DR-788

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

Appendix C

AUG 15 1966

50-247

Mr. Harold L. Price
Director of Regulation
U. S. Atomic Energy Commission
4915 St. Elmo Avenue
Bethesda, Maryland 20545

Dear Mr. Price:

Transmitted herewith are statements on the geology and hydrology of the Indian Point site as requested in Mr. Case's letter of December 10, 1965.

The statements were prepared by Henry W. Coulter of the Geologic Division and Eric L. Meyer of the Water Resources Division, and have been discussed with members of your staff.

We have no objection to your making these statements a part of the public record.

Sincerely yours,

Arthur A. Baker

Acting Director

Enclosures

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Indian Point Nuclear Generating Unit No. 2
Buchanan, New York

Geology

Based on a careful review of the applicant's report (A.E.C. Docket No. 50-247, Vol. I, Exhibit B) and of the available literature, it appears that their geological analysis is carefully derived and presents an adequate appraisal of those aspects of the geology which would be pertinent to an engineering evaluation of the site.

Although it may be anticipated that earthquakes within the general region will continue to occur with approximately the same frequency and with approximately the same intensity with which they have been recorded during the past 100 years, there are no identifiable faults or other geologic structures which could be expected to localize earthquakes in the immediate vicinity of the site.

Appendix C

Review of Hydrology Section of Preliminary Safety Analysis Report, Indian Point Nuclear Generating Unit No. 2, Consolidated Edison Company of New York, Inc.

The site is on the estuary of the Hudson River about 36 miles up-stream from the Narrows. In this reach the river's flow and stage are determined both by runoff from its drainage basin and by tides.

Discharge of the river has been measured by the U.S. Geological Survey at Green Island, near Troy, since 1946. The drainage area above the gage is 8,090 square miles; intervening drainage area between the gage and the site is estimated to be about 4,500 square miles. The mean flow at Green Island during 1946-66 has been 13,060 cfs (cubic feet per second), and the corresponding flow past the site is estimated to have been about 20,000 cfs. Minimum daily flow at Green Island was 1,010 cfs on September 7, 1964; during the period of record the flow has been greater than 4,000 cfs 90 percent of the time, and greater than 8,000 cfs 53 percent of the time. The relationship of low flows at the Green Island gage to low flows at the site is not as readily estimable as that of mean flow; however, it is likely that equivalent low flows at the site are also about 1½ times as high as at the gage. The maximum flow observed at the gage during the period of record was 215,000 cfs, occurring on March 19, 1936, but the stage at the site is not known. Another major flood occurred on March 28, 1913, but the discharge is unknown at either the gage or the site.

Flow in the river at Peekskill is principally in the downstream direction only during periods of high freshwater runoff. At medium and low runoff there is upstream flow during flood tides, and salt water begins to travel upstream when flow at Green Island is near 8,000 cfs, or slightly below median flow. Typically, freshwater runoff in the Hudson River drainage is above median during winter and spring, and below median during summer and fall. Median monthly average flows at the Green Island gage for the period 1946-60 are less than 8,000 cfs for the months of July through October.

When freshwater flow is below the median point, tidal currents reverse flow during the flood tide and water would then recycle past the site. The recycling water masses would mix with fresher water coming from upstream and with saltier water from downstream. Under these conditions contaminants released at the site would disperse both in the upstream and downstream direction.

The Hudson River downstream from the site is not used for drinking water supplies; however, at Chelsea, 22 miles upstream from the site, the city of New York has installed facilities for pumping water from the Hudson to augment other sources in emergencies or during extended periods of drought. Contaminants released to the river at the site would not reach Chelsea, except when freshwater flow drops below the median point. During these periods, contaminants would be dispersed in a large volume of water extending both above and below the release point prior to reaching the intake. The highest concentrations would remain near the release point, the lowest at the upstream and downstream edges of the spread of the contaminant. It would take a number of tidal cycles, probably more than five, before the contaminant could extend to the Chelsea intakes. A quantitative estimate of the number of tidal cycles required or the amount of the number of tidal cycles required or the amount of dispersion cannot be readily made without data on stream velocities and dispersion characteristics in this reach. However, a study of dispersion in New York Harbor supported by the Atomic Energy Commission may have generated sufficient data to permit an adequate estimate.

The study was carried out by the Chesapeake Bay Institute (Pritchard and others, 1962) to determine the dispersion of an assumed instantaneous contaminant release to the river at the Battery in lower Manhattan. Current velocity and salinity data were obtained by the Coast Guard at 55 stations extending from the Lower Bay to Highland Falls, New York, about 8 miles above Indian Point. Dye dispersion experiments were carried out in the hydraulic model of New York Harbor located at the U.S. Army Engineers Waterways Experiment Station in Vicksburg, Mississippi. This model can reproduce the prototype tidal fluctuations, current velocities and salinities as far upstream as Hyde Park, New York, about 40 miles above Indian Point. One of a series of dye dispersion experiments indicates that with a flow of 6,000 cfs, traces of a contaminant would move about 22 miles upstream from the release point between the 5th and 10th tidal cycle and would have a concentration at the point of about 5×10^{-13} per cubic meter per unit of released contaminant. The farthest upstream extent of the contaminant was found about 25 miles above the release point and reports of the study do not concern the river above that point. A mathematical analysis using the current velocity and salinity data in a computer program yielded comparable results.

The figures above are of course not directly applicable to releases at the site, but information from this study, along with general information on the river, indicates that dispersion would be substantial.

The stage of the Hudson River near the site is affected by tides. The range of the tide has been measured at a tide gage near Verplank, New York, about 3/4 of a mile downstream from the site sporadically from 1919 to 1930 (Schureman, 1934). Monthly average tidal ranges were found to be on the order of 2.5 to 3 feet. Referred to Sandy Hook sea level datum, the mean low water level was about 0.5 feet below sea level, and mean high water was from 2 to 2.5 feet above sea level.

High stages at the site are due primarily to high tides caused by storm surges from the ocean. Freshwater floods alone are not likely to lead to the highest stages at the site, because the river has a high cross-sectional area in comparison to the maximum floods observed. Tidal storm surges caused by either hurricanes or extratropical storms have been observed to travel up the Hudson. The highest storm surge in the Hudson in recent years occurred in November, 1950, when a stage of 7.4 feet above mean sea level was observed at Peekskill by the Corps of Engineers. Storm surges considerably higher than those of November, 1950, are a possibility. Wilson (1960, p. 64) in a theoretical study of hurricane storm-tide in New York Bay has computed maximum storm surges of 8.7 feet above predicted astronomical tides, on basis of transposing the track of the major 1938 hurricane to the New York Bay area. Storm surges can travel up the Hudson as far as the site without diminishing in height. If such a storm surge were combined with high astronomical tide, stages near the site might reach 10 to 11 feet.

Appendix C

REFERENCES

Pritchard, D. W., Okubo, Akira and Mehr, Emanuel, 1962, A study of the movement and diffusion of an introduced contaminant in New York Harbor Waters: Chesapeake Bay Institute Tech. Rep. 31, Reference 62-21.

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