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W.P. Gammil	1 signed			SENT LOCAL PDR

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DESCRIPTION:

Ltr trans the following.....comments on the geological findings by the US Dept. of Interior.

ENCLOSURES:

Preliminary review of aspects of the geology of the Bellefonte Nuclear Plant as presented in the PSAR.

ACKNOWLEDGED

DO NOT REMOVE

PLANT NAME: Bellefonte

FOR ACTION/INFORMATION 11-20-73 JB

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Regulatory File

United States Department of the Interior

GEOLOGICAL SURVEY
~~WASHINGTON, D.C. 20242~~
Reston, Va. 22092

50-438
50-439

November 15, 1973

Mr. William P. Gammill, Chief
Site Analysis Branch
Directorate of Licensing
Office of Regulation
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Gammill:

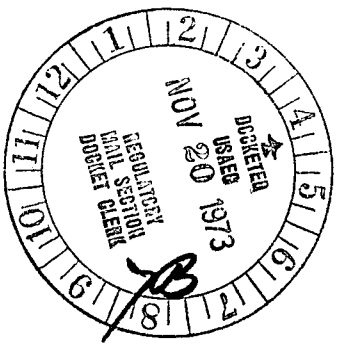
Enclosed for your information is a preliminary review of aspects of the geology of the Tennessee Valley Authority Bellefonte Nuclear Plant, as presented in the Preliminary Safety Analysis and amendment 1 (AEC Docket Nos. 438 and 439). The review was prepared by Mr. Francis A. McKeown.

Sincerely yours,

Elmer H. Baltz, Jr.

Elmer H. Baltz, Jr.
Deputy Chief for Engineering Geology
Office of Environmental Geology

Enclosure



8357

Prelim[redacted]y Review
FAMcKeown
10/13/73

Tennessee Valley Authority
Bellefonte Nuclear Plant Site
AEC Docket Nos. 438 and 439

Geology[1]

The geologic data presented in the Preliminary Safety Analysis Report (PSAR) and Amendment 1 for the Bellefonte Nuclear Plant Site have been reviewed for technical accuracy and applicability to evaluating earth science aspects of the safe operation of the nuclear plant.

In general the geologic data presented conforms in format and contents of PSAR's currently requested by the Regulatory Staff of the Atomic Energy Commission. Some parts of the report lack detail, clarity, and supporting documentation, however. The deficiencies in the report as determined from this preliminary review are outlined in the following paragraphs.

General comments

Although a list of references is given on pages 2.5-31, -32, and -33, they are not referred to in the text except for a few referred to on pages 2.5-23 and 2.5-24. The reader must guess which references the applicant wants to use to support many statements. The references should be used properly or at least an explanation

[1] Sections of the PSAR concerning Hydrology, and Rock Mechanics or Soils Engineering were not a part of this review.

of why they are included should be given.

The applicant's responses to questions asked in the AEC Acceptance Review appear to be incomplete in the data submitted to the USGS. Review of these responses is, therefore, deferred.

The applicant has presented some geologic and seismic data and arguments to support his use of an Intensity VIII earthquake for a Safe Shutdown Earthquake. In general, the data are that the site is in an area of low seismicity and that no surface evidence of active faults is known. However, the report needs to be strengthened with more cogent geologic information and arguments that describe the probable seismic risk of the Bellefonte site. A more detailed and documented account of apparent regional relationships of seismicity to structural provinces in eastern United States could add support to the proposal of a low intensity Safe Shutdown Earthquake.

Specific Comments and Questions

Page No.

2.5-3 Where is the area of greatest displacement on the Sequatchie thrust?

2.5-5 What is the evidence for a steep dip on the Sequatchie thrust fault? Milici (1963) claims that the dip is at a low angle.

It is assumed in the PSAR that movements on major geologic structures have not occurred since the end of the Paleozoic era. However, recent concepts from Plate Tectonic theory suggest that the North American continent started separating from the African continent in Triassic time (see Dietz, 1972, for example). Large horizontal stresses must have been involved in this separation of continents; these would be tensional in some zones, and compressional in other zones. Would you not expect therefore that faulting might have continued in the Appalachians area for a considerable time, at least into the Mesozoic era or later? A discussion of this possibility and its relevance to the site should be given.

Unconsolidated deposits on floodplains and terraces are said to be undeformed. What studies have been made to demonstrate this? Parts of the small-scale longitudinal profiles of terraces prepared by Milici (1968, fig. 5) might be claimed as suggestive of deformation. Additional documentation

of possible deformation in post-Paleozoic deposits, interpretation of such data, and relevance to the site are needed.

2.5-10 A statement is made on this page that the middle 500 feet of the Chickamauga formation was penetrated by drilling at the site. The cross section on figure 2.5-2 however indicates that the site is underlain by the lower 600± feet of the Chickamauga formation. If both identifications are correct, folding or faulting at or near the site is suggested. Clarification of these data is needed.

2.5-12 The interpretation of the physiography presented here differs from that of Hack (1966) and Milici (1968). The significance of concordant or offset terrace levels is critically dependent upon whether the physiography is interpreted in terms of erosion to base levels (the W. M. Davis school of thought) or in terms of the dynamic equilibrium theory described by Hack (1960, 1966). A more explicit and better supported discussion of the interpretation of the physiography is needed.

2.5-13 Lack of core disking and distortion of drill holes are not conclusive evidence that no unrelieved stresses are in the bedrock. The directions of the principal stresses and their magnitude relative to the orientation of the drill holes, and the anisotropy of the rock would be critical parameters in producing such visual effects as distortion of drill holes or disking of core. Measurements of in situ stress, rather than speculation on indirect evidence of stress, are needed if questions about stress are to be answered.

2.5-23 Statements that no evidence of active faults are known in the vicinity of the Bellefonte site are not quite correct. No physical surficial evidence of earthquakes may exist, but the fact that earthquakes occur in the "Southern Appalachian Tectonic Province" (p. 2.5-15) and that an MM V shock occurred within 5 miles of the site is direct evidence that some faults near the site may be active or become active. Such faults could be at depths of tens of kilometers and small movements on them presumably are not transmitted to the surface, but the evidence should be discussed.

Fig. 2.5-1B What is the source of inset showing rates of uplift and subsidence? According to this inset the Bellefonte site is in an area of uplift with a rate of 1-5 mm per year, which is the same as the tectonically active areas

of western U.S. If the uplift data are correct, the interpretation that can be made is that the site is in a tectonically active area. This interpretation conflicts of course with statements such as on page 2.5-4 namely: " . . . However, since the close of the Paleozoic era there is no indication of continued structural mobility in the area and the structures can be considered to be 'fossilized.'"

Fig. 2.5-2 What is the source of the geology in this figure?

Fig. 2.5-3 What is the source of the geology in this map? Although the contacts shown on this map are dashed, and presumably approximately located, they should indicate the attitude of the stratigraphic units. The attitudes on the southeast limb of the Sequatchie anticline inferred from this map dip to the northwest, vertically, and shallowly to the southeast. This is not consistent with the repeated descriptions of the anticline, which state that the southeast limb dips shallowly to the southeast.

Where is the axis of the Sequatchie anticline? Presumably it is northwest of the site as shown on figure 2.5-2; although on figure 2.5-1B it is east of the site. Presumably this figure (2.5-3) is to show detailed geology of the site area and if so, it is not adequate. In addition to inaccurate plotting of

contacts the map lacks attitudes of bedding, bedrock-surficial deposit contacts, directions of joints, small faults (if any) and fold symbols.

References cited

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Milici, R. C., 1963, Low-angle overthrust faulting, as illustrated by the Cumberland Plateau-Sequatchie Valley fault system: Am. Jour. Sci. 261, p. 815-825.

_____ 1968, The physiography of Sequatchie Valley and adjacent portions of the Cumberland Plateau, Tennessee: State of Tenn., Dept. of Conservation, Division of Geology, Rept. of Investigations No. 22, p. 179-193.