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

December 19, 1979

Director of Nuclear Reactor Regulation
Attention: Mr. L. S. Rubenstein, Acting Chief
Light Water Reactors Branch No. 4
Division of Project Management
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Rubenstein:

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

Enclosed is the additional information requested in your letter to H. G. Parris dated October 29, 1979, concerning qualification of resistance temperature detectors (RTD's), field connections for RTD's, and remote bellows sensing containment pressure transmitters. This information should assist your review of Westinghouse WCAP-9157, "Environmental Qualification of Safety-Related Class IE Process Instrumentation."

This information will be incorporated into Amendment 42 of the Watts Bar Nuclear Plant Final Safety Analysis Report.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Regulation and Safety

Enclosure

B001 S E/1 1

7912270356

ENCLOSURE

RESPONSES TO NRC CONCERNS TRANSMITTED BY L. S. RUBENSTEIN'S
LETTER TO H. G. PARRIS DATED OCTOBER 26, 1979

THE QUALIFIED LIFE OF RESISTANCE TEMPERATURE DETECTORS (RTD'S) TO BE USED TO MEASURE THE TEMPERATURE OF REACTOR COOLANT

In an effort to avoid retesting the resistance temperature detectors (RTD's) to the new NRC requirements, TVA requested Westinghouse to investigate the possibility of showing that the radiation doses used in the tests reported in WCAP 9157 were adequate for 100 days post-LOCA. While such a demonstration is possible for the radiation dose used, the two-week post accident thermal aging simulation could not be extended in a similar manner. The attached calculation separately derives the gamma dose applicable to those parts of the RTD external and internal to the RCS pressure boundary.

ATTACHMENT

WATTS BAR NUCLEAR PLANT
RADIATION DOSE CALCULATIONS FOR RTD'S

The object of the following calculations is to estimate the plant specific inservice life that, when taken in conjunction with assuming the RTD's operate for 100 days in a post-LOCA environment, yields a total dose equal to 1×10^8 Rads as employed by Westinghouse for the testing reported in WCAP-9157.

External Environment

WCAP-8587, Figure 6-4, indicates a containment atmosphere dose of 1×10^8 Rads for 100 days post-LOCA. This value is based on a TID calculation for a 4100 MW reactor and a containment volume of 1.1×10^6 ft^3. The Westinghouse calculated dose can be approximately scaled for application to Watts Bar by the formulae:

$$D = 1.0 \times 10^8 \quad \frac{P}{4100} \qquad \frac{1.1 \times 10^6}{V} \qquad \text{Rads}$$

Inserting a value of 3565 MW (P) and 1.1×10^6 (V) as applicable to Sequoyah yields a post-LOCA 100 day integrated dose of 8.7×10^7 Rads for the RTD external connection. Since the narrow range RTD is only required for a short time after the event, this calculation only applies to the wide range measurement. The external dose for the narrow range RTD is on the order of 10^6 Rads and is insignificant compared to the test condition.

The remaining dose available to cover inservice effects is the difference between the total dose employed in the Westinghouse test reported in WCAP-9157 (i.e., 1×10^8 Rads) and the above calculated post-LOCA dose for the wide range (i.e., 8.7×10^7 Rads), which is 1.3×10^7 Rads. The dose rate during normal operation appropriate to the external connection is taken as 165 R/hr (Table 6-2, WCAP-8587). Thus, assuming an 80 percent load factor, the time required to attain this remaining dose is:

Wide Range $\frac{1.3 \times 10^7}{165x24x365x0.8}$ = 11.2 years

Narrow Range $\frac{1.0 \times 10^8}{165x24x365x0.8}$ = 86 years

The Westinghouse calculated doses post-LOCA presented in WCAP-8587, Figure 6-4, for the post-LOCA containment environment are conservative with respect to the doses recommended by the Staff in NUREG-0588. From Appendix D of this document a conservative 100 day dose post-LOCA is 2×10^7 Rads for a containment volume of 2.52×10^6 ft^3 and a power of 4000 MW. Repeating the calculation above using this data yields an equivalent inservice life of approximately 50 years for the wide range RTD external connections.

Internal Environment

WCAP-8587, Figure 6-8, indicates a RCS internal pipe dose of 1.8×10^7 Rads for 100 days post-LOCA. Without considering any reduction in this value by scaling for Watts Bar, the remaining dose available to cover inservice radiation effects on the RTD is 8.2×10^7 Rads. The dose rate during normal operation for wide range RTD's installed directly in the reactor coolant system is conservatively taken as 820 R/hr as defined for the RCL pipe center in Table 6-2, WCAP-8587. For the bypass line, narrow range RTD's, the dose rate is conservatively taken as 165 R/hr as defined for the RCL outside surface. Thus, assuming an 80 percent load factor the time required for the internal part of the RTD to attain the remaining dose is:

Narrow Range $\frac{8.2 \times 10^7}{165x24x365x0.8}$ = 70.9 years

Wide Range $\frac{8.2 \times 10^7}{820x24x365x0.8}$ = 14.3 years

Summary

Using Westinghouse dose estimates from WCAP-8587 scaled for Watts Bar, the shortest demonstrated life equivalent to the 1×10^8 Rads used in the RTD tests (WCAP-9157) is defined by the external connections and is conservatively estimated to be 11 years for the wide range RTD's. The demonstrated life of the narrow range RTD's exceeds 40 years. Using the post-LOCA doses recommended by the NRC in NUREG-0588 scaled for Watts Bar, the shortest life for the wide range RTD is 14.3 years and greater than 40 years for the narrow range RTD.

QUALIFICATION OF FIELD CONNECTIONS FOR THE RTD'S

The resistance temperature detectors (RTD's) are furnished with a calibrated length of cable. The conductors of the RTD cables are interfaced with field wiring on terminal blocks located in a junction box. Terminations are needed to accommodate RTD calibration checkpoint, maintenance, and/or replacement.

At most, only two RTD cables interface in a junction box. The covers of the junction boxes are gasketed and the cable entries into the boxes are sealed with room temperature vulcanizing (RTV) silicone rubber to restrict moisture entry and chemical exposure to terminations in the event of a loss of coolant accident (LOCA).

To ensure the field connections are protected for post-LOCA condition, the RTD terminations have been coated with Dow Corning 3140 RTV Silicone Coating. Information from the manufacturer indicates that this protective coating has a temperature range of $-65^{\circ}C$ to $250^{\circ}C$ and is effective after a radiation exposure of 100 megarads. Also, it is electrically nonconductive, has good insulation properties, and provides protection against corrosion. From this analyses TVA considers the installed configuration of the RTD field connections to be acceptable for measuring the reactor coolant temperature under a post-LOCA environment.

QUALIFICATION OF REMOTE BELLOWS SENSING PRESSURE TRANSMITTERS TO BE USED TO MEASURE PRESSURE OF THE CONTAINMENT ATMOSPHERE

Watts Bar does not use remote bellows sensors for containment pressure sensing, therefore TVA does not have a concern for the phenomenon observed during the bellows testing reported in WCAP-9157.

Document Management Branch 016

DISTRIBUTION (w/enclosure)

~~Docket File~~
NRC PDR
Local PDR
NSIC
TIC
LWR-4 File
C. Stahle
V. Benaroya
John Buchanan
Phil Stoddart
Ed Wenzinger
Al Hintze
ACRS (1)

DISTRIBUTION (w/o enclosure)

S. Varga
F. Williams
L. Rubenstein
M. Service
D. Crutchfield
IE (3)
ACRS (16)
G. Arlotto

MA
4