Log # TXX-4755
File # 10068

TEXAS UTILITIES GENERATING COMPANY

SKYWAY TOWER · 400 NORTH OLIVE STREET, L.B. 81 · DALLAS, TEXAS 75201

April 11, 1986

WILLIAM G. COUNSIL
EXECUTIVE VICE PRESIDENT

Director of Nuclear Reactor Regulation
Attention: Mr. Vince S. Noonan, Director
Comanche Peak Project
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 AND 50-446
PERCHED WATER EVALUATION

Dear Mr. Noonan:

Attached for your review is TUGCo Memorandum TSG-16176 dated February 27, 1986 which provides the CPSES Perched Water Evaluation. The purpose of the evaluation is to resolve any concerns with water leakage into Category I structures.

Very truly yours,

W L Counsil

W. G. Counsil

BSD/arm
Attachment

Original + 1 copy

c - Mr. R. E. Camp w/o attachment
Mr. H. A. Harrison w/o attachment
Mr. L. D. Nace w/o attachment
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TSG-16,176 TEXAS UTILITIES GENERATING COMPANY

OFFICE MEMORANDUM

To F. W. Madden Glen Rose, Texas February 27, 1986

Subject COMANCHE PEAK STEAM ELECTRIC STATION
TNE PERCHED WATER EVALUATION

PROBLEM

For a number of years small volumes of water inleakage to CPSES structures have been observed at elevations below grade. This inleakage was predominately associated with the Turbine Building, but has also been observed as a recurring problem in the Category I structures.

Early tests indicated that a large portion of the inleakage in the Turbine Building was the result of underground piping leaks and construction related runoffs with subsequent corrective actions substantially reducing the inleakage volume. All sources of inleakage water could not be eliminated, such as, perched water and rainfall runoff that migrates to the exterior wall surfaces though natural and excavation induced native rock fractures. This water collects between the wall, which was poured neat against the excavated rock face, and the rock surface. Albeit this represents a very small volume of water, the resulting hydrostatic head caused inleakage to the Turbine Building. This inleakage was characterized by wetness on the inside surface of exterior walls and some puddling on floors. To relieve this condition a system of headered drains extending through the Turbine Building exterior walls to the native rock face was installed. This "Turbine Building Seepage Collection System" provides drainage, collection, and disposal of the small volumes of water associated with the external hydrostatic head. The total volume of water collected by this system varies with rainfall, but has been previously estimated not to exceed about 2000 ml/min as a maximum. Following installation of the collection system no Turbine Building inleakage has been observed.

Recurring inleakage to the Category I Structures has been observed with varying estimates of volume and frequency. The problem has been mainly associated with inleakage at the seismic gaps, but has also been observed as wetness at sinkage cracks and inleakage at penetrations. It has also been suggested that water external to the structures may have contributed to interior floor coating failures at lower building elevations.

OBJECTIVE

The Perched Water Evaluation is a continuing study by TNE to identify the sources, quantify the volumes, and formulate solutions to stop or minimize inleakage to the Category I structures. The study includes inleakage flow measurements and piezometric measurements to characterize and trend inflows and yard area hydrostatic heads.

A total of eight inleakage locations were selected for measurement. These eight had been previously identified as major inleakage problems relative to plant location, inflow rates, and/or frequency. The selected measurement locations are as follows:

1. Safeguards Building #1 room 64 (el. 790') at the Containment seismic gap

2. Safeguards Building #1 room 70 (el. 790') at the Aux. Building seismic gap (location 70A)

3. Safeguards Building #1 room 70 (el. 790') at the pipe tunnel seismic gap (location 70B)

4. Service water pipe tunnel north wall leakage located 7' east of col. line B-F (location SW-A)

5. Service water pipe tunnel at piping penetrations (locations SW-B and SW-C)

6. Unit #1 Chiller Room, room 115A

7. Unit #2 Chiller Room, room 115B

8. Safeguards Building #2 room 63 south wall at pipe sleeve

A total of eight yard area piezometers were installed outside the Unit #1 and Unit #2 Category I Structures. These piezometers were located to predict the hydrostatic head at or near the inleakage measurement locations. The piezometer locations are as follows:

Piezometer #1 - Near seismic gap between Switch Gear Building #1 and Safeguards Building #1

Piezometer #2 - Near seismic gap between Containment #1 and Safeguards Building #1

Piezometer #3 - Near seismic gap between Containment #1 and the Fuel Building

Piezometer #4 - Service water pipe trench, north side

Piezometer #5 - Near seismic gap between Containment #2 and the Fuel Building

Piezometer #6 - Near seismic gap between Safeguards Building

#1 and pipe tunnel, west side.

Piezometer #7 - Near seismic gap between Safeguards Building #1 and pipe tunnel, east side

Piezometer #8 - Service water pipe trench, at centerline

Inleakage data and piezometer observation from these locations are correlated with rainfall data and physical plant systems and configurations to characterize, evaluate, and solve inleakage problems.

PROCEDURE

The Perched Water Evaluation has been conducted to date in three parts with the first two parts providing base line data and analyses and the third part as an on-going data collection and analyses program to formulate and verify inleakage solutions.

Part one of the study collected inleakage data, recorded piezometer levels, and evaluated the variation of each parameter with rainfall events and intensities.

The second part of the study collected inleakage data and recorded piezometric water levels before and after bailing. These data were used to characterize piezometer recovery rates, establish inleakage rates as a function of piezometer water levels, and evaluate the variation of each parameter with rainfall events and intensities.

Inleakage field measurements were recorded based upon semi-quantitative techniques to establish inleakage trends. Piezometer field measurements were recorded as negative feet from the top of the piezometer to the surface of the water in the piezometer. Rainfall data were obtained from the CPSES site monitoring station at the concrete batch plant.

The base line data and analyses were used to characterize the inleakage rates and sources, produce conceptual solutions to inleakage problems, and formulate additional investigation requirements. The on-going part three of the study provides field data collection and analyses to evaluate corrective actions and input additional conceptual solutions.

OBSERVATIONS/DISCUSSION

Analyses of the base line data show that piezometer equilibrium elevations and recovery rates vary with piezometer location and are mainly a function of rainfall events. Analyses also show that building inleakage occurrences and flow rates are a function of both rainfall events and associated piezometer water levels.

The volumes of water associated with hydrostatic heads external to the Category I structures are small as shown by the very low recovery rates of piezometers 2,3,4,5, and 8. Piezometers 1,6 and 7, located in the area of the seismic gap between Safeguards Building #1 and the pipe tunnel, intersect utility trenches. The relatively high recovery rates of these piezometers are associated with leakage in underground non-safety related pipe systems such as fire protection, potable water, and construction non potable water, and construction/maintenance runoffs in the immediate area.

Several monitored inleakage locations demonstrate flow rates and frequencies that are a direct function of the water level observed in an associated piezometer. The piezometer #5 water levels and the observed inleakage occurrences in Safeguards Building #2 room 63 are an example. When the piezometer is maintained in a bailed condition, the inleakage to room 63 stops. Room 63 inleakage rates as high as 82 gpd have been observed with corresponding piezometer elevation of about 805 feet. When the piezometer is maintained in a bailed condition (about elevation 776 feet) inleakage to room 63 does not occur. Piezometer #5 recovery rates have been observed to be less than one foot per day but as high as about 36 feet per day during rainfall events.

The piezometer #8 water levels and the inleakage occurrences observed in the Service Water Tunnel at the lower service water pipe penetrations are also directly related. The lower pipe penetrations are at elevation about 787 feet. When the piezometer is maintained in a bailed condition below this elevation, the inleakage through the pipe penetrations stops. Inleakage rates at this location without bailing average about 288 gpd but have been observed to be as high as about 528 gpd during rainfall events. This inleakage is water that is perched in the service water pipe trench excavated into the impervious native rock. Numerous other utility trenches intersect the service water pipe trench, thus the observed recovery rates for this piezometer of about 0.5 foot per day are influenced not only by direct rainfall and the perched water storage volume of the trench but also by underground pipe systems leakage and construction related runoffs.

Piezometer #2 water levels and the inleakage volumes to Safeguards Building #1 room 64 are related but not directly. Maintaining piezometer #2 in a bailed condition produces an apparent reduction in the observed inleakage at this location but does not stop it. The average inleakage rate is about 43 gpd with a corresponding piezometer elevation of about 796 feet. When the piezometer is maintained in the bailed condition (about elevation 780 feet), inleakage rates are reduced to about 12 gpd. Piezometer #2 recovery rates have been observed to be about 2 feet per day.

With the exception of the seismic gap between the Safeguards Building #1 and the pipe tunnel which averages about 0.4 gpd inleakage, the remaining monitored inleakage locations (the chiller rooms, Service Water Pipe Tunnel wall and the seismic gap between the Aux. Building and Safeguards Building #1) are not directly associated with an existing piezometer. However, inleakage flow measurements confirm the fact that inleakage rates at these locations are mainly a function of site rainfall events. The chiller rooms and tunnel wall composite average inleakage rate is about 1.2 gpd while the Aux. Building seismic gap inleakage average rate is about 42 gpd.

The piezometer #3 is an example of the fact that no general condition of high hydrostatic head exists in the area of the Category I structures. This piezometer is located at the seismic gap between the Unit #1 Containment and the Fuel Building. No hydrostatic head has been measured in this piezometer and no recovery or inleakage has been observed. This condition is indicative of the observations in other areas at the CPSES site during excavation. The most recent experience being the Unit #1 and Unit #2 Main Condenser Changeout Pits which were excavated to an elevation of about 761 feet without encountering inleakage other than minor perched water volumes. Piezometer observations on three borings in the pit areas prior to excavation showed water elevations of 786 feet, 804 feet and 750 feet respectively. Subsequent excavation proved that the 786 feet and 804 feet piezometer elevations were the result of low volume perched water sources. At the completion of excavation for the two pits about 21,000 square feet of native rock face was exposed. The only observed inleakage without rainfall was associated with about four isolated areas that exhibited wetness of the face but not collectable inflow.

CONCLUSION

The Perched Water Evaluation has demonstrated that the inleakages to Category 1 Structures are predominantly the result of surface generated waters, either rainfall runoff or construction/maintenance runoff, and, to a lesser extent, of naturally occurring perched water residing near the structures. The waters migrate to the building exterior surfaces through excavation induced fractures in the native rock or through utility trenches that intersect the structures.

No general condition of high hydrostatic head exist around the Category 1 Structures. The small volumes of water observed in the area piezometers or as inleakage to the structures are the result of water artificially perched in the building and utility trench excavations. The piezometer observations demonstrate localized hydrostatic heads that vary widely over short distances. These localized variations are manifested as a general condition by migration at and around building exterior surfaces through the imperfect building wall and native rock interface and through the seismic gaps separating the structures.

Inleakage flows to the Category 1 structures are collected in the nontritiated waste subsystem of the Liquid Waste Processing System in one of three floor drain tanks with a total retention volume of 50,000 gal. The normal input flow rate to this subsystem without building inleakage is about 900 gpd/reactor. This waste plus building inleakage waste is processed through a 21,600 gpd floor drain evaporator, and the distillate collected in one of two 5,000 gal. waste monitor tanks prior to sampling and discharge. The actual inleakage volumes to Category 1 Structures are small. The computed average inflow rate for a three month period including April, May, and June of 1985 for all monitored inleakage locations is 375 gpd. As previously discussed, three major inleakage locations can be readily reduced to a zero inflow rate by maintaining the associated piezometer in a bailed or pumped down condition. In consideration of this demonstrated fact, the remaining building inleakage flows for which no solution has yet been proposed result in an average building inflow of only about 67 gpd. However, the unabated inleakage flow rate of 375 gpd represents less than a two percent increase in the normal input flow rate verses the installed processing capacity of the nontritiated waste subsystem (2175 gpd input vs. 21,600 gpd capacity). This increase will not affect the safe operation of the plant or adversely alter the capabilities of the Liquid Waste Processing System to meet the demands that result from anticipated operational occurrences.

The Perched Water Evaluation to date has demonstrated that the inleakage problem to the Category I Structures can be solved. Solutions are generally required on a case by case basis because of physical plant variations and the absence of general hydrostatic head. The following solutions are now being evaluated, designed, or implemented:

1. Automatic pump down of selected piezometers at existing and new locations, discharging to the storm drain system.

2. Artificially creating leak paths from problem areas (such as seismic gaps) to selected piezometer locations to facilitate drainage and pump out.

3. Storm water runoff control utilizing concrete swales and roof drain routing.

4. Relief of exterior wall hydrostatic heads with through wall drainage and collection systems similar to that in the Turbine Building.

5. Identification of water sources including underground piping leakage, construction and maintenance runoffs, and the systematic elimination or control of these sources on an on-going basis.

Each location-specific solution is being evaluated and designed to assure the most cost effective and efficient solutions are implemented.

John H. James

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