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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO GROUND WATER LEVEL CONTROL AND MONITORING

ENTERGY OPERATIONS, INC.

GRAND GULF NUCLEAR STATION

DOCKET NO. 50-416

1.0 INTRODUCTION

The licensee, Entergy Operations Inc. (EOI) (formerly Mississippi Power & Light Co.), submitted a detailed report in April 1992 describing actions taken to resolve the ground water issue at Grand Gulf Nuclear Station (GGNS) pending since 1985 (Ref. 1). In its final effort to resolve this issue, EOI proposed two actions, namely, 1) raise the Design Ground Water Level (DGWL) from Elevation (El) 109 feet (ft) above mean sea level (msl) to El 114.5 ft above msl, and 2) discontinue ground water level (GWL) monitoring. The staff reviewed EOI's report and found its proposals acceptable as discussed below.

The power block structures at GGNS are founded on the Catahoula Formation which is comprised of dense claystone. The material overlying the Catahoula Formation consists of terrace deposits, loess, and alluvium. The power block structures and the Stand-by Service Water (SSW) basins for Grand Gulf Units 1 and 2 were constructed within an open excavation that extended from yard grade at El 132.5 ft msl to the Catahoula Formation at about El 97 ft msl (Ref. 1). This excavation was performed inside a tieback wall; as the structures were completed, the area between the tieback wall and the building walls was backfilled with a granular material and capped with a 2-ft thick clay surface seal to minimize rainfall infiltration and recharge of ground water. Historically, GWLs in the power block area have been at elevations higher than the regional GWL, which occurs generally at an elevation of about 75 ft, north and south of the plant area. The average GWL at the plant is about 100 ft, which reflects a mounded condition coinciding with a rise in the top of the underlying Catahoula Formation.

Seven monitoring wells (MW-1 through MW-7) were installed around the power block in 1976 to replace the 11 construction observation wells destroyed during the start of construction in 1975. These wells are 6-inch diameter PVC pipe installed within the backfill. Seepage of ground water into the excavation was initially controlled by pumping from sumps and later by a dewatering well system that was installed in 1979 and 1980. The construction dewatering system consisted of eight 10-inch diameter wells (DW-1 through DW-8). Later, five monitoring wells (MW-8 through MW-12) were installed to monitor water levels in the circulating water pipe trench (CWPT) backfill and in the terrace deposits east of the power block, and fifteen monitoring wells (MW-13 through MW-26) were installed in the terrace deposits in the vicinity

of the cooling tower and in the north site area to better define ground water flow patterns across the site and recharge sources.

Water levels in well DW-8, which was installed in July 1980, have typically been higher than those recorded in other dewatering and monitoring wells in the power block area. The water level in well DW-8 exceeded the DGWL of 109.0 ft by up to 1.2 ft during January to June 1983. In December 1983, GGNS conducted the first of several "Ground Water Level Studies" to investigate the causes of exceedance of DGWL in DW-8, and reported the results of this study to NRC in February 1985. This report provided information regarding the effect of the exceedance on safety-related structures and equipment, precipitation data, models to calculate GWL and the dewatering systems for Units 1 and 2. The NRC staff reviewed the licensee's submittal and issued a detailed safety evaluation on this issue, concluding that the reported exceedance of the DGWL did not compromise the integrity of the safety-related facilities (Ref. 2). However, this issue was considered an open item because the construction of Unit 2 including the backfilling and the clay seal was not completed. Considering the licensee's commitment to retain dewatering capability for Units 1 and 2 until completion of Unit 2 construction, and the low probability of occurrence of rainfall necessary to exceed a GWL of 109 ft msl, the staff concluded that final projection of the maximum post-construction ground water level and resolution of exceedance of the design basis GWL could be delayed for up to 5 years, but no later than December 1990. If a final resolution of this issue was delayed beyond 1990, the licensee was required to provide, at that time, a status report and schedule for submittal of a final report (Ref. 2).

Since this issue was not resolved by December 1990, the licensee submitted several status reports. The first status report in December 1990 described five additional events of exceedance of DGWL due to malfunction or stopping of the dewatering pumps (Ref. 3). The licensee conducted two more "Ground Water Level Studies" in 1990 and 1991, as it did in 1983. Using the data from these studies, the licensee prepared a detailed report and proposed a resolution of the ground water level issue in April 1992 (Ref. 1). The staff reviewed this report and requested additional information (Ref. 4), which the licensee has provided (Ref. 5). The staff's evaluation of the licensee's proposed resolution of high ground water level issue is given below.

2.0 EVALUATION

In its detailed April 1992 report, the licensee summarized the results of several hydrological studies and structural and geotechnical calculations it has performed since 1983 (Refs. 1 and 5). The principal objectives of these studies were to: (1) ascertain the causes of exceedence of DGWL; (2) determine the maximum possible GWL at the site and then propose a new DGWL; (3) evaluate the effects of raising the DGWL on the safety of structures and equipment; and (4) finally determine if GWL monitoring can be terminated.

The first of the above mentioned studies, performed in 1983, included structural calculations by its consultant, Bechtel Power Corporation, for the

Unit 1 structures. These calculations indicated that the Control Building and the SSW basins are safe for a GWL elevation of 114.5 ft and the remaining safety-related structures are safe for a GWL elevation of 117.0 ft. The licensee also investigated the effect of raising the DGWL on the in-structure response spectra by considering the changes in the dynamic soil properties due to the raised DGWL. EOI found that the slight variations in soil properties had a minimal effect on structural response and that it would be adequately enveloped by the +/- 15% broadening of the design in-structure response spectra (Ref. 5).

The licensee conducted two more studies - one in 1990 and another in 1991. The results of the study conducted in 1990 indicated that the sources of ground water within the power block area are leakage from the cooling tower and infiltration from precipitation. The 1991 study results confirmed the 1990 study findings. These studies were used to develop the post-construction GWL map and to determine the maximum GWL expected to occur at the site without the influence of the leakage from the cooling tower.

The post-construction GWL contour map shows the estimated average GWLs considered likely to occur at GGNS during the life of the plant. The map is based on GWLs that have occurred since the achievement of final site configuration, the elimination of cooling tower leakage (which had previously raised the plant GWL), and no further pumping from the dewatering wells. EOI has determined the maximum expected post-construction GWL within the power block area to be 113 ft msl. EOI has reported that the leakage noticed at the cooling tower has been fixed (Ref. 5). In response to a staff query on this subject, EOI has stated that a major leak that occurred at a damaged expansion joint in the warm-water inlet tunnel under the cooling tower basin had been fixed by installing a different type of seal (Refs. 1, 4, & 5). Several minor expansion/contraction cracks in the tunnel walls were also repaired to prevent degradation of rebars in the tunnel walls. Nonetheless, EOI has committed to perform a visual inspection of the cooling tower during each refueling outage to verify that no potential leakage paths exist (Ref. 5).

Based on the findings of the above studies, EOI has proposed to raise the DGWL from 109 ft to 114.5 ft for all structures within the power block. EOI determined the new DGWL by adding the highest recorded level (EL 110.2) with minimum influence from the plant recharge source to the highest GWL change (3 ft) from a period of heavy precipitation (Ref. 5). The staff accepts this proposal to raise DGWL for the following reasons:

1. The structural calculations by Bechtel Power Corporation indicates that all the safety-related structures are safe for a GWL of 114.5 ft.

2. In response to a staff question (Appendix I to Reference 1), EOI has stated that adequate factors of safety against liquefaction within the Category I backfill exist for water levels up to El 124 ft, based on its detailed engineering assessment of the seismic structural calculations.

EOI's second proposal deals with the discontinuance of GWL monitoring at GGNS. As stated in Section 2.5.4.6 of the Updated Final Safety Analysis Report (UFSAR), the construction system was originally installed to remove seepage of ground water into the excavation and inflow of precipitation during construction. Since the Unit 2 construction has been terminated and the required backfill completed, repairs to the cooling tower completed, and the expected maximum GWL determined, the licensee sees no need to continue monitoring the plant GWL (Ref. 1). However, during a teleconference with EOI's staff on December 23, 1992, the NRC staff was informed that the licensee will continue to maintain the ground water monitoring wells, and take GWL measurements after heavy rainfall and also at intervals determined by its Civil Engineering personnel. EOI's staff also stated that it will report to the NRC staff if the GWL exceeds the increased DGWL of 114.5 ft. However, the licensee proposes to discontinue measuring the GWLs monthly, as has been done so far in connection with the Environmental Report it submits to NRC. In view of the above commitments by EOI, the staff accepts the licensee's proposal to discontinue the current GWL monitoring program.

3.0 CONCLUSION

Based on a review of the licensee's April 30, 1992, report and its September 25, 1992, response to the staff's queries, the staff concludes that the licensee has taken necessary steps to resolve the outstanding ground water issues at GGNS following the staff's detailed safety evaluation on this subject issued in August 1985 (Ref. 2). The staff accepts the licensee's proposal to raise the DGWL from 109 ft msl to 114.5 ft msl, as the structural calculations by its consultant, Bechtel Power Corporation, have shown that this action does not compromise the structural stability of the safety-related facilities due to the increased hydrostatic loading.

The staff accepts EOI's proposal to discontinue the current GWL monitoring, subject to the following commitments made by EOI in its September 1992 response (Ref. 5) and again during a teleconference on December 23, 1992: 1) continue to monitor the GWLs by measuring the water levels in a representative sample of the wells in the power block area at intervals determined by its engineering staff (and after periods of heavy rainfall), and report to NRC if the GWL exceeds revised DGWL; and 2) carry out a visual inspection of the cooling tower during each refueling outage to verify that no potential leakage paths exist which would cause the GWL to rise above the new DGWL.

4.0 REFERENCES

1. Letter from W. T. Cottle, EOI (formerly Mississippi Power and Light Co.), to USNRC, dated April 30, 1992. Subject: Grand Gulf Nuclear Station Unit 1 - Resolution of High Ground Water Levels.

2. Letter from T. M. Novak, NRC, to J. B. Richard, EOI, dated August 19, 1985. Subject: Grand Gulf Nuclear Station, Units 1 and 2 - High Ground Water Level.

3. Letter from W. T. Cottle, EOI, to USNRC, dated December 21, 1990. Subject: Grand Gulf Nuclear Station Unit 1 - Ground Water Monitoring Program.

4. Letter from Paul W. O' Connor, USNRC, dated July 17, 1992. Subject: Grand Gulf Nuclear Station, Request for Additional Information

5. Letter from W. T. Cottle, EOI, to USNRC, dated September 25, 1992. Subject: Grand Gulf Nuclear Station Unit 1 - Response to Request for Additional Information related to Ground Water Level Control and Monitoring.

Principal Contributor: R. Pichumani

Date:

A copy of the staff's detailed safety evaluation is enclosed. This completes the staff's action on this issue.

Sincerely,

Original signed by H. Rood for
Paul W. O'Connor, Senior Project Manager
Project Directorate IV-1
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation

Enclosure.
Safety Evaluation

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