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Dr. Perry Y. Amimoto
Senior Geologist
Department of Conservation
Division of Mines and Geology
1416 19th Street, Room 1341
Sacramento, California 95814

Dear Perry:

Thank you for your participation in the Humboldt meeting on May 5th. It was obvious to me that you and the CDMG staff put a lot of effort and time into your review of the Humboldt Bay geology reports. The discussion that you afforded us during the May 5th meeting has greatly benefitted our review of this site.

We are using your comments, the USGS comments, and our own review of the material to form an agenda for a formal meeting with PG&E. The meeting is tentatively scheduled for June 29th in Bethesda, Md. We will keep you informed as the details of the meeting develop. Please let me know if there are any difficulties in your being able to participate.

Sincerely,

J. Carl Stepp, Chief
Geosciences Branch
Division of Site Safety
and Environmental Analysis

cc: Tom Gay
J. Devine
W. Gammill
T. Cardone
J. Kelleher
R. Hofmann
L. Heller
J. Greeves

FOIA-87-462
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SURNAME	TCardone:lm	JStepp				
DATE	5/ /77	5/27/77				

STATE OF CALIFORNIA—THE RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

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SACRAMENTO DISTRICT OFFICE

July 29, 1977

J. Carl Stepp, Chief
Geosciences Branch
Division of Site Safety and
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Carl:

Subject: Humboldt Bay Nuclear Power Plant Project

The Division of Mines and Geology has the following concerns on the geologic/seismic questions on the Humboldt Bay Nuclear Power Plant Project:

1. Conclusive evidence has not been presented to disprove the possible connection between the Bay Entrance and Little Salmon faults.

2. The information showing that the Little Salmon fault is not a capable fault was inadequate and inconclusive.

3. The offsets in the ravine and quarry at Fields Landing should be considered evidence of post Hookton faulting unless conclusively disproven.

4. The discussion of other faults, such as the Mad River fault zone, was not adequate. The consideration of such faults, the tectonic framework, and the offsets in the ravine and quarry should be, in addition to the Bay Entrance and Little Salmon faults, an integral part of the determination of the potential maximum earthquake magnitude and its effect on the site.

The basis for the above are documented in the attached report by Wagner and Jennings.

~~8103040246 8PP~~

Sincerely,

APPROVED:

FOIA-87-462
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Perry Y. Amimoto

Thomas E. Gay, Jr.
State Geologist, RG 2634

Perry Y. Amimoto
District Geologist
CEG 460, RCE 20375

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PRELIMINARY REPORT - CDMG

D. L. Wagner
C. W. Jennings

July 28, 1977

HUMBOLDT BAY NUCLEAR POWER PLANT
Geologic Considerations Relative to Seismic Safety

Introduction

The concerns of the staff of the California Division of Mines and Geology remain essentially the same as those which we presented at the meeting of May 4, 1977 at Menlo Park, California. The applicant's presentation of July 6-7, 1977 did not significantly change our basic position regarding the review of the site of the Humboldt Bay Nuclear Power Plant.

Bay Entrance Fault

The location of the Bay Entrance Fault in the immediate vicinity of Buhne Point is well defined, with its closest approach to the plant being about 2,000 feet. The consultant's report shows (Pls. IV, VII, VIII, IX), the fault as a very complex structure consisting of segments of differing attitudes. At present, the extent of this fault is not known for certain.

The consultant still has not shown that the Bay Entrance fault is a separate fault and not part of a system dominated by the Little Salmon fault. If the Bay Entrance cannot be shown to be a separate fault which truncates the Little Salmon thrust, it must be considered to be related to the Little Salmon. If that is the case, then the plant site is on the leading edge of a thrust block, which greatly increases the potential for surface rupture at the site. Before we can accept their interpretation of the relationship between the Little Salmon and Bay Entrance faults, the consultant must conclusively demonstrate the existence of the offset portion of the Little Salmon fault immediately west of the Bay Entrance fault. An attempt should have been made to locate the offset part of the Little Salmon fault as suggested during the field portion of the review (see memo of Aug. 27, 1976 by Cardone).

The pattern of the Bay Entrance fault, as it is presently interpreted, presents some problems. First, the consultant indicates that the dip of the Bay Entrance fault is greater than or equal to 70°. It does not seem geometrically possible for such a steep fault to have such a scalloped pattern as shown on their maps.

Finally, we question the consultant's conclusion that the Bay Entrance fault can be traced to Loleta. To help support this, the consultant should demonstrate the existence of the fault between boreholes B-75 and B-52 on a section drawn through boreholes B-29, B-74, B-75, B-52, B-53, and B-56.

In summary, we feel that the Bay Entrance and Little Salmon faults, both reverse faults, are probably related and are essentially the same age. Before we can accept the consultant's interpretation, some unequivocal evidence must be offered.

Little Salmon Fault

The location, geometry, and age of the Little Salmon fault, we feel, are still open to dispute. Most of the conclusions reached by the consultant seem to be based on the assumption that the Little Salmon fault is a simple plane. It is more likely that a fault the size of the Little Salmon fault (more than 34 miles long and as much as 6,000 feet vertical displacement) would be very complex when examined in detail. One would expect such a structure to be a complex fault system rather than a simple planar structure. The complexity of the fault pattern evolving from the detailed work done, tends to substantiate this view. Furthermore, there are still insufficient data for the Little Salmon fault to prove or preclude an abrupt steepening of the fault at its leading edge.

The consultant's interpretation of the Bay Entrance-Little Salmon fault relationship implies that a displaced part of the Little Salmon fault should exist west of the Bay Entrance fault. To date, this has not been substantiated, so there seems little support for separating the Bay Entrance segment from the Little Salmon fault.

The age of the Little Salmon fault hinges on the recognition of the rocks mapped as Hookton and Carlotta Formations. These two units are extremely difficult to tell apart in the field and the map configuration of these two units has changed from one set of reports to the next. The present report varies considerably from Ogle's mapping (CDMG Bull. 164) at critical places along the Little Salmon fault. For example, for about 6 miles along the Little Salmon fault (in the Newburg area), Ogle showed the Little Salmon fault cutting Hookton Formation. The latest report (Pl. II) shows a narrow selvage of Carlotta Fm. in contact with the fault (signified by a dashed or approximately located contact). The evidence for changing the recognition of this unit from the younger Hookton Fm. to the older Carlotta Fm. seems

inadequate and to be acceptable should be supported by detailed mapping with careful stratigraphic control (by paleontology, paleomagnetism, radioactive or amino acid dating methods). Furthermore, along the entire length of the Little Salmon fault, wherever it lies in contact with what has been mapped as Carlotta Formation, undisputable evidence should be presented to show that these rocks are not in fact, Hookton Fm. Only in this way can the age of the Little Salmon fault be established with confidence.

It is our opinion that distinguishing the so called Bay Entrance fault from the Little Salmon fault on the basis of dip, is questionable. The difference in dip could just as reasonably be explained by a steepening along the strike of the fault. An example can be seen along the Little Salmon fault as it steepens abruptly to the south in the Holmes Camp (Yager Creek Area). In a similar fashion, the Little Salmon fault could steepen to the north and could become the fault segment referred to by the applicant as the Bay Entrance fault.

Offsets in the Ravine and the Quarry at Fields Landing

We do not accept the consultant's conclusion that the offsets in the ravine and some of those in the quarry are intraformational deformation. We feel these features are tectonic and constitute evidence of post Hookton faulting in the Humboldt Hill area.

Regional Tectonic Framework

The Mad River Fault Zone has been demonstrated to be a capable fault by the ESA report, and it is considered to be the "probable source of the Dec. 21, 1954 M 6.5 earthquake and 5 aftershocks (Table A). Also it is considered to be the probable source of other earthquakes felt in Eureka and the associated micro-seismicity recorded by Stewart Smith's micro-seismicity network (p. 11-12 and Table A). This zone also shows evidence of late Quaternary faulting (p. 12). The fault is recognized as being 35-40 miles long and extending both NW to Oregon (offshore), and SE through the Coast Ranges (Table A). It is our observation that this fault probably extends far beyond regional map Plate I, and could easily be 160 miles long or longer if it is continous with strong lineaments aligned with the Mad River fault zone in the unmapped area to the SE. This strongly suggests the Mad River fault zone is a fault of major dimensions and possibly capable of generating a very large earthquake. The minimum distance of this fault zone to the plant is 11 miles (Table A).

Likewise, the Hayward-Rogers Creek-Healdsburg-Maacama-"en echelon" fault system heads NW along a number of other partially mapped fault traces and a number of strong lineaments visible on LANDSAT imagery. This fault zone has recently been extended by the USGS as far north as Willits (see statement of Daryl Herd re Warm Springs Dam) and could easily extend as far north as Cape Mendocino. (Herd, 1977).

Considering the magnitude of these still incompletely mapped, but strongly suggestive major fault zones in the area, the proximity to the triple junction at Cape Mendocino, and the very active seismicity recorded in the area, we feel it would be prudent to consider a larger magnitude earthquake capable of occuring closer to the plant than heretofore considered.