

January 30, 1976

Docket Nos. 50-269
 50-270
and 50-287

Duke Power Company
ATTN: Mr. William O. Parker, Jr.
 Vice President
 Steam Production
Post Office Box 2178
422 South Church Street
Charlotte, North Carolina 28242

Gentlemen:

Your facility is one of several with nuclear steam supply systems supplied by Babcock and Wilcox (B&W) that are equipped with reactor internals vent valves to prevent vapor lock in the reactor vessel in the event of a reactor coolant cold leg leak. In the past, facilities having this design feature have been assessed a flow penalty to allow for the potential of a vent valve being stuck open during normal operation. This penalty represents a reduction in core flow of about 5%. In August, 1975, B&W submitted to the NRC a generic report entitled, "B&W Operating Experience of Reactor Internals Vent Valves." Based on our review of this report, we have concluded that sufficient evidence has been presented to assure that the reactor internals vent valves on B&W plants will remain closed during normal operation. A copy of our Report Evaluation is enclosed.

This letter is being sent to you for your information in the event that you wish to eliminate the vent valve flow penalty for your facility. In accordance with the conclusions reached in our evaluation, an application for a license amendment to accomplish this must include proposed changes to the facility Technical Specifications to require surveillance testing during each refueling outage to confirm that no vent valve is stuck in an open position and that each valve exhibits complete freedom of movement.

Sincerely,
Original signed by:
Robert A. Purple

Robert A. Purple, Chief
Operating Reactors Branch #1
Division of Operating Reactors



OFFICE ➤						
SURNAME ➤						
DATE ➤						

Duke Power Company

- 2 -

January 30, 1976

Enclosure:

NRC Staff Safety Evaluation on
"B&W Operating Experience of
Reactor Internals Vent Valves"

cc w/enclosure:

Mr. William L. Porter
Duke Power Company
P. O. Box 2178
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Charlotte, North Carolina 28242

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REPORT EVALUATION: "B&W OPERATING EXPERIENCE OF REACTOR INTERNALS VENT VALVES"

SUMMARY OF REPORT

In accordance with a request from B&W, the Nuclear Regulatory Commission staff (the staff) has reviewed the subject report which was enclosed with the request. This report contains operating and test data from B&W's six operating units intended to demonstrate that reactor internals vent valves remain closed during normal operation. In addition to the information submitted in this report, the staff's review included information obtained from a telephone conversation with B&W on September 24, 1975.

The staff has taken the position on recent applications which utilize the B&W reactor internals vent valves that the applicants must either: (1) take a flow penalty for a vent valve being open during operation, (2) provide instrumentation to ensure that the vent valves remain closed, or (3) provide operating data from other B&W plants which demonstrate that the vent valves remain closed during normal operation. It is B&W's contention that this report resolves the staff's position and that this item should no longer be considered an open item on current applications. |

When B&W plants first began commercial operation, the staff's position was that until sufficient operating experience became available, a flow penalty would be imposed to account for the potential of a vent valve being stuck open during normal operation, thereby reducing core flow by an amount equivalent to the bypass capability of the open vent valve (about 5%). This report was reviewed to evaluate the feasibility of removing this flow penalty. B&W's conclusion that a flow penalty is no longer warranted is based essentially on the following sources of information:

1. Oconee inspection results obtained during hot functional testing and during a recent refueling outage.
2. Rancho Seco internals vent valve thermocouple data.
3. Rancho Seco loose parts monitoring system results.

B&W provided a discussion of their Oconee inspection results obtained following hot functional testing. All eight valve body seating surfaces

were examined by B&W. Each valve showed a difference in the tone of the oxide coating inside and outside the seating surface, representing a turbulent inlet area (outside the vent valve) and a lower velocity area inside. An area of good contact between the valve body and seat appeared as a narrow dark line approximately at the center of the flat body seating surface. B&W indicates that all eight vent valves showed such contact area. Enclosed is a summary of pertinent inspections conducted by B&W on their operating reactors (Table 1).

Rancho Seco was utilized as the site for the installation of vent valve thermocouples just inside each valve. B&W stated that a vent valve was considered to be open if two of the three installed thermocouples on a particular valve indicated a temperature 25°F below the reactor outlet temperature when the power level was greater than 80% of rated power. This criterion was based on results of testing conducted at B&W's Alliance Research Center in 1969. B&W concludes that a review of the thermocouple data shows that at no time did any of the vent valve thermocouple temperatures (average of the three) approach a 25°F departure from hot leg temperature. We have reviewed the representative data provided by B&W and agree with this conclusion. Using the B&W criterion, the presented data do not reveal any anomalous behavior of the vent valves. B&W has indicated that the remaining thermocouple data (not submitted) showed nothing to dispute this conclusion. Several instances of unusual thermocouple temperatures were attributed to individual instrument malfunctions. The redundant thermocouples on each valve formed the basis for this contention.

Loose parts monitoring programs continuously monitor for unusual noises within the reactor vessel. B&W points out that specific investigations of unusual noises, at Rancho Seco, Oconee 2 and Three Mile Island Unit 1 have excluded vibrating vent valves as the source. Specific mention was made of the vibration program investigation at Rancho Seco which included an instrument location in the general vicinity of a vent valve. Although impacts of a vibrating vent valve would have been expected to be heard at other locations, it should clearly have been heard at this vent valve location. No impacts coming from the area of the vent valves were detected. Similarly, other loose parts monitoring programs on the remaining operating B&W reactors have not shown vent valves to be vibrating. While not evidence that a vent valve was not stuck in an open position, such information does provide further assurance that vent valves do not undergo vibratory motion between the disc and seat during normal operation.

B&W points out that the inclination (5° off vertical) of the valve body seal face provides a positive closing force. This vent valve design feature, coupled with the normal differential pressure across the core and vessel internals, keeps the valves closed. About 1500 lbs. closing force on each vent valve is calculated by B&W to exist during 2-pump operation. During 4-pump operation, this closing force increases to about 6000 lbs. B&W states that their vessel model flow tests verify that a positive hydraulic closing force is exerted on the valve disc regardless of its angular position between 0 and 21 degrees (full open).

STAFF CONCLUSIONS

Based upon the information provided by B&W, the staff believes that sufficient assurance exists that reactor internals vent valves are not opening in operating reactors and that the possibility of a stuck open vent valve is acceptably low. To further minimize the probability for such an occurrence, the staff will require testing to be conducted each refueling outage to confirm that no vent valve is stuck in an open position and that each valve continues to exhibit complete freedom of movement. In addition, loose parts monitoring programs are recognized to be the sentinel for abnormal noise behavior. Reports to NRC shall specify any anomaly attributed to a vibrating vent valve or vent valve components. We therefore conclude that B&W plants which incorporate the aforementioned surveillance requirements into their Station Technical Specifications need not include a vent valve flow penalty in their design and safety analyses. Significant departures from the vent valve design currently on operating reactors would warrant a re-evaluation of these conclusions.

TABLE 1

BABCOCK AND WILCOX

VENT VALVE INSPECTION SUMMARY

1. The valves operate freely.

The vent valves on all six of BSW's operating plants were checked prior to Hot Functional Testing and found to operate freely. There have been no reports of binding, or excessive friction, with relation to vent valve disc freedom of movement. The Oconee 1 valves were checked after both Hot Functional Testing and refueling and found to operate freely.

2. The valve disc hangs closed due to its own weight.

All valves were inspected before and after Hot Functional Testing on all six plants and on Oconee 1 and 2 after power operation. In all cases, the valves were found to be closed.

3. The valve seal surfaces indicate contact during operation.

The reactor internals become discolored during operation due to oxidation of the metal surface. Surfaces which are clamped together, such as the plenum to core support clamping surfaces, have a different discoloration and surface texture than surfaces exposed to coolant flow. The vent valve seal surfaces exhibited oxidation coloring similar to other clamped surfaces. Inspections of the seal surfaces have consistently indicated contact between the valve body and disc. The discoloration also is used to indicate significant leakage through the valve. No significant leakage has been observed.

4. The valve does not open during reactor operational transients.

Coolant velocity is higher than normal during Hot Functional Testing due to the absence of the core. Should a valve open during transients such as pump switching, it would most likely happen at that time. Any valve opening and closing would have left impact marks on the valve seal surfaces and possibly on the reactor vessel. No impact marks have been discovered during the post Hot Functional Testing inspections of the six operating B&W plants or at any other time.