MAY 18 1973

R. C. DeYoung, Assistant Director for PWR's, L

GEOLOGY, SEISMOLOGY, AND FOUNDATIONS ENGINEERING SECTION FOR SAFETY EVALUATION

PLANT NAME: Indian Point Nuclear Generating Station Unit 3
LICENSING STAGE: OL
DOCKET NUMBER: 50-286
RESPONSIBLE BRANCH: PWR #1
REQUESTED COMPLETION DATE: 5/11/73
APPLICANTS RESPONSE DATE NECESSARY FOR
NEXT ACTION PLANNED ON PROJECT: None
DESCRIPTION OF RESPONSE: N/A
REVIEW STATUS: Geology - Complete

Enclosed is the section covering the geological, seismological, and foundation engineering aspects of the subject site. The section was prepared by R. B. McMullen, Site Analysis Branch, L.

Original signed by
H. R. Denton

Harold R. Denton, Assistant Director
for Site Safety
Directorate of Licensing

Enclosure:
As stated

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INDIAN POINT NUCLEAR GENERATING STATION UNIT NO. 3
GEOLOGY, SEISMOLOGY, AND FOUNDATION ENGINEERING
FINAL REPORT

SUMMARY

The staff has completed its review of the amended Final Safety Analysis Report for the Indian Point Nuclear Generating Unit No. 3. At the conclusion of the construction permit application review, based on reports included in the Safety Evaluation Report by our advisors the U.S. Geological Survey (USGS) and the U.S. Coast and Geodetic Survey now called National Oceanic and Atmospheric Administration (NOAA), we concluded that the applicant's appraisal of the geological and seismological aspects of the site were adequate. The staff concludes that site foundation conditions are favorable for the construction and operation of the Unit 3 facility. The following is a brief discussion of the geological, seismological, and foundation engineering aspects of the site.

GEOLOGY

The Indian Point Unit 3 site is adjacent to Untis 1 & 2 on

the east bank of the Hudson River, approximately 35 miles north of New York City. In the general area of the site the Hudson River is bounded by rocky, relatively steep banks that extend +80 and +90 feet above mean sea level. The site is on a break in this terrain that forms a small, relatively flat basin which slopes toward the river. The basin is rimmed by low hills and/or ridges.

Regionally, the site is located within the New England Uplands Province of New York. The physiography is rugged and is underlain mainly by complexly folded metamorphic rocks associated with granite and dioritic intrusives. Predominant dip of the stratigraphic horizons in the area around the site is to the southeast.

Immediately to the south is the Piedmont Province, which is mostly underlain by complexly folded and faulted Pre-Cambrian and Paleozoic crystalline rocks. The area immediately south of the New England Uplands Province, but still within the Piedmont includes the Newark Basin which was formed during the Triassic by down faulting of a large block of the crystalline basement rock. The basin formed in this manner was subsequently filled with sandstones, shales and conglomerates which were intruded

by basic igneous rocks. This stratigraphic section is called the Newark series in New Jersey and forms the Palisades on the west bank of the Hudson River. The series extends to the north to a point near Stony Point across the river from the site.

Beyond the Piedmont to the south and southeast lies the Coastal Plain Province. The Coastal Plain is formed by seaward sloping Cretaceous and later sediments that overlie the crystalline bedrock which is near the surface within the Piedmont. The sediments pinch out at the Fall Line, the surface boundary between the two provinces, and thicken to several thousand feet beneath the Atlantic Ocean.

West of the New England Upland Province is the Ridge and Valley Province. This province is made up of relatively flat lying, essentially unmetamorphosed Paleozoic sedimentary rock.

The site proper is underlain by dolomite, which is probably somewhat metamorphosed. The geological consultant for Con Ed has interpreted the bedrock at the site as being the equivalent of the Wappinger Limestone to the north and the metamorphosed Inwood Limestone to the south. A

similar dolomite is exposed in a quarry at Tomkins Cove across the river and in a quarry south and southeast of Peekskill. The applicant's geological consultant has concluded that the two exposures can be correlated with the dolomite at the site.

Stratigraphically higher and believed to be conformable with the dolomite, is a phyllite or schist which has been correlated, by the applicant's consultant, with the Hudson River shales to the north and the Manhattan schist of Manhattan Island to the south. The phyllite does not underlie the site but bounds the limestone terrain to the north and east. East of the site the schist has been intruded by basic igneous rock known as the Cortlandt Series.

According to the applicant's consultant, the site is situated, from a structural standpoint, on the eastern limb of an overturned anticline. The anticline strikes N 35°E, is overturned to the northwest, and appears to plunge northeastward beneath the Hudson River. This conclusion is based on detailed field reconnaissances of the Tomkins Cove Quarry across the river from the site, the quarry east of the river and north of Verplanck, and a study of several core borings drilled on-site. The

dolomite bedrock underlying the reactor site is intensly fractured. Bedding planes strike N 35°E and dip about 70° to the southeast. The site was visited by a representative from the USGS who examined excavations on the site and orally reported that the bedrock, although badly fractured, was not cavernous. We conclude that no cavernous conditions exist at the site.

VIBRATORY GROUND MOTIONS

In its input to the Safety Evaluation Report following review of the construction permit application for the Indian Point Unit 3, the US Geological Survey stated that "There are now known active faults or other young geologic structures in the area that could be expected to localize earthquakes in the immediate vicinity of the site. Although several ancient faults occur in the area, none appears to have been tectonically active since glacial times, or for at least the past several hundred thousand years."

Likewise, in its evaluation of the seismological aspects of the Unit 3 site, the U.S. Coast and Geodetic Survey (now NOAA) stated that "based on the review of the seismic

history of the site and the related geologic considerations, the Coast and Geodetic Survey believes that the applicant's proposal to use 0.10g for representing earthquake disturbances likely to occur within the lifetime of the facility to be adequate. The survey agrees with the applicant that 0.15g would provide adequate basis for designing protection against loss of function of components important to safety."

FOUNDATION ENGINEERING

The dolomite bedrock at the site is overlain by several feet of glacial deposits, fill, and/or alluvium. It is our understanding that all Category 1 structures are supported directly on bedrock, except the Waste Holdup Tank Pit and the east end of the PAB which are supported on caissons drilled into bedrock. The dolomite is extremely fractured, which accounts for the poor recovery and high permeability noted during core drilling operations. The applicant's geological consultant concluded that there were no cavernous conditions within the bedrock at the site. He based this conclusion on detailed studies of two nearby quarries. The applicant reported that when excavations were made for Units 1, 2, and 3 cavernous conditions were not encountered. A representative from the US Geological Survey visited the site and orally

reported that there were no cavernous conditions. Further, the applicant stated that "The Unit No. 1 structures are now at least 12 years old and there has never been any evidence of settlement cracking or other settlement related problems. The same can be said for recently completed Unit No. 2 structures."

The reported good foundation performance experienced by Units 1 and 2 confirm that assumptions pertaining to the physical properties of foundations were adequate, and that the bedrock is capable of supporting the Unit 3 structures.