UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON, D.C. 20242

Mr. L. Manning Muntzing
Director of Regulation
U.S. Atomic Energy Commission
7920 Norfolk Avenue
Bethesda, Maryland 20545

50-390
50-391

Dear Mr. Muntzing:

Transmitted herewith in response to a request by Mr. Richard DeYoung, is a review of the geologic and hydrologic aspects of the Watts Bar Nuclear Plant - AEC Docket Nos. 50-390 and 50-391, proposed by the Tennessee Valley Authority.

The review was prepared by F. A. Kilpatrick and F. M. Byers, Jr. and has been discussed with members of your staff. We have no objections to your making this review a part of the public record.

Sincerely yours,

W. A. Radlinski

Acting Director

Enclosure

cc: A. J. Pressesky, AEC

4568

LB

Watts Bar Nuclear Plant
Tennessee Valley Authority

AEC Docket Nos. 50-390 and 50-391

This plant site is on the west bank of the Tennessee River on Chickamauga Reservoir at Tennessee River mile 528, 1.9 miles below the Watts Bar Hydroelectric Dam. Chattanooga and Oak Ridge, Tennessee are 50 miles southwest and 40 miles northeast respectively of the plant site. The plant is to consist of two reactors each having a capacity of 3,411 Mwt (1,180 Mwe).

Geology

The analysis of the geology of the Tennessee Valley Authority's Watts Bar Nuclear Site, Units 1 and 2, as presented in AEC Docket Nos. 50-390 and 50-391 and supplements, was reviewed and compared with the available literature. The site was visited on February 1, 1972. In general the analysis appears to present an adequate appraisal of those aspects of the geology that are pertinent to an engineering evaluation of the site.

The proposed nuclear plant at Watts Bar is in the western part of the Valley and Ridge physiographic province of the Appalachian Mountains about 8 miles southeast of the northeasterly trending Eastern Cumberland Escarpment. This is an irregular southeasterly facing escarpment, as much as 1,000 feet high, that marks the physiographic and structural boundary between the Cumberland Plateau to the northwest and the folded and thrust-faulted Appalachians to the southeast.

The geologic structural setting of the proposed Watts Bar Nuclear Plant is closely similar to the Sequoyah Nuclear Plant of TVA, now under construction. Both sites are underlain by the Conasauga Shale of Cambrian age that dips generally southeastward at moderate angles. The regional structural setting is mainly one of imbricate thrust faulting and minor folding involving generally southeasterly dipping lower Paleozoic rocks. The northeasterly trending Kingston thrust fault parallels the attitude of the beds and reaches the surface about 1 mile northwest of the site. None of the thrust faults, however, under either the Cumberland Plateau or the Valley and Ridge province have been active since Paleozoic time.

There are no known active faults or other major geologic structures in the area that are thought potentially capable of localizing seismicity in the immediate vicinity of the site. The nearest probable active fault zone, about 275 miles west of the site, is along the axis of the Mississippi Embayment, a large depositional syncline approximately centered on the Mississippi River (Stearns and Marcher, 1962). Movements on this fault zone probably occurred during the earthquakes of 1811-1812 near New Madrid, Missouri. The faults that cut the Paleozoic rocks of the Valley and Ridge and Cumberland Plateau structural subprovinces ceased movement over 200 million year ago. Although many earth tremors have been felt in the

Southern Appalachian Structural Province, none can be related directly to movement on any of the faults within the area. It is assumed, therefore, that the maximum earthquake intensity previously experienced in the region might also occur again anywhere in the region, including the vicinity of the proposed Watts Bar site.

Bedrock at the plant site consists of about 1,000 feet of the lower third of the Middle Cambrian Conasauga Shale, underlain by at least 2,000 feet of the Lower Cambrian Rome Formation. According to the applicant's report, drill cores showed the Conasauga Shale to be dominantly fine-grained clastics, the limestone content of which ranges from 9 to 25 percent and averages about 16 percent; none of the limestone beds, however, exceed 6 inches in thickness. These figures appear to be representative, based on the examination of drill cores at the site, and on published descriptions of the lower part of the Conasauga Shale as exposed in foundation excavations during construction of the Watts Bar Dam (Fox, 1943, p. 168-169). The underlying Lower Cambrian Rome Foundation, which is partly exposed in the west bank of the Tennessee River at Watts Bar Dam, consists of shale, siltstone and sandstone in order of abundance.

Assuming a general southeasterly dip of about 30° for the Kingston thrust fault and the sedimentary rocks, the Kingston thrust fault underlies the site at a depth of about 3,000 feet; minor isoclinal folds in the Rome Formation adjacent to the fault would increase rather than decrease the apparent thicknesses of these formations underlying the site.

The applicant proposes to site all Class I buildings on unweathered Conasauga Shale, which will require removal of about 40 feet of overburden at the site. Based on the boring logs, the elevation of the weathered top of the shale under the proposed nuclear plant ranges between 688 and 701 feet above sea level. Final foundation grade for the proposed plant will be 690 feet. In situ and dynamic seismic testing by the applicant indicates that the unweathered Conasauga Shale is adequate to support the proposed nuclear plant. Boring logs, however, indicate a weathered zone 1 to 3 feet thick beneath the upper surface of the Conasauga Shale. The top of unweathered shale, therefore, would generally be below foundation grade at holes 21, 29, 36, and 43 (fig. 2.8-59, rev. 1, PSAR). Moreover, it is possible that in some places between drill holes the top surface of unweathered Conasauga Shale may be possibly several feet below proposed foundation grade for Class I structures, owing to a local deeper scour of the former course of the Tennessee River.

Hydrology

Cooling towers are to be utilized for cooling condenser water with about 133 cfs (cubic feet per second) of makeup water to be taken from Chickamauga Reservoir. Minimum flow at the site prior to the construction of dams on the Tennessee River was 2,600 cfs. Water should be adequate since the applicant has specified that flows in excess of 2,000 cfs will be released from Watts Bar Dam.

Plant foundation grade is to be at approximately elevation 690 ft MSL (mean sea level) in the sedimentary rock of the Conasauga Formation. At the site the upper surface of the Conasauga is at about 700 ft MSL. This is overlain by high level terrace deposits about 30 feet thick. Ground water to approximately elevation 720 ft exists in the overlying terrace deposits and hence is above the grade of the plant foundation.

Numerous wells and springs exist within the vicinity of the plant site. The data on well and spring water levels supplied by the applicant indicates that the water table slopes toward Watts Bar Lake. No groundwater users are presently downgradient from the plant. Measures should be taken to prevent the development of any new ground-water supplies downgradient between the plant and the lake.

The applicant should be more specific at the FSAR stage in spelling out the location, type and frequency of sampling of the water environment.

While it is not felt that any problems exist, the applicant's dilution and dispersion analysis of accidentally released liquid wastes into the Tennessee River is inadequate.

The applicant has stated that "inadvertent release from the radioactive liquid waste system to the environment does not occur;" such statements are likely to undermine the credibility of the applicant's other analyses.

At the request of the AEC, the potential, safety related effects of site flooding were not reviewed.

References

Fox, P. P., 1943, Character of the Rome and Rutledge Formations at Watts Bar Dam: Jour. Tenn. Academy Science, v. 18, p. 157-171.

Stearns, R. G., and Marcher, M. V., 1962, Late Cretaceous and subsequent structural development of the northern Mississippi Embayment Area: Tenn. Dept. Conservation and Commerce, Div. Geology, Rept. Inv. No. 18; also pub. in Geol. Soc. Amer. Bull., v. 73, p. 1387-1394.