UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
BOSTON EDISON COMPANY
PILGRIM NUCLEAR POWER STATION, UNIT NO. 1
DOCKET NO. 50-293
DEMONSTRATION OF CONTAINMENT PURGE AND VENT VALVE OPERABILITY

1.0 Requirement

Demonstration of operability of the containment purge and vent valves, 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

Valve Number	Size (Inches)	Use	Location
AO-5035A	8	Drywell purge	Outside containment
AO-5035B	8	Drywell purge	Outside containment
AO-5036A	8	Torus purge	Outside containment
AO-5036B	8	Torus purge	Outside containment
AO-5044A	8	Drywell vent	Outside containment
AO-5044B	8	Drywell vent	Outside containment
AO-5042A	8	Torus vent	Outside containment
AO-5042B	8	Torus vent	Outside containment

The eight (8-inch) Clow containment purge and vent system butterfly valves at the Pilgrim Nuclear Power Station replace eight (20-inch) valves originally installed.

Actuators used with the Clow valve are Bettis Model Number N732-SR80-S pneumatic actuators (air open-spring close).

3.0 Demonstration of Operability

The Boston Edison Company (BECo) in their submittal dated April 6, 1984 provided the operability demonstration information for the containment purge and vent valves at their Pilgrim Nuclear Power Station.

Clow Corporation Report Number 11-15-83 attached to the April 6, 1984 submittal contains the specifics for demonstration of valve operability.

A. Valve loads are predicted using model test data for the prediction of dynamic torque coefficients. The model tests take into account the effects of upstream and downstream piping elements (elbows, tees, etc.) including various separation distances and orientations. Conservative assumptions are used in the determination of dynamic torque with no credit taken for pressure ramp in containment and no credit taken for backpressure due to downstream piping. Peak LOCA containment pressure of 56 psig is assumed to be constant during valve closure.

B. The Bettis Model Number N732-SR80-S actuators provided with the Clow valves have a minimum spring torque based on actual testing of each actuator of 9,263 in-lbs at 0°. Required torque to seat the valves, which is the maximum torque required during valve closure is 7,681 in-lbs.

C. The valve frequency and stress analysis are accomplished by comparing the nuclear specific requirements of the Pilgrim design requirements, Bechtel Number 8031-P-353, Revision 4, Addendum 1 to an already performed worst case generic qualification report for a Clow 8-inch Wafer Stop valve, PEI-TR-83-24, Revision A. Table 4 taken from the licensee's submittal of April 6, 1984 presents the comparison of design requirements for Pilgrim versus the generically qualified data. This table shows that the loading and dimensional parameters for the subject valves are adequately enveloped by the generic nuclear qualification.

D. Seismic qualification is demonstrated by stress and freqency analysis prepared by Patel Engineers of Huntsville, Alabama in Report Numbers PEI-TR-83-24, Revision A and PEI-TR-83-33.

4.0 Evaluation

4.1 The April 6, 1984 submittal from BECo which includes the Clow Corporation's report entitled "Purge and Vent Valve Operability Qualification Analysis" contains information that demonstrates adequate torque and stress margins.

The Clow analysis assumes worst case postulated accident conditions using peak containment pressure taken from the LOCA containment response curves and takes no credit for ramp pressure rise, which the staff finds acceptably conservative.

Dynamic torque coefficients are derived from a model test program performed for Clow by Dr. A. L. Addy of the University of Illinois using the University's facilities. From the data base developed by the model test, a computer program (Clow valve analysis program - CVAP) is used to predict valve operating characteristics.

Tables 1 and 2 (taken from the licensee's April 6, 1984 submittal) tabulate the "normal" and "maximum" dynamic torques developed during closure under LOCA conditions. Differences in "normal" torques shown in the two tables are caused by valve disc orientation with respect to flow direction.

The peak dynamic torque is shown to be 5,556 in-lbs from the tables and is acting to close the valve. The seating torque of 7,681 in-lbs acts to oppose valve closure, however, the available actuator spring torque at 0° of 9,263 in-lbs provides adequate torque margin for closure and sealing.

Table 1. Torque for as installed conditions for valves AO-5035A, AO-5044A, and AO-5044B. All torques in in-lbs (positive torque tends to close valve).

Model Test Valve Angle	Actual Valve Angle	Torque for Installed Condition	
		Normal*	Maximum**
80	90	73	2,477
70	80	130	4,476
60	70	164	5,410
50	60	177	5,556
40	50	173	5,180
30	40	158	4,572
20	30	142	4,030
10	20	137	3,848

*At 1.5 psid
**At 56 psid

Table 2. Torque for as installed conditions for valves AO-5036A, AO-5036B, AO-5042A, and AO-5042B. All torques in in-lbs (positive torque tends to close valve, negative torque tends to open valve).

Model Test Valve Angle	Actual Valve Angle	Torque for Installed Condition	
		Normal*	Maximum**
80	90	-34	2,477
70	80	-61	4,476
60	70	-79	5,410
50	60	-89	5,556
40	50	-93	5,180
30	40	-93	4,572
20	30	-89	4,030
10	20	-84	3,848

*At 1.5 psid
**At 56 psid

4.2 The N732-SR80-S Bettis actuators used with the purge and vent valves at Pilgrim have a large structural margin of safety evidenced by the torque rating specified by the manufacturer to be 27,776 in-lbs at 100 psi compared to the maximum torque requirement for seating the valve of 7,681 in-lbs.

4.3 The valve frequency and stress analysis are accomplished by comparing BECo's design requirements to the worst case generic nuclear qualification analysis for the Clow 8-inch wafer stop valves. Table 3 represents this comparison and demonstrates that the loading and dimensional parameters are

Table 3. Comparison of Pilgrim Nuclear specific requirements to generic nuclear qualification data (Reference 1).

	Generic	Pilgrim
Loadings		
Pressure:		
Shell (psig)	285	285
Seat (psid)	75	56
Torque (in-lb)	1,6643	9,056
Seismic Acceleration:		
NS (g)	7.0	4.5
EW (g)	7.0	4.5
Vertical (g)	7.0	4.5
Operator Weight (lb)	550	360
Center of Gravity:		
X (in)	10	10.81
Y (in)	10	1.01
Z (in)	18	3.99
Freqnency f_o (Hz)	59.5	$f_o \geq 33$ Hz
EVALUATION AGAINST	ASME Section II Design & Level A	ASME Section III Design & Level A

adequately enveloped by the generic nuclear qualification parameters. A summary of allowable stresses, stress values and seismic loadings is included in the Clow report as Table 5, with the stress ratios shown to be acceptably low.

4.4 The staff finds that seismic qualification has been acceptably addressed by the licensee in the April 6, 1984 submittal.

5.0 Conclusion

We find that the information submitted has satisfactorily demonstrated the ability of the Clow valves to close against the buildup of containment pressure in the event of a DBA/LOCA at the Pilgrim Station.

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Dated: September 24, 1984