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December 21, 1990

U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D.C. 20555

Attention: Document Control Desk

SUBJECT: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
Groundwater Monitoring Program

GNRO-90/00006

Gentlemen:

In 1985, the NRC issued a Safety Evaluation Report (SER) (MAEC-85/0284, dated August 19, 1985) which presented the results of NRC's review of several high groundwater events. These events involved groundwater levels in excess of the design basis value of 109.0 feet Mean Sea Level (MSL) at dewatering well-8 (DW-8). The SER had concluded ".... the integrity of safety related facilities was not compromised by the reported exceedance of the design basis groundwater level."

The SER also indicated, however, that due to Unit 2 construction activities, GGNS was not able to provide a modified groundwater level that would have supported the closure of this issue. Accordingly, the SER required the following: ".... the Staff concludes that the final projection of a maximum post-construction groundwater level and resolution of exceedance to the design basis groundwater level can be delayed for up to 5 years, but no later than December, 1990. If a final resolution of this issue is delayed beyond 1990, licensee is requested to provide, at that time, a status report and schedule for submittal of a final report." In accordance with this request, Entergy Operations, Inc. has developed the enclosed status report.

As noted in the attached status report, stabilization of the Unit 2 site did not occur until 1989 when backfilling and installation of the clay cap was completed. Prior to this, a "maximum post-construction groundwater level" could not be developed and activities initiated since that time have been designed to provide a better definition of the groundwater profile. Data gathered to date indicates that the high groundwater events reported at GGNS are the result of leakage from onsite sources and precipitation in areas away from safety related structures.

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The groundwater level around safety related structures has consistently been below the design maximum groundwater level of 109.0 feet MSL. In an area south of the Radwaste Building as discussed in the attached status report levels have exceeded 109.0 feet MSL.

In response to the need for a post-construction maximum groundwater level and to better define influences from precipitation, Entergy Operations, Inc. is implementing various tasks designed to provide a better definition of groundwater level at Grand Gulf. These tasks include the installation of fifteen additional monitoring wells at areas around the cooling tower basin and on the north end of the site. Data from the wells around the cooling tower basin will allow a better characterization of the magnitude of water addition from this structure to the groundwater supply, while the new wells on the northern portion of the site will enhance the amount of data available in evaluating overall groundwater flow across the site. The flow instrumentation installed on the dewatering pump discharges will be monitored to provide additional data that can be used to characterize overall groundwater flow within the plant site.

As discussed in the attached status report, data gathering activities with the new monitoring wells and flow instrumentation will continue until mid-1991, normally a period high in precipitation. This will help in resolving issues associated with high groundwater level south of the Radwaste Building and influence from precipitation. A final report delineating the results of these activities will be provided by April 30, 1992.

If you require additional information, please advise.

Yours truly,

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File (Central) (w/a) (15)

Attachment to
GNRO-90/00006

GRAND GULF NUCLEAR STATION

GROUNDWATER MONITORING

STATUS REPORT

Dated: December 20, 1990

I. INTRODUCTION

The Grand Gulf Nuclear Station has a Groundwater Monitoring and Construction Dewatering System which was used during construction and continues to be used to monitor the groundwater level at various locations adjacent to the power block and in surrounding areas of the site. This system is responsible for monitoring and dewatering of the perched acquifer which underlies the power block. As reported in Section 2.4.13.5 of the UFSAR, the design maximum groundwater level in the aquifer for the site was calculated to be 109.00 feet Mean Sea Level (MSL). However, in reports to the NRC, Grand Gulf has documented cases wherein the groundwater level at at least one dewatering well exceeded this design level.

In order to both determine the cause of the high groundwater level events and to assess the safety significance of the events, Entergy Operations, Inc. has completed several studies which have supported the development of an enhanced monitoring program currently ongoing. This program will gather data from new monitoring wells and flow instrumentation on existing dewatering wells which will be used to develop a post-construction groundwater profile for the GGNS site.

The following sections provide a status report on the work completed to date and a summary of the programs underway to resolve the issue of high groundwater levels.

II. BACKGROUND

II.1 Grand Gulf Site

Sections 2.4 and 2.5 of the UFSAR provide a detailed description of the site's geological formations and groundwater tables, as well as present the design basis for the subsurface hydrostatic loading. As presented in the UFSAR, the power block structures are supported by the Catahoula Formation which is comprised of dense claystone. The material overlying the Catahoula Formation consists of terrace deposits, loess and alluvium. Regionally, groundwater occurs within the terrace and alluvium deposits and, to a lesser extent, within relatively thin, fine sand lenses in the Catahoula Formation. During construction, groundwater was initially controlled by a ditch and sump system within the excavated area. As structures were built, control of groundwater was switched to dewatering wells.

Within the plant property, groundwater flows westward and discharges into the Mississippi River. Groundwater north and south of the power plant is at an elevation of approximately 75 feet Mean Sea Level (MSL) based on contours of average water levels collected between January 1984 and July 1990. The water table typically occurs in the permeable terrace, loess and alluvial deposits that overlie the less permeable silt and clay comprising the upper part of the Catahoula Formation.

Backfill placement around Unit 1 structures was completed in 1982. Placement of Unit 2 backfill remained at about Elevation 110 until late 1988. Backfilling and installation of the clay seal were completed in early 1989 and final site grading in the Unit 2 area was performed to stabilize the site in a post-construction condition.

II.2 Groundwater Level Monitoring

As noted above, seepage of groundwater into the Unit 1 and 2 excavation was initially controlled by pumping from sumps and, later, by a construction dewatering system that was installed in 1979 and 1980. The construction dewatering system consists of eight 10-inch diameter wells (DW-1 through DW-8) as shown on Figure 1. In addition, 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.

Subsequently, five additional monitoring wells (MW-8 through MW-12) were installed south and east of DW-8, as well as a supplementary dewatering well (DW-8A). These wells were installed in September, 1986 in accordance with recommendations from the 1983 Groundwater Level Study.

As will be discussed in Section III, fifteen additional monitoring wells are being installed to further clarify the direction of groundwater flow and the nature of recharge sources.

Groundwater levels have been monitored in regional and site monitoring wells at least monthly since 1973. (Exceptions: April, 1982 to September, 1982 and November, 1982 to January, 1983 - only Unit 1 wells monitored.) At present, regional wells are read on two week intervals and the results are submitted in the annual environmental operating report. The perched wells are read on monthly intervals and any well level equal to or greater than 109.0 feet MSL is reported to the NRC in accordance with their August 19, 1985 letter (MAEC-85/0284). The results are also submitted in the annual environmental operating report.

II.3 High Groundwater Level Events

From March, 1984 through October, 1990, Grand Gulf has provided several reports documenting groundwater levels at one or more wells which exceeded the design maximum groundwater level of 109.00 feet MSL. These reports are summarized below.

a. January through July, 1983: Unusually high rainfall caused the water level in the perched aquifer to rise significantly. In the case of dewatering well DW-8, the design maximum level of 109.00 feet MSL was exceeded during the referenced period with the maximum recorded level reaching 110.21 feet MSL. (Reference AECM-84/0020, dated March 9, 1984.)

b. February 28, 1985: Equipment failure (clogged screens on the pump) coupled with above average precipitation appeared to be the cause for the groundwater level rise at DW-8 which peaked at 109.1 feet MSL. (Reference AECM-85/0088, dated March 25, 1985.)

c. Late November through December, 1985: A groundwater elevation of 111.3 feet MSL at DW-8 was discovered during a routine perched aquifer surveillance on November 25, 1985. An investigation attributed the high level to a possible malfunction of the conductivity probe and/or pump. Both components were replaced. During troubleshooting of this event, groundwater level exceeding 109.00 feet MSL occurred on three other occasions. (Reference AECM-86/0002, dated February 7, 1986.)

d. March, 1990: In order to install flow monitoring instrumentation on the DW-8 pump discharge, it was necessary to remove the pump from service. As a result of this work, the groundwater level at this well exceeded 109.00 feet MSL with a maximum level of 109.8 feet MSL. (Reference AECM-90/0062, dated April 16, 1990.)

e. April, 1990: A water level reading at DW-8 on April 12, 1990 indicated a groundwater level of 109.4 feet MSL. The level increase was apparently due to an incorrectly set level sensing probe. (Reference AECM-90/0083, dated May 8, 1990.)

f. September, 1990: A water level reading taken from dewatering well DW-6 indicated a level of 122.3 feet MSL. The high level was apparently due to surface and roof run-off which momentarily overflowed DW-6's manhole. This provided recharge, however, the level was not indicative of the groundwater level. The DW-6 pump switch had been inadvertently left in the "off" position; therefore, the pump was unable to automatically maintain proper level. (Reference AECM-90/0183, dated October 10, 1990.)

In addition to these reports, Grand Gulf provided a "High Groundwater Level Study" which addressed the probable causes and consequences of the high groundwater levels reported in Item (a) above. The groundwater study was submitted to the NRC on February 14, 1985 via AECM-85/0035. This report is summarized in Section III.

As indicated in Items (a) through (e), virtually all of the high groundwater level events occurred at DW-8. This well is located in the circulating water pipeline trench backfill which is southeast of the Radwaste Building. This well is not near safety related buildings as illustrated in Figure 1.

III. GROUNDWATER STUDIES

As previous discussed, Grand Gulf has completed several studies of the groundwater levels at and around power block structures. These studies have provided a better understanding of the groundwater levels and flow characteristics, and have identified additional actions which could be taken to provide a definite, post-construction profile of the site groundwater levels. The following summarizes these studies.

III.1 Groundwater Level Study - 1983

In response to the high groundwater level which occurred from January through July of 1983 (as discussed in Section II.3.a), Grand Gulf initiated a Groundwater Level Study in December, 1983. The results of the study were submitted to the NRC in February, 1985 with the exceedance attributed to:

- Excessive precipitation at the site
- Lack of completion of Unit 2 structures
- Lack of completion of the clay seal
- General yard area grading not completed
- Increased infiltration from natural causes

Recommendations from the Groundwater Level Study that were implemented were to re-establish temporary power to Unit 1 construction dewatering wells and operate them when groundwater level approaches elevation 109.0 feet MSL and the installation of five additional monitoring wells south and east of DW-8, as well as the installation of a supplementary dewatering well. Two of these monitoring wells (MW-11 and MW-12) were located in the Circulating Water Trench backfill and three (MW-8,9 and 10) were installed to the east of the Circulating Water Trench. The supplementary dewatering well (DW-8A) was installed adjacent to DW-8 in the terrace deposits. These activities were implemented in 1986 to provide a better characterization of the direction of groundwater flow around both DW-8 and the circulation water pipe trench.

III.2 Subsequent Groundwater Studies

Ongoing studies by Grand Gulf use data from the various monitoring and dewatering wells to evaluate the many factors that can influence groundwater level. Water levels measured in the power block area and surrounding plant property between January 1984 and July 1990 were evaluated in order to determine average groundwater flow patterns and to determine potential sources of groundwater recharge and locations of groundwater discharge. The Catahoula Formation was also evaluated to determine if variations in the elevation of the top of the Catahoula Formation contribute to the high water conditions. The following provides a discussion of these various factors.

III.2.1 Catahoula "Hump"

Groundwater levels in the southern portion of the plant (areas including the Circulating Water Piping Trench and Cooling Tower Basin) are at elevations greater than in surrounding areas. A review of data from the monitoring and dewatering wells suggest two factors which produce the higher groundwater level. One factor involves the addition of water to the groundwater inventory from the cooling tower and related piping. This factor is discussed in Section III.2.2.

The second factor is a local increase in the elevation of the Catahoula Formation under the site. The top of the Catahoula Formation is above regional groundwater levels at the nuclear generating station, exceeding 70 feet MSL elevation throughout most of the power block area and exceeding 100 feet MSL elevation between the power block area and the cooling tower. The mounding of the Catahoula at the generating station causes the regional groundwater flow patterns to diverge north and south of the nuclear generating station.

In addition, the low permeable silt and clay which comprise the Catahoula Formation retard the south to north flow of groundwater from the cooling tower basin towards the power plant. This aids the groundwater in local mounding, or gathering, in areas south of the power block.

III.2.2 Additions to Groundwater

While the mounding of the Catahoula Formation appears to retard the flow of groundwater across the site, the local inventory of groundwater in the southern portion of the site appears to be increased by water from the cooling tower basin, circulating water piping, and/or associated systems. This addition to the groundwater inventory tends to increase the local groundwater level.

III.2.3 Summary

The combined effect of the mounded Catahoula Formation and the addition of water from the cooling tower basin, et al, is to increase the groundwater level in areas south of the plant i.e., in areas near and south of the area monitored by DW-8. This is supported by groundwater level readings.

Groundwater levels from 1984 to the present at wells DW-1 and MW-7 (i.e., the northern side of the Catahoula Formation's mound) averaged approximately 90 feet MSL, while similar readings at DW-8 (i.e., southern side of mound) averaged 107 feet MSL. Further, the minimum groundwater elevation of 85 feet MSL was observed at monitoring well MW-7 in February of 1985 and the maximum elevation of 111 feet MSL was observed at dewatering well DW-8 in November of 1985.

Water levels exceeded 109 feet MSL on 8 occasions between January 1984 and July 1990 and each of these occurred at dewatering well DW-8. South of the power block area average water levels varied between 105 feet MSL immediately south of the power block to 118 feet MSL near the cooling tower.

III.3 Groundwater Recharge Sources

Data from the monitoring and dewatering wells was also evaluated to determine if the higher than expected groundwater levels were a result of offsite recharge sources. It was determined that groundwater at the nuclear generating station is acquired solely from onsite sources. This is indicated by regional groundwater flow patterns which are directed away rather than towards the site. Sources of recharge include precipitation and leakage from onsite sources, such as the cooling tower basin. Within this divide, groundwater is derived from recharge and flows towards the existing dewatering wells in the power block area. Outside this divide, groundwater flows radially away from the plant site. Some of the groundwater in the cooling tower area flows northward towards the dewatering wells in the power block area, however, most of the groundwater in that area flows east, south and west and, eventually, joins the regional groundwater flow system.

Water levels and precipitation rates could not be related on either a monthly or yearly basis. However, water level responses to large variations in precipitation were observed in monitoring wells located between the power block and the cooling tower indicating that precipitation is a source of groundwater recharge at the facility. In 1989, water levels rose during the wet summer months and declined in the fall in response to the abrupt decrease in precipitation.

IV. CONTINUING ACTIONS

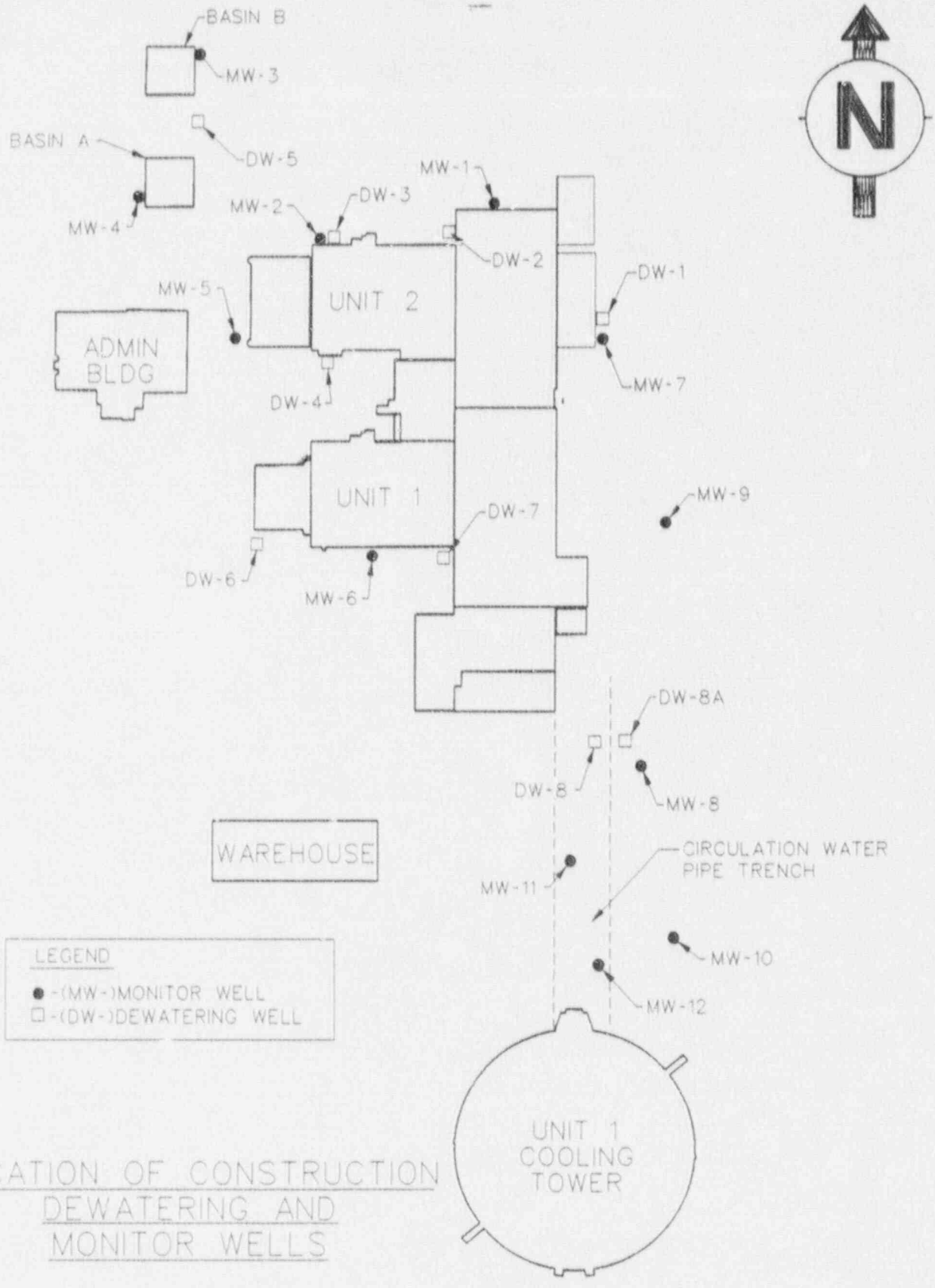
Presently, fifteen new monitoring wells are being installed to help further define the direction of groundwater flow. Thirteen of these new wells will be located around the Unit 1 Cooling Tower and two will be located north of the plant. Data collected from these new wells over the next few months will help clarify the source of recharge and direction of groundwater flow. In addition to the new wells, flow instrumentation was installed on the discharge of dewatering pumps in 1990 to provide a quantifiable measure of groundwater from the wells.

Data from the new wells and flow instrumentation will be collected through mid-1991 to provide data from the Spring (i.e., wet) season. This will provide a better definition of recharge influences attributable to precipitation.

V. CONCLUSIONS

The review of groundwater level data to date indicates that the high groundwater events reported at GGNS are the result of leakage from onsite sources and precipitation in areas away from safety related structures. The groundwater level around safety related structures has consistently been below the design maximum groundwater level of 109.0 feet MSL.

However, in response to the need for a post-construction maximum groundwater level and to better define influences from precipitation, Entergy Operations, Inc. is implementing tasks designed to provide a better definition of groundwater level at Grand Gulf. As discussed in Section IV, these tasks include the installation of fifteen additional monitoring wells and monitoring of flow instrumentation installed on dewatering pump discharges. Entergy Operations, Inc. will collect data from these sources throughout the Spring (i.e., wet) season and use the data to develop the post-construction maximum groundwater level and/or to identify additional measures which may be required to fully respond to the high groundwater level events addressed by the NRC's SER. The completion of these tasks will support the issuance of a final report by April 30, 1992.



LOCATION OF CONSTRUCTION DEWATERING AND MONITOR WELLS

FIGURE 1