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MAR 25 1983

Docket Nos: 50-390
and 50-391

Mr. H. G. Parris
Manager of Power
Tennessee Valley Authority
500A Chestnut Street, Tower II
Chattanooga, Tennessee 37401

Dear Mr. Parris:

Subject: Alternate Shutdown Capabilities at the Watts Bar Nuclear Plant, Units 1 and 2

As part of our review regarding compliance with the requirements of Sections III.G and III.L of Appendix R to 10 CFR Part 50, the staff reviews the ultility's methodology with respect to the analyses and means of ensuring the capability of safely shutting down the plant following a fire. In addition to this review, portions of the facility design are audited to verify the effectiveness of methodology implementation in the plant layout.

Your submittals on the Watts Bar facility do not contain sufficient information necessary for us to conduct this verification. Thus, in order for the staff to complete our review, we request that you provide the information that will best illustrate and verify the means by which the requirements of Sections III.G and III.L are satisfied (such as color coded line-drawings or listings of cabling, controls and components associated with the systems needed for hot and cold shutdown that would be affected by fire in each of the designated fire areas, and the available redundant or alternate counterpart). One item of particular interest is the potential discrepancy between "stated" design and the "as built" configuration of systems described under NI #1 in the January 13, 1983 PSB visit report. Such potential discrepancies pertain to the routing of essential redundant cabling associated with the auxiliary feedwater pumps, and the 6900 volt and 480 volt buses at Watts Bar.

Attached for your information is the staff's position regarding instrumentation necessary to comply with Section III.L of Appendix R to 10 CFR Part 50, including a list of instruments remote to the control room which are needed to comply with Appendix R.

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The NRC staff is willing to meet with your staff to facilitate resolution of our concerns. We request that this information be submitted by July 31, 1983, in keeping with your projected fuel load date.

The reporting and/or recordkeeping requirements contained in this letter affect fewer than ten respondents; therefore, OMB clearance is not required under P.L. 96-511.

If you have any questions concerning this matter, please contact the Project Manager, T. J. Kenyon, at (301)492-7266.

Sincerely,

Elinor G. Adensam, Chief
Licensing Branch No. 4
Division of Licensing

cc: See next page

Enclosure:
As stated

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Enclosure

Staff Position

Section III.L.1 of Appendix R to 10 CFR 50 requires that alternative shutdown capability shall be able to achieve and maintain subcritical reactivity conditions in the reactor. Section III.L.2 of Appendix R to 10 CFR 50 requires provision for direct readings of the process variables necessary to perform and control the reactor shutdown function.

Among the process variables which are to be monitored are: source range flux, reactor coolant temperature, and steam generator pressure. These three have been controversial so we have set forth our basis for concluding that they are necessary in order to meet Section III.L of Appendix R.

Source Range Flux

Monitoring of core flux provides a direct indication of the reactor shutdown condition. The monitoring of other process variables would provide an inferred answer only. With regard to the fission process, changes in neutron flux provides the quickest means of assessing reactor criticality conditions. Dilution events caused by the postulated spurious operation of valves could result in power excursion which would not be readily detected by interpreting the changes in other process variables (such as reactor coolant temperature or pressure). Periodic sampling of the reactor coolant for boron concentration is considered inadequate for determining "real-time" boron requirements. Additionally, should the operators fail to detect a loss of negative reactivity in a timely manner, the capability to prevent a criticality is indeterminate since components needed for such actions may be unavailable due to fire. Thus, the provision for post fire source range flux monitoring is necessary to meet Section III.L.2 of Appendix R.

Reactor Coolant Temperatures

The reactor coolant temperatures, in conjunction with the reactor coolant system (RCS) pressure, are essential parameters necessary for plant cooldown and control and, hence, conformance with Section III.L.2 of Appendix R. The plant control elements which rely on accurate reactor coolant temperature indication are, natural circulation, subcooling and pressurized thermal shock concerns.

(1) Natural Circulation: In the natural circulation mode of operation, the hot leg temperature, cold leg temperature and the difference between the hot leg and cold leg temperatures, ($T_H - T_C$), provide indication by which natural circulation conditions can be determined. In order to verify that natural circulation has been established, normal plant procedures require the operator to use cold leg temperature T_C. It has been suggested that the saturation temperature corresponding to the secondary side steam generator pressure T_{sat}, will approximate T_C. The staff

acknowledges that such a condition can exist if natural circulation is occurring; however, the converse cannot be assumed. Cooldown is usually achieved by the operator controlling the steam generator pressure and auxiliary feedwater flow to the steam generators. Due to the inherent lag in response between the secondary and primary side, T_C cannot be inferred from T_{sat}. Natural circulation is normally determined by knowing T_H, T_C, observing that T_H and T_C are constant or decreasing, and by monitoring (T_H-T_C). Since normal control room procedures require the use of T_C in confirming natural circulation, emergency procedures should not deviate from this practice. Thus the provision for post fire cold leg temperature, T_C wide range indication is necessary for meeting Section III.L.2 of Appendix R.

(2) Subcooling: The bulk fluid temperature T_H provides a reliable indication of the degree of RCS subcooling when used in conjunction with the RCS pressure. T_H is also used as a means of verifying natural circulation. It has been suggested that exit core thermocouples (ECTs) provide temperature indications equivalent to T_H. ECT readings provide local temperature conditions above the core, and can give representative equivalent T_H provided the individual ECTs are judiciously selected, since ECT readings are dependent not only upon radial positioning, but also local flow rates past the ECTs. Thus, the provision for wide range ECTs is an acceptable alternate to wide range T_H loop RTDs for meeting Section III.L.2 of Appendix R, provided that the licensee demonstrates that their selection of ECTs will result in averaged temperature readings representative of T_H. Also, the licensees should demonstrate that under conditions where the reactor vessel upper head void is expanding thus, bringing higher temperature fluid into the outlet plenum and hot legs, the ECTs give a conservative indication of outlet plenum temperature.

(3) Pressurized Thermal Shock and Appendix G Considerations: T_C, in conjunction with the RCS pressure, provides a direct indication of the plant condition relative to the plant's pressure/temperature limits as it pertains to the Pressurized Thermal Shock considerations and the low temperature overpressure protection as outlined in Appendix G of 10 CFR 50. Due to the collective effect of the steam generator conditions (i.e., feedwater flow and steam generator pressure) on the primary coolant temperatures, and the inherent lag beteen the secondary and primary sides conditions especially during transient conditions, T_C may not be accurately inferred from the secondary side steam conditions.

Steam Generator Pressure

During non-power modes of operation, "control" is effected principally by adjusting secondary system parameters (the parameter usually specified by procedures is pressure) to compensate for variances in primary system

performance. Maintenance of level in the steam generators may not be sufficient in itself to control the heat removal rate and thereby maintain a "hot standby" or "hot shutdown" mode, or translate from "hot shutdown" mode to "cold shutdown" mode. Improper pressure control may cause an imbalance in heat removal which could result in excessive depressurization, the result of which could be generation of an undesired bubble in the primary system (e.g., upper head for all PWRs or candy cane for B&W designs) or rapid cooldown and potential for violation of vessel pressure/temperature limits. For the monitoring of secondary system heat removal, two secondary system parameters should be known: level (inventory), and pressure. Thus, provisions for post fire steam generator pressure and level monitoring are necessary for meeting Section III.L.2 of Appendix R.

Instrumentation Guidelines

Section III.L.6 requires that, "Shutdown systems installed to ensure post-fire shutdown capability need not be designed to meet seismic Category I criteria, single failure criteria, or other design basis accident criteria, except where for required for other reasons, e.g., because of interface with or impact on existing safety systems, or because of adverse valve actions due to fire damage." Thus the monitors for the above listed parameters need not be "safety grade" in order to meet the requirements of Appendix R.

Section III.G.3 requires that, "Alternate or dedicated shutdown capability and its associated circuits, independent of cables, systems or components in the area, room or zone under consideration, shall be provided." For a postulated fire, an electrically independent monitoring capability for the above listed parameters should be provided outside the control room.

Based on the above, the list of instrumentation needed for PWRs is:

a) pressurizer pressure and level,
b) reactor coolant hot leg temperature or exit core thermocouples, and cold leg temperature,
c) steam generator pressure and level (wide range),
d) source range flux monitor,
e) diagnostic instrumentation for shutdown systems, and
f) level indication for all tanks used (e.g., CST).