TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

June 30, 1982

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

Dear Ms. Adensam:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

The Sequoyah Nuclear Plant unit 1 and unit 2 operating license conditions 2.C(23).j(2) and 2.C(16).i, respectively, require TVA to "conform to the EPRI test program" and to "provide documentation for qualifying (a) reactor coolant system relief and safety valves, (b) piping and supports, and (c) block valves in accordance with the review schedule in SECY 81-491. . . ." Also, NUREG-0737 item II.D.1, as revised by D. G. Eisenhut's September 29, 1981 letter, requires documentation to be submitted for items (a), (b), and (c) above. A response for item (a) was submitted by letter from me to you on April 1, 1982. Enclosed is our response for item (b), piping and supports, and item (c) block valves, which satisfies the requirements of the license conditions and NUREG-0737.

If you have any questions concerning this matter, please get in touch with J. E. Wills at FTS 858-2683.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L M Mills

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 30th day of June 1982

Bryant M. Lowery
Notary Public
My Commission Expires 4/8/86

Enclosure
cc: See page 2

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cc: U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

ENCLOSURE

Performance Testing of Pressurized
Water Reactor Relief and Safety Valves
(NUREG-0737, Item II.D.1)

Sequoyah Nuclear Plant
Units 1 and 2

Operating License Conditions
Unit 1 - 2.C(23).j(2); Unit 2 - 2.C(16).i

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1.0 Introduction

As required by NUREG-0737, Item II.D.1, TVA, as a participating utility in the Electric Power Research Institute (EPRI) Safety and Relief Valve Testing Program, has completed a full-scale test program to demonstrate the functional performance capabilities of the relief and safety valves utilized in the Sequoyah Nuclear Plant's reactor coolant system. The results of the many tests performed by EPRI have been forwarded to the Nuclear Regulatory Commission and form an integral part of this submittal. The following reports prepared by EPRI are applicable to Sequoyah Nuclear Plant.

a. Valve Selection/Justification Report
b. Test Condition Justification Report
c. Westinghouse Plant Condition Justification Report
d. Safety and Relief Valve Test Report
e. EPRI/Marshall Motor Operated Valve (Block Valve) Interim Test Data Report

Documents a, b, c, and d were transmitted to NRC by David Hoffman of Consumers Power Company by letter on April 1, 1982, and document e was tranmitted to NRC by R. C. Youngdahl of Consumers Power Company by letter on June 1, 1982.

TVA's submittal to the NRC dated April 1, 1982, indicated our preliminary assessment based on the preliminary test data available at that time. Since then, additional program information has been received. This submittal is based on evaluation of applicable test information received to date. Final test data from EPRI is scheduled to be released on July 1, 1982.

Pertinent design information on the Sequoyah block, relief, and safety valves is shown on Tables 1.0, 2.0, and 3.0, respectively. Additional information is available in the valve selection/justification report. The EPRI inlet and discharge piping is similar to the physical piping geometry at Sequoyah.

2.0 Summary of Evaluations

Based on our evaluations to date, TVA has concluded the following:

2.1 Block Valve Performance

The block valves at Sequoyah are the Velan Engineering Company's model No. B10-3054B-13MS, 3-inch motor-operated, bolted bonnet gate valve with the Limitorque SMB-00-15 operator for unit 1 and SMB-00-25 for unit 2 (see table 1.0). The same valve was tested at the Marshall facility. These tests demonstrated the capability of full opening and closing on demand with preloads at pressure up to 2500 psig for all tests. Leakage testing indicated zero leakage at pressures up to 2500 psig. Additional information has been provided to NRC by R. C. Youngdahl by letter dated June 1, 1982. From the test data presented, TVA concludes that operability of the block valves, as defined in NUREG-0737, item II.D.1, has been satisfactorily demonstrated.

2.2 Relief Valve Performance

The Sequoyah unit 1 PORV is a 2-inch Masoneilan International 20,000 series, air-operated globe valve (see Table 2.0). TVA provided this valve model to EPRI for the testing program. These tests demonstrated the capability of the valve to be fully opened on demand and fully closed on demand under operating conditions similar to that expected at Sequoyah.

The Sequoyah unit 2 PORV is a 3-inch Copes-Vulcan Model No. D-100-160, air-operated globe valve (see table 2.0). This valve was also tested by EPRI. The valve also fully opened on demand and fully closed on demand. These valves were inspected during and after testing with no damage observed.

With regard to valve performance for cold overpressure protection conditions, NRC has conditioned each of the Sequoyah operating licenses to require plant modifications for protection against cold overpressurization events prior to startup after the first refueling outages. TVA will ensure that the cold overpressure protection system will meet the Westinghouse performance requirements at the time of installation.

2.3 Safety Valve Performance

The Sequoyah units 1 and 2 safety valves are Crosby HB-BP-86 6M6 valves with loop seal internals (see Table 3.0). TVA's evaluation of the EPRI tests is summarized below.

It was shown during testing that the Crosby 6M6 valve exhibits fluttering and/or chattering with liquid loop seal discharge. Fluttering caused a momentary delay in valve lifting. The results indicate that the delay did not cause an increase in overpressure to an unacceptable limit. Also, the test valve fluttering during loop seal discharge did not result in damage to the valve that would prevent the valve from further operation. The valve remains in stable operation with steam discharge.

The EPRI test results indicate initial factory recommended ring settings may not necessarily provide expected valve performance, as specified by the ASME Code, i.e., blowdowns for the 6M6 valve were in excess of 5 percent (range of 5 to approximately 14 percent). Tentatively, Westinghouse has indicated that blowdowns of the magnitude experienced in the 6M6 testing are adequate (considering their transient analyses) and will be addressed more fully in their "Safety Valve Operability Report" to be submitted to Westinghouse Owners Group utilities. However, the EPRI tests for the 6M6 valve indicates full rated flow was achieved.

TVA has also reviewed the effect of high ramp rates (280 to 375 psi/sec pressurization rates) used during the EPRI tests. These high ramp rates caused the valve to "pop" open (after loop seal discharge) at higher pressures. TVA has reviewed the applicable transients and finds the maximum expected ramp rate to be 144 psi/sec. Extrapolating from the EPRI tests would indicate valve opening pressures of no more than 2600 psia for a ramp rate of 144 psi/sec. This would indicate a maximum pres[illegible] the bottom of the reactor vessel of 2660 psia (consi[illegible]ing [illegible] piping pressure drop and static head). This figure is below the permissible 110 percent maximum pressure (2750 psia). Liquid discharge is predicted for only one FSAR transient, the feedline break accident. The temperature of the reactor coolant for Sequoyah is expected to be not less than 650°F for this transient. The Crosby valve, when tested at this condition, showed acceptable performance.

On extended operation of the safety injection system, subcooled water discharge may occur after the pressurizer becomes water solid. As reflected in the EPRI test data, the Crosby valve showed undesirable performance at subcooled conditions. However, under these conditions, a "water solid" Reactor Coolant System is not expected to occur for at least 20 minutes. Given this timeframe, successful mitigative action by the reactor operators is expected. Therefore, it is our opinion that the Crosby 6M6 valve will perform satisfactorily.

3.0 Summary of Piping/Support Evaluations

Qualification of the SQNP-1 and 2 safety and relief valve (S/RV) system piping and supports has been accomplished in part through the benchmarking of the original design shock loads analysis methodology (RELAP4/MOD5) against applicable EPRI S/RV test data. However, the preliminary results of this benchmarking evaluation have identified unanticipated physical phenomena occurring at the inlet and discharge of the safety valves. The nature of these new phenomena and their potential impact on SQN design pipe stresses and support loads is discussed below.

Tests of the Crosby Model HB-BP-86 (6M6) Safety Valve have shown oscilliatory behavior of the valve stem during the period when the valve is discharging subcooled loop seal water. These stem oscillations produced high frequency, high magnitude water hammer pressure spikes at the valve inlet. It is our opinion that the oscillatory nature of these pressure spikes (frequencies ranged from 100-250 Hz) and their short duration places them outside the range of applicability of the SQN design basis for piping stress (ANSI B31.1). The code allowable, for the integrity of the pressure boundary, is based on quasi-statically applied pressure throughout the piping, not on localized pressure pulses. These pressure oscillations therefore do not invalidate the original qualification of this portion of the S/RV piping system. In addition, preliminary results indicate that no permanent strains result from these spikes. The pressure spikes therefore pose no threat to the integrity of the SQN unit 1 and unit 2 S/RV piping system.

Results of the RELAP 4/MOD5 benchmarking evaluation indicate that the original SQN design shock loads analysis conservatively predicted piping stresses and support loads for the majority of the S/RV discharge piping. However, higher than anticipated support loads were measured immediately downstream of the safety valves in applicable EPRI tests. These high loads, which resulted from the discharge of a high density slug of subcooled water through the piping system, were not predicted in the original SQN design analysis. This analysis must therefore be augmented to include consideration of these higher discharge piping loads. Our final evaluation of the magnitude of these water slug loads at SQN unit 1 and unit 2 and their impact upon the existing S/RV piping support designs is currently underway and will be completed by October 15, 1982. Should the results of this study indicate that design modifications are required to ensure complete compliance with the current SQN unit 1 and unit 2 design basis, a schedule for implementation of those modifications will be provided at that time.

TABLE 1.0

	1.0 Block Valves	Unit 1		Unit 2	
1.1	No. of valves	2		2	
1.2	Manufacturer	Velan		Velan	
1.3	Type	model# B10-3054B-13MS Bolted bonnet motor-operated flex wedge gate valve		B10-3054B-13MS Bolted bonnet motor-operated flex wedge gate valves	
1.4	Limitorque model number	SMB-00-15		SMB-00-25	
1.5	Size (inlet, outlet)	(3" BW,3"BW)		(3" BW,3" BW)	
1.6	Design temperature and pressure	688 F, 2485 psig		688 F, 2485 psig	
		Open	Close	Open	Close
1.7	Torque switch setting (specified @ delta P=2750 psi)	2 0	2 0	2	2
1.8	Attaching inlet pipe (size, schedule, material)	(3", 160, 316 SS)		(3", 160, 316 SS)	
1.9	Attaching discharge pipe	(3", 160, 316 SS)		(3", 160", 316 SS)	

TABLE 2.0

2.0	Relief Valves	Unit 1	Unit 2
2.1	No. of Valves	2	2
2.2	Manufacturer	Masoneilan	Copes-Vulcan
2.3	Type	20,000 series, 2" NPS, air-operated globe, standard quick change trim	Air-operated globe D-100-160, 17-4PH cage, 3" NPS, 316 w/stellite plug
2.4	Size (inlet, outlet)	(3" butt welding end, 3" butt welding ends)	(3" BW, 3" BW)
2.5	Steam flow capacity (rated)	210,000 lb/hr	210,000 lb/hr
2.6	Design temp. & pressure	2485 psig, 688 F	2485 psig, 688 F
2.7	Air supply (spec max)	55 psig	100 psig
2.8	Attaching inlet pipe (size, schedule, material)	3", 160, 316 SS	3", 160, 316 SS
2.9	Attaching discharge pipe (size, schedule, material)	(3",40, 304 SS)	(3", 40, 304 SS)

TABLE 3.0

3.0	Safety Valves (Units 1 & 2)	
3.1	Number of valves	3
3.2	Manufacturer	Crosby
3.3	Type	Spring-loaded safety, back pressure compensating valve, HB-BP-86, 6M6
3.4	Size (inlet, outlet, orifice)	(6" NPS, 6" NPS, 3.6 in^2)
3.5	Steam flow capacity (rated)	420,000 lb/hr
3.6	Design temperature and pressure	688 F, 2485 psig
3.7	Inlet flange rating	ANSI 1500 lb, 6"
3.8	Discharge flange rating	ANSI 600 lb, 6"
3.9	Set pressure	2485 psig
3.10	Inlet piping pressure drop	30 psi
3.11	Discharging piping pressure drop	610 psi max based on 3 safety and 2 relief valves discharging simultaneously
3.12	Attaching inlet pipe (size, schedule, material)	(6", 160, 316 SS)
3.13	Attaching discharge pipe (size, schedule, material)	(6", 40, 316 SS)