TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

May 14, 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 the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

Enclosed for NRC review is TVA's response to NRC question 22.49 concerning Watts Bar Nuclear Plant. This response provides TVA's position with respect to Branch Technical Position (BTP) CSB 6-4, "Containment Purging During Normal Plant Operation." This information should resolve open item 12 of the draft Safety Evaluation Report.

If you have any questions concerning this matter, please get in touch with D. P. Ormsby at FTS 858-2682.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

D S Kammer

D. S. Kammer
Nuclear Engineer

Sworn to and subscribed before me
this 14th day of May 1982
Paulette H. White
Notary Public
My Commission Expires 9-5-84

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

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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
BRANCH TECHNICAL POSITION CSB 6-4

Question 22.49

We find that we will require further information to complete our review of your intended use of the containment purge system during normal plant operating periods. Your responses to staff questions 22.3 and 22.19 are incomplete. Of major importance is the analysis of containment atmosphere releases prior to isolation valve closure. The information provided in this regard is insufficient to determine how the mass of containment air or steam was calculated, the effect of break size, the formulas used to calculate flow through the isolation system, flow loss-coefficients and the iodine concentration in the reactor coolant at the time of the assumed RCS pipe rupture. This information is required for us to conclude our review of your calculations of releases. We suggest that your response to this request for information address each paragraph and subparagraph of Branch Technical Position CSB 6-4, "Containment Purging During Normal Plant Operation." A paragraph-by-paragraph demonstration that the Watts Bar containment purge system design and your intended use of the system than the current TVA statement that the design "is totally adequate" with very little supporting information.

Response

The design of the purge system at the Watts Bar plant is based in part on the need to periodically enter the containment for surveillance and maintenance during and following full power operations. The containment purge system is designed such that if a LOCA occurs during containment purge, (a) that core cooling system effectiveness is not degraded, (b) that there are no unacceptable radiological consequences, and (c) that valve operability is assured.

The general surveillance and maintenance required for the ice condenser and other containment features necessitate periodic entry into the containment. Experience at TVA's Sequoyah Nuclear Plant and other ice condenser plants indicates that containment entries are required at least every two days to perform maintenance on the ice condenser systems. Ice weighing activities are expected to require several weeks per year with a working crew inside the containment for several hours each day. Other maintenance activities expected to require entry into containment are activities such as maintenance on pressurizer and steam generator pressure and level instrumentation, reactor coolant pump seal flow transmitters, containment air monitors, and moveable detectors. Based on this high rate of maintenance, entries are expected daily to inspect these units. Therefore, the required technical specification surveillance frequency and allowances for maintenance, coupled with the relatively high radioactivity level in the Watts Bar lower compartment (due to its small volume), show purging at power to be mandatory.

Since purging the containment will be required during full power operation, the system design was predicated on providing a sufficient purge rate to efficiently and effectively make the containment habitable while guaranteeing public and plant safety. Our analyses show that the present purge system is acceptable.

Presented below is TVA's response point by point to Branch Technical Position CSB 6-4.

1.a The vendor for the purge valves at Watts Bar Nuclear Plant (WBN) is Posi-Seal International (PSI). At TVA's request, PSI has performed an operability analysis using conservative parameters and assumptions. A constant ΔP of 33.2 lb/in^2 was assumed across the valve (the containment design pressure is 15.0 $lb/in^2 g$). No consideration was taken for pressure losses upstream or downstream of the purge valve due to valves, bends, elbows, tees, and debris screens. Pressure losses due to upstream valves were not considered in the analysis either. The torques considered are:

T_{TTO} = The net torque.

T_{flow} = The torque due to aerodynamic flow caused by LOCA.

T_{air} = The torque exerted by the actuator as a result of the air acting on the actuator piston tending to open the valve.

T_{spring} = The torque exerted by the actuator spring tending to close the valve.

$T_{packing\ and\ seal}$ = Torque of the packing and the seal resisting the closing motion of the valve.

$T_{inertia}$ = Torque due to inertia of the disc assembly.

$T_{bearing}$ = Torque due to the ΔP acting across the valve which forces the stem/disc assembly into the bearings.

These torques were then considered for their effects on the various valve components. The analysis showed that the most critical component was the 24-inch valve disc pin. The calculated stress in the disc pin is less than 71 percent of the allowable. Calculated stresses for other components of all valves were a much lower percentage of the allowable.

The analysis did not consider the actual pipe configuration for its effects on the LOCA flows. Flow changes due to elbows, bends, tees, etc., will cause nonuniform flow distributions in the plane of the elbow (etc.). To prevent an increase in the aerodynamic forces due to these nonuniform flow distributions, the valves have been rotated such that the valve disk stem lies in the plane of the elbow (etc.).

The containment isolation purge valves have nonsymmetrical disks. To ensure that the valves do not exhibit any torque reversal phenomena, the valves have been oriented, as recommended by Posi-Seal, such that seal retaining ring side is downstream of the LOCA flow, which ensures a flow-induced closing torque.

1.b At WBN, two supply and two exhaust lines will be used at any one time.

1.c The use of the 24-inch purge lines at WBN is acceptable for the following reasons:

(1) Two continuously opened eight-inch penetrations (one inlet and one outlet) do not necessarily provide a more reliable design when compared to the use of a few larger penetrations that are open only when required.

(2) Section 9.4.6.1 of the Watts Bar FSAR states that one of the purge system design bases is to assure an unimpeded closure during a LOCA of the purge system containment isolation valves. A large valve can be protected from debris as easily as an eight-inch valve.

1.d The containment isolation provisions for the purge system lines meet the standards appropriate to engineered safety features, as specified in GDCs 54 and 56.

1.e The purge system lines have redundant isolation valves (two trains) which are actuated by such diverse parameters as high containment pressure, safety injection actuation, containment exhaust high radiation, and high containment radiation level. In addition, upon loss of power, the valves fail closed.

1.f The no-load purge system isolation valve closure time is 4.5 seconds, which includes a .5-second instrument delay time.

1.g A dual debris screen system, similar to that used at our Browns Ferry and Sequoyah Nuclear Plants, has been installed in the purge line system at WBN. The debris screens, consisting of first a large grid screen and then a smaller grid screen (see Figure 22.49-1), both located just upstream (LOCA flow) of the primary containment isolation valve, ensure that no debris of large enough size to preclude closure of the valve is allowed to pass to the valve.

2. The purge system is not used for temperature or humidity control within the containment.

3. An air cleanup system had been provided in the original design of WBN. The air cleanup system was evaluated and found not to be cost beneficial under the criteria of Appendix I to 10CFR50. Further, the amount of purge time did not decrease appreciably with the addition of the air cleanup system since the purge duration is controlled by the noble gas concentration. The cleanup system was deleted in the final design of WBN.

4. Provisions for testing the availability of the isolation function have been provided. The frequency of such tests is given in the technical specifications for WBN. Special provisions have been made for testing the leakage rate of the isolation valves during reactor operation.

5.a Analyses were performed which show that the increase in the offsite dose due to the escape of containment air prior to isolation valve closure in the event of a LOCA would be small and that the resulting overall dose will be within the guidelines of 10CFR100. In the analyses, all seven of the large purge lines were assumed to be initially open and held open for five seconds after the LOCA initiation. At this point, instantaneous closure was assumed. A constant pressure differential of 15 $lb/in^2 d$ was also assumed. The critical flow calculation took no credit for the flow losses due to the open (or partially open) purge valves, the debris screen system, or other line losses. The offsite dose, assuming the FSAR table 11.1-2 source term (which is based on one-percent failed fuel and a ground level release) for releases while purge lines are open, and adding the calculated maximum hypothetical accident (MHA) doses from chapter 15, table 15.5-9, would be:

Gamma Dose = 2.7 rem
Beta Dose = 1.1 rem
Thyroid Dose = 7.9 rem

Iodine spiking was not considered in this analyses. Even if iodine spiking were assumed, the total calculated dose would still be far below the 300 rem guideline limit.

5.b The secondary containment annulus would not be affected by a LOCA during purge. The use of piping qualified to greater than 15 $lb/in^2 g$ in the annulus guarantees that (a) the annulus pressure would not change and (b) that the Emergency Gas Treatment System operation would not be affected.

The air escaping from the containment through the purge lines prior to containment isolation could potentially damage some of the purge system ductwork inside the auxiliary building. This potential damage would have no effect on the ability of the purge line to be isolated nor would it affect the secondary containment. The equipment which could be damaged is not required for LOCA mitigation. If the low pressure portions of

the purge system were damaged, the escaping air would exhaust into the auxiliary building. The pressure rise in the auxiliary building secondary containment enclosure (ABSCE) due to containment air loss prior to valve closure would be five-inch water gauge. One train of the Auxiliary Building Gas Treatment System (ABGTS) would reduce this pressure in the ABSCE to a negative 1/4-inch water gauge within 4 minutes.

5.c An Appendix K ECCS analysis has been performed by Westinghouse which shows that the loss of noncondensibles from the containment prior to purge valve closure during a LOCA would not result in the peak fuel clad temperature exceeding 2200°F.

5.d A portion of the containment maximum allowable leak rate has been assigned to the containment purge lines. The seven 24" containment purge lines have a maximum allowable leak rate of 1.44 standard cubic feet per hour (scfh) each; the two 12" instrument room purge lines have a maximum allowable leak rate of 0.72 scfh each; and the one 8" containment pressure control line has a maximum allowable leak rate of 0.48 scfh. These leakage limits have been determined to assure the allowable offsite dose limits will not be exceeded. The purge system design incorporates bleed-off nipples into the annulus which eliminate any bypass leakage to the environment when the containment is isolated.

FIGURE 22.49-1
DEBRIS SCREENS