CRITERIA FOR SELECTION

OF

CRITICAL WAVE DIRECTION

by

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for

Pacific Gas and Electric Co.

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Mr. R. V. Bettinger, Chief Civil Engineer
Pacific Gas and Electric Company
77 Beale Street, Room 2653
San Francisco, California 94106

Dear Mr. Bettinger:

The effect on deep water waves by the refraction that develops while those waves move toward Diablo Canyon Site was evaluated in part with use of the numerical model described beginning at page 8 in the report dated March 15, 1982 by Lillevang, Raichlen and Cox and titled "The Height Limiting Effect of Sea Floor Terrain Features and of Hypothetically Extensively Reduced Breakwaters on Wave Action at Diablo Canyon Sea Water Intake".

A quick overview of wave refraction phenomena in the vicinity of the intake basin was first acquired by calculating and plotting 46-ray fan diagrams of refraction for each of 5 wave periods, from 22 seconds to 8.5 seconds. The rays were 2.5 degrees apart at their initial point and radiated to directions in deep water between 180° and 292.5°. Deep water waves in the southeast quadrant were not studied, because Point Arguello and San Miguel Island shelter the Diablo Canyon reach of the coast from such waves.

Sets of wave orthogonals were calculated next for all five of the wave periods to determine wave height variations at the site. The several directions in deep water from which those sets of orthogonals were produced toward the coast varied, but the average increment in deep water azimuth between them is about 11.25 degrees. Their directions were varied above and below that average selectively, with guidance that had become available from the fan diagrams. In the octant between deep water azimuths of 180° and 225° the average difference between adjoining diagrams was less than 11.25°, in fact less than 8°. At the site, after the effect of refraction, the average difference in direction between adjoining diagrams was less than 3°. Changes in wave characteristics between directions of approach were shown by these studies to be gradual and fairly systematic, particularly in the Southwest quadrant. Interpolations of conditions between directions for which there were data from the physical model thus could be relied upon.

The physical model experiments with the breakwaters levelled to mean lower low water demonstrated that high waves from every direction are reduced to heights of 20 to 22 feet at the intake, even with abnormally high tide stages, by the combined effect of refraction shoreward of the 100 feet depth contour, of shoaling, of reflection and of diffraction. That is to say, there is really no single direction at Diablo from which the extreme wave would arrive at the site. Such slight variation as might be detected in the model data suggest the limited wave height from South may be two feet higher than from Southwest, and that between those directions interpolated values are valid as borne out by the refraction analyses.

The ventilation risers for the Auxiliary Salt Water Pumps are so sheltered by the 110 feet high rock mass that rises immediately alongside the Sea Water Intake Structure that an attack by water moving normal to the riser walls on that side is not possible. Water moving obliguely to either exposed wall of a riser imposes lesser loading on the riser and splashes to lower heights than when the attack is normal to one wall or the other. That is logical to assume and experiments in the physical model confirmed it. Thus the conclusion was obvious, that waves for demonstrating maximum possible loading on the risers, and maximum possible splash-up there, would be limit height waves moving from South toward the site. The refracted direction of such waves at the entrance to the intake basin, 201° to 205°, is directly through that entrance and toward the risers and essentially normal to the seaward walls of the intake facilities.

Very truly yours,

Omar J. Lillevang

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