UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 145 TO FACILITY OPERATING LICENSE NO. DPR-66

DUQUESNE LIGHT COMPANY
OHIO EDISON COMPANY
PENNSYLVANIA POWER COMPANY

BEAVER VALLEY POWER STATION, UNIT NO. 1

DOCKET NO. 50-334

1.0 INTRODUCTION

By letter dated April 21, 1989, Duquesne Light Company requested various changes to the Technical Specifications for Beaver Valley, Unit 1. These changes result from proposed plant modifications involving removal of the reactor coolant system resistance temperature detector (RTD) bypass manifold, and replacement by fast response RTDs located directly in the reactor coolant system hot and cold leg piping. We have reviewed the modifications and the requested technical specification changes.

2.0 DISCUSSION AND EVALUATION

2.1 Design Change

Currently, the hot and cold leg RTDs are inserted into the reactor coolant bypass loop. A bypass loop from upstream of the steam generator to downstream of the steam generator is used for the hot leg RTDs, and a bypass loop from downstream of the reactor coolant pump to upstream of the pump is used for the cold leg RTDs. The RTDs are located in the manifolds and are directly inserted into the reactor coolant bypass without thermowells. Each RTD manifold (one hot leg and one cold leg per reactor coolant loop) contains two narrow-range RTDs: one for protection and control system inputs and one as a spare. Flow into each bypass loop is provided by three scoops located at 120° intervals around the hot leg, and a tap into the corresponding cold leg.

Each loop's pair of RTDs (one in the hot leg and one in the cold leg) is used to provide inputs for protection system functions based on the average loop temperatures (Tavg) and the loop differential temperature (ΔT). Protection functions based on these inputs are: overtemperature ΔT and overpower ΔT reactor trips with their associated rod stop and turbine runback actions, low Tavg main feedwater isolation, and low-low Tavg steam dump block signals. Each loop's pair of RTDs are also used to provide inputs for control systems functions based on the average loop temperature and the loop differential temperature.

In its April 21, 1989 letter, the licensee proposed to modify the RTD system. The hot leg temperature measurement on each loop will be accomplished with three fast-response, narrow-range, single-element RTDs mounted in thermowells located within the existing RTD bypass manifold scoops. A hole will be drilled through the end of each scoop so that water will flow through the existing holes in the leading edge of the scoop, past the RTD, and out through the new hole. These three RTDs will measure the hot leg temperature which is used to calculate the reactor coolant loop differential temperature (ΔT) and average temperature (Tavg). This modification will not affect the single wide-range RTD currently installed near the entrance of each steam generator. The RTD will continue to provide the hot leg temperature used to monitor the reactor coolant temperature during startup, shutdown, and post-accident conditions. The present Reactor Vessel Level Instrumentation System (RVLIS) has pressure taps located in the RTD bypass piping hot leg branch lines. In order to retain the hot leg connection for the RVLIS, a new boss will be mounted at the same elevation as the existing connections on the same two hot legs.

One fast-response, narrow-range, dual-element RTD will be located in each cold leg at the discharge of the reactor coolant pump. This will be the replacement for the cold leg RTD located in the bypass manifold. Temperature streaming in the cold leg is not a concern due to the mixing action of the RCP. For this reason, only one RTD is required. This RTD will measure the cold leg temperature which is used to calculate reactor coolant loop ΔT and Tavg. One element of the RTD will be considered active and the other element will be held in reserve as a spare. This modification will not affect the single wide-range RTD in each cold leg currently installed at the discharge of the reactor coolant pump. This wide-range RTD will continue to provide the cold leg temperature used to monitor reactor coolant temperature during startup, shutdown, and post-accident conditions.

The hot leg RTD measurements (three per loop) will be electronically averaged in the process protection system. The average Thot signal will then be used with the Tcold signal to calculate reactor coolant loop ΔT and Tavg which are used in the reactor control and protection system. This will be accomplished by addition to the existing process protection system equipment.

The present RCS loop temperature measurement system uses dedicated direct immersion RTDs for the control and protection systems. This arrangement satisfied the IEEE Standard 279-1971 which applied the single failure criterion to the control and protection system interaction. To continue to satisfy the requirements of IEEE 279-1971, the Tavg and ΔT signals used in the control-grade logic will be input into a median signal selector, which will select the signal which is in between the highest and lowest valves of the three loop inputs. The use of the median select will avoid any adverse plant response that could be caused by a single signal failure. The median selector was previously reviewed and approved by the staff for H. B. Robinson (Amendment No. 121, dated January 9, 1989) and Salem 1 & 2 (Amendment No. 84 & 56, dated November 16, 1987).

Existing control board ΔT and Tavg indicators and alarms will continue to provide the means of identifying RTD failures. Upon identification of a failed RTD, the operator would place that protection channel in a trip condition, consistent with the time requirements specified in the Technical Specifications. The spare cold leg RTD element provides sufficient spare capacity to accommodate a single cold leg RTD failure per loop. Failure of a hot leg RTD is addressed via manual action as the plant I&C personnel would defeat the failed signal and rescale the electronics to average the remaining two hot leg signals.

The objectives of this review were to confirm that the reactor trip and engineered safety features actuation systems satisfy the requirements of the acceptance criteria and guidelines applicable to the protection system and will perform their safety function during all plant conditions for which they are required. Since our review indicates that the modified system does not functionally change the reactor trip or the engineered safety features actuation systems, our original evaluation and conclusion for these systems remain valid. Based on this and the licensee's commitment that the new 7100 Process Electronics and RTD have been qualified to the criteria pres[illegible] in WCAP-12058 "RTD Bypass Elimination Licensing Report For Beaver [illegible] Unit 1 " (proprietary), we find the proposed plant modifications to elimi[illegible] the RTD bypass manifold, and install fast-response RTDs directly in the reactor coolant system hot and cold legs to be acceptable.

2.2 Technical Specification Changes

The new RTD system will have a total response time identical to that of the present system. Therefore, there will be no impact on the overall Tavg channel response, and no need, as a result of implementing the new system, to revise any of the setpoints in the Technical Specifications. The new RTDs have a slower response time compared to the old ones (4.0 seconds vs. 2.0 second). However, the new design eliminates the bypass thermal lag time of 2.0 seconds, thus making the total response time the same as before (i.e. 6.0 seconds). There is, therefore, no change to the function of the RTDs and the new RTD response time is acceptable.

However, the above components of the RTD system response time provide input to the trip functions of overpower delta T, overtemperature delta T and loss-of-flow. As a result, the allowable values of these trip functions are changed.

In summary, the changes proposed by the licensee to pages 2-6, 2-10, 3/4 3-6 and 3/4 3-9 reflect the approved new RTD design, do not affect previously accepted analyses, and are thus acceptable.

2.3 Updated Final Safety Analysis Report (UFSAR) Changes

The licensee proposed changes to certain UFSAR pages to reflect the new RTD design. On the basis of our acceptance of the new RTD design, we also find the proposed UFSAR changes acceptable.

3.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. We have determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. We have previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

4.0 CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: October 23, 1989

Principal Contributor: Sang Rhow
Peter S. Tam