements at this pressure level include a 20 percent increase to allow for potential errors in measurements. Pressure versus displacements will be plotted at $p = 0, 30, 45, 55,$ and 63.3 psig during pressurization; and at $p = 55, 45, 30,$ and 0 psig during depressurization. The curves so plotted during the test are limited by:

- a. The horizontal line at $p = 63.3$ psig
- b. The vertical line labeled "limiting displacement"

A typical predicted radial displacement curve of the Reactor Building is shown on Figure 7.

Stress cracking from the applied pressure loading is not anticipated due to the residual compressive stress remaining in the shell at the pressure peak of 63.3 psig. But existing shrinkage cracks would enlarge slightly in width and also propagate in length during pressurization of the Reactor Building. Also, some new hairline cracks may occur that were not initially observed. The crack pattern will be random and the crack width enlargement should be less than 0.010 inch. Figures 8, 9, 10, and 11 show the configurations and locations of the crack pattern areas and are noted as to the cracking which might occur. Copies of these same figures will be used to record any cracking that does occur.

Local larger crack widths could appear, and will then be evaluated with related parameters as to its effect on the overall structural integrity.

7.2 CALCULATED DISPLACEMENTS

The calculated displacements for each radial and vertical measurement point (the scales, LVDT'S, and tapes) are shown on Figures 12 through 22: also, the measured values will be plotted on their respective graph. The graphs or instrument locations are enumerated as follows:

- a. Cylinder base radial displacements, LVDT gage location 1-6, are shown on Figure 12.

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- b. Cylinder base and wall radial displacements, LVDT gage locations 7-12, are shown on Figure 13.
- c. Cylinder wall and dome radial displacements, scale locations 13-24, are shown on Figures 14 and 15.
- d. Dome radial displacements and cylinder ledge (top of ring girder) vertical displacements, scale locations 25-27, and tape locations 28-30 are shown on Figure 16.
- e. Cylinder base and dome apex vertical displacements, rod locations 31-33, and LVDT gage location 34 are shown on Figure 17.
- f. Equipment access, radial and vertical displacements, LVDT gage locations 35-48. See Figures 18, 19, 20, 21, and 22.

7.3 MEASUREMENT, ANALYSIS, AND CONSTRUCTION INACCURACIES

Accepted standards for comparison of displacement measurements with predicted displacements are based upon increasing predicted displacements for the 63.3 psig pressure by 20 percent. This reflects all variables, including precision of measurements, design variables such as accuracy of design loads and analysis techniques, and construction variables such as variation of dimensions.

8. FORMS FOR RECORDING THE MEASURED DISPLACEMENTS, STRAINS, TEMPERATURE, AND TENDON ANCHORAGE OBSERVATIONS

The forms for recording the measured displacements, strains, temperatures, and tendon anchorage observations during the test are shown on:

Table 2 - Strain Gages Full Bridge

Table 3 - Strain Gages Rosettes

Table 4 - Displacement LVDT'S

Table 5 - Displacement Scales and Tapes

Table 6 - Temperature Readings

Table 7 - Tendon Anchorage Observations - Wire Failures

9. INTERPRETATION OF RESULTS

The displacements, strains and observations data and crack pattern charts will be included in a report along with the interpretation and conclusions of the Structural Integrity Test. This report will be filed with the AEC.

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TABLE 5E-1
(Sh. 1 of 4)
INSTRUMENT LOCATION

The location of displacement measurements are as follows:

1-1 Cylinder Base Radial Displacement -- LVDT

<u>LVDT Gage Loc.</u>	<u>Elevation</u>	<u>Azimuth</u>	<u>Notes</u>
1,2,3	284'-0"	108°, 243°, 352°	Radial Displacement
4,5,6	294'-0"	108°, 243°, 352°	Radial Displacement
7,8,9	326'-0"	108°, 243°, 348°	Radial Displacement
10,11	358'-0"	108°, 348°	Radial Displacement
12	390'-0"	108°	Radial Displacement

1-2 Cylinder Wall and Dome Radial Displacement - Jig Transit and Scales

<u>Scale Loc.</u>	<u>Elevation</u>	<u>Azimuth</u>	<u>Notes</u>
13	358'-0"	245°	Radial Displacement
14,15	390'-0"	245°, 352°	Radial Displacement
16,17,18	422'-0"	108°, 245°, 352°	Radial Displacement
19,20,21	432'-0"	108°, 245°, 352°	Radial Displacement
22,23,24	439'-2"	108°, 245°, 352°	Radial Displacement
25,26,27	453'-6"	108°, 245°, 352°	Radial Displacement

1-3 Cylinder Ledge and Base Vertical Displacement - Invar Tape, Rod and Level

<u>Tape & Rod Loc.</u>	<u>Elevation</u>	<u>Azimuth</u>	<u>Notes</u>
28,29,30	453'-6"	132°, 247°, 11°	Wall-Vertical Displacement
31,32,33,	279'-0"	131°, 248°, 9°	Base-Vertical Displacement
34	468'-4-1/8"	Dome Apex	See Dome Vertical Displ.

1-4 Dome Apex Vertical Displacement - Invar Tape and LVDT

<u>Tape Location</u>	<u>Elevation</u>	<u>Location</u>	<u>Notes</u>
34	468'-4-1/8"	Dome Apex	

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Table 5E-1
(Sh. 2 of 4)

1-5 Equipment Access Opening Displacement - LVDT

<u>LVDT Gage Loc.</u>	<u>Elevation</u>	<u>Notes</u>
35,37,38,39,40,41,42	319'-2"	Radial Displacement
35,37,38,39,40,41,42	319'-2"	Vertical Displacement
36	307'-2"	Radial Displacement
36	307'-2"	Vertical Displacement
43	331'-2"	Radial Displacement
43	331'-2"	Vertical Displacement
44	354'-7-3/4"	Radial Displacement
44	354'-7-3/4"	Vertical Displacement
45	338'-8"	Radial Displacement
45	338'-8"	Vertical Displacement
46	342'-8"	Radial Displacement
46	342'-8"	Vertical Displacement
47	346'-8"	Radial Displacement
47	346'-8"	Vertical Displacement
48	350'-8"	Radial Displacement
48	350'-8"	Vertical Displacement

The location of strain measurements are as follows:

1-6 Equipment Access Opening - Reinforcing Bar Strain

<u>Strain Gage Loc.</u>	<u>Elevation</u>	<u>Notes</u>
35,37,38,39,40,41,42	319'-1"	Hoop Strain
35,37,38,39,40,41,42	319'-2"	Meridional Strain
36	307'-2"	Hoop Strain
36	307'-2"	Meridional Strain
43	331'-2"	Hoop Strain
43	331'-2"	Meridional Strain
44	334'-5"	Hoop Strain
44	334'-5"	Meridional Strain

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Table 5E-1
(Sheet 3 of 4)

<u>Strain Gage Loc.</u>	<u>Elevation</u>	<u>Notes</u>
45	338'-8"	Hoop Strain
45	338'-8"	Meridional Strain
46	342'-8"	Hoop Strain
46	342'-8"	Meridional Strain
47	346'-8"	Hoop Strain
47	346'-8"	Meridional Strain
48	350'-8"	Hoop Strain
48	350'-8"	Meridional Strain

1-7 Cylinder Wall and Dome Junction - Reinforcing Bar Strain

<u>Strain Gage Loc.</u>	<u>Elevation</u>	<u>Azimuth</u>	<u>Notes</u>
49,50,51	430'-0"	108°, 245°, 352°	Wall-Meridional Strain
49,50,51	430'-0"	108°, 245°, 352°	Wall-Hoop Strain
52,53,54	435'-0"	108°, 245°, 352°	Wall-Meridional Strain
52,53,54	435'-0"	108°, 245°, 352°	Wall-Hoop Strain
55,56,57	440'-0"	108°, 245°, 352°	Ring Girder-Mer. Strain
55,56,57	440'-0"	108°, 245°, 352°	Ring Girder-Hoop Strain
58,59,60	446'-0"	108°, 245°, 352°	Ring Girder-Mer. Strain
58,59,60	446'-0"	108°, 245°, 352°	Ring Girder-Hoop Strain
61,62,63	452'-0"	108°, 245°, 352°	Ring Girder-Mer. Strain
61,62,63	452'-0"	108°, 245°, 352°	Ring Girder-Hoop Strain
64,65,66	454'-0"	108°, 245°, 352°	Dome-Meridional Strain
64,65,66	454'-0"	108°, 245°, 352°	Dome-Hoop Strain
67,68,69	458'-0"	108°, 245°, 352°	Dome-Meridional Strain
67,68,69	458'-0"	108°, 245°, 352°	Dome-Hoop Strain
129,130	446'-0"	80°, 320°	Ring Girder-Hoop Strain
129,130	446'-0"	80°, 320°	Ring Girder-Mer. Strain

TMI-1 UFSAR

Table 5E-1
(Sh. 4 of 4)

1-8 Liner Strain-Rosettes

<u>Rosette Strain Gage Loc.</u>	<u>Elevation</u>	<u>Azimuth</u>	<u>Notes</u>
70,71,72	358'-0"	108°, 245°, 352°	Liner Strain
73,74,75	390'-0"	108°, 245°, 352°	Liner Strain

1-9 Liner Strain at Penetrations - Rosettes

<u>Rosette Strain Gage Loc.</u>	<u>Elevation</u>	<u>Azimuth</u>	<u>Notes</u>
76,77,78,79,80,81,82	337'-0"	7° 47' 30"	Main Steam Penetration
83,84,85,86,87,88,89	337'-8"	7° 47' 30"	Main Steam Penetration
90,91,92,93,94,95,96	316'-1-11/16"	7° 47' 30"	Feedwater Penetration
97,98,99,100,101,102,103	316'-1-11/16"	7° 47' 30"	Feedwater Penetration
104,105,106,107,108, 109,110	317'-6"	331° 39' 50"	R.B. Leak Test Press. Sensing
111,112,113,114,115, 116,117,	317'-6"	331° 39' 50"	R.B. Leak Test Pressure Sensing

White Wash of Reactor Building:

1-10 White Wash - Crack Pattern and Spacing

<u>Area No.</u>	<u>Elevation</u>	<u>Azimuth</u>
118	284'-0"	175°
119	360'-0"	175°
120	453'-6"	175°
121	319'-2"	Equipment Access Opening
131	445'-0"	22°
132	445'-0"	320°
133	445'-0"	350°

Temperature Check Points:

1-11 Ambient Temperature

<u>Thermometer Loc.</u>	<u>Elevation</u>	<u>Azimuth</u>
122,123	456'-0"	245°, 352°
124,125	380'-0"	245°, 352°
126,127	380'-0"	245°, 352°
128	Average Temperature inside the Containment Vessel	

