

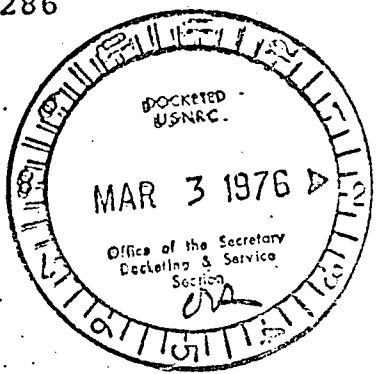
UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of)
)
CONSOLIDATED EDISON COMPANY)
OF NEW YORK, INC., AND POWER)
AUTHORITY OF THE STATE OF)
NEW YORK)
(Indian Point Station, Units)
1, 2 and 3)

Docket Nos. 50-3
50-247
50-286

CITIZENS' COMMITTEE FOR PROTECTION OF THE
ENVIRONMENT'S (CCPE) RESPONSE TO CON EDISON'S
WRITTEN INTERROGATORIES, DATED JANUARY 30, 1976



Answer to Interrogatories 1 and 2.

Dr. Sykes will testify that the seismic reflection results in the Hudson River contained in the Dames and Moore report are highly suggestive that there has been movement along the Ramapo fault system during the past 10,000 years. References in the literature which provide grounds for this opinion are contained in the Attachment A to these answers.

Answer to Interrogatory 3.

Dr. Sykes will testify that the Rockland County, N.Y., earthquake of September 3, 1951 is a macro-earthquake instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault. Twenty-seven(27) seismographs of that event have been collected from the following stations: Palisades, Fordham, and City College, N.Y.; Weston, Mass.; Ottawa, Seven Falls and Shawiningan, Canada. The Palisades records are

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characterized by an impulsive first motion of the P wave from the north 40°W and with a clear S-P time. The records from Fordham and City College have an impulsive and clear P, S and Rayleigh wave train. The large 1-2 second Rayleigh waves at City College and Fordham are indicative of a focal depth of at most a few kilometers, and probably less than 1 kilometer. Hence, in the revised computation a depth of 0 was used.

A revised location was obtained at $41^{\circ}10.1'\text{N}$, $74^{\circ}05.2'\text{W}$ at an origin time of 21h26m27.2s GMT. The following information was used in obtaining this revised hypocenter: P and S times at Palisades and City College and an S-P time at Fordham as well as the amplitudes of the P wave on all three components at Palisades. The location was obtained graphically on a map and was also checked using the computer program described by Lee and Lahr. The velocities of Anderson and Dorman (1973) for the Palisades diabase, the Triassic sedimentary rocks and the basement were used in converting travel time differences to distances from the various stations. An average P wave velocity of 4.5 km/sec was used for the path to Palisades and 5.0 km/sec for City College and Fordham. The velocity of 5.0 is consistent with the basement velocities of Anderson and Dorman while velocities of 4.0 to 5.0 km/sec are believed bracket the actual average velocities to Palisades from their study. An average velocity of 3.1 which was obtained by Anderson and Dorman for the sedimentary rocks appears to be too low for the average velocity since the path undoubtedly traverses at least in part higher velocity rocks and traverses the sedimentary rocks at depths such that the velocity will be increased considerably above the 3.1 value which was obtained by Worzel and

Drake in a shallow seismic reflection profile in the Hudson River. The P wave amplitudes at Palisades are believed to constrain the azimuth of the event from that station to $N40^{\circ}W$ plus or minus 5° . Also, the records of the P wave from City College indicate that the source was nearly directly north of that station. The above revised location is within one kilometer of the Ramapo fault as described in Ratcliffe (1971) and the most recent geologic map of New York State. This section of the Ramapo fault system is mapped in the above two documents as a single fault; hence, the problem of multi-branched faulting is not important in this case.

When only the P and S times were used in computing a location, a hypocenter location about 5 km southwest of that mentioned above was obtained which is still within about 1 km of the Ramapo fault. The more southwesterly epicenter, however, is not preferred, since it does not have the constraints posed from the observations of the P wave amplitudes at Palisades and City College. Nevertheless, it appears to be extremely difficult to move the computed hypocenter more than about 1 or 2 km from the surface trace of the Ramapo fault. Also, any reasonable variations in depth of focus which would be consistent with the large surface waves would still place the focus of the earthquake within a few km of the fault.

The 1951 earthquake is regarded as a macroearthquake. Richter, Elementary Seismology, W.H. Freeman and Co., San Francisco, 1958 page 16, defines "macroseismic effects of earthquakes are those that can be observed on a large scale, in the field, without instrumental aid. Microseismic effects are small-scale,

observable only with instruments." While it can be argued that macroseismic is any event felt over a large region of Intensity II or III Modified Mercalli, our main arguments are directed to the 1951 earthquake in Rockland County, New York of maximum Intensity V and to similar and larger earthquakes on or near the Ramapo fault from the historic record. Intensity V is described in Earthquake History of the United States by J.L. Coffman and Carl A. vonHake, U.S. Department of Commerce, 1973 as "felt by nearly everyone; many awakened. Some dishes, windows, and etc., broken; a few instances of cracked plaster; and stable objects overturned. Disturbance of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop." The same publication has a map of earthquakes of Intensity V and above which is here taken to be indicative of damaging or potentially damaging earthquakes. The same publication lists the earthquake of Sept. 3, 1951 as felt from Windsor, Conn. southwest to Pompton Lakes and Dover, New Jersey and from the north shore of Long Island Sound to Walden and Middletown, New York. The intensity and large distance over which this event was felt certainly qualifies it as a macro-event. Smith (1966) assigns the 1951 earthquake a magnitude of 4.4.

Answer to Interrogatory 4.

Davis, J.F., P.W. Pomeroy, R.H. Fakundiny, J.E. Oliver, and N. Ratcliffe, April 19, 1974, Statement: Geological Survey - New York State Museum and Science Service regarding Licensing of Indian Point Reactor #3 and discussion of the Final Safety Analysis Report sections 2.7 (Geology) and 2.3 (Seismology).

Answer to Interrogatory 5.

See Answer to Interrogatory 3, above.

Answer to Interrogatories 6 and 7.

No.

Answer to Interrogatories 8 and 9.

Ratcliffe (1971) and the geologic map of New York State (1970) are taken as the sources of the location of the Ramapo fault and the Ramapo fault system. In addition, Dr. Sykes has reviewed the latest mapping of the Ramapo by Dr. Ratcliffe in connection with his work for Consolidated Edison.

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