TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

July 22, 1983

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

Please refer to L. M. Mills' letters to you dated September 14 and October 29, 1981, which provided our initial and revised response to NUREG-0737 item II.D.1, respectively. Enclosed is our final response to this item.

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

D S Kammer

D. S. Kammer
Nuclear Engineer

Sworn to and subscribed before me
this 22nd day of July 1983

Paulette H. White
Notary Public
My Commission Expires 9-5-84

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

A001
1/1

PERFORMANCE TESTING OF PRESSURIZED-WATER REACTOR
RELIEF AND SAFETY VALVES

TVA Response (Revised July 22, 1983)

As required by NUREG-0737, item II.D.1, TVA, as a participating utility in the Electric Power Research Institute's (EPRI) Safety and Relief Valve Testing Program, has completed a full-scale test and evaluation program to demonstrate the functional performance capabilities of the block, relief, and safety valves, utilized in the Watts Bar Nuclear Plant's (WBN) 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 (except item g which was prepared by Westinghouse) are applicable to WBN.

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

f. Application of RELAP 5/MOD 1 for Calculation of Safety and Relief Valve Discharge Piping Hydrodynamic Loads, NP2479-LD, July 1982.

g. Review of Pressurizer Safety Valve Performances as Observed in the EPRI Safety and Relief Valve Test Program, WCAP-10105, June 1982.

Documents a, b, c, and d were transmitted to NRC by David Hoffman of Consumers Power Company by letter dated April 1, 1982; document e was transmitted to NRC by R. C. Youngdahl of Consumers Power Company by letter dated June 1, 1982; document f, along with other "bound" reports, was transmitted to Harold Denton of NRC by David Hoffman of Consumers Power by letter dated September 30, 1982; document g was transmitted to Harold Denton by O. D. Kingsley of Alabama Power by letter dated July 27, 1982 on behalf of participating utilities in the Westinghouse Owner's Group.

TVA's submittal is based on our evaluation of the above documents as well as plant specific conditions. Pertinent design information on the Watts Bar block, relief, and safety valves is shown on Tables 1.0, 2.0, and 3.0, respectively. The EPRI inlet and discharge piping is similar to the physical piping geometry at Watts Bar.

1.0 Summary of Evaluations

Based on our evaluation TVA has concluded the following:

1.1 Block Valve Performance

The block valves at Watts Bar are the Westinghouse Corporation's model No. MOD 03000GM88FNH008 3-inch motor-operated, bolted bonnet gate valve with the Limitorque SB-00-15 operator (see Table 1.0). The same type (3GM 88 series) valve was tested at the Marshall facility. These tests demonstrated the capability of full opening and closing on demand with pressures to 2500 lb/in^2g for all tests. However, during initial checkout of the test loop at the Marshall facility, the valve did not close completely and modifications were required to permit the valve to close. As a result of the EPRI testing program, TVA has received instructions from Westinghouse to make changes to the valve's motor operator which will ensure complete valve shutoff on the closing stroke.

These modifications have been completed for unit 1 and are scheduled to be implemented by August 9, 1984, for unit 2. 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.

1.2 Relief Valve Performance

TVA will use solenoid-operated Target Rock valves (see Table 2.0) at WBN. This change was instigated to comply with NUREG-0737, item II.B.1, "Reactor Coolant System Vents." Additionally, we believe that the cold overpressure protection system will be enhanced with a faster acting valve. The new valve will adequately serve the intended functions.

The new PORV, Target Rock model No. 82UU-001, is the same type valve as the Target Rock model 80X-006 tested by EPRI. The tests demonstrated that the valve would fully open on demand and fully close on demand. However, during the Wyle tests, test No. 7-TR-7W, the valve opened on demand, but did not "immediately" close on demand (12-second delay was encountered). This test was a water seal simulation test (approximately 110°F water followed by 650°F water). The valve was disassembled and inspected after testing with no damage observed which might affect the ability of the valve to open or close on demand. However, due to recently discovered high discharge piping loads in the RELAP 5 piping analysis, TVA has decided to remove the PORV loop seals which will have the benefit of eliminating the concern for valve closing delays and high discharge piping loads. The Target Rock valves have been installed in unit 1 and are scheduled to be installed before August 9, 1984, in unit 2.

1.3 Safety Valve Performance

The WBN units 1 and 2 safety valves are Crosby HB-BP-86 6M6 valves with loop seal internals (see Table 3.0). TVA will modify the safety valve loop seals to be self-draining and change the safety valve internals from water to steam. These modifications are scheduled to be completed on unit 1 by September 30, 1983, and on unit 2 by August 9, 1984. Additionally, draining the safety valve loop seals will eliminate the concern for fluttering and/or chattering during loop seal discharge, water hammer type oscillatory pressure spikes in the inlet piping, as well as the previously mentioned higher than anticipated discharge piping loads. Evaluations to date indicate that changes to support loads, due to subcooled water slug flow, will probably involve several major support modifications. Additional comments are contained in item 3.0, "Piping/Support Evaluations." It is noted from the EPRI testing that the 6M6 valve remains in stable operation with steam discharge.

TVA has evaluated the effects of water discharge through the safety valves. The two FSAR transients that might produce a water solid pressurizer are the main feedline break accident and the extended operation of the safety injection system. For the feedline break accident, the temperature of the reactor coolant is expected to be approximately 650°F. The Crosby 6M6 valve, when tested at this condition, showed acceptable performance. On extended operation of the safety injection system, subcooled water may occur after the pressurizer becomes water solid. As reflected in the EPRI test data, the Crosby 6M6 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.

In addition to our evaluations, the Westinghouse Owners Group instituted a program to review the EPRI test data and to report on the acceptability of safety valve performance. These results are discussed in WCAP-10105. This report concludes that the Crosby 6M6 safety valves should perform adequately. TVA concurs that the safety valves as installed at WBN should perform adequately.

2.0 Summary of Piping/Support Evaluations

During the EPRI valve testing, higher than anticipated support were measured immediately downstream of the safety valves. 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 WBN design analysis. To reduce these high loads, TVA plans to modify the safety valve loop seals to be self-draining and remove the power-operated relief valve loop seals and existing

PORVs and replace with the Target Rock valves. These modifications have been completed on unit 1 and are scheduled to be completed on unit 2 by August 9, 1984. It should be noted that draining the safety valve loop seals will also eliminate the concern for high pressure oscillations in the safety valve inlet piping, and will improve valve performance by reducing the amount of possible valve fluttering and/or chattering.

Through the application of RELAP 4/MOD 5 and conservative assumptions about the impact of water slug flow, evaluations of the safety valve piping and the PORV piping to date indicate that increases in support loads involve several major support modifications for existing WBN supports. These support modifications have been completed for unit 1 and are scheduled to be completed on unit 2 by August 9, 1984. Qualification of the piping/support system will be verified through the application of the new RELAP 5/MOD 1 analysis. This thermal hydraulic code will more accurately simulate the actual plant conditions than did the RELAP 4 program.

TABLE 1.0

1.0	Block Valves	WBN Units 1 & 2
1.1	No. of Valves	2
1.2	Manufacturer	Westinghouse
1.3	Type	Motor-operated gate model: 03000GM88 FNH00B
1.4	Limitorque model #	SB-00-15
1.5	Size (inlet, outlet)	(3" BW, 3" BW)
1.6	Design temp. & pressure	650°F, 2500 psia
1.7	Torque switch setting* (specified) @ ΔP = 2750 psi	2.0 open & close
1.8	Attaching inlet pipe (size, schedule, material)	(3", 160, 304 SS)
1.9	Attaching discharge pipe (size, schedule, material)	(3", 160, 304 SS)

*The method for setting valve closure torque is being revised by Westinghouse FCN #WATM - 10621A to a stem nut deflection method.

TABLE 2.0

2.0	Relief Valves	WBN Units 1 & 2
2.1	No. of Valves	2
2.2	Manufacturer	Target Rock
2.3	Type	Solenoid power operated, model: 82UU-001, ANSI press. class 1707 lb.
2.4	Size (inlet, outlet)	3" - 2500 lb. flange, 3" - 2500 lb. flange
2.5	Steam flow capacity	Max. - 210,000 lb/hr at 2339 psia
2.6	Design temp. & pressure	650°F, 2485 psig
2.7	Voltage	125-V dc
2.8	Attaching inlet pipe (size, schedule, material)	(3", 160, 304 SS)
2.9	Attaching discharge pipe (size, schedule, material)	(3", 160, 304 SS)

TABLE 3.0

3.0	Safety Valves	WBN Units 1 & 2
3.1	No. of Valves	3
3.2	Manufacturer	Crosby
3.3	Type	6M6, HB-BP-86
3.4	Size (inlet, outlet, orifice)	(6" NPS, 6" NPS, 2.154")
3.5	Steam flow capacity	420,000 lb/hr at 2500 psia
3.6	Design temp. & pressure	2485 psig, 650°F
3.7	Inlet flange rating	1500 lb. ANSI STD
3.8	Discharge flange rating	600 lb. ANSI STD
3.9	Set pressure	2485 psig
3.10	Inlet piping pressure drop	30 psi at rated flow
3.11	Discharging piping pressure drop	610 psi maximum (based on 3 safety and 2 relief valves discharging simultaneously)
3.12	Attaching inlet pipe (size, schedule, material)	(6", 160, 304 SS)
3.13	Attaching discharge pipe (size, schedule, material)	(6", 40, 304 SS)