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DUKE POWER

June 5, 1996

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Subject: Catawba Nuclear Station, Unit 1,
Docket No. 50-413
Response to Request For Additional Information

By letter dated January 26, 1996, Duke Power Company submitted a proposed one time Technical Specification change that would allow operation of the Containment Purge Ventilation System during Modes 3 and 4 following startup from the steam generator replacement outage.

On April 26, 1996, the NRC Staff provided a Request for Additional Information concerning the proposed Technical Specification change. A response to these questions was submitted on May 20, 1996. On June 3, 1996, a conference call was held in an attempt to clarify portions of the May 20 responses. The attached questions and responses are provided as a supplement to the May 20, 1996 letter.

If additional information is required, please call Robert Sharpe at (704) 382-0956.

Very truly yours,

WR McCollum Jr / [illegible]

W. R. McCollum, Jr.

Attachments

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Duke Power Company
Catawba Nuclear Station, Unit 1
Supplement to May 20, 1996 RIA Response

1) Can the duration of operation of the Containment Purge System be limited to 7 days cumulative operating time in Modes 3 and 4?

Response:

The Containment Purge Isolation valves of Catawba Unit 1 will be open for a cumulative time of seven (7) days or less while Unit 1 is in Mode 4 or Mode 3 following startup from the steam generator replacement outage. The proposed changes to Technical Specification (TS) 3.6.1.1, TS 3.6.1.2, and 3.6.1.9 have been revised to include this restriction. The marked-up and typed copies of the proposed changes are attached.

2) Has Duke reviewed the valve response analyses by Fisher and does Duke agree with these analyses? Compare the analyses of the Containment Purge isolation valves to the analyses performed for the Nuclear Service Water butterfly valves.

Response:

Fisher's torque prediction methodology for the Catawba containment purge butterfly valves was developed through the use of scaling techniques and nondimensional variable analysis (disc aspect ratios, for example) utilizing data from a series of controlled laboratory flow tests of representative butterfly valve models.

This approach basically mirrors the approach used by EPRI in developing the performance prediction program for butterfly valves, of which results from the INEL purge valve testing program were incorporated. While Fisher has provided some laboratory testing data in the subject report for viewing purposes, the collective results are considered proprietary by the company.

Duke Power Company has reviewed the analysis supplied by Fisher in Engineering Qualification Report FQR-49, Revision A. Duke has confidence in the results provided in the report, as they generally parallel the butterfly valve behaviors that have been documented through Catawba's GL 89-10 valve testing and surveillance activities.

For the subject containment purge butterfly valves, the primary safety function of concern is closing. Duke and EPRI testing efforts have demonstrated that aero/hydrodynamic torque requirements generally work against the butterfly valve disc as it moves to the fully open position (in effect, the flow is trying to close the valve as the actuator is trying to open the valve). Thus, as a butterfly valve is stroked closed, these same forces assist the disc as it moves, thus significantly reducing torque requirements. These testing efforts only reinforced widely understood butterfly valve behaviors.

This phenomena explains why the opening direction torque profile, with respect to dynamic torque, is normally bounding and the closing direction torque profile is generally characterized by negative torque requirements (in effect, the valve will close without the help of an actuator). These results are consistent with the torque profiles generated under the Catawba GL 89-10 butterfly valve program and the closing torque profiles for the subject Catawba containment purge butterfly valves generated by Fisher.

The torque reversals in the two torque profiles generated by Fisher between the 80° and the 90° disc positions are not unusual nor unexpected. This phenomena correlates with the sample test data which Fisher supplied in the subject report (Attachment E), and it also correlates with results obtained from Catawba's GL 89-10 program. This is especially true for the inboard butterfly valves, where the hub side of the disc is downstream. For the outboard butterfly valves, where the hub side of the disc is upstream, disc travel limiters will be installed on the respective actuators so that the valves are not allowed to open past the 80° position. Thus, the torque reversal for the outboard butterfly valves will be eliminated from consideration, and the dynamic torque profile for these valves will be entirely negative.

The method used in this analysis is similar to the approach that was used to analyze the torque requirements of the Catawba Nuclear Service Water System discharge isolation motor operated butterfly valves at the time of the failures described in Catawba LER 413/93-002, in that a vendor supplied analysis methodology is being used. However, there are differences between these two applications as discussed below.

First, the Nuclear Service Water System butterfly valves were manufactured by B.I.F., which applied an almost straight adaptation of AWWA torque prediction methods to its butterfly valves. Specific B.I.F. design considerations, such as packing load, were not accounted for in the analysis. Fisher s analysis is based upon an actual testing program conducted on its butterfly valves.

Second, the Nuclear Service Water System butterfly valve failures occurred as the valves were attempting to open, which as previously discussed, typically results in bounding torque requirements. The Catawba containment purge butterfly valves will be required to close, and with the exception of the 90° position for the inboard valves, the dynamic torque profiles for both sets of valves will be entirely negative.

Finally, the primary root cause of the subject Catawba Nuclear Service Water System butterfly valve failures was determined to be raw water degradation of the shaft bearings, not the overall structure of the torque prediction model that was used. This is not a concern for the containment purge butterfly valves, as these valves are in air service and would not be susceptible to this failure mode.

Thus, as the containment purge butterfly valve analysis supplied by Fisher contains no counter-intuitive behavior patterns, with negative dynamic torque requirements dominating the profiles, and is based upon a differential pressure testing program conducted by Fisher, utilizing scaling techniques and nondimensional variable analysis methods similar to those used by EPRI, the results are judged by Duke to be accurate and dependable.

3) As discussed in the May 20, 1996 response, a test could be performed to measure the valve spring output torque. Such a test should be performed to verify the analysis assumptions for valve closing torque.

Response:

A test will be performed to determine the spring torque output of each Containment Purge Isolation valve to be open in Mode 4 or Mode 3. All spring output tests will be completed prior to entry into Mode 4.

4) Please confirm that leak rate tests will be performed to validate the valve leakage assumed in the analysis of radiological consequences.

Response:

The technical justification prepared in support of the proposed amendments (letter, W. R. McCollum, Jr. to USNRC, January 26, 1996) included a report of the analyses of the radiological consequences of a DBLOCA at Unit 1 in Mode 3 with its Containment Purge Isolation Valves initially open. This discussion may be found in Attachment 2 of the referenced submittal, Pg. 6 of 9. There it is noted that "Initial values of leakage as high as 100% of the containment volume per day were assumed arbitrarily." This value was chosen to ensure that leakage past these valves would be bounded above in the analyses of radiological consequences. The precise assumption made was 100% per day for the first 24 hours, and 50% per day afterwards. This profile is consistent with the guidelines of SRP 15.6.5A.

The tests which will be conducted on the Containment Purge Isolation valves to be used in the proposed operation have been listed in the response to Question (2) of the RAI (cf. letter, W. R. McCollum, Jr. to USNRC, May 20, 1996) and in the January 26, 1996 amendment request, Attachment 2, Compensatory Actions. The tests to be conducted on each of these valves prior to entry to Mode 4 will include a leak rate test as well as a series of Category A Active Valve tests.