TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

November 6, 1981

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 No. 50-328
Tennessee Valley Authority)

Your letter dated August 27, 1981 to H. G. Parris requested information on the proposed upgrade of incore thermocouples for unit 2 of our Sequoyah Nuclear Plant. My letter to you dated September 4, 1981 provided information requested by item 1 of your letter for incore thermocouples. As stated in my October 1, 1981 letter to you, we consider the short term requirements for upgrading incore thermocouples to be resolved as documented by the unit 2 full power operating license. Enclosed is additional information that responds to the remaining items (2, 3, and 4) of your August 27, 1981 letter for incore thermocouples.

If you have any questions regarding this subject, please call Jerry Wills at FTS 858-2683.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Regulation and Safety

Sworn to and subscribed before me
this 6th day of November 1981

Bryant M. Lowery
Notary Public
My Commission Expires 4/4/82

Enclosure

B001
s
1/1

ENCLOSURE

RESPONSE TO NRC REQUEST FOR INFORMATION DATED AUGUST 27, 1981 REGARDING INCORE THERMOCOUPLES

Item 2

The response given in item 5 addresses cable separation for incore thermocouples with respect to PAM 1 and 2. This discussion should be expanded to identify the relationship between the minimum 16 thermocouples for backup display and other thermocouples connected to the primary display as well as address the signific[illegible] of the PAM 1 and 2 separation groups.

Response to Item 2

There will be 16 thermocouples (T/Cs) designated as PAM instrumentation. These will be the same 16 T/Cs for the backup display. Eight T/Cs will be Pam 1 and eight T/Cs will be PAM 2. The response to item 5 in our July 1, 1981 submittal addressed the cable separation for the PAM T/Cs.

All core exit T/C cables will exit the reactor cavity wall through one conduit. Outside the re ctor cavity wall, but inside the containment building, PAM 1 and PAM 2 core exit T/C cables will be separated and routed in seismically supported conduit to separate temperature reference junction boxes. PAM 1 and 2 T/C cables will be in conduit with other low-level cables including non-Pam T/C cables from the reactor cavity wall to separate temperature reference junctions.

From the separate temperature reference junctions, PAM 1 cables will be a separate conduit to a separate containment penetration. PAM 2 and the non-PAM cables will be routed in a conduit, separate from the PAM 1 cables, to a separate containment penetration. The containment penetrations used for all core exit T/C cables may also be used by low and medium level nonsafety-related signal cables. Outside the containment building, PAM 1 and cables shall be routed independently from PAM 2 and all other T/C cables may be routed to raceways with nonsafety-related cables provided the voltage levels are compatible. PAM 1 T/C cables shall be routed in seismically supported conduit with nothing but other PAM 1 cables, thus providing separation such that no single failure in the cables for PAM 1 or PAM 2 devices would cause both indicating systems to fail simultaneously. This separation scheme satisfies the intent of Regulatory Guide 1.97 for the following reasons:

1. PAM 1 T/C cables are routed in a dedicated conduit system which is seismically supported and contain nothing but other PAM 1 cables outside containment.

2. PAM 2 and non-Pam T/C cables are routed in nonsafety-related raceways which meet the following conditions:

   a. Are seismically supported

   b. Contain cables of similar voltage levels

c. Contain cables which are subject to the same requirements as Class IE circuits such as cable derating, flame retardance, environmental qualification, splicing restrictions, and raceway fill

d. Contain medium- and low-level signal and instrument type cables used to convey information. Medium-level signal cables include instrument control loop cables, digital computer cables, shielded annunciator input cables used with solid-state equipment, and instrument signal cables associated with transmitters, recorders, and indicators other than thermocouples. Low-level signal cables consist of thermocouple cables, strain gauge cables, vibration detector cables, thermal converter cables, and resistance-type temperature detector signal cables. These type circuits carry a small amount of power. Instrument control loop and associated instrument signal cables operated in a range of 10-50 MA with power supply voltages up to 85-V dc. The annunciator circuits operate at approximately 1MA, 140-V dc intermittent duty. The computer cables operate at 160 MV into a high impedance. Thermocouples, strain gauges, accelerometers, and resistance-type temperature detectors are low excitation voltage devices; these cables operate at 15 volts and carry negligible current. Conductor heating of these circuits is considered insignificant.

e. Where routed in cable trays, the trays contain cables whose exposed surfaces are coated with fire-resistant flamemastic in areas outside primary containment containing safety-related equipment.

f. Where routed in cable trays that are in a tier beneath other cable trays containing Class IE cables, the cables will also be protected by a fixed water suppression system.

g. PAM 1 and PAM 2 cables from inside primary containment shall be routed through separate electrical penetrations.

Item 3

The response given in item 6 indicates that the isolation between primary and backup channels is implemented in the form of electrical switches. This discussion should be expanded to clarify the independence of primary and backup indication. The discussion should address the input isolation for the primary display, backup display and subcooling meter for which the response to item 2e indicates that the average of all T/C readings are used in the calculation for the subcooling meter.

Response to Item 3

The primary display, a computer-drive printer, is normally isolated from the thermocouples by normally open contacts. The thermocouples are addressed individually according to the sample frequency. The voltage signal is converted to a frequency signal by a voltage-to-frequency conversion card which is isolated from the thermocouples by normally open contacts. When each thermocouple is addressed, it is checked for an open circuit. The backup display (Honeywell indicator), located in the main control room, is capable of displaying individual T/C values. This display is normally isolated from the thermocouples by means of a nonlocking key switch which spring-returns to the open position when released.

The subcooling monitor function is performed by a dedicated trend recorder whose input is furnished by the process computer through a ladder-type voltage selector. This voltage selector consists of a ladder network digital-to-analog converter connected through relay contacts to a separate power supply, and these relay contacts are selectively closed by the process computer to determine the output voltage. The use of relays as an interface between the computer and the recorder provides protection of the primary display from disruptions in the subcooling monitor.

Item 4

The response to item 7 indicates that the incore T/C system is a very simple set of hardware. This discussion should be supplemented to specifically address the environmental qualifications of electrical cables, connectors, and reference junctions located in containment.

Response to Item 4

The T/C cables and reference junctions located in containment are not environmentally qualified in accordance with Regulatory Guide 1.89, 'Qualification of Class IE Equipment for Nuclear Power Plants,' and the methodology described in NUREG-0588, 'Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment.' The T/C connectors are not qualified with respect to the effects of thermal expansion and stresses. The PAM 1 and 2 T/C connectors will be replaced if a more reliable connector is developed.

The temperature reference junction (which provides a controlled 160°F temperature reference) could fail and not affect the primary display because the temperature of the terminal strip (in the reference junction) is detected by RTDs whose output is monitored by the computer (primary display). The computer uses a variable reference junction compensation technique which would compensate for failure of the reference junction. In the event of primary display failure in conjunction with reference junction failure, the output of the RTDs could be measured independently of the computer (in the computer room) and used as a compensation factor to enable use of the backup display. In the event of primary and secondary display failure, the T/C signals and reference junction RTD outputs can be measured in the computer room.