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

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SEP 28 1965

Filed

50-237

Mr. Harold L. Price
Director of Regulation
U. S. Atomic Energy Commission
4915 St. Elmo Avenue
Bethesda, Maryland

Dear Mr. Price:

Transmitted herewith are two copies of our review of the geology and hydrology of the Dresden site, Grundy County, Illinois.

The report was prepared in our Water Resources Division and was reviewed and approved in our Geologic Division. A draft of this report was sent to you with our letter of September 13; the changes requested on September 24 by Mr. Case and Mr. Hadlock have been made in this final version.

We have no objection to your making this report a part of the public record.

Sincerely yours,

William A. Baker

Acting Director

Enclosure

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Date 9-29-65
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Geology and Hydrology of the Site of the Dresden No. 2 Unit, a Proposed Nuclear Power Plant, Grundy County, Illinois (AEC Docket No. 50-237)

By

E. L. Meyer and Alfred Clebsch, Jr.

Introduction

This statement is based on a review of information supplied in the Plant Design and Analysis Report for the Dresden Nuclear Power Station, Unit 2, compiled by Commonwealth Edison Company, and supplemented by further checking of pertinent published geologic and hydrologic reports. The exploratory drilling, testing, and analysis of geologic data by Dames and Moore and the Illinois State Geological Survey appears accurate and thorough. Field inspection of the site was not considered necessary.

Geology

Earth materials of concern at the site include thin unconsolidated glacial deposits of Pleistocene age and sedimentary rocks of Pennsylvanian and Ordovician ages.

Discontinuous patches of sandstone of the Pottsville(?) Formation of Pennsylvanian age underlie the glacial deposits; in the area of the No. 2 unit the sandstone is 40 to 50 feet thick. Beneath the sandstone the Divine Limestone of Lamar and Willman, 1931 (18 to 35 feet in thickness) and Maquoketa Shale of Ordovician age extend to maximum depths of 110 to 130 feet below the surface. The contact between the Divine and the Maquoketa ranges from 430 to 475 feet above sea level. Thus the plant foundation at about 470 feet above sea level will rest on Divine Limestone and the underlying Maquoketa Shale. Although some of the test specimens of shale have low values of ultimate compressive strength (Pl. III - 2 - 15) the rock in general seems to be adequate as a foundation for heavy structures. If major zones of weak rock are encountered in the shale during excavation, these rocks may have to be replaced with materials having higher ultimate compressive strength. Such conditions would not affect the suitability of the site.

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Faults have been found in the Maquoketa Shale in cores from three holes. In other borings departures from the assumed regional southeasterly dip of the Maquoketa Shale suggest the presence of other faults that cut the Maquoketa Shale and probably extend into the overlying Divine Limestone. The Pottsville sandstone at the site is not faulted.

In the absence of faults in the Pottsville sandstone that can be related to faults in the Maquoketa Shale at the site it is inferred that the latter faults occurred subsequent to the deposition of the Divine Limestone, but prior to the deposition of the Pottsville sandstone, and therefore that faults through the site have been inactive since before Pennsylvanian time.

The Sandwich fault or fault zone strikes approximately S 60° E and passes about six miles northeast of the Dresden site; no information is available on its dip. The principal movement took place after Silurian time, and several authors have inferred that most of the movement took place after Mississippian time and before Pennsylvanian time (on the order of 300 million years ago). Because the youngest consolidated rocks in the area are of Pennsylvanian age, the history of the fault movement since the Pennsylvanian cannot be determined. Minor faults and folds in the Pennsylvanian rocks in the general area as well as gentle warping (Culver, 1923, p. 166 and 167) suggest some post-Pennsylvanian tectonic activity, the time of which cannot be ascertained. The faulting has also been explained as a result of differential compaction of underlying sedimentary rocks. There appear to be no reports of the displacement of deposits of Pleistocene age, and no ground displacement was reported after the earthquakes of 1909 and 1912, which were the most severe earthquakes experienced at the site in historical times. Therefore the probability of faulting through the site in the next 50 years is considered to be extremely remote. The relatively flat topography and firm foundation rocks preclude the occurrence of landslides.

Hydrology

The site is about 2,000 feet shoreward from the Dresden Island Dam pool in the Illinois River, immediately below the confluence of the Des Plaines and Kankakee Rivers.

Normal pool elevation at the site is 505 feet; the highest recorded stage for the river at the site since at least 1883 occurred in July, 1957, when the pool elevation reached 506.6 feet. A discharge of 93,700 cfs (cubic feet per second) was recorded for this flood at the Illinois River

at Marseilles gage, 26 miles downstream. On the basis of flood frequency graphs for this gage shown by Mitchell (1954) a flood of that magnitude or greater has about a 25-year recurrence interval, or in other words, a 4 per cent chance of occurring in any one year.

Flow of the Illinois River consists of the natural runoff plus the diversions from Lake Michigan into the Chicago Sanitary and Ship Canal. During low flow the latter contributes a major part of the flow. The diversions from Lake Michigan into the canal are limited by order of the U. S. Supreme Court to an annual mean of 1,500 cfs (cubic feet per second) plus the total pumpage of the Chicago water supply system. The effect of the management of the diversion during the past several years has been to maintain a daily flow between 3,000 and 4,000 cfs in the canal whenever possible. This has the effect of stabilizing minimum flow in the Illinois River, shown in the report by the partial flow-duration series for the Illinois River at Marseilles, where flow is comparable to that at the site (Pls. III - 5 - 7 and III - 5 - 8). Natural low flow at the site can be characterized by the low flow pattern of the Kankakee River which contributes about 4/5 of the natural drainage area of the Illinois River at the site.

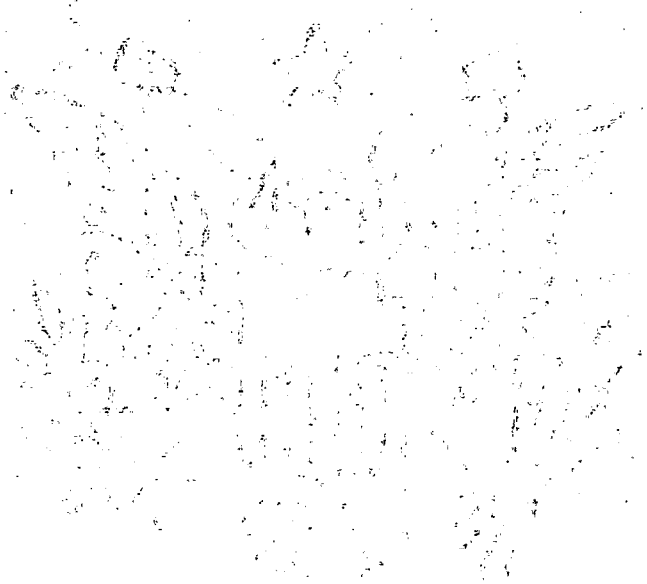
Records from the Kankakee River gage near Wilmington, about six miles upstream from the site, furnish an approximate picture of the natural low flow pattern at the site; in 27 years of record (1933-1960) minimum flow was 204 cfs, minimum daily flow, 319 cfs, and the lowest mean discharge for 30 consecutive days 376 cfs. Corresponding natural flows at the site could be estimated to be about 1/4 larger.

Public water supplies in towns in the vicinity of the site generally use ground water; surface water for public supplies in the general area is obtained from Lake Michigan and from the Kankakee River above the site, the Illinois River below the site, and the Vermillion River southwest of the site.

The nearest public water supply using the Illinois River is at Peoria, about 105 river miles downstream from the site. Peoria draws the major part of its supply from the Illinois River but also has a well field. The other nearby public supplies using surface water are at Kankakee (Kankakee River) about 28 miles southeast, Pontiac (Vermillion River) 35 miles southwest, Streator (Vermillion River) 40 miles west southwest, and Chicago (Lake Michigan) about 45 miles north northeast of the site.

Within a 15 mile radius of the site there are 11 public water supply systems, all using ground water. These supplies tap the St. Peter and Galesville Sandstones, at depths greater than 500 feet below the surface. A few of their wells also obtain a small fraction of their supply from the Galena Dolomite, of Ordovician age.

The water resources currently in use in the area are quite well protected from accidental releases of radionuclides at the site. Contaminants released to the Illinois River are likely to take several days to reach Peoria at high flows and more than ten days at medium and low flows. The other surface water supplies are far enough from the site so that atmospheric dispersion would render insignificant the quantities of radionuclides estimated to escape in the major accidents as described in chapter XI, section 5. The public ground water supplies in the area are effectively separated from liquids deposited near the surface of the ground.



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