TECHNICAL EVALUATION REPORT

CONTAINMENT LEAKAGE RATE TESTING

CAROLINA POWER AND LIGHT COMPANY
H. B. ROBINSON, UNIT 2

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1. BACKGROUND

On August 7, 1975 [1], the NRC requested Carolina Power and Light Company (CP&L) to review the containment leakage testing program at H. B. Robinson Unit 2 and to provide a plan for achieving full compliance, where necessary, including appropriate design modifications, changes to technical specifications, and requests for exemption from the requirements pursuant to 10CFR50.12.

On September 16, 1975 [2], CP&L replied that three areas had been found which, while in compliance with technical specifications, did not comply with Appendix J. In this reply, CP&L submitted requests for exemption from the method of calculating the maximum allowable leakage rate at the reduced containment test pressure and from Type B testing of the containment airlocks every 6 months or after each opening. In addition, CP&L noted that a technical specification change was required so that the acceptance criteria for Type A tests would comply with Appendix J.

This report provides technical evaluations of the requests for exemption from the requirements of Appendix J submitted by CP&L in Reference 2.

2. REVIEW CRITERIA

Code of Federal Regulations, Title 10, Part 50 (10CFR50), Appendix J, Containment Leakage Testing, was specified by the NRC as the basis of these evaluations. The criteria are either referenced or briefly stated to support the results of the evaluations. Furthermore, in recognition of the plant-specific conditions which could lead to requests for exemption not explicitly covered by the regulations, the NRC directed that the technical review constantly emphasize the basic intent of Appendix J, that potential containment atmospheric leakage paths be identified, monitored, and maintained below established limits.

3. TECHNICAL EVALUATION

3.1 REQUEST FOR EXEMPTION FROM THE REQUIREMENTS OF APPENDIX J

Reference 2 requested exemptions from the requirements of Appendix J regarding (1) the method of calculating the maximum allowable leakage rate at the reduced containment test pressure and (2) Type B testing of the containment airlocks every 6 months or after each opening. The following sections provide an evaluation of these requests.

3.1.1 Exemption from the Method of Calculating the Maximum Allowable Leakage Rate at the Reduced Containment Test Pressure

Section III.A.4(a)(iii) of Appendix J requires that the following equations be used to calculate L_t, the maximum allowable leakage rate at the reduced containment test pressure, P_t:

$$L_t = L_a \left(\frac{L_{tm}}{L_{am}}\right) \qquad \text{for } \frac{L_{tm}}{L_{am}} < 0.7$$

$$L_t = L_a \left(\frac{P_t}{P_a}\right)^{1/2} \qquad \text{for } \frac{L_{tm}}{L_{am}} > 0.7$$

L_a is the maximum allowable leakage rate at the calculated peak containment pressure (Pa) related to the design basis accident. The subscript "m" denotes the total measured containment leakage rates.

In Reference 2, CP&L stated:

> Technical Specification 4.4.1.1.f.2 of H. B. Robinson Unit 2 utilizes the same equations, although with a different nomenclature, but specifies that the minimum of the values determined from the equations be used as the limit. The use of the lowest value of acceptable test leakage is clearly conservative.

CP&L requested an exemption from the above-cited requirement of Appendix J for the maximum acceptable test leakage if the ratio L_{tm}/L_{am} becomes greater than 0.7, and proposed to continue using the lower of the values calculated by the use of the two equations.

Evaluation. The procedure used by CP&L for the H. B. Robinson Unit 2 facility meets the requirements of Appendix J, Section III.A.4(a)(iii), and the use of the lower calculated value of L_t is acceptable. Using the lower calculated value of L_t results in a smaller value of maximum acceptable test leakage, never greater than the value allowed by Appendix J. No exemption from the requirements of Appendix J is required.

3.1.2 Airlock Testing

In Reference 2, CP&L requested exemption from the Type B testing requirements of the containment airlocks. Specifically, CP&L requested an exemption from the frequency of airlock testing and indicated that the airlock door seals are tested at pressure Pa on a continuous basis by the plant penetration pressurization system. In Reference 3, the NRC requested additional information. This request questioned the definition of an acceptable leakage rate for the airlock door seals, the sensitivity of the continuous pressurization monitoring system to detect the leakage rate, and the reliability of maintaining an acceptable leak rate for the total airlock system when the interval between tests is increased.

In response to Reference 3, CP&L submitted additional information [4] supporting the contention that airlocks should be tested during each refueling outage. In addition to providing the basis for leakage detection sensitivity, CP&L stated that the only unmonitored portion of the airlock is the handwheel shaft seals. CP&L also cited the need for continuous access to containment and the performance history of the shaft seals as sufficient bases for exemption from the required 6-month test interval and for continued use of refueling interval testing.

Evaluation. Appendix J, Sections III.B.2 and III.D.2, require that reactor containment airlocks be leak tested at the peak calculated accident pressure, Pa, at 6-month intervals. Further, should the airlocks be opened between such intervals, they will be leak tested after each opening. Airlocks represent potentially large leakage paths that are more subject to human error than other isolation barriers; therefore, they are tested more often than

other isolation barriers. Additionally, to ensure that the sealing mechanisms were not damaged during an airlock entry and also to ensure that this large potential leakage path was correctly secured after use, the requirement to test after each use was added.

For certain types of reactors in which airlocks are used frequently, testing of airlocks after each opening may create a situation in which more rapid degradation of the critical isolation barriers occurs. Moreover, experience obtained from testing of airlocks since 1969 indicates that only a few airlock tests have resulted in greater-than-allowable leakage rates. This infrequent failure of airlock tests plus the possibility that excessive testing could lead to a loss of reliability due to equipment degradation leads to the conclusion that testing after each opening may be undesirable.

Since 1969, there have been approximately 40 instances in which airlock leak tests have resulted in greater-than-allowable leak rates. However, they all were caused by the failure of door seals, not the entire doors. Continuous pressurization at a pressure of Pa between the double-gasketed seals at H. B. Robinson Unit 2 is an acceptable method for detecting door seal leakage while at the same time eliminating the impracticalities, and perhaps the reduction of reliability, associated with full airlock testing at Pa after each opening. In Reference 4, CP&L has demonstrated that the plant penetration pressurization system is sufficiently sensitive to detect a change in the leakage rate of the door seals with an alarm setpoint on this system equivalent to 0.1 La.

CP&L proposes to test airlocks once per refueling cycle and opposes a 6-month test interval because of an apparent need for continuous and immediate access to the containment during normal operation. Although continuous pressurization at Pa demonstrates the adequacy of the door seals, it does not satisfy the objective of the 6-month test interval, i.e., to provide an integrated leakage rate for the entire airlock assembly, including electrical and mechanical penetrations, the airlock cylinder, hinge assemblies, welded connections, and other potential leakage paths.

In view of the above discussions, CP&L's proposal to verify airlock door seals at Pa on a continuous basis by pressurizing between the double-gasketed seals is an acceptable alternative to performing a Type B test of the airlock after each use; an exemption from this requirement of Appendix J is acceptable. However, CP&L's request for an exemption from the required testing of airlocks every 6 months is not acceptable, and a Type B test in accordance with Appendix J must be performed every 6 months.

3.2 TECHNICAL SPECIFICATION CHANGES

In Reference 2, CP&L stated that a revised Technical Specification 4.4.1.1.f.3 would be submitted to bring it into compliance with Appendix J. Specifically, the Technical Specification currently requires that the allowable test leakage "shall not exceed 0.75," while the acceptance criteria for Type A test in Section III.A.4(b).(1) and (2) of Appendix J require that values "shall be less than 0.75."

Evaluation. CP&L's suggested modification meets the requirements of Appendix J, Sections III.A.4.(b).(1) and (2). A Technical Specification modification would be acceptable.

4. CONCLUSIONS

Technical evaluation of CP&L's requests for exemptions from the requirements of 10CFR50, Appendix J, Containment Leakage Testing, and technical evaluation of a proposed modification to Technical Specification 4.4.1.1.f.3 for H. B. Robinson Unit 2 have resulted in the following conclusions:

1. CP&L's request for exemption from the maximum acceptable test leakage if the ratio L_{tm}/L_{am} becomes greater than 0.7 is not necessary since the intent of Appendix J has been satisfied.

2. CP&L's request for exemption from testing airlocks every 6 months is unacceptable.

3. CP&L's request for exemption from testing airlocks after each opening is acceptable provided that the double seals are pressurized on a continuous basis at pressure Pa.

4. A proposed modification to Technical Specification 4.4.1.1.f.3 to change "shall not exceed 0.75" to read "shall be less than 0.75" is acceptable.

5. REFERENCES

1. K. Goller (NRC)
Letter to Carolina Power and Light Company
August 7, 1975

2. E. E. Utley (CP&L)
Letter to K. Goller (NRC)
September 16, 1975

3. R. W. Reid (NRC)
Letter to J. A. Jones (CP&L)
July 5, 1977

4. E. E. Utley (CP&L)
Letter to R. W. Reid (NRC)
September 21, 1977