TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

October 25, 1984

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

By letter dated December 6, 1983, TVA, as requested by NRC letter dated October 5, 1982, provided additional information in response to item 6 of NUREG-0737, Item II.E.4.2 concerning containment purge and vent valve operability assurance. By letter dated August 24, 1984, NRC indicated that TVA had not demonstrated, to the NRC staff's satisfaction, the ability of the eight-inch and 24-inch valves to close from a fully open position in the event of a DBA/LOCA and that additional information is again needed to complete the review of this matter. Specifically, additional information was requested with respect to; (1) the methodology used to derive aerodynamic torques for the eight-inch and 24-inch valves, and (2) verification that the valves have been installed in the preferred orientation described by the valve manufacturer.

Enclosed you will find the following information:

(1) A discussion addressing NRC concerns on the operability of the 24-inch valves in the upper containment compartment,

(2) A discussion addressing anticipated neck stresses in the eight-inch valves,

(3) A discussion on valve orientation including a table which provides a breakdown by valve number, size, use, and location, and

(4) Supporting vendor information.

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Director of Nuclear Reactor Regulation October 25, 1984

Please note that information addressing NRC concerns on the operability of the 24-inch valves in the lower containment compartment will be provided before unit 1 fuel loading.

If you have any questions concerning this matter, please get in touch with D. B. Ellis at FTS 858-2681.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 25th day of Oct. 1984

Paulette H. White

Notary Public
My Commission Expires 8-24-88

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

ENCLOSURE
WATTS BAR NUCLEAR PLANT
NRC REQUEST FOR ADDITIONAL INFORMATION
NUREG-0737, II.E.4.2
CONTAINMENT PURGE AND VENT VALVE OPERABILITY

24-inch Valves - Upper Compartment

The Watts Bar Nuclear Plant (WBN) is an ice condenser plant which has two major containment volumes denoted as the upper and lower compartments. Under certain conditions, these compartments communicate through the ice condenser. There is no high energy piping located in the upper compartment. The same differential pressure (18.5 lb/in^2) has been used to evaluate the subject valves irrespective of their location. The peak pressure in the upper compartment due to a large break LOCA is actually less than 8 lb/in^{2}g during the first 30 seconds of the event and less than 7 lb/in^{2}g during the valve closure period. Thus, the differential pressure across the valve is 11.5 lb/in^{2}g lower than the differential pressure used in evaluating the valves and also imposes a factor of conservatism equal to 2.6 (18.5/7.0) on the calculated aerodynamic torque. (Note that the pressure indicated in section 3.0 of the draft SER should be 33.2 lb/in^{2}a rather than 33.2 lb/in^{2}g.) In addition, the mach speed in the upper compartment is expected to be closer to 0.3. This implies that the assumptions concerning lift and drag coefficients were appropriate. Attachment 1 indicates that the valve vendor is in agreement with this position. For these reasons, the upper compartment 24-inch valves (see table 1) should be left in their current configuration (i.e., 70 degrees open).

24-inch Valves - Lower Compartment

We are currently working with the valve manufacturer to resolve the NRC concerns on the remaining 24-inch valves. Additional information will be provided by unit 1 fuel load.

8-inch Valves - Anticipated Neck Stresses

In response to the NRC concerns on the 8-inch valve neck stresses, the attached valve vendor report (attachment 2) states that while the valve neck stresses are not totally independent of the aerodynamic torques, the applied aerodynamic torque would have to be quadrupled for the calculated stress to approach the allowable limit. Thus, the 8-inch valve should be operated in the full open position.

Valve Orientation

The 8- and 12-inch valves will be installed in the vendor's preferred orientation (valve seal retaining ring downstream relative to LOCA flow) by unit 1 fuel load.

The 24-inch valves have been locked at 70-degrees open (or less) therefore, there is no concern over possible torque reversal for these asymmetrical disc valves. Thus the valve's seal retaining ring may be placed either upstream or downstream relative to LOCA flow. The valve manufacturer has confirmed that the valves may be placed in either orientation provided the valve is locked at 70-degrees open (or less; see attachment 1).

TABLE 1
WATTS BAR NUCLEAR PLANT
CONTAINMENT ISOLATION PURGE VALVES

Valve No.	Size (in)	Use	Location
30-40	8	Pressure Relief	Accumulator Rm 4
30-37	8	Pressure Relief	Accumulator Rm 4
30-19	12	Purge Supply	Instrument Rm
30-20	12	Purge Supply	Instrument Rm
30-58	12	Purge Exhaust	Instrument Rm
30-59	12	Purge Exhaust	Instrument Rm
30-7	24	Purge Supply	Upper Compartment
30-8	24	Purge Supply	Upper Compartment
30-9	24	Purge Supply	Upper Compartment
30-10	24	Purge Supply	Upper Compartment
30-14	24	Purge Supply	Lower Compartment
30-15	24	Purge Supply	Lower Compartment
30-16	24	Purge Supply	Lower Compartment
30-17	24	Purge Supply	Lower Compartment
30-50	24	Purge Exhaust	Upper Compartment
30-51	24	Purge Exhaust	Upper Compartment
30-52	24	Purge Exhaust	Upper Compartment
30-53	24	Purge Exhaust	Upper Compartment
30-56	24	Purge Exhaust	Lower Compartment
30-57	24	Purge Exhaust	Lower Compartment

ATTACHMENT 1

POSI-SEAL INTERNATIONAL, INC.
ROUTES 49 & US 95 NORTH STONINGTON CT 06359 203 580 1143 TELEX 966443

August 23, 1984
PSI Corr. No. 20.0.003.84

Tennessee Valley Authority
W10D203, 400 West Summit Hill Ave.
Knoxville, TN 37902

Attention: Mr. J. Smith x 7220
Nuclear Engineering Branch

Subject: Watts Bar Nuclear Plant
Butterfly Valves for Containment Isolation
Contract 81KA3-828342
Posi-Seal Ref. No. 13069
LOCA and Seismic Analysis

Dear Jim:

The purpose of this letter is to confirm what was stated in our telephone conversations of August 21 and 22, 1984.

Posi-Seal concurs that if the 24" valves located in the upper compartment of containment are only subject to a maximum pressure drop of 8 psig, that the amount of valve opening can be restricted to 70 degrees open rather than 50 degrees. This conclusion is based on the rationale that the aerodynamic torque is directly proportional to the pressure drop across the valve. Therefore, if the pressure drop is 8 psig rather than the 18.5 psig used for the original analysis, then the aerodynamic torque will be less than half of the torque originally calculated. In their letter of July 19, 1984 the NRC found the 12" valves to be acceptable based on a safety factor of two when applied to the aerodynamic torque. Therefore, Posi-Seal feels justified in applying the safety factor of two to these 24" valves.

POSI-SEAL INTERNATIONAL, INC.
ROUTES 49 & US 95 NORTH STONINGTON, CT 06378 (203) 599-1140 TELEX 96443

August 23, 1984
PSI Corr. No. 20.0.003.84
Page - 2

With these 24" valves having a restricted opening of 70 degrees, they can be placed in either the preferred or nonpreferred direction since in both cases the flow will tend to close the valve.

If I can be of further assistance please let me know.

Sincerely,

John G. Rodgers
Supervisor of Engineering

jh

P.S you are completely right Mr. S

ATTACHMENT 2

POSI-SEAL INTERNATIONAL, INC.
ROUTES 49 & US 95 NORTH STONINGTON CT 06359 203 599 1140 TELEX 966443

August 21, 1984
PSI Corr. No. 20.0.002.84

Tennessee Valley Authority
W10D203, 400 West Summit Hill Ave.
Knoxville, TN 37902

Attention: Mr. J. Smith
Mechanical Engineering Branch

Subject: Watts Bar Nuclear Plant
Butterfly Valves for Containment Isolation
Contract 81KA3-828342
Posi-Seal Ref. No. 13069
LOCA and Seismic Analysis

Dear Jim:

The purpose of this letter is to respond to comments made by the NRC in their letter of July 19, 1984 pertaining to Posi-Seal's LOCA and Seismic Analysis.

Posi-Seal concurs with the NRC that the coefficients of lift and drag are a function of Mach number and that Posi-Seal did not take this into consideration when performing the analysis. However, how much of an influence this has on the analysis Posi-Seal is not in a position to state at this time. As a consequence, it is recommended that the amount of valve opening for the 24" valves be restricted to 50 degrees for the time being.

It should be noted that the method used for the LOCA analysis is the same method used successfully by Posi-Seal to size actuators for use on valves with critical flow. Examples of this are control valves presently being used in jet engine and gas turbine test stands.

POSI-SEAL INTERNATIONAL, INC.
ROUTES 49 & US 95 NORTH STONINGTON CT 06359 203 599 1140 TELEX 966443

As for the 8" valves, Posi-Seal has performed a seismic analysis of these valves with no torque applied. The resulting valve neck stresses were 23,300 psi. Also performed was an analysis to determine the amount of torque needed to overstress the valve neck. This torque is approximately 3400 in.lbs. Ignoring the packing and bearing torque which would resist the valve closing with flow in the preferred direction, the torque required to overstress the neck is four times greater than the maximum calculated aerodynamic torque in the preferred direction (842 in.lbs).

The NRC in paragraph 4.3 of their letter state that the 12" valves can remain in the open position since even if the aerodynamic torque is doubled the valves will not be overstressed. Using this same rationale Posi-Seal concludes that the 8" valves can also be left in the open position.

Enclosed are copies of the additional analyses. As can be seen the format of these analyses is slightly different than those originally submitted. To demonstrate that the equations used are the same, an analysis which is comparable to one original submitted has also been enclosed.

If you have any comments or questions pertaining to this subject please let me know.

Sincerely,

John G. Rodgers
Supervisor of Engineering

jh

Enclosure

POSI-SEAL INTERNATIONAL, INC.
NUCLEAR SEISMIC ANALYSIS

8 CLASS 150 VALVE ASSEMBLY
WITH [illegible] ACTUATOR

CUSTOMER: TVA
[illegible]
SPEC.NO.:
REF.NO.: 13069
ITEM NO.: 3

REFERENCE DWGS.	ALLOWABLE STRESSES (PSI)
A.BODY DWG.NO.: [illegible] REV.D	A.BODY: [illegible]
B.BODY DWG.NO.: 1144-080-16 REV.-	B.STEM: 54300
C.DISC DWG.NO.: 1144-080-15 REV.H	C.PIN: 54300
D.STEM DWG.NO.: [illegible] REV.A	D.BRACKET: 20550
E.PIN DWG.NO.: 1306-3 REV.A	E.BOLTING: 37500
F.BRACKET DWG.NO.12296 REV.-	

DESIGN CONDITIONS
PRESSURE(PSIG)= 33.2 (should be 18.5)
TEMPERATURE(°F)= 250

= 529 + 10 = 564

	G LOADINGS
LOCA TORQUE= 1123	TRANSVERSE= 3
MEDIA=STEAM	VERTICAL= 3
FLOW DIRECTION=NONPREFERRED	LONGITUDINAL= 3

DIMENSIONAL DATA

X1= 2	X2= 8.034	X3= 3.25	X4= 4	X5= 3.313	W1= 165	W2= 11
W4= 15	T1= .5	T2= 4.5	T3= 3.182	T4= 0	T9= .5	T0= .5
d3= 1.791	Di= 1.375	D1= .872	D= 7.912	E1= 1.062	E2= .687	
L2= .187	Y2= 1	N1= 4	A1= .1416	X6= 4.5	N2= 4	
A2= .1416	X7= 3.182	X8= 3.182	T2= 8	R5= 0	R6= 0	
%= 65	dp= .309	d1= 10.875	R7= 8.125	R8= 8.625	R9= 7.981	
L= 2.75	T= .375	B= 1	E= 30000000			

NATURAL FREQUENCIES (HZ.)	ACTUATOR BOLT STRESSES
LONGITUDINAL(Z) ACT./VALVE= 37 VS. 33HZ.	SHEAR= 4230 PSI
VERTICAL(Y) ACT./VALVE= 433 VS. 33HZ.	TENSILE= 5684 PSI
TRANSVERSE(X) ACT./VALVE= 62 VS.33HZ.	COMBINED= 7939 PSI VS.ALLOW.= 37500
LATERAL DISC/STEM= 928 VS.33HZ.	

BRACKET BOLT STRESSES	BRACKET STRESSES
SHEAR= 4456 PSI	SHEAR= 599 PSI
TENSILE= 9082 PSI	TENSILE= 2786 PSI
COMBINED= 10903 PSI VS.ALLOW= 37500	COMBINED= 2909 PSI VS.ALLOW= 20550

VALVE NECK STRESSES	STEM STRESSES
SHEAR= 8102 PSI	SHEAR= 9625 PSI
TENSILE= 21487 PSI	TENSILE= 2706 PSI
COMBINED= 24200 PSI VS.ALLOW= 21250	COMBINED= 10094 PSI VS.ALLOW= 54300

DISC PIN STRESS	SECTION MODULUS
SHEAR= 10927 PSI VS.ALLOW= 32580	VALVE= 86.92 IN↑3
	PIPING= 16.8 IN↑3

ACTUATOR DEFLECTIONS	BODY BOLTING
LONGITUDINAL= 2.04020000E-02 INCHES	NOT APPLICABLE
VERTICAL= 1.51000000E-04 INCHES	
TRANSVERSE= 7.30000000E-03 INCHES	

SIGNED. [signature] .....DATED. 9/13/84.....

7945

POSI-SEAL INTERNATIONAL, INC.
NUCLEAR SEISMIC ANALYSIS

8 CLASS 150 VALVE ASSEMBLY
WITH [illegible] ACTUATOR

CUSTOMER: TVA
P.O. NO.: [illegible]
SPEC.NO.:
REF.NO.: 13069
ITEM NO.: 3

REFERENCE DWGS.
A.BODY DWG.NO.: 12421 REV.D
B.BODY DWG.NO.: 1144-080-15 REV.-
C.DISC DWG.NO.: 1144-080-15 REV.H
D.STEM DWG.NO.: 1304-295 REV.A
E.PIN DWG.NO.: 1306-3 REV.A
F.BRACKET DWG.NO.: 12296 REV.-

ALLOWABLE STRESSES (PSI)
A.BODY: 26250
B.STEM: 54300
C.PIN: 54300
D.BRACKET: 20550
E.BOLTING: 37500

DESIGN CONDITIONS
PRESSURE(PSIC)= 18.5
TEMPERATURE(°F)= 250

LOCA TORQUE= 3400
MEDIA=STEAM
FLOW DIRECTION=NONPREFERRED

G LOADINGS
TRANSVERSE= 3
VERTICAL= 3
LONGITUDINAL= 3

DIMENSIONAL DATA

X1= 2	X2= 8.034	X3= 3.25	X4= 4	X5= 3.313	W1= 165	W2= 11
W4= 15	T1= .5	T2= 4.5	T3= 3.132	T4= 0	T9= .5	T0= .5
d3= 1.781	Di= 1.375	D1= .872	D= 7.912	E1= 1.062	E2= .687	
L2= .187	Y2= 1	N1= 4	A1= .1416	X6= 4.5	N2= 4	
A2= .1416	X7= 3.132	X8= 3.132	T5= 8	R5= 0	R6= 0	
Z= 65	dp= .309	d1= 10.875	R7= 8.125	R8= 8.625	R9= 7.981	
L= 2.75	T= .375	B= 1	E= 30000000			

NATURAL FREQUENCIES (HZ.)
LONGITUDINAL(Z) ACT./VALVE= 37 VS. 33HZ.
VERTICAL(Y) ACT./VALVE= 433 VS. 33HZ.
TRANSVERSE(X) ACT./VALVE= 62 VS.33HZ.
LATERAL DISC/STEM= 931 VS.33HZ.

ACTUATOR BOLT STRESSES
SHEAR= 5968 PSI
TENSILE= 5684 PSI
COMBINED= 9452 PSI VS.ALLOW.= 37500

BRACKET BOLT STRESSES
SHEAR= 6192 PSI
TENSILE= 9082 PSI
COMBINED= 12219 PSI VS.ALLOW= 37500

BRACKET STRESSES
SHEAR= 725 PSI
TENSILE= 3461 PSI
COMBINED= 3607 PSI VS.ALLOW= 20550

VALVE NECK STRESSES
SHEAR= 11245 PSI
TENSILE= 21429 PSI
COMBINED= 26247 PSI VS.ALLOW= 26250

STEM STRESSES
SHEAR= 26115 PSI
TENSILE= 1484 PSI
COMBINED= 26848 PSI VS.ALLOW= 54300

DISC PIN STRESS
SHEAR= 33083 PSI VS.ALLOW= 32580

SECTION MODULUS
VALVE= 86.92 IN↑3
PIPING= 16.8 IN↑3

ACTUATOR DEFLECTIONS
LONGITUDINAL= 2.04020000E-02 INCHES
VERTICAL= 1.51000000E-04 INCHES
TRANSVERSE= 7.30000000E-03 INCHES

BODY BOLTING
NOT APPLICABLE

SIGNED.. [signature] .....DATED..8/22/84.....

POSI-SEAL INTERNATIONAL, INC.
NUCLEAR SEISMIC ANALYSIS

8 CLASS 150 VALVE ASSEMBLY
WITH [illegible] ACTUATOR

CUSTOMER: TVA
P.O.NO. [illegible]
SPEC.NO.:
REF.NO.: 13069
ITEM NO.: 3

REFERENCE DWGS.
A.ASSY DWG.NO.: [illegible] REV.D
B.BODY DWG.NO.: 1144-080-16 REV.-
C.DISC DWG.NO.: 1144-080-15 REV.H
D.STEM DWG.NO.: [illegible] REV.[illegible]
E.PIN DWG.NO.: 1306-3 REV.A
F.BRACKET DWG.NO.12296 REV.-

ALLOWABLE STRESSES (PSI)
A.BODY: [illegible]
B.STEM: 54300
C.PIN: 54300
D.BRACKET: [illegible]
E.BOLTING: 37500

DESIGN CONDITIONS
PRESSURE(PSIG)= 19.5
TEMPERATURE(°F)= 250

LOCA TORQUE= 0
MEDIA=
FLOW DIRECTION=

G LOADINGS
TRANSVERSE= 3
VERTICAL= 3
LONGITUDINAL= 3

DIMENSIONAL DATA

X1= 2	X2= 8.034	X3= 3.25	X4= 4	X5= 3.313	W1= 165	W2= 11
W4= 15	T1= .5	T2= 4.5	T3= 3.182	T4= 0	T9= .5	T0= .5
d3= 1.781	Di= 1.375	D1= .872	D= 7.912	E1= 1.062	E2= .687	
L2= .187	Y2= 1	N1= 4	A1= .1416	X6= 4.5	N2= 4	
A2= .1416	X7= 3.182	X8= 3.182	T8= 8	R8= 0	R6= 0	
%= 65	dp= .309	d1= 10.875	R7= 8.125	R8= 8.625	R9= 7.981	
L= 2.75	T= .375	B= 1	E= 30000000			

NATURAL FREQUENCIES (HZ.)
LONGITUDINAL(Z) ACT./VALVE= 37 VS. 33HZ.
VERTICAL(Y) ACT./VALVE= 433 VS. 33HZ.
TRANSVERSE(X) ACT./VALVE= 62 VS.33HZ.
LATERAL DISC/STEM= 931 VS.33HZ.

ACTUATOR BOLT STRESSES
SHEAR= 3393 PSI
TENSILE= [illegible] PSI
COMBINED= 7269 PSI VS.ALLOW.= 37500

BRACKET BOLT STRESSES
SHEAR= 3619 PSI
TENSILE= 9082 PSI
COMBINED= 10348 PSI VS.ALLOW= 37500

BRACKET STRESSES
SHEAR= 536 PSI
TENSILE= 2453 PSI
COMBINED= 2566 PSI VS.ALLOW= 20550

VALVE NECK STRESSES
SHEAR= 6553 PSI
TENSILE= 21429 PSI
COMBINED= 23274 PSI VS.ALLOW= 26250

STEM STRESSES
SHEAR= 0 PSI
TENSILE= 1484 PSI
COMBINED= 1484 PSI VS.ALLOW= 54300

DISC PIN STRESS
SHEAR= 0 PSI VS.ALLOW= 32580

SECTION MODULUS
VALVE= 86.92 IN↑3
PIPING= 16.8 IN↑3

ACTUATOR DEFLECTIONS
LONGITUDINAL= 2.04020000E-02 INCHES
VERTICAL= 1.51000000E-04 INCHES
TRANSVERSE= 7.30000000E-03 INCHES

BODY BOLTING
NOT APPLICABLE

SIGNED... [signature] .....DATED...8/12/84.....