Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

JUL 10 1991

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of the Application of) Docket No. 50-390
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - INSTALLATION OF WESTINGHOUSE EAGLE-21 PROCESS PROTECTION SYSTEM

This letter is notification of a design change that is planned for WBN Unit 1 prior to fuel loading. TVA has contracted with Westinghouse Electric Corporation for the replacement of WBN Unit 1's existing Foxboro process control system with their new Eagle-21 process protection system. This hardware changeout represents a transition from analog electronics to digital electronics, which TVA believes will provide greater equipment reliability along with improved testing and maintenance capabilities. Also, as part of the Eagle-21 design change, several reactor protection system functions will be revised to simplify operational control of the plant and to reduce the potential for initiation of unnecessary protective actions. Additional details of the planned design change are presented in Enclosure 1. A preliminary schedule for the major activities related to WBN's Eagle-21 modification work is presented in Enclosure 2.

Please recall that WBN has already installed four Eagle-21 cabinets as part of an earlier design change for resistance temperature detector (RTD) bypass elimination. The NRC staff approved the use of these four Eagle-21 cabinets in a safety evaluation report issued in a letter from S. Black (NRC) to O. D. Kingsley, Jr., (TVA) dated June 13, 1989. The planned design change will upgrade the remaining 10 Foxboro cabinets to the Eagle-21 digital electronics. As further background information, TVA's Sequoyah Nuclear Plant (SQN) has also installed an Eagle-21 process protection system with a design that is virtually identical to the one which is planned for WBN. The only functional difference is that WBN does not plan to install an environmental allowance modifier (used at SQN to reduce the uncertainty of possible reference leg heatup related to the steam generator low water level trip).

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To support installation of the Eagle-21 system at WBN, TVA would appreciate a tentative list of any design, construction, or testing activities (related to Enclosure 2) that the NRC staff proposes to review or audit at Westinghouse or the WBN site. TVA will be glad to arrange a presentation meeting, teleconference, or individual briefings to provide whatever additional technical information the NRC staff may need in determining the extent of its review.

Please be prepared to discuss your expectations at the August TVA/NRC monthly status meeting that is held with Mr. Peter Tam of your staff. TVA will also be prepared to discuss any updates to the Eagle-21 schedule at this and subsequent monthly status meetings.

If there are questions about this submittal, please telephone M. C. Bryan at (615) 365-8819.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

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ENCLOSURE 1

SUMMARY DESCRIPTION OF DESIGN CHANGE TO INSTALL WESTINGHOUSE EAGLE-21 PROCESS PROTECTION SYSTEM

The Westinghouse Eagle-21 process protection system is a direct equipment replacement for the Foxboro process control system that was provided by Westinghouse as part of WBN's original design. The Eagle-21 equipment uses current-generation microprocessor technology to improve the reliability and accuracy of process data signals, to simplify calibration testing and maintenance of the electronics, and to accommodate future additions of improved control and monitoring instrumentation as it becomes available. No replacements of field instrumentation or cabling are planned as part of the Eagle-21 upgrade. Only processor electronics are involved in the change.

At WBN, the Eagle-21 upgrade has already been started since 4 of the 14 Foxboro cabinets were replaced as part of the earlier design change to remove the resistance temperature detector (RTD) bypass piping and manifolds from the reactor coolant loops. The design change which is now in progress will replace the remaining ten Foxboro cabinets with Eagle-21 cabinets.

Many of the digital electronic modules (or printed circuit board assemblies) in the Eagle-21 system perform several different functions. Multiple channel input modules are used to power the field sensors and to perform signal conditioning. All calculations for the process channel functions are performed by a centralized loop calculation processor (LCP). Typical functions performed by the LCP are summation, lead/lag, multiplication, comparator, averaging, and square root conversion. Outputs to the trip logic are provided through multiple channel partial trip output modules. Analog outputs are provided, where needed, by multiple channel analog output modules via appropriate isolation devices.

All Eagle-21 process protection channels are configured to perform automatic surveillance testing through a centralized test sequence processor. There are also built-in automatic functional testers and various system self-testing features that can detect and annunciate most types of anticipated hardware or system malfunctions. A portable man-machine interface cart and cabinet test panels provide an enhanced "user friendly" means of performing routine calibration and diagnostic testing of the system.

As part of the Eagle-21 upgrade, WBN has chosen to implement several optional design changes offered by Westinghouse. These include:

1. Conversion of the electronics in the existing 4 Eagle-21 cabinets to the latest design used in the 10 new Eagle-21 cabinets -- When modifications are complete, it is planned to have the same revision level of each type of interchangeable printed circuit board in all 14 Eagle-21 cabinets.

2. New steamline break protection features -- This change incorporates some of the engineered safety features actuation system (ESFAS) signals used in the design of later vintage Westinghouse plants for reactor protection against a steamline break. Compared to WBN's previous steamline break protection features, the change will reduce the potential for spurious actuation of safety injection (SI) at low power. The change involves the addition of two new ESFAS functions and the deletion of two existing functions. The following functions will be added to the Eagle-21 system and the solid state protection system (SSPS): 1) SI and steamline isolation on steamline low pressure and 2) steamline isolation on steamline pressure high negative rate coincident with P-11 pressurizer pressure. The following

functions will be deleted: 1) SI and steamline isolation on steamline high flow coincident with P-12 low-low T_{avg} or steamline low pressure and 2) SI on steamline high differential pressure.

3. Reduction of steam generator (SG) low-low level trip setpoint -- This change reduces the potential for unnecessary reactor trips due to feedwater (FW) operational transients. Reanalysis of various FW accidents and mass/energy release data is expected to demonstrate that the SG low-low level trip setpoint can safely be set at a constant value of 17% for all power levels in place of the current programmed setpoint which varies linearly from 17% at 30% power to 54.9% at 100% power.

4. SG low-low level trip time delay (TTD) -- This change also reduces the potential for unnecesary reactor trips and auxiliary feedwater (AFW) actuations due to FW operational transients. Reanalysis of the various accidents that are assumed to be mitigated by a reactor trip or AFW actuation in response to a SG low-low level trip signal will be performed. The results are expected to demonstrate that a TTD can safely be incorporated from 0% - 50% power with the amount of the delay linearly decreasing to zero at 50% power.

5. Elimination of FW low flow reactor trip via median signal selector (MSS) -- This change reduces the potential challenges to the reactor protection system and thereby enhances its reliability. Currently, the reactor trip on steam flow/FW flow mismatch coincident with SG low level is provided only because of a possible interaction between the control and protection functions derived from the SG level transmitters. Such interaction is prohibited by IEEE-279. It could occur because one of the three transmitters used as input to the SG low-low level trip is also used for SG level control. If this transmitter failed high, it would reduce flow through the FW regulating valve. This, in turn, could lead to a reactor trip on SG low-low level, a protective action for which the failed transmitter provides input. By incorporating MSS circuitry, only the median output signal from the three level transmitters is used for SG level control. Consequently, there is no possibility that a failure of one of the transmitters could perturb SG level control so as to force a protective action. With the MSS installed, the diverse FW low flow reactor trip is no longer required as a defense against control/protection interaction and the trip can be deleted.

ENCLOSURE 2

PRELIMINARY SCHEDULE FOR EAGLE-21 WORK

1.	Westinghouse began plant-specific design work for Eagle-21 process protection system equipment	May 1991
2.	Submit Westinghouse topical report(s) describing design details of Eagle-21 equipment and associated solid state protection system (SSPS) modifications	September 1991
3.	Submit draft FSAR changes related to Eagle-21 equipment, associated design changes, and affected accident analyses	November 1991
4.	Complete factory assembly and testing of Eagle-21 equipment	December 1991
5.	Submit Westinghouse software verification and validation report	January 1992
6.	Field installation by Westinghouse of all Eagle-21 racks and associated SSPS modifications	April - May 1992
7.	Site acceptance testing by Westinghouse of Eagle-21 racks and associated SSPS modifications	May - June 1992
8.	Post-modification testing by TVA of Eagle-21 equipment and associated design changes	Later