FRANK NEUMANN
4546 FORTY-FIFTH AVENUE N.E.
SEATTLE, WASH., 98105

July 26, 1963.

Dr. Robert H. Bryan,
Division of Licensing and Regulation,
U. S. Atomic Energy Commission,
Washington 25, D. C.

Dear Dr. Bryan:

Enclosed are two memoranda commenting on (1) Prof.
Housner's processed memoranda distributed at Argonne Laboratories
on August 2, 1963 and (2) statements made in the course of his talks
there. I presume you would want to know about any differences in
basic seismological concepts that exist between us.

Professor Housner is rather unique in American seismology in
that by training he is not a seismologist (so far as I know) yet is
almost prolific in his elucidation of seismological principles to the
engineering profession. He speaks of his concepts as facts and,
since he seldom quotes the views of others, the listener may easily
assume his views represent those of the entire seismological profes-
sion. Caltech's seismologist Dr. C. F. Richter, who in 1957 wrote a
768-page book on "Elementary Seismology", frequently mentions Housner
as an earthquake engineer but says little or nothing about his purely
seismological concepts. Most seismologists would hesitate to question
the late Dr. Gutenberg's conclusions on the interpretation of seismo-
logical data, or question other phenomena that virtually all seismolo-
gists have accepted as authentic for many years. Housner evidently
places the results of his mathematical studies above everything else;
to him they are the facts.

Please let me know in case I can do anything that will help mat-
ters along.

Sincerely yours,

Frank Neumann.

5293

NOTES ON SI MEMORANDA DISTRIBUTED BY PROF. JUSNER AT THE

ARGONNE LABORATORIES ON JULY 2, 1963

(By F. Neumann)

Memo No.1 Table I. Data from "United States Earthquakes 1933-61".

This is a series of annual reports, many of which I authored. Ordinarily
distance to fault was not given, nor the durations; some of the tabular
figures must be Housner's.

Housner is evidently trying to tie magnitude in with something but not
having much success. I used the same figures and, with distance and
acceleration as arguments, plotted the actual magnitudes. There was no
consistancy anywhere. I do not see what purpose the two Housner charts
serve.

Memo No.2 Table II. Spectrum intensities.

I have never seen any need for spectral intensities that are based on
(x-y) instead of y, where y is the motion of the ground and x the motion
of the oscillator. In his 1952 paper on this subject he tried to relate
it to MM intensity but there was poor agreement. He admitted that they
are not the same thing which is quite obvious. Again, I do not see
the purpose of the chart.

Memo No.3 Effect of ground on intensity of shaking.

Housner evidently does not believe in the results published in my booklet
"Earthquake Intensity and Related Ground Motion". The first sentence
is contrary to the findings of many seismologists especially those at
the Pasadena (Caltech) Seismological Lab. They found differences of 10
to 1 between alluvium and rock motions; I have suggested a 22:1 ratio,
the U.S. Bureau of Mines, in blasting vibrations, finds ratios of
approximately 30:1 between alluvium and rock. Housner admits it could
be more than 2:1 if there was "appreciable model excitation" but apparently
he has not observed it on "firm" alluvium. In my AEC report now in
preparation, a ratio of 2:1 is suggested between "sedimentary basement

rock" and "granitic basement rock". What is "well known" about the 2:1 ratio as Housner states in his first sentence?

In showing an example, Housner's "best comparison" is rather unfortunate in that we have no reliable record of the acceleration at Long Beach and this is stated in the Coast Survey report. The horizontal components are so badly overlapped they are impossible to separate (I spent a long time trying to do this right after the record was obtained). The reported .23 g is open to doubt. The distance to the "maximum intensity" epicenter near Signal Hill is 4 miles, not 17. This single example is entirely inadequate to prove Housner's 2:1 ratio idea. The Coast Survey currently adjusts its accelerometers to accomodate expectable accelerations of .25 g on rock, .40 g on residual clay and shale, and .70 g on alluvium. This is a 3:1 ratio: intended to take care of good building sites.

As far as the Taft record is concerned, just what acceleration should one expect for a shock of given magnitude at a given distance? I know of no formula that would enable one to reach Housner's conclusion.

Memo No.4   El Centro, May 18, 1940 earthquake ground motion.

The U.S.C. & G.S. did not rate the intensity at El Centro as IX but VII to VIII. Ulrich's report, to which reference is made, was a preliminary report; VII to VIII appears in the Survey's final reports. After special study of descriptive material, I judged it to be MM-8.3. See my current report for further discussion.

Where were the two farm houses 1000 ft. from the fault that were not damaged? Intensity or damage is primarily a function of distance to epicenter, not distance to fault. (Housner evidently does not accept this thesis, he believes in a "planar" source of energy.)

Memo No.5 Hebgen Lake, Montana Earthquake.

There is nothing special about the point raised that "a sizable area in

the epicentral region was subjected to almost the same level of acceler-

ations...as in West Yellostone or places 5 to 10 miles from the fault".

Generally, however, the acceleration would be somewhat greater and the

duration less as one gets closer to the epicenter, the intensity remaining

the same. Writers frequently confuse acceleration and intensity.

Dixie Valley--Fairview Peak Earthquakes.

Without mention of the epicentral distance of the structures (near the

fault) that suffered only minor damage, this memorandum has little or no

sig ificance.

Memo No.6 Acceleration adjacent to a fault produced by the slip displacement.

From the discussion of the El Centro record one would expect to learn

just what this acceleration was at El Centro but it is not to be found.

If one assumes that this first motion had the basic characteristics of

a sinusoidal motion, which seems reasonable (the computed velocity and

displacement curves have such characteristics), and assumes a resultant

velocity of about 35 cm/sec combined with a period of 3.5 or 4.0 second,

the corresponding acceleration would be about .06 g. (This is shown in

all of my period-amplitude graphs for the El Centro motion, i.e. Fig.6

of my report mailed on July 20, 1963.) In fact, a wave of this order

of period and maximum acceleration can be drawn on the acceleration curves

in Memo No. 6 if one tries to draw a curvilinear axis of such nature that

the areas (of the high frequency waves) above this axis will equal the

areas below it.

I do not see eye-to-eye with all of Housner's reasoning in this memorandum,

largely because we have different concepts on how earthquakes are ganerated

(fault locks vs. uniform planar friction?). I think the high frequency

waves were generated the instant the rocks were ruptured at the fault

lock, simultaneously with the start of the fault movement. The waves

generated by these two events are independent wave forms that have dif-

ferent dispersion characteristics.

Neither Housner's statements of "fact" nor mine should be accepted

at face value as facts which seismologists generally accept; it is all

conjecture which may or may not have useful engineering application.

I cannot see the purpose of this memo in the current project.

If the El Centro fault had been "greased" no energy could have been stored

up and there would have been no earthquake.

Memo No.7   Damage to structures adjacent to the San Andreas Fault, San Francisco

earthquake, 1906.

This heading is misleading. The official name is "The California

Earthquake....,"; it was Bodego Head's earthqake as much as San Francisco's,

both being about 40 miles from the epicenter.

This is an extraordinary document in that Housner, in the opening

paragraph, introduces an entirely new concept of earthquake intensity,

different from anything the Coast and Geodetic Survey, the Caltech

Seismological Lab or the Berkeley Seismological Station, use in there

published evaluations of intensity. He states that "those structures

which have receivedd little or no damage are good indications of the

upper bound for intensity of ground motion. For example, if an

unreinforced brick chimney was bot broken off, it is clear that

the ground motion was not sufficiently intense to destroy the stronger

chimneys". He wants to measure intensity by damage that was not done

while everyone else measures it by damage that was done. All intensity

scales and the people who use them are geared to using positive fact

rather than negative assumptions in evaluating intesity from descrip-

tive information so that, invariably, a published intensity means the

maximum that can be derived from the descriptive data regardless of

the fact that other information could indicate intensities (in the -5
same town) that could be one, two, three or even four grades of
intensity lower.

Nevertheless, Housner uses this kind of logic to justify taking only
that information from the Lawson report which yields the lowest, not
the highest intensity. In item 3, for instance, he states that "only
three or four houses were passed, and these were uninjured except for
broken chimneys". He does not report that just beyond this a hotel
was badly wrecked and a barn near Bodega Head was completely wrecked.
This is typical of virtually all of the 14 items Housner mentions to show
how low the intensities were. I could summarize many pages of notes that
could be included or appended to this letter but they would all boild
down to this same basic attitude.

Perhaps the most amazing statement of all is the last paragraph in which
he states "From the foregoing description of damage it can be concluded
that the intensity of ground shaking in the vicinity of the fault was
not remarkably intense. Except for cases of special ground conditions,
the damage appears to be consistent with a modified-Mercalli intensity
rating of about VII to VIII. It also appears to be consistent with
ground motions whose maximum acceleration was approximately 15 to 20%g."
For one thing, he does not describe the damage except that which applies
to minimum intensity. This would be consistent in part with my conclusions
if one agrees that intensities of VII to X were observed within say 30
miles of the epicenter. Housner, would agree to the VII or VIII.
I have spent much time and made many notes on the descriptive information
in the State Commission's Report to find evidence that intensity along
the fault might be less than a few miles back. No evidence has been
found. It would take weeks to make a thorough study of the entire report
but enough has been done in the general epicentral area to feel that this
is a true statement. It is felt that if all the intensities were carefully

re-evaluated on the MM scale the intensity distribution over the entire
shaken area would be very similar to that shown elsewhere for the Puget
Sound shock of 1949. Maximum intensities would be registered on poor
ground out to 100 miles or more. Epicentral distance and local geology
would be the controlling factors.

Santa Rosa was one of the worst shaken towns in California...30 miles
from epicenter. "Practically everyone on foot at the time was thrown
to the ground...". Other evidence shows that some had difficulty standing,
others did not fall. In the epicentral area at some places all men and
cattle were thrown to the ground, sometimes twice. In the absence of struc-
tures in the epicentral area these facts indicate that the intensity was
quite as great in the epicentral area as in Santa Rosa, probably the
most damaged town in California. (This follows the pattern of the
Puget Sound shock in 1949.)

In the last paragraph, p.4, how does Housner know that the maximum
acceleration was approximately 15 to 20%? At Mr. Doda's ranch, 150
feet west of fault a daughter was lifted off the floor more than once;
a ranch hand saw water tank tower lifted vertically upward 5 feet and then
collapse in ruins. Was this 20%g? A bed was also lifted from the floor
at Seaview near Fort Ross.

This entire memorandum is quite obviously an effort to downgrade
intensities in epicentral areas and is contrary to all the conclusions
reached by the writer in his booklet "Earthquake Intensity and Related
Ground Motion".

COMMENTS ON VARIOUS STATEMENTS MADE BY PROF. G. W. HOUSNER

AT ARGONNE LABORATORIES OF A. E. C. ON JULY2, 1963.

(By F. Neumann)

1. Statement: The longer the fault the greater the energy release.

   Comment: This should be accepted with caution; some strong shocks show no surface faulting. Magnitude is the best measure of energy release; the area over which a shock is perceptible is perhaps the next best measure. I have never seen any statistical data to tie in length of faulting with evergy release; it is primarily a theoretical conclusion that could be countered by the "fault lock" theory of Benioff which in the writer's opinion fits observed intensity distribution in shaken areas better than Housner's "Planar" energy source theory.

2. Statement: From 0 to 10 miles from a fault there is uniform response (intensity because of focal depth.

   Comment: Is is found from basement rock (minimum) intensity graphs that one can go to within 3 miles of an epicenter before uniform maximum intensity is reached. Elsewhere Dr. Housner tries to show that maximum intensity occurs several miles from a fault.

3. Statement: Farm houses along the El Centro Fault were not damaged.

   Comment. In his distributed notes he gives distances to faults but not to epicenters. Epicentral distance, not fault distance determines the intensity. In printed notes on the 1906 shock he cited a similar case that was 150 miles from the epicenter. Why should there be damage?

4. Statement: The velocity spectrum is a good measure of intensity.

   Comment. In his 1952 report on "Intensity of Ground Motion During Strong Earthquakes" he concludes: "There is only an approximate agreement between the spectrum intensity of an earthquake and the Modified

Mercalli intensity. These two do not measure precisely the same thing.
and it is concluded that the spectrum intensity is more meaningful for
engineering design". Actually, spectral intensity is a measure of the
differential motion between building (or oscillator) and ground, not a
measure of the ground motion. I do not know of anyone but Housner who
uses it.

5. Statement: He gave impression that El Centro earthquake motion was about
the strongest that may be expected anywhere.

Comment: In the reference just quoted he concludes:" It is estimated that
the maximum ground acceleration to which a California city may be subject-
ed is 0.66g or approximately twice that experienced at El Centro --". The
writer has cited 0.7g as a minimum and 1.0g as a possible maximum for the
1906 earthquake.

6. Statement: There is no peaking (of intensity) in the vicinity of a fault.

Comment: All intensity distribution maps show that there is a peaking of
basement rock (minimum) intensities in the immediate epicentral zone which
is either on or above a fault. This does not support Housner's planar
energy source theory on which the above statement is based.

7. Statement: Faults move in jerks as shown by peaks on accelerograms.

Comment: Why then did the El Centro record show not only 5 peaks while
the fault was slipping but a continuous series of peaks for 30 seconds
after? The writer does not believe the various wave types are generated
in the manner suggested by Housner who also distibuted a note on the sub-
ject.

8. Statement: Long Beach epicenter was 17 miles from seismograph station.

Comment: The intensity distribution map shows maximum intensity at Sig-
nal Hill only a few miles away where aftershocks also centered. The
epicenter 17 miles away was a foreshock that triggered the Signal Hill
shockm a rather common occurrence.

9. Statement: He disbelieves Gutenberg's statement that in the Imperial

Valley 1940 earthquake the motion on alluvium was 8 times greater than

on rock.

Comment: I believe with Gutenberg that this actually did happen; it is

commonplace for four grades of intensity to be reported at the same epi-

central distance but in different areas. This is equivalent to an 8-fold

range in ground motion.

10.-Statement: There were stronger motions 5 miles from the San Andreas Fault

than right on it.

Comment. This is challenged in comments on his printed memorandum cover-

ing this subject.

11. Statement: The energy source is planar in character.

Comment: The writer believes that all intensity distribution maps support

the fault lock concept -- that a fault plane becomes distorted thus pre-

venting smooth motion along the fault surface. When accumulating stresses

are sufficient to overcome the lock this area becomes the focus of an

earthquake and the source of maximum energy release. Basement rock at-

tenuation graphs indicate a circular radiation of energy, not elliptical

as called for by the planar energy concept.

12. Statement. 0.5g is a reasonable estimate of the "upper bound" associated

with any fault displacement. He does not accept the observation that in

the great Assam earthquake of 1897 the vertical accelerations exceeded g.

Comment. In the writer's latest revision of his A.E.C. seismological re-

port the reasons are given for believing that g has been exceeded in vert-

ical motion of the ground. In the 1906 shock one person and a bed were

thrown upward off the floor and on the ground a water tank was reported

to have raised up off the ground and then collapsed.

13. Statement: One mile from the San Andreas Fault 0.2g was an upper limit in 1906.

   Comment: Santa Rosa, in an alluvial valley 30 miles from the epicenter and 18 miles from the fault, was perhaps the most severely damaged town in California. Compared with damage in other shocks the writer believes the acceleration must have been close to 0.2g here with a duration very much longer than near the epicenter. This would not seem incompatible with an acceleration of 0.7 or 1.0g at the epicenter.

14. Statement: In citing factual data from the 1906 earthquake report Housner cited the slight damage to Chittenden Bridge over the Pajarro River which is practically on the fault.

   Comment: There is no lack of evidence to show that even a large fault displacement is not necessarily accompanied by violent vibrations. The important thing is: How far was it from the epicenter. In this case it was 100 miles.

15. Statement: Could have a 1906 earthquake every day without damaging the proposed power plant.

   Comment: Does Housner not know that all of the Coast Survey's strong motion data show that intensity, which is equivalent to damaging potential, is a function of duration? This is indeed a rash statement considering that 700 people were killed in 1906 and the damage in today's dollars would be between one and two billion dollars.

16. Statement: In California building designs provide for only about one-fourth the theoretical earthquake forces.

   Comment: The usual explanation for this is that structures absorb energy and there are also other reasons that have more of an engineering than seismological basis. I seldom if ever hear about what part resonance plays in building responses to earthquake forces. All spectra represent

what are primarily maximum, or resonant (or near resonant) responses to a particular earthquake motion. I am ready to believe that thousands of structures withstand earthquake forces simply because they never experience resonance; this means that they could easily experience only about a fourth of the acceleration a series of resonant vibrations would impress on them.

8/5
(Date)

TO: _LHR_
_____

___ For Information

___ For appropriate handling

___ For preparation of reply for Chairman's
signature (Refer to Manual Chapter 0240)

___ For discussion at Commissioners' Information
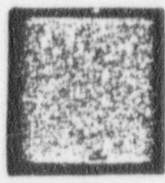Meeting

___ For distribution to other Commissioners

___ Daily Log

REMARKS:

RECEIVED
AUG 6 1963
U. S. ATOMIC ENERGY COMMISSION
Division of
Licensing & Regulation

ACTION

Howard C. Brown, Jr.
For the Chairman

5495

President John F. Kennedy
White House
Washington, D.C.

Dear President Kennedy,

Re: Nuclear Power Plant at Bodega Bay, California

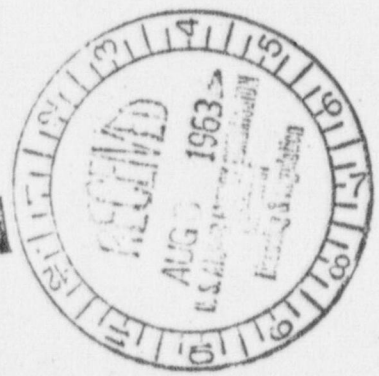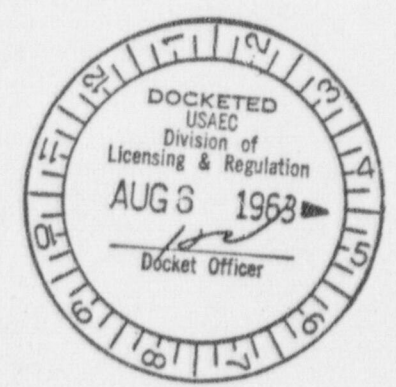Please use my letter as one of many in protesting the building the Nuclear Power Plant at Bodega Bay, California.

It seems to me that the indication of this proposal embodies an attempt at furthering security for the people of the world. However it also threatens the security and health of the people in the immediate area. I am sure there are areas of the United States less populated and less prone to endanger the lives of so many people that would better suit the building of the plant, if the building of such a plant is necessary.

Thank you for your attention.

Respectfully,

Josephine Hanson

Josephine Hanson
969 Dolores Street
San Francisco 10, Calif.

5495

FROM: Mrs. Guy Alexander Palo Alto, Calif.	DATE OF DOCUMENT: 7-30-63		DATE RECEIVED B-6-3		NO.: 549
	LTR. X	MEMO:	REPORT:		OTHER:
TO: Seaborg (forwarded to IX by Howard Brown)	ORIG.: X	CC:		OTHER:	
	ACTION NECESSARY ☒ CONCURRENCE - ☐			DATE ANSWERED:	
	NO ACTION NECESSARY ☐ COMMENT ☐			BY:	

CLASSIF.: U	POST OFFICE	FILE CODE: 50-205			
	REG. NO:				
DESCRIPTION: (Must Be Unclassified) Ltr. req. answers to some questions in re to the proposed plant at Bodega Head.		REFERRED TO	DATE	RECEIVED BY	DATE
		Edwards:	8-7		
		w/suppl file cy — FOR ACTION 3 extras			
ENCLOSURES:		H. Pries:	8-7		
		w/extra cy, for info			
		Lowenstains	8-7		
		w/extra cy, for info			
REMARKS: N R Distribution: 1 - fernal file 1 - SAN FL 1 - AEC PDR			Answered 10-4-63		
				5	

8/5
(Date)

TO: _LtR_

_RK_

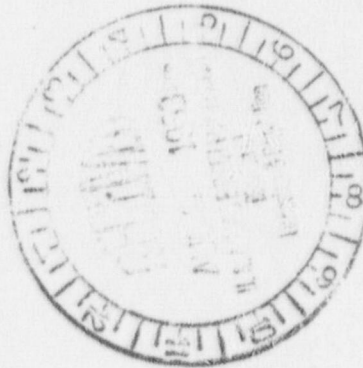For Information

_✓_ For appropriate handling

___ For preparation of reply for Chairman's
signature (Refer to Manual Chapter 0240)

___ For discussion at Commissioners' Information
Meeting

___ For distribution to other Commissioners

___ Daily Log

REMARKS:

Howard C. Brown, Jr.
For the Chairman

5496