

EVALUATION OF CONTAINMENT STRUCTURAL
INTEGRITY TEST REPORT - GRAND GULF
NUCLEAR STATION UNIT 1

Report Title: Grand Gulf Nuclear Station Unit 1, Primary Reactor
Containment Structural Integrity Test - Final Report

Report Date: January, 1982

Originating Organization: Mississippi Power and Light Co.

SUMMARY OF REPORT

The Grand Gulf Unit 1 Containment Structural Integrity Test (SIT) was conducted during December 31, 1981 to January 2, 1982. The primary purpose was to verify the design and structural integrity of the containment structure by imposing 115% of the design pressure for a period of not less than 1 hour.

The containment consists of a reinforced concrete cylinder and hemispherical dome connected to and supported by a massive reinforced concrete base slab.

Principal dimensions are:

Inside diameter	124ft.
Inside height	206ft. 8 1/2in.
Vertical wall thickness	3ft. 6in.
Dome thickness	2ft. 6in.
Foundation slab thickness	9ft. 6in.

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Test measurements for the containment included gross structural deformations and concrete crack growth. Measurement points were located at typical sections of the structure with measurements obtained at specified stages during the pressurization cycle. The structure withstood the internal pressure with no observable indications of structural distress. All measured structural deformations were less than the design allowable values. All dome and vertical measurement points recovered more than 70 percent of their maximum deflection. Radial deflections at the elevation of maximum average deflection also recovered more than 70 percent of their maximum deflection.

DISCUSSION

The SIT procedure complies with the requirements of Regulatory Guide 1.18 which has been superseded by Regulatory Guide 1.136, Revision 2, since July 1, 1981. The latter guide essentially accepts the requirements specified in Article CC-6000 of the "Code for Concrete Reactor Vessels and Containments," ASME Boiler and Pressure Vessel Code, Section III, Division 2, 1980 Edition, (also known as ACI Standard 359-80), and is therefore used as the basis of review for the Grand Gulf SIT report.

Article CC-6211, Test Pressure, requires that "Containment Structures shall be subjected to an acceptance test by which the internal pressure is increased from atmospheric pressure to at least 1.15 times the containment design pressure

in five or more approximately equal pressure increments. The Grand Gulf containment structure was pressurized pneumatically to an internal peak pressure of 17.25 psig in only four pressure increments and therefore does not meet the requirement of five or more increments. However, in view of the low pressure nature of a BWR containment, insistence on smaller pressure increments may cause unnecessary difficulty and involve impractical retest. We therefore accept the test results as if the test pressure were increased correctly, considering the fact that the containment can contain the internal design pressure with a sufficient margin of safety.

Concrete crack patterns of Grand Gulf containment structure were mapped in crucial areas with lengths and widths of all visible cracks recorded prior to the start of pressurization, at 10 psig during pressurization, at peak test pressure, and following the completion of depressurization. The ASME Code CC-6233 requires that inspection and mapping be performed at each specified pressure increment during pressurization and the Grand Gulf SIT did not provide data at the 5 psig and 15 psig levels to satisfy this requirement. However, because of the low pressure nature of a BWR containment and lack of apparent damaging wide cracks, we believe that the provided information is sufficient to ascertain the safety margin of the containment under test pressure.

This SIT report has met the minimum report requirements as specified in ASME B&PV code Section III, Division 2, CC-6263 which included the following items:

- (a) a description of the test procedure and the instrumentation;
- (b) a comparison of the test measurements with the allowable limits (predicted response plus tolerance) for deflections, strains, and cracks width;
- (c) an evaluation of the estimated accuracy of the measurements;
- (d) an evaluation of any deviation (such as test results that exceed the allowable limits), the distortion of the deviations, and the need for corrective measures.

CONCLUSION

The structural integrity test for the containment of Grand Gulf Nuclear Station Unit 1 complies in general with Regulatory Guide 1.136, which supersedes Regulatory Guide 1.18, and the ASME Boiler and Pressure Vessel Code, Section III, Division 2. Deviations are few and insignificant to safety. The test is, therefore, in our opinion, acceptable.

References:

1. Mississippi Power and Light Company - Grand Gulf Nuclear Station Unit 1, "Primary Reactor Containment Structural Integrity Test," Final Report January 1982. Transmitted by letter from L. F. Dale, MP&L to H. R. Denton, NRC, AECM - 82/140 dated April 14, 1982.
2. Letter from L. F. dated, MP&L to H. R. Denton, NRC, AECM - 83/0669, dated October 14, 1983, with attachments.