UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 123 TO

FACILITY OPERATING LICENSE NO. NPF-38

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

1.0 INTRODUCTION

By application dated July 25, 1996, as supplemented by letter dated January 27, 1997, Entergy Operations, Inc. (the licensee), submitted a request for changes to the Waterford Steam Electric Station, Unit 3, Technical Specifications (TSs). The requested changes would modify TS 3/4.7.4 to incorporate more restrictive fan operability requirements and lower the maximum allowed basin temperature. The proposed change became necessary when the licensee determined that system fouling had not been adequately addressed and analyzed in the thermal design performance evaluation for the ultimate heat sink (UHS) and, therefore, the licensee concluded that the existing TS for the UHS was not conservative with respect to the revised design basis calculations.

The January 27, 1997, letter withdrew the proposal to remove descriptive information from TS 3/4.7.4. Their amendment of the application did not change the initial proposed no significant hazards consideration determination and the application as amended, remained within the scope of the original notice.

2.0 DISCUSSION

The ultimate heat sink at Waterford, Unit 3 is redundant and consists of two forced draft dry cooling towers (DCTs) and two mechanical draft wet cooling towers (WCTs) with water stored in the basins of the WCTs. Each train of the UHS uses one DCT and one WCT which are essentially in series. During normal plant operation two component cooling water (CCW) system loops supply cooling water to all the plant loads using the DCTs for final heat removal. Although the DCTs are the primary heat sink for the CCW system, each CCW loop also has a CCW heat exchanger which is supplied cooling water from an auxiliary component cooling water (ACCW) system train which uses one of the two WCTs for heat removal. CCW flows through the CCW heat exchanger whenever the CCW system is in operation and ACCW flow is supplied to the CCW heat exchanger whenever the DCT is not adequate to maintain CCW temperature within the desired range. The ACCW system and WCTs are designed to operate following an accident and whenever the heat rejection capacity of the DCTs is exceeded or ambient environmental conditions prohibit the DCTs from rejecting their design

heat load. Each DCT is sized to dissipate approximately 60 percent of the heat removed by the CCW system following a design basis loss of coolant accident (LOCA) while each WCT is sized to dissipate approximately 40 percent of this design basis heat load. Therefore, each train of the UHS, consisting of a CCW train and an ACCW train, is designed to be 100 percent redundant under the worst case design basis accident conditions.

The DCTs are forced draft, dry type, parallel flow heat exchangers with each tower consisting of five separate cells. Each cell contains two 40 foot finned vertical cooling coils with forced cooling air flow on the outside of the tubes that is supplied by three fans for each cell. Therefore, there is a total of 15 fans for each DCT. The DCT fans are started and secured automatically to maintain the CCW system temperature at a predetermined value measured at the outlet of the CCW heat exchanger. When the CCW temperature in a CCW loop exceeds that value, the associated ACCW pump starts to initiate additional CCW cooling via the WCT.

The WCTs are mechanical draft, wet type, mixed flow heat exchangers with each tower consisting of two cells. Each cell is serviced by four induced draft fans for a total of 8 fans per WCT. There is a concrete partition that prevents air recirculation between the fans of each cell. The WCT fans are automatically started whenever the water temperature in the WCT basin exceeds a predetermined setpoint, and continue to run until they are shut off by the operator. Unlike the DCTs, the forced air actually contacts ACCW during the heat removal process. ACCW enters the WCT and is sprayed downward towards the basin into fill modules separating the water into droplets. Air is drawn upward through the modules and spray area by the fans which are located at the top of the tower.

During refueling outage number six (RF-6), testing revealed fouling in the CCW heat exchangers that resulted in degraded system performance. The heat exchangers (shell side) were cleaned during RF-6 and a task force was established by the licensee, to incorporate a maximum fouling factor into the UHS design basis. The task force identified conservatism in the UHS performance analysis to provide margin for fouling in the CCW heat exchangers. However, the task force also discovered that the minimum fan requirements in TS 3/4.7.4 were determined by using start-up test data and the design basis calculations did not include adequate margin to allow for system fouling that can occur during the life of the plant.

The initial calculation demonstrated that the UHS had sufficient capacity to dissipate the heat loads following a design basis LOCA and assuming the historical highest dry bulb temperature and highest historical wet bulb temperature. However, DCT performance is not affected by wet bulb temperature and WCT performance is not affected by dry bulb temperature. Since the historically high temperatures do not occur at the same time, the margin associated with this conservative assumption was reduced and used to determine the maximum fouling that can occur in the CCW heat exchangers. A revised calculation determined that the most limiting meteorological condition was 102 degrees Fahrenheit (°F) dry bulb coincident with 78 F wet bulb.

Changing the UHS meteorological design basis required a reduced WCT basin temperature to provide additional allowance for fouling in the CCW heat exchanger. With the initial design basis, the effectiveness of the CCW heat exchanger was optimum and, therefore, design WCT basin temperature was only required to be maintained at or below 95°F. With the revised design basis, the allowance for CCW heat exchanger fouling requires the WCT basin temperature to be maintained at or below 89°F to preserve heat exchanger capacity.

Failure to incorporate an adequate equipment fouling factor in the original UHS design analysis also resulted in less conservative UHS minimum fan operability requirements specified in Table 3.7-3 of TS 3/4.7.4. The revised analysis considered the WCTs and DCTs separately in order not to affect the CCW heat exchanger design basis fouling and to preserve the design basis heat load that each UHS component is expected to dissipate following the design basis LOCA. TS Table 3.7-3 currently specifies minimum number of combined DCT and WCT fans whenever a specified value of wet or dry bulb temperature is exceeded. The proposed revision to Table 3.7-3 separates the number of DCT fans and WCT fans required to be operable such that the DCT fans are only associated with the dry bulb temperature and the WCT fans are only associated with the wet bulb temperature.

In addition to the proposed changes to the WCT basin temperature and the minimum fan requirements identified in Table 3.7-3, the licensee also proposed a number of other changes to TS 3/4.7.4 and its Bases that are primarily administrative in nature to clarify the specification and make it consistent with the revised analysis.

3.0 EVALUATION

The licensee's proposed revision to TS 3/4.7.4 includes two primary technical changes, the first is to the maximum allowed WCT basin temperature and the second is to the minimum required number of operable cooling tower fans. The existing specification identifies a basin water temperature for the WCT of less that or equal to 95°F as a limiting condition for operation (LCO). The proposed change would revise this LCO to specify that the basin water temperature must be less than or equal to 89°F for continued operation. The proposed change is conservative in that the upper temperature limit for continued plant operation has been reduced. The proposed new limit is also consistent with the licensee's revised transient heat analysis for the UHS which included equipment fouling factors that are conservative and consistent with actual plant experience. The methodology used in the licensee's revised analysis is consistent with the recommendations of Regulatory Guide 1.27 "Ultimate Heat Sink for Nuclear Power Plants," and the results of the analysis verified that CCW system temperatures would remain within equipment limits throughout the course of a design basis accident. The proposed change to the temperature limit is, therefore, acceptable.

The proposed changes to the UHS minimum fan requirements are contained in revised Table 3.7-3. The existing table specifies the minimum number of fans for both the DCT and WCT fans for specified ambient conditions which include either dry or wet bulb temperature. The revised table specifies the minimum number of DCT fans that are required for specified dry bulb temperatures and the minimum number of WCT fans for specified wet bulb temperature. The proposed separation of the wet and dry cooling tower fan requirements is acceptable because the wet bulb temperature is not a controlling factor in DCT performance and conversely, the dry bulb temperature is not a controlling factor in WCT performance. Therefore, the proposed separation is more consistent with cooling tower performance and with the actual transient heat analysis. Additionally, there are no situations where the required number of operable fans for either the WCT or the DCT have been reduced by the proposed revision, they have either remained the same or have been increased. The only changes to the number of fans required to be operable are for a higher number of fans under certain ambient conditions. Thus, all changes to the required number of fans are conservative and, therefore, acceptable.

The proposed administrative changes and the changes to the Bases for TS 3/4.7.4 do not alter any of the actual requirements of TS 3/4.7.4 but provide for more concise and clear requirements that are consistent with the actual plant design and analysis. They are, therefore, also acceptable.

Based on its evaluation the staff concluded that the proposed changes are consistent with Regulatory Guide 1.27, are conservative in nature, provide clearer and more concise requirements that reflect the latest UHS transient heat analysis at Waterford, Unit 3. The staff, therefore, concludes that the proposed changes to TS 3/4.7.4 and its Bases are acceptable.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Louisiana State official was notified of the proposed issuance of the amendment. The State official had no comments.

4.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has 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. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (61 FR 58903). Accordingly, the 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 the amendment.

5.0 CONCLUSION

The Commission has 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: February 13, 1997