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SUBJECT: Forwards response to questions raised at 901031 meeting re Lake Robinson flooding during Oct 1990.

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United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
RESPONSE TO QUESTIONS REGARDING LAKE ROBINSON FLOODING

Gentlemen:

The attached summarizes the responses to NRC questions regarding flooding at Lake Robinson during October 1990. The flooding has been the topic of discussions between members of our staff on several occasions in recent weeks. The three specific questions were raised during a general issues review meeting between CP&L and NRC on October 31, 1990 in NRC offices in White Flint.

Questions regarding the matter may be referred to Mr. R. W. Prunty at (919) 546-7318.

Yours very truly,

S. D. Floyd

S. D. Floyd
Manager
Nuclear Licensing Section

JSK/cwh (901RNP)

Attachment

cc: Mr. S. D. Ebneter
Mr. L. Garner (NRC-HBR)
Mr. R. Lo

411 Fayetteville Street • P. O. Box 1551 • Raleigh, N. C. 27602

A001

Attachment

Question 1 Discuss the actual rainfall compared to the maximum flooding/precipitation analyzed in the FSAR.

Response Two peak flows were considered as discussed in FSAR Section 2.4.4.2, with a peak discharge into the lake of 23,000 cfs and 39,000 cfs respectively. The first peak flow was based on the July, 1916, tropical storm, transposed from its actual location near Asheville, North Carolina, and centered on the Black Creek drainage area. Indicated peak discharge into the lake for an equivalent storm on the H. B. Robinson drainage basin was 23,000 cfs. The second peak flow determined was the one which would result from the Probable Maximum Precipitation (PMP) for the area taken from charts prepared by the Hydrometeorological Section of the Weather Bureau. This calculation yielded a peak discharge into the lake of 39,000 cfs. The project spillway is capable of passing 40,000 cfs at elevation 221.67.

During the October 1990 flood, the 36 inch Howell Bunger valves A and B were open 62% and 35% respectively, with flow estimated at 936 cfs. Additionally the "B" tainter gate was open to approximately 30 inches (vs a maximum opening of about 28 feet) which yields a discharge flow of approximately 2000 cfs. The total estimated flow of about 2936 cfs is well below the peak flows discussed in FSAR Section 2.4.2 and the maximum discharge capacity of the spillway.

Also, preliminary data indicate that the total rainfall for the period of October 10-12, 1990 at the HBR2 site was 6.91 inches. The maximum 24 hour total from 8:00 A. M. on October 10, 1990 to 8:00 A. M. on October 11, 1990 was 5.40 inches. The return period for this rainfall rate in 24 hours is greater than 5 years but less than 10 years for Darlington County. Since this exceeds the precipitation extreme of 4.76 inches discussed in FSAR section 2.3.2.1.4 and Table 2.3.2-14, changes to the FSAR will be required.

Question 2 What is the basis for taking action (i.e., opening the flood gates) at the lake elevation of 222 feet?

Response H.B. Robinson Steam Electric Plant Unit No. 1 Operating Instruction No.16, "Robinson Impoundment Operation" discusses operation of the dam under flood conditions. The instruction states that during flood conditions the lake level should be controlled such that it does not exceed the HBR2 FSAR value of 222 feet. Also it states that the lake level should not be allowed to decrease, thereby aggravating the flood by adding stored water to it.

The actions are based on dam design considerations. The spillway is designed to discharge 40,000 cfs at elevation 221.67 feet as discussed in the response to question 1. At elevation 222 feet there remains 8 feet to the top of the dam and 3 feet to the top of the clay core. By taking action to stabilize the lake level at 222 feet, the margin to the top of the dam and the top of the clay core is maintained, and the flooding effects are minimized. Thus, actions taken at 222 feet ensure both integrity of the dam and minimalization of downstream flooding.

Question 3 How is the integrity of the ultimate heat sink ensured?

Response The dam was completed in 1960 prior to construction of HBR2 in 1966-1970, consistent with accepted design and construction techniques. The main dam is about 4,000 feet long and has a maximum structural height of about 55 feet. A gated concrete overflow spillway is provided near the old streambed of Black Creek. The lake impounded by the dam is about 7.3 miles long in the north-south direction and has an average width of about 2,500 feet. At the normal water surface elevation of 220 feet msl, the surface area of the lake is 2,242 acres. The dam was designed by and constructed under the supervision of Ebasco Services, Inc.

The site was explored by Eustis Engineering Company of New Orleans by means of 50 undisturbed soil borings, 103 wash borings, and 298 auger borings. Shelby tube samples of clays and piston tube samples of sands were obtained from the undisturbed soil borings. The wash borings were made for the purpose of tracing out the location, thickness, and extent of clay deposits in the foundation of the dam.

The design of the dam provides for a 15-foot wide berm on the downstream face Elevation 200 feet, where the ground surface was at or below that elevation. The face of the berm was protected against wavewash during flood periods and against backwater currents by an 18-inch thickness of riprap underlain by 8 inches of crushed stone placed below Elevation 195 feet. A crushed stone toe drain, 15 feet in width at its base, was provided at the toe of the berm. Wavewash protection on the upstream face of the dam was provided between the crest and Elevation 205 feet by 24 inches if riprap underlain by 8 inches of crushed stone. From Elevation 205 feet down the slope to natural ground, a 2-inch sand-asphalt blanket was placed for wavewash protection during reservoir filling. A central vertical core of compacted impervious material (clay) 12 feet wide was provided from Elevation 225 feet to the base of the dam proper, thence extending downward along the downstream slope of a cutoff trench which, in the western portion of the dam, extended to the lower clay stratum at Elevation 170 feet. The shells of the dam are largely sand. A blanket of clean, impervious sand 10 feet thick was placed on the surface of the base of the dam downstream of the vertical core.

The eastern part of the dam was of similar construction, except that the cutoff trench was not carried to the lower clay stratum at Elevation 170 feet but was excavated to the surface of the upper irregular silty clay stratum found in this area and described previously. In order to reduce the quantity of underseepage which might pass through the sand strata found between the two clay strata, a very long path of percolation was created by tying the two clay strata together by means of a trench and clay facing backfill extending upstream for a distance of about 700 feet. As mentioned previously, the west abutment of the dam consists almost entirely of sand. In order to minimize seepage through it, the abutment was blanketed with a 5-foot thickness of clay between the end of the dam and the plant intake structure, a distance of about 600 feet.

The seismicity of the site was thoroughly investigated by several experts in the field of seismology in connection with the licensing of the 1970 nuclear unit. Studies were made by Dames and Moore, Drs. J. L. Stucky and L. L. Smith, Dr. Perry Byerly, Dr. George W. Housner, and by the Savannah River Operations Office of the U.S. Atomic Energy Commission. It was concluded that, on a historical basis, it would appear that the site will not experience damaging earthquake motion during the life of the facilities. The sediments underlying the site are quite thick and apparently undisturbed. Active faults are unknown in the area.

Also, the stability of the dam was reviewed in connection with the FSAR for the nuclear unit. The earth dam was analyzed using the circular arc "method of slices" under the assumed hypothetical earthquake, with two-thirds of the horizontal acceleration in the vertical direction. The ratio of the sum of all the resisting forces divided by the sum of all the forces tending to cause displacement is 1.08. The dam was also analyzed by the Newmark method. This indicated that no appreciable displacement or yielding of the embankment could be expected when it is subjected to the hypothetical earthquake.

Continued assurance of the integrity of the dam is provided by periodic dam inspections. As part of its on-going dam safety program, Carolina Power & Light Company (CP&L) conducts independent dam safety inspections at five year intervals.

The scope of this inspection has been as generally outlined for a Phase I dam safety inspection in the Corps of Engineers publication "Recommended Guidelines for Safety Inspection of Dams." The H. B. Robinson Steam Electric Plant facilities include a main dam, spillway, ash pond and cooling water canal. A review is made of pertinent available geologic and engineering data as well as available design, construction and operating information for the critical project features. A detailed visual inspection is made of the critical water-retaining facilities relative to stability, operational adequacy and safety.