NINE MILE POINT 1
DOCKET NO. 50-220

DEMONSTRATION OF CONTAINMENT PURGE AND VENT VALVE OPERABILITY (B-24)

1.0 Requirement

Demonstration of operability of the containment purge and vent valves, and particularly, the ability of these valves to close during a design basis accident is necessary to assure containment isolation. This demonstration of operability is required by BTP CSB 6-4 and SRP 3.10 for containment purge and vent valves which are not sealed closed during operational conditions 1, 2, 3, and 4.

2.0 Description of Purge and Vent Valves

The valves identified as the containment isolation valves in the purge and vent system are as follows:

Valve Tag No.	Valve Size (Inches)	Type	Use	Location
BFV 201-07	20	Butterfly	Suppression chamber purge and vent.	Outside containment
BFV 201-08	20	Butterfly		Outside containment
BFV 201-17	20	Butterfly		Outside containment
BFV 201-16	20	Butterfly		Outside containment
BFV 201-09	24	Butterfly	Dry well purge and vent.	Outside containment
BFV 201-31	24	Butterfly		Outside containment
BFV 201-10	24	Butterfly		Outside containment
BFV 201-32	24	Butterfly		Outside containment

The butterfly valves are manufactured by Allis Chalmers. The 24-inch valves are used for purging and venting the drywell and the 20-inch valves purge and vent the suppression chamber. All lines have two valves in series; with the inboard valves being air operated and the outboard valves motor operated. All valves are mechanically blocked for a 50° maximum opening (90°-full open).

The pneumatic operators are manufactured by Bettis and the electric motor operators are made by Limitorque. Model numbers for the operators are not furnished in the licensee's submittals. No information is provided in the submittals concerning the pilot solenoid valves.

3.0 Demonstration of Operability

Niagara Mohawk Power Corporation (NMPC) has provided operability demonstration information for the containment purge and vent system isolation valves at their Nine Mile Point nuclear station in the following submittals:

Reference A - NMPC letter of January 29, 1982, T. E. Lampages to D. B. Vassallo (NRC).

Reference B - Niagara Mohawk Power Corporation, letter of December 17, 1979, D. P. Dise to T. A. Ippolito (NRC).

Reference C - Allis Chalmers test report for containment isolation valves dated August 1, 1980 and attached to Reference A.

3.1 Niagara Mohawk's approach to operability demonstration is based on the test report from Allis-Chalmers (Reference C). The test report includes a tabulation for each valve, from 90° (open) to 0° (closed) in 10° increments of the dynamic torque coefficient (C_t), the dynamic torque (T_D), the bearing torque (T_b), the combined dynamic and bearing torques ($T_O = T_D + T_b$) and at each increment of angle, the available operator torque. Although not stated, the dynamic torque coefficients are derived from the model testing program; the results of which are presented in the Allis Chalmers report VER-0209.

Allis Chalmers conclusions in the test report (Reference C) are that all valves except for 201-07, -08, and -17 have operators that are more than adequate to provide closure during the worst case D.B.A. Valves 201-07 and -17 should be blocked at 75° open, and that the operator for valve 201-08 should either be replaced with a larger unit or reset to provide a faster stroke time.

3.2 Peak drywell containment pressure from the LOCA pressure response curve is assumed at the start of closure from the 90° open position with a 0 sec delay time.

3.3 The maximum allowable shaft torques are stated as 2,050 ft-lbs for the 20-inch valves and 2,200 ft-lbs for the 24-inch valves. The largest required operating torques calculated are -1,376 ft-lbs for the 20-inch valves and -913 ft-lbs for the 24-inch valves.

The required operating torque is obtained by combining the dynamic torque T_D and the bearing torque T_B with the negative sign denoting torque assisting valve closure. The maximum required operating torques occur at the 90° (full open) valve position. The maximum shaft allowable torques although not stated, are taken from Table 1 of ANSI/AWWA Standard C504.

4.0 Evaluation

4.1 The bearing torques (T_b) tabulated in the Allis Chalmers test report for valve No. 201-07 have an error in sign. T_b always opposes valve closure and should be assigned a negative sign. The combined torque T_O in this case would therefore be larger than listed in the tabulation for this valve (201-07) since the dynamic torques are all negative and oppose closure. From the tabulation sheet for this valve (201-07), selecting 50° open:

T_D = -541 ft-lbs
T_B = 62 ft-lbs
T_O = 541 + 62 = -479 ft-lbs

Using the proper sign for T_B, T_O = -541 + (-62)
= -603 ft-lbs

Despite the increase in T_O from (-)479 ft-lbs to (-)603 ft-lbs, the resultant torque margin of 497 ft-lbs is adequate (available operator torque = 1,100 ft-lbs).

4.2 The 24-inch valves have large torque margins and are capable of closure against the buildup of containment pressure during the postulated LOCA.

4.3. The Allis Chalmer test report (Reference C) presents calculated valve torques predicated upon a peak LOCA containment pressure of 34.5 psig occurring when the valve starts closure from full open (90°) and a declining pressure ramp for the other valve positions calculated to valve closure. A "0" second delay is also assumed and the valve closure time used for the analysis is 60 sec.

Since the licensee has chosen to block all the valves at 50° open, it would be more approproate to calculate the valve torques based on closure from 50° open.

For example, recalculating the 20-inch butterfly valve 201-17 assuming 34.5 psig peak LOCA containment pressure and "0" sec delay at the 50° opening corresponding to start of closure, indicates insufficient operator torque capacity as shown below.

Using the standard equation for calculating dynamic torque

$$T_D = C_T (D^3) \Delta P$$

where

T_D = dynamic torque in ft-lbs
C_T = the dynamic torque coefficient
D = disc diameter in ft = 20/12
ΔP = pressure drop across the valve in psi.

C_T and ΔP are determined by using the appropriate tables in Allis Chalmers model test report VER-0209. The Allis Chalmers test report (Reference C) uses Test No. 21 data contained in VER-0209, therefore using the Test No. 21 data the following values are obtained:

P_1 = 40 psig
Valve angle = 50° C_T = -11.4 and ΔP = 29 psi

P1 = 30 psig
Valve angle = 50° C_T = -8.5 and ΔP = 24.5 psi

For 34.5 psig
Valve angle = 50° C_T and ΔP are obtained by interpolation.
from the above

P_1 = 34.5 psig C_T = -9.81 ΔP = 26.53 psi

$$T_D = C_T (D^3) \Delta P$$

$$= -9.81 \left(\frac{20^3}{12}\right) 26.53$$

$$= -1{,}209 \text{ ft-lbs}$$

Note: The (-) sign for T_D indicates torque opposing closure.

Bearing torque (T_B) must also be determined and combined with T_D to obtain the required operating torque (T_O).

The standard valve industry equation used to determine bearing torque is $T_B = 4.71\ D^2 df \Delta P$

T_B = Bearing torque, ft-lbs
D = Disc diameter in ft
d = Shaft diameter in inches
f = Friction coefficient
ΔP = Pressure drop across valve in psi.

Using the value of -3.93 from the Allis Chalmers test report:

$$4.71\ D^2 df = -3.93$$
$$T_B = -3.93 \times 26.53 = -104$$

Required operating torque or $T_O = T_D + T_B$

Note: The (-) sign indicates torque opposing closure

$$= -1{,}209 + (-104)$$
$$= -1{,}313 \text{ ft-lbs}$$

The available operator torque for valve No. 201-17 listed in the Allis Chalmers test report (Reference C) is 1,100 ft-lbs. Thus the operator has inadequate torque for closure from 50° open. Since the valve is blocked open at 50°, concern exists not only with the long-term acceptability but also with meeting the interim operability position.

4.4 The licensee has not provided a stress analysis for critical valve parts and operator mounting hardware that combined LOCA and seismic loads. However, since the plant received a construction permit prior to

October 27, 1972, these load combinations are not currently required. But, Niagara Mohawk Power Corporation should confirm that a seismic analysis was performed for these components.

5.0 Summary

We have completed our review of information submitted to date concerning the operability of containment purge and vent valves for Nine Mile Point 1. Section 4.3 and 4.4 are the basis for the conclusion drawn by the staff. We find the information submitted failed to demonstrate the ability of both the 20-inch and 24-inch valves to close against the buildup of containment pressure in the event of a LOCA. For this reason, the purge and vent valves should be sealed closed in accordance with SRP Section 6.2.4, II.6.f. Furthermore, these valves should be verified to be closed at least once every 31-days.

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Dated: September 21, 1983