Omaha Public Power District

1623 HARNEY ■ OMAHA, NEBRASKA 68102 ■ TELEPHONE 536-4000 AREA CODE 402

November 5, 1982
LIC-82-370

Mr. Robert A. Clark, Chief
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Branch No. 3
Washington, D.C. 20555

Reference: Docket No. 50-285

Dear Mr. Clark:

10 CFR 50, Appendix J
Containment Leakage Testing Program

Omaha Public Power District's letter to the Commission dated September 3, 1982 provided the District's initial response to the three open items identified in the Commission's letter dated July 23, 1982 regarding the subject issue. The District stated in our letter that further analysis regarding the first and third open items would be conducted and the Commission would be provided a final response after the evaluation was completed. The District has completed this evaluation and, accordingly, please find attached the District's response to the subject open items.

Sincerely,

W. C. Jones
Division Manager
Production Operations

WCJ/TLP:jmm

Attachment

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036

A017

Attachment

Open Item #1

OPPD's correlation to extrapolate leakage rates at 5 psig to 60 psig for containment airlocks is not sufficiently conservative.

Response

The District has reviewed the extrapolation methodology presented in Appendix A to the Commission's letter dated July 23, 1982. This methodology was prepared by the Franklin Research Center. The District also reviewed the four references provided in Appendix A, specifically Reference 4 (i.e., "U.S. Reactor Containment Technology", edited by Cottrell and Savolainen). The results of our review are provided below:

1. Appendix A begins the discussion by stating, "that if (a) the test medium is air, (b) Pa is appreciable compared to one atmosphere, and (c) the leakage path is such as to produce laminar viscous flow (i.e., capillary-like rather than orifice-like), the calculation appropriate to this test medium yields a substantially higher calculated value of Pa than would be obtained by assuming leakage to be directly proportional to the pressure differential to the one-half power." It should be noted that the rationale for at least two of the above assumptions is ambiguous as background derivation and discussion is not provided. In contrast, the Cottrell and Savolainen reference states that investigations which emphasize the effects of pressure on the flow rate of leakage are not always simply apparent because a given leak can exhibit several different types of flow. Also, for a particular characteristic geometry of a leak in a vessel, it is desirable to recognize the type of flow that may occur, since it defines the expected leakage rate.

   Cottrell and Savolainen continue by stating that although for many reported containment leakage tests it has been assumed that compressible flow through orifices is representative of the leakage behavior, no available test data or evidence justify the assumption or support this conclusion. Each containment structure should preferably be considered as uniquely influenced by several or all of the following factors that ultimately determine its leakage rate: temperature and pressure in containment, composition and physical properties of the containment atmosphere, number of potential leakage paths, dissimilarity of flow characteristics among existing leaks, variations of leak geometry with variations of internal containment pressures, and the extent of containment boundary limits beyond the containment shell.

2. Appendix A provides the calculations and results that apparently demonstrate that the District's correlation underestimates the leakage mass flow rate by approximately 20%. However, Cottrell and Savolainen state that for extrapolation of leakage rates from a low test pressure to a higher pressure, laminar flow will yield a higher leakage rate than other modes of flow.

3. Appendix A also justifies, based on purely viscous flow, that the District's methodology is unconservative by a factor of 8.9. In contrast, Cottrell and Savolainen state, "that because of the various leak geometries (cross section dimensions and length of leak path) encountered in containment vessel structures, two leaks exhibiting the same flow rate at one pressure condition will probably not have the same flow rate for a different set of conditions. Although the majority of significant leaks in a containment vessel may well be in the laminar flow regime at one pressure, it is conceivable that with higher velocities, turbulent flow conditions will be attained in irregular leak passages."

   Therefore, assuming that all flow is laminar may be overly conservative. The degree of conservatism is reflected by the following statement taken from Appendix A: ". . . the conversion should not be more conservative than necessary in light of available data, because excess conservatism could frequently result in the interpretation that a given leak exceeds its maximum allowable limit when in fact it would not exceed that limit if Pa were actually applied."

   Based on the above arguments and the discussions provided in Reference 4 to Appendix A, the District concludes that the proposed changes to the District's method for calculating the leak rate of the personnel access lock (PAL) door are not appropriately justified because Appendix A proposes the adoption of overly conservative and unpractical estimates. It should also be emphasized that the present reduced pressure test on the PAL door system is conducted by pressurizing the space between the two resilient seals on each door and that testing at a very high pressure (e.g., Pa) would tend to unseat the resilient seals because this pressure is applied opposite to the accident pressure which tends to seat the resilient seals for a tighter closure. Therefore, the District will continue to use the ASME Code endorsed pressure extrapolation methodology and, in order to increase the degree of conservatism in utilizing this methodology, we propose to increase the reduced pressure test from 5 psig to 15 psig. The District will submit a revised amendment application under separate cover which incorporates this change, along with other administrative changes.

Open Item #2

The valve or valves associated with penetration M-3 should be tested in accordance with Appendix J.

Response

A complete response to this item was provided in the District's letter dated September 3, 1982.

Open Item #3

The valve or valves associated with penetration M-44 should be tested in accordance with Appendix J.

Response

Penetration M-44 will be tested in accordance with Appendix J, and the District's amendment application will be revised accordingly.