

50-205

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October 11, 1963.

Mr. Gerald F. Hadlock,  
Counsel for AEC Regulatory Staff,  
U. S. Atomic Energy Commission,  
Washington 25, D. C.

Re: Pacific Gas and Electric Co.,  
Bodega Bay Atomic Park,  
Unit No. 1,  
Docket No. 50-205

Dear Mr. Hadlock:

On September 12 you mailed me a copy of Dr. Pierre Saint-Amand's report entitled "Geologic and Seismologic Study of Bodega Head" with the request that I comment on it, if possible at the September 17 meeting in Bethesda. As the report did not reach me in Seattle until after I returned from the meeting I made only a few verbal comments to you after looking over a copy of the report in Bethesda.

I am enclosing some written comments on the report in order to keep your records complete. I am also reporting today to Dr. Bryan on Jerry P. Eaton's report a copy of which Dr. Bryan sent me earlier in the week.

Very truly yours,



Frank Neumann.

Comments on "Geologic and Seismologic Study of Bodega Head" by St. Amand, 1963.

By Frank Neumann

(Only the seismological aspects are discussed in the following paragraphs.)

At bottom of p. 5, St. Amand states, "A combination of the fracturing, mylonitization, deep weathering, and an abundance of ground water render the bedrock far less stable than similar rock would be had it not been comminuted by the eons of shearing which it has undergone." If this condition extends down to depth of the order of 50 feet, then the granodiorite in Bodega Head may not possess all the seismic stability we generally credit to granitic rock--a rock which for the present purpose must be defined as one yielding minimum earthquake intensities. The writer has previously stated in AEC memoranda that the true seismic foundation factor at the Head can be obtained only after a number of strong motion seismograph records are obtained on this rock. For epicenters within only a few miles of the Head the local geology is not a serious factor, but if the rock were less stable than granite, a maximum intensity might be experienced from earthquakes that centered possibly 10, 20, or 30 miles away. The rapid intensity attenuation found in granitic basement rock would not apply to the allegedly less stable rocks of Bodega Head.

Page 16, Richter's table showing magnitude-intensity relationship. St. Amand says the table values are in good agreement with those observed in actual earthquakes. Just how good this agreement is can be seen in Fig. 4 of the writer's paper on Bodega Head now under review by the L & R Division of A.E.C. The table entirely ignores the lower intensities experienced on granitic rocks for the deeper type California earthquakes, and the reader is left to conjecture what it might be. Fig. 4 shows it directly. The writer deplores the practice of those who attempt to evaluate the work of others without offering any worthwhile evidence to support such evaluations.

In the middle paragraph of p. 16 St. Amand explains the attenuation of the El Centro earthquake as being due to the thick alluvium beneath El Centro. Fig. 3 of my report, which is now being reviewed, shows El Centro as having the minimum intensity of a town on the thick sedimentary basement of southern California, so there is no need to postulate a thick alluvial overburden to explain its intensity or the character of the record obtained. We are not sure to what extent the sedimentary basement itself "alters the power spectrum." St. Amand assumes this alluvial cover somewhat masked the effect of the "fling" at El Centro. In my recent comments on statements by Prof. Housner in Chicago I stated that the acceleration due to this so-called "fling" is quite clearly defined on the El Centro acceleration record. St. Amand evidently hoped to see his "fling" concept better illustrated on seismograph records than it actually is. As to the shaking being much harder in the direction in which faulting progresses, this is entirely a theoretical consideration that still has to be proved from observational data. The shaking is certainly not so much harder that it can be immediately spotted on an intensity distribution map of a shaken area. None of these are seriously important considerations but point up the weakness that many seismologists have in treating their theoretical concepts as facts.

In paragraph 4 I thoroughly agree with St. Amand in his statement that the historical record shows very clearly that higher intensities go with larger earthquakes; and that the use of the El Centro record will not guarantee adequate design factor for the proposed Bodega Head power plant.

Using the equation at the bottom of p. 16 St. Amand arrives at a value of 1 g for  $m-10^{1/2}$ . If reference is made to Fig. 5 of the writer's Bodega Head report now in preparation, it will be seen that the same result will be



obtained by extending line "C" (for average earthquake accelerations) to 1 g. acceleration. It is felt that Fig. 5 gives a far better picture of the intensity-acceleration relationship and its deviations than the Gutenberg-Richter formula quoted by St. Amand.

Last line on p. 16. - St. Amand evidently believes that 1 g. accelerations have been observed; so does the writer. Dr. Housner does not.

Seattle, Washington,

October 11, 1963