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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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In the matter of: :
GENERAL ELECTRIC COMPANY : Docket No. 50-70
 : Operating License
 : No. TR-1
(Vallecitos Nuclear Center - : (Show-Cause)
General Electric Test Reactor) :
-----x

Holiday Inn - Golden Gateway
Van Ness at Pine
San Francisco, California
Gold Rush B Room

Monday, June 1, 1981

The above-entitled matter resumed at 9:30 a.m.,
pursuant to adjournment.

BEFORE:

HERBERT GROSSMAN, ESQ., CHAIRMAN,
Atomic Safety & Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

GEORGE A. FERGUSON, Ph.D., Member

HARRY FOREMAN, M.D., Ph.D., Member.

APPEARANCES:

DANIEL SWANSON, ESQ.
RICHARD G. BACHMANN, ESQ.
Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Washington, D.C.,

Appearing for the NRC Staff.

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EDWARD A. FIRESTONE, ESQ.
General Electric Company
Nuclear Energy Company
175 Curtner Avenue
San Jose, California 95125

-and-

GEORGE L. EDGAR, ESQ.,
FRANK PETERSON, ESQ.,
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Washington, D.C.,

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EARTH, et al.

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COUNSEL FOR CONGRESSMAN RONALD V. DELLUMS,
8th DISTRICT, CALIFORNIA.

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1	<u>C O N T E N T S</u>	
2	<u>Limited Appearance Statement of:</u>	<u>Page:</u>
3	Dr. Malcolm Powell, on behalf of the Society	
4	of Nuclear Medicine and the American	
	College of Nuclear Physicians	731
5	Sharon Paltin	733
6	George Gerth, on behalf of Mallinckrodt	
7	Diagnostics, Inc., St. Louis, Missouri	735
8	Walter Peebles, Jr., on behalf of Gulf	
	Nuclear, Inc., Webster, Texas	737
9	Thomas M. Gaines	741
10	Sue Hughes	743
11	Helen Serenca	745
12	Edith Stock	747
13	Vada Ulrech	749
14	Rev. William A. Smith	751
15	Marlin J. Ebert	754
16	Kenneth A. Nightingale	756
17	Betty Shockley	760
18	Kenneth Mercer, Mayor of Pleasanton,	
19	California (by telegram)	767
20	Phil Gardner	807
21	Mrs. Gardner	809
22		
23	-----	
24		
25		

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<u>Witness:</u>	<u>Direct</u>	<u>V.Dire</u>	<u>Cross</u>	<u>Board</u>
David Brillinger (resumed)			772	811
James Barlow		844 (Board)		
		849 (Edgar)		
		859 (Swanson)		
		384 (Board)		
			905 (Edgar)	
			913 (Swanson)	

<u>Exhibits:</u>	<u>Identified:</u>	<u>Received:</u>
Intervenor's Exhibit No. 6	784	

P R O C E E D I N G S

JUDGE GROSSMAN: This hearing is reconvened.

This is the fourth day of hearing in the matter of the General Electric Test Reactor at the Vallecitos Nuclear Center, relating to the show-cause order that had been issued by the NRC in October of 1977.

For those of you who were not at any of the first three days of hearing, let me again mention that the GE Test Reactor, sometimes referred to as GETR, has been shut down since October of 1977; that subsequent to that time, there have been reports issued by the NRC Staff which indicate that the Staff now agrees that the reactor could be reopened under certain conditions, and that the hearing has been convened for the purpose of determining whether or not that reactor can begin operations again.

Again, because some of you were not at the hearing at Livermore, I will introduce the Board once more. As some of you are aware, these Atomic Safety & Licensing Boards are generally composed of an attorney-chairman and two scientists.

The scientists for this Board are Judge Harry Foreman, who is a medical doctor. He is sitting on my right. He also has a Ph.D. in biochemistry. He is the Director of the Center for Population Studies at the University of Minnesota, in addition to being a professor at that

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1 university.

2 On my left is Judge George Ferguson, who has a
3 Ph.D. in nuclear physics, and is a professor at Howard
4 University in Washington, D.C.

5 My name is Herbert Grossman. My background is
6 that of a trial and appellate attorney for over 15 years
7 with the Department of Justice in Washington.

8 I would like counsel again to introduce themselves,
9 beginning on my left with counsel for the General Electric
10 Company.

11 MR. FIRESTONE: My name is Ed Firestone. I am
12 counsel for General Electric Company. George Edgar who is
13 not here at the moment, will be down, and he is an attorney
14 with Morgan, Lewis & Bockius. Seated to my left is Frank
15 Peterson, an associate with the law firm of Morgan, Lewis
16 & Bockius.

17 MR. SWANSON: My name is Daniel Swanson. I am
18 counsel for the NRC Staff. Also with me, serving as
19 counsel for the Staff, is Mr. Richard Bachmann on my left.
20 Sitting with me at counsel table, though not making an
21 appearance, is the project manager for the Staff for this
22 proceeding, Mr. Christian Nelson.

23 MR. CADY: My name is Glenn Cady. I am an
24 attorney for the Intervenors, Friends of the Earth,
25 Congressman Dellums, Congressman Burton, Congressman Burton,

1 and Barbara Shockley. I am with the law firm of Carniato &
2 Dodge, located in Lafayette.

3 JUDGE GROSSMAN: The first order of business for
4 us this morning is listening to limited appearance statements.
5 As we indicated in the orders issued noticing this hearing,
6 we provided for the taking of limited appearance statements
7 in Livermore during the first day of hearing, and also
8 indicated that we would take those statements this morning
9 here in San Francisco.

10 At the rear of the hearing room is Mr. Paul
11 Hamilton, who is a member of our staff, and he will take
12 names and addresses of those who want to speak. The general
13 limit is five minutes per person. In certain cases if the
14 matter is important, and there is a slightly longer
15 statement, we will generally listen to it, but please
16 attempt to limit your statement to five minutes.

17 At this point, in order to allow Mr. Hamilton
18 to take the names, we will recess for approximately 10
19 minutes, until 9:45, and all those who want, may sign up
20 with Mr. Hamilton.

21 Thank you.

22 (Recess.)

23 JUDGE GROSSMAN: The hearing is in session.

24 We have a list of names of persons who wish to
25 make limited appearance statements. The procedure will be

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1 for the first three persons to come forward and sit at the
2 table, and beginning with Malcolm Powell, Sharon Paltin,
3 and George Gerth. Each of the witnesses in turn will state
4 his or her full name and address and make the statement,
5 beginning with Mr. Powell.

6 LIMITED APPEARANCE STATEMENT OF MALCOLM

7 POWELL, M.D.

8 DR. POWELL: Your Honor, my name is Malcolm R.
9 Powell, and I am a physician in the private practice of
10 nuclear medicine here in San Francisco.

11 My testimony is at the request of the Society of
12 Nuclear Medicine, and the American College of Nuclear
13 Physicians, of which I am the President of the California
14 Chapter.

15 Nuclear medicine is the medical specialty --

16 JUDGE GROSSMAN: Sir, could you also state your
17 address?

18 DR. POWELL: 350 Parnassas Avenue, San Francisco
19 94117.

20 Nuclear medicine is the medical specialty which
21 uses radionuclide tracers for medical diagnosis and also
22 for therapy. The diagnostic tests are performed both
23 in vivo and in vitro. There are approximately 3500 nuclear
24 medicine laboratories in the United States. These
25 laboratories perform 15 to 20 million in vivo tests per



1 and 80 to 100 million in vitro tests per year at the present
2 time.

3 Radionuclide-labeled pharmaceuticals are well
4 accepted as one of the safest of all pharmaceutical agents.
5 The in vivo tests we perform are noninvasive and they are
6 widely used in various medical specialties.

7 The Society of Nuclear Medicine, for which I
8 speak today, consists of over 11,000 members, among whom
9 are physicians, allied scientists and the technologists
10 who actually perform the tests.

11 Up to about three and a half years ago, the GE
12 reactor at Vallecitos, California produced over 90 percent
13 of the radionuclides used in medical diagnosis and treatment
14 in the U.S. Now there is only one domestic commercial
15 isotope production reactor in this country. This is the
16 Tuxedo, New York reactor which is now foreign-owned, after
17 the purchase of this reactor from the Union Carbide
18 Corporation by the Medi-Physics Division of Hoffman-LaRoche.
19 Large amounts of fission molybdenum-99 also come into the
20 United States from Atomic Energy of Canada, Ltd.

21 We in nuclear medicine have been very much
22 concerned that the U.S.A. is no longer a major producer of
23 radionuclides for medical use. We would like to see a second
24 commercial source become available again in the United
25 States, particularly one that is home-owned. We believe

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1 that our medical specialty and that our patients will benefit
2 from competition in reactor production of commercial radio-
3 pharmaceuticals.

4 We therefore wish to recommend to the NRC that
5 reopening of the Vallecitos Reactor be supported and
6 expedited. We believe that the exhaustive studies performed
7 concerning seismic safety over the last three and a half
8 years, and the resulting modifications of the design of this
9 reactor, are ample assurance of its safety.

10 Nuclear medicine has enjoyed considerable
11 support from the NRC in times past, and I thank you for
12 listening to me this morning.

13 JUDGE GROSSMAN: Thank you.

14 Our next speaker is Sharon Paltin.

15 LIMITED APPEARANCE STATEMENT OF SHARON

16 PALTIN.

17 MS. PALTIN: Yes. I live at 2035 Channingway,
18 Apartment 201, in Berkeley. My background is environmental
19 sciences, and I am now studying to be an EMT.

20 I am also concerned about people's health. The
21 basic thrust of what I have to say is that you never know, and
22 this is a basic rule of ecology, that the whole is greater
23 than the sum. One plus one equals more than two. You
24 can't predict everything that will come out of a situation.
25 Even if we knew everything about earthquakes and everything

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1 about buildings, still when we add the two together, there
2 will be things we can't predict coming out of that. We
3 don't know everything about earthquakes. It's foolhardy for
4 us to try and even say that the earth will not do such and
5 such. Because I have a couple of examples where it has
6 fooled us, you know, where buildings we have built that
7 are supposed to stand up to earthquakes just have not made it.

8 For instance, the Government Services Building
9 in El Centro was called highly earthquake-resistant. It
10 was built in 1970 and was designed to the most modern standards.
11 The Imperial Valley quake of 1979, in October, was about a
12 6.4, and heavy damage was sustained by that building, by
13 the support columns. You know, surprise, surprise.

14 Also, the Olive View Hospital in '71, in the
15 San Fernando Valley quake was a 6.5 and that sustained heavy
16 damage.

17 I was going to Fairfax High School at the time,
18 and shortly thereafter L.A. High School went on double
19 sessions with us, because L.A. High School -- the second
20 floor had fallen on the first floor. And we were nowhere
21 near the epicenter.

22 In other words, it is unacceptable to risk
23 people's health and lives by trying to guess what the earth
24 will do and what our structures will do when such things as
25 radiation, long-lasting things that affect people's health

1 are stake.

2 I believe that it is your function to protect us
3 from possible health hazards, above and beyond protecting
4 corporate interests and GE's profits, that it is far more
5 important for you to protect the public's interest.

6 Also, the reactor was built in 1957, and we
7 have learned a lot about earthquakes since then, but I still
8 don't think that we have any idea what faults are in there
9 and which way the earth is going to thrust. Nobody really
10 knows this, and if we study it very hard, it will be a lot
11 of years before we really do know.

12 In the end, the whole is greater than the sum of
13 the parts.

14 JUDGE GROSSMAN: Thank you, Ms. Paltin.

15 Before we listen to Mr. Gerth, could the two
16 who have spoken excuse themselves from the table, and we
17 will allow the next two to sit, and the next two being
18 Walter Peeples, Jr., and Thomas Gaines.

19 Mr. Gerth, you may proceed.

20 LIMITED APPEARANCE STATEMENT OF GEORGE
21 GERTH, MALLINCKRODT DIAGNOSTICS, ST. LOUIS,
22 MISSOURI.

23 MR. GERTH: My name is George Gerth. I live at
24 12153 Country Manor Lane, Missouri 63141.

25 I am the Manager of Plant Services for

1 Mallinckrodt Diagnostics, a Division of Mallinckrodt, Inc.
2 This division is based in St. Louis, and is a primary
3 supplier of radiopharmaceuticals to the medical community.

4 We believe that approval for the safe restart
5 of the General Electric Test Reactor at Vallecitos is in
6 the public interest.

7 On Thursday, October 27th, 1977, the U.S.
8 Nuclear Regulatory Commission temporarily suspended the
9 operating licenses of the General Electric Test Reactor.

10 General Electric was the primary supplier of
11 radioactive isotopes used in nuclear medicine. General
12 Electric was the largest and most reliable producer of
13 molybdenum-99. Molybdenum-99 is used by the radio-
14 pharmaceutical manufacturers' industry worldwide to produce
15 technetium-99 generators which are used by nuclear medicine
16 physicians for the detection of brain tumors, liver
17 disease, bone tumors, and to measure many other vital
18 functions in the examinations deemed essential in patient
19 care.

20 Prior to the shutdown of the General Electric
21 Test Reactor, GE supplied approximately 50 percent of the
22 world's primary radioactivity used by companies producing
23 diagnostic and therapeutic radiopharmaceuticals to maintain
24 the necessary tools so critical to the medical community.

25 Due to this shutdown, Mallinckrodt and other

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1 U.S. companies were forced to expend additional dollars
2 abroad.

3 Additionally, foreign companies who at one time
4 were purchasing isotopes from U.S.-based General Electric
5 were forced to obtain these from other countries. Both
6 of these actions continue to broaden our balance-of-payments
7 deficit in which the same manner as our reliance on OPEC
8 oil, including the phenomenon of ever-increasing prices.

9 Our reliance on foreign supplies of radioactive
10 raw materials and the continued spending of U.S. dollars
11 in foreign markets unnecessarily is not in our best interest.

12 By removing the temporary suspension of the
13 General Electric Test Reactor license, an important domestic
14 supplier of radioactive raw material will return to the
15 marketplace.

16 This return will definitely assure an improved
17 supply of quality materials to serve the medical community.

18 It will also assist in controlling the overall
19 cost of domestic medicine and medical care in the United
20 States.

21 An additional benefit will be that this reactor
22 will be U.S.-based and will prevent the outflow of funds
23 currently going to foreign sources of material, and thus help
24 to improve the U.S. balance-of-payment position.

25 Again, I urge you to remove the temporary

1 license suspension, and in the public interest permit the
2 restart of the General Electric Test Reactor at Vallecitos.

3 Thank you very much.

4 JUDGE GROSSMAN: Thank you, Mr. Gerth.

5 Mr. Peeples?

6 LIMITED APPEARANCE STATEMENT OF WALTER
7 PEEPLES, JR., ON BEHALF OF GULF NUCLEAR, INC.,
8 WEBSTER, TEXAS.

9 MR. PEEPLES: My name is Walter Peeples. My
10 address is 202 Medical Center Boulevard, Webster, Texas
11 77598.

12 I am president of Gulf Nuclear, Inc., a small
13 privately-owned corporation that manufactures a wide range
14 of radioactive sources.

15 We are gathered here today to consider a show-
16 cause action concerning the license to be issued for the
17 General Electric Company Test Reactor at Vallecitos,
18 California.

19 Whether or not this license is issued, I am
20 sure has a great deal to do with the outcome of this hearing.
21 As most of us are aware, this reactor ceased to operate
22 when the management of the reactor reported that it was
23 located near a suspected earthquake fault, and that certain
24 precautions would be taken to test and be sure that
25 operations would be maintained without the possibility of



1 harmful effect on the environment.

2 These tests have been carried out by General
3 Electric and outside consulting firms for approximately
4 three years. Considering the worst conceivable situation,
5 I believe that General Electric has proved beyond a shadow
6 of a doubt that the license should be issued permitting
7 this reactor to start up again.

8 I represent an area of industry devoted to the
9 safety and protection of all the citizens through quality
10 control. We are major users of Iridium-192 and Cobalt-60
11 for the purpose of industrial inspection. Our efforts yield
12 a degree of safety to all people.

13 In fact, it wouldn't surprise me if this very
14 building we are in were not inspected at some point during
15 its construction with the radioactive substances which we
16 use.

17 In fact, the airplanes which brought a lot of us
18 to the meeting here are inspected quite frequently for
19 safety using these radioactive materials.

20 It is not my intention to dwell on the
21 importance of the products we produce. It is my intention
22 to stress the importance of the General Electric reactor,
23 because those of us who produce the usable product must
24 depend on them for the raw materials used in this vital
25 area.

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1 Prior to the shutdown of this reactor a few
 2 years back, it was the major free enterprise supplier of
 3 all these isotopes throughout the free world. The technology
 4 of those that operate this reactor and facility is a valuable
 5 asset and tool to those of us engaged in manufacturing.
 6 The quality of the product produced by this group has yet
 7 to be exceeded.

8 This reactor has functioned safely without
 9 serious mishap for many years, and General Electric has
 10 been a major contributor economically to the well-being
 11 of the community, as well as a good neighbor.

12 We urge that in considering this license
 13 application that the Board carefully consider the facts,
 14 taking into consideration the major contribution of this
 15 facility to the industrial as well as the medical community,
 16 not just here in California, but throughout its sphere of
 17 influence worldwide.

18 We would hope that politics could be ignored
 19 and that simple scientific facts would be the basic
 20 assumption for licensing. We do, however, realize that
 21 politics cannot be ignored and that it will play as much a
 22 part in the decision as simple scientific fact.

23 Politics unfortunately does not always deal
 24 with truth because truth and fact are never as exciting,
 25 nor is the effect as stimulating as a vivid imagination

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1 run rampant.

2 My position is for full support of issuance for
3 this license because of the necessity of requirement of
4 the products produced.

5 Quality of product is as much a point in
6 consideration of licensing as all other previously considered
7 points. Quality has been a standard for General Electric
8 in the production of radiosotopes for medical and industrial
9 uses.

10 There is an important point for consideration of
11 this license. General Electric is free enterprise. To
12 hold its markets, it must supply the best.

13 In other words, production by government entities
14 is captive markets, and quality is secondary.

15 I wish to express my appreciation for the
16 opportunity to present my views. Thank you.

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JUDGE GROSSMAN: Thank you, Mr. People.
Mr. Gaines?

LIMITED APPEARANCE STATEMENT OF THOMAS M.
GAINES, ALBANY, CALIFORNIA.

MR. GAINES: Honorable Judges, my name is
Thomas M. Gaines. My address is 1605 Senoma Avenue,
Albany, California 94707.

First, the written policy as I understand it
of the Federal Government is not to compete with private
industry. At the time that the GETR reactor was shut
down, this was waived of necessity in order to keep an
industry going.

This is an ongoing industry involving many
millions of dollars, many thousands of employees, many
dollars of business, and a great deal of safety, as the
previous speaker touched on. It is an ongoing industry
that we all rely on, everyone in the United States, for our
own personal safety, whether it be medical or industrial
and it will continue. It will not be killed by the
failure to start GETR.

From a practical standpoint, however, General
Electric has had an outstanding history for safety, for
technical excellence, for outstanding service to the user
industry. They cannot be faulted there. Their history
is excellent.



2-2 jwb

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1 I have talked last week to every American
2 manufacturer of industrial radiography equipment, those
3 who repair the radioisotopes that come from GETR or HYFR
4 at the present time. They are all in accord in that they
5 desire GETR to be restarted as promptly as possible.

6 Now the next item has been touched on too many
7 times: Safety. I won't minimize safety for a moment.
8 However, we hear "earthquake-proof," and the immediate
9 reaction that people have is a building, a structure that
10 no earthquake could damage. That is such an idiotic
11 misnomer, and yet it sells. The basic intent of an
12 so-called "earthquake-proof" building is not to stand
13 with absolute integrity, but to maintain sufficient
14 safety as to prevent loss of life or endangering the
15 general public.

16 In sincerely submit that General Electric has
17 done as much as or more than can be reasonable expected
18 in this aspect.

19 And the last item, again safety, I am going to
20 pick on the Intervenors here, because I am sick and tired
21 of the general public being fed this line of "it's not
22 safe." All right, let's use the same general philosophy
23 on the automobile, and say that you will not use an
24 automobile for anything that is not absolutely essential.
25 You will not use an aircraft for anything that is not

1 absolutely essential. And I think it fits.

2 Thank you for hearing me.

3 JUDGE GROSSMAN: Thank you, Mr. Gaines, and
4 thank you gentlemen.

5 Before we go on to the next speakers, let me
6 mention that the purpose of the limited appearance state-
7 ments is for people living in the vicinity to bring
8 information before the Board that the Board might not
9 otherwise receive during a formal hearing process. It is
10 not to supply a head count for the local papers as to how
11 many were pro and how many were con.

12 To the extent that certain people have given
13 limited appearance statements at Livermore, we thank you,
14 and we do have that information that you have supplied
15 to us, and we would prefer not having you speak again so
16 as to indicate how many people are pro or con.

17 And with that in mind, I believe the next-
18 listed speakers who have not spoken before are Sue Hughes,
19 Helen Serenca, and Edith Stock. Would you ladies please
20 have a seat at the witness table. Thank you.

21 Ms. Hughes, please.

22 LIMITED APPEARANCE STATEMENT OF SUE HUGHES,
23 SARATOGA, CALIFORNIA.

24 MS. HUGHES: My name is Sue Hughes, 19668
25 Ashton Court, Saratoga, California.

2-4 jwb

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1 Gentlemen, my name is Sue Hughes. I am from
2 Saratoga, which is within the 40-mile contamination
3 radius that the Intervenors have claimed is dangerous in
4 case of an accident at this plant, Vallecitos.

5 I am a wife and mother of two teenaged sons
6 and a substitute teacher. I have taken the day off from
7 work to come here today. At the recent hearings on
8 Diablo Canyon a woman representing Mothers for Peace was
9 quoted as saying, "God damn it, I am a taxpayer." Well,
10 gentlemen, God damn it, I am a taxpayer, too, and I am
11 tired of wasting my money on further hearings on this
12 particular subject.

13 I think four years is ample time for the
14 Intervenors in this case to present a valid case against
15 licensing Vallecitos. Since no valid reason has been
16 found or proven, I urge you to license this reactor.

17 I say to you: Enough is enough. If the
18 Intervenors in this case have their way, we will study
19 this reactor, and study it some more, until the General
20 Electric Company finally gives up and goes away.

21 A recent incident is brought to my mind. A
22 young man came to my door soliciting for Green Peace. He
23 urged me to contribute so his organization could save the
24 whales, the seals, and all humanity from nuclear power.
25 We had a rather heated conversation. He told me about the

1 danger of nuclear power plants. I asked him if he was an
2 engineer. He said, "No."

3 When he told me my children would die from
4 leukemia from the radiation, I asked him if he was a
5 physician or a scientist. He said, "No."

6 When he told me about the danger of a nuclear
7 power plant being built on an earthquake fault, I asked him
8 if he was a geologist. He said, "No."

9 What were his credentials, then, I asked? He
10 said, after much hesitation, that he had a degree in
11 economics, and a masters in environmental politics. Well,
12 our conversation had obviously come to a dead end. He
13 stated that "I" had wasted enough of "his" time, and he
14 went on to the next house.

15 I say to you today that enough of your time
16 and my money has been wasted. Please license this plant
17 and let us get on with other matters.

18 Thank you for listening.

19 JUDGE GROSSMAN: Thank you, Mrs. Hughes.

20 Mrs. Serenca?

21 LIMITED APPEARANCE STATEMENT OF HELEN SERENCA,
22 SAN JOSE, CALIFORNIA.

23 MS. SERENCA: My name is Helen Serenca, and I
24 live at 319 Los Pinos Way in San Jose. I am the mother of
25 five children, and I have three grandchildren.

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1 Mr. Chairman and Members of the Committee,
2 ladies and gentlemen, and friends of Mommy Earth out
3 there, there has been a lot of time and money spent to
4 upgrade Vallecitos, and I believe it is safe.

5 My three grandchildren live nearby, and if I
6 thought for one moment that it wasn't safe, I would
7 personally go up there and close the damn place down. I
8 am sick and tired of you people keeping us back from
9 having our freedom and jobs

10 The people opposing Vallecitos are holding
11 back our good old American productivity, and they're
12 adding to inflation. And unless they can prove they are
13 right, Vallecitos is right and you are wrong. I say,
14 Devil be damned.

15 Finally, I think it is a disgrace that a plant
16 that produces radioisotopes for medical purposes has to
17 be shut down, and American has to go begging for nuclear
18 medicine outside of this great country of ours. I want
19 to tell you something. As far as nuclear medicine goes,
20 two years ago we had -- a member of our family came down
21 with a malignant tumor. He would have been gone in three
22 months had it not been for nuclear medicine. He died
23 July 21 of 1980.

24 I am sick and tired of you people saying that
25 you are concerned about our health and welfare, because

1 you aren't. You are only concerned about yourselves and
2 getting publicity.

3 Thank you.

4 JUDGE GROSSMAN: Thank you, Mrs. Serenka.

5 Edith Stock?

6 LIMITED STATEMENT OF EDITH STOCK,

7 LIVERMORE, CALIFORNIA

8 MS. STOCK: My name is Edith Stock. My
9 address is 2262 Hampton Road, Livermore. I have no
10 present or past connections with General Electric at all.
11 My husband does not and never has worked for GE. I know
12 of their contributions to the medical research and to field
13 testing, and for the last 18 years I have lived within
14 six to ten miles of the plant.

15 I have raised two sons who enjoyed the country
16 atmosphere of the plant, hunted birds, and camped and hiked
17 around the plant. They have since grown to adulthood and
18 are quite normal, functioning men.

19 During the earthquake of 1980, my confidence in
20 GE was such that my concern was whether my pool was going
21 to crack, and not whether GE was going to harm the valley.
22 I think my confidence is well placed because of the
23 meticulous precautions that are required in building and
24 operating this plant.

25 The plant was shut down during that earthquake

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1 immediately. There was no danger. There was no problem
2 at all. It was not one of my concerns. My larger concern
3 is that a small group of people consistently conjure up
4 nightmares from "what ifs". Their fears are reminiscent
5 of some people's fears of electricity.

6 I recall my father telling me the story that
7 when electricity was going to be carried into the rural
8 areas of Wyoming, where I was raised, that many people
9 said, "Oh, we can't have that. What if the wires fall
10 on the ground? Then the cattle will be electrocuted and
11 we will lose everything."

12 Because of this small group's incessant
13 repetition of nightmares, our society is denied beneficial
14 technology. I urge that you not listen to them, and
15 listen to the people that live in the valley. This group
16 doesn't even live there, and I do not appreciate or need
17 outside intervention in the name of my protection. In fact,
18 this group is interfering with the technology that
19 benefits me and my family. I question their motives, and
20 I can no longer silently allow them to influence decisions
21 that affect me.

22 I am a teacher in the valley, and I too had
23 to take the day off at a day's pay to come in and see you
24 today. Thank you.

25 JUDGE GROSSMAN: Thank you, Mrs. Stock. Thank

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you, ladies.

Then next listed speakers are Vada Ulrech, and the Reverende W. A. Smith. And if we have further speakers who have not yet signed up with Mr. Hamilton, could you please sign up now?

We also have Marlin J. Ebert. Could he also have a seat at the witness table.

Ms. Ulrech?

LIMITED APPEARANCE STATEMENT OF VADA ULRECH, SUNOL, CALIFORNIA.

MS. ULRECH: My name is Vada Ulrech, and I live at 3453 Little Valley Road, Sunol.

Gentlemen, good morning to you. I have been a resident with my family on Little Valley Road in Sunol for 17 years. That is longer than any other family now living on the road. My home is approximately one mile from the General Electric Test Reactor to the west northwest of the facility.

I am here to encourage you, as the panel of Judges, to allow the GETR to restart its operation. I believe the seismic issue has been and still is being tremendously overstated. It is hard for me to believe that the so-called "verona," whatever it is, is a serious threat to the safe operation of the GETR.

If you had been at my home during the two

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1 earthquakes during January of 1980, you wouldn't have
2 believed that they were as strong and as close as they
3 were. Those events did not even tip over one of the
4 many tall, trophy-like unstable objects that we have on
5 our fireplace mantel.

6 At the time the GETR was shut down by the
7 Nuclear Regulatory Commission, my husband was employed as
8 an engineer with the nuclear safety operation of the
9 Vallecitos site, and was directly involved with the safe
10 operation of the GETR.

11 He was one of those who lost their jobs at the
12 site due to the reactor shutdown. The event has had a
13 dramatic effect on the entire family, from my husband who
14 is now establishing pension credits with a new employer,
15 to my son who at one time thought he might have to drop
16 out of college for lack of funds.

17 Although my husband no longer is employed by
18 the General Electric Company, he and I and my family
19 believe the restart and operation of the GETR poses no
20 serious risk to our health and safety, or to the health
21 and safety of the local community, let along the cities
22 of Alameda, Berkeley, San Francisco, and communities of
23 Merin 25 to 50 miles away.

24 We who have the most to lose from a nuclear
25 accident at the GETR believe the risk is infinitely less

2-11 jwb

1 than the risk we take driving on the highways of the
2 Nation, or walking the streets of Alameda. Berkeley, or
3 San Francisco.

4 I am again encouraging you, the members of the
5 ASLB, to make a positive response which allows the GETR to
6 commence operations again.

7 Thank you very much.

8 JUDGE GROSSMAN: Thank you, Mrs. Ulrech.

9 The Reverend Smith.

10 LIMITED APPEARANCE STATEMENT OF WILLIAM

11 A. SMITH, LIVERMORE, CALIFORNIA.

12 REV. SMITH: My name is William Smith, and
13 I live at 438 Armeda Court in Livermore, and have lived
14 there for eleven years. I am an Episcopal Priest, and
15 I am the Vicar of St. Claire's Episcopal Church in
16 Pleasanton. Until March of 1978, I was the Manager of
17 Nuclear Safety and Quality Assurance at the Vallecitos
18 Nuclear Center, responsible for monitoring the safety of
19 the GETR, among other tasks.

20 I come before you as a Livermore resident of
21 13 years, the leader of a Christian community in
22 Pleasanton, and a person who has had the unique opportunity
23 of looking at the GETR safety issue from the inside out,
24 and from the outside in.

25 I cannot speak for all of Livermore, Pleasanton,

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1 or my church, but as an individual I can. I also consider
2 myself an environmentalist, and on many issues could find
3 myself aligned with Mr. Barlow and his friends, but this
4 is certainly not one of them.

5 The pressure to shut down the GETR implied that
6 the people at Vallecitos were either technically behind
7 the state of the art, technically incompetent, anti-
8 environment, stupid, immoral, insensitive to the community
9 demands, or a combination of all of the above.

10 I do not believe that any of them are true. In
11 my years with GE, I was always impressed with the
12 corporation's willingness to admit the need for technical
13 assistance in many areas where the local GE people did
14 not have special expertise.

15 In my review of the seismic studies done for
16 GE over 25 years, GE always tried to get the best available
17 geologic and seismic expertise. I think this is exemplified
18 by the talent you have seen assembled for this hearing.

19 GE has spent a great deal of money and effort
20 over the years in keeping up with the state of the art.
21 The work of the technical people at Vallecitos has stood
22 constant review of the internal audit and of government
23 audit. The local NRC was seemingly always with us looking
24 in great detail at our calculations and our operational
25 details of the reactor.

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1 GE's technical competence was verified by the
2 20-year safety record of the GETR. While I was with GE,
3 we consistently kept our water and air releases well
4 within regulatory standards. Vallecitos was really an
5 environmentally pleasant place with eagles soaring in
6 the GETR steam, and deer and mountain lions drinking from
7 Lake Lee, which has since been drained.

8 We were all proud of the site and did all we
9 could to make it an environmentally safe and pleasant
10 place to be. While employed by GE, I always understood
11 very clearly that I represented a multinational corpora-
12 tion and not a small reactor in the hills of California.
13 We would not be so stupid as to risk GE's corporate image
14 by taking any safety risks, and I believe that was clearly
15 understood by all of the people that worked for me.

16 The workers at Vallecitos are not immoral
17 people. We would not make deft decisions which would
18 endanger the health of the people living around us,
19 including our own families. It is one of the aspects of
20 the intervention which always boggled my mind. The
21 alarmed citizenry was initially from San Francisco and
22 Berkeley. They did not even know what GETR was, let alone
23 know where it was.

24 The people living around Vallecitos are a very
25 technologically knowledgeable group and were not concerned.

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I think this was mainly because they knew that their technically competent neighbors were making the safety decisions. In picking on GE for their thrust at the nuclear industry, I think the Friends of the Earth have wasted a great deal of effort that they might better have used in protecting the environment.

Thank you, gentlemen.

JUDGE GROSSMAN: Thank you, Reverend Smith.

Is there anyone in the room who would like to offer a limited appearance statement who has not signed up with Mr. Hamilton at the back of the room? If so, please sign up now.

The next speaker is Mr. Ebert.

LIMITED APPEARANCE STATEMENT OF MARLIN J. EBERT, LIVERMORE, CALIFORNIA

MR. EBERT: My name is Marlin J. Ebert. I live at 4049 Fiest Street, Livermore, California. I have resided in the Valley for approximately 11 years, and I would like to tell you briefly of my qualifications so you will understand where I come from in my feelings about the test reactor.

I worked at the test reactor from 1970 until 1976. I have a degree in soil science; I have a degree in molecular biophysics; and I am a registered nuclear engineer; and I am president of a private corporation



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1 which has its base of operation in Livermore, where we
2 do nuclear consulting and we also make nuclear safety
3 equipment, and we do some other things in electronics.

4 I am deeply involved in my community. I am a
5 City Councilman, although I do not speak as a representa-
6 tive of the City Council. You have already had that from
7 Mayor Turner.

8 I believe that General Electric has provided
9 the community with a unique opportunity for private
10 enterprise to exhibit its capabilities within a very,
11 very technically demanding type of situation.

12 I also am a full member of the Society of
13 Nuclear Medicine, and have been deeply involved in that
14 for a number of years.

15 I would like you to realize, I believe, that
16 within the community that we live we have better than
17 8000 qualified scientists and engineers -- that is, within
18 the Livermore, Pleasanton, overall Valley area. And there
19 has been no concern, ever, to my knowledge, exhibited by
20 any of these highly technically qualified gentlemen and
21 ladies who occupy that community to ever come before the
22 City Council of Livermore, Pleasanton, or any of the
23 surrounding communities and voice any concern about the
24 operation of the General Electric Test Reactor.

25 I would point out to you, as I am sure you know,

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1 that the GETR has Test Reactor License No. 1. It has
2 been operated on that site for 24 years now, and it has
3 been done so with a great degree of competence and safety.
4 I personally feel as a scientist and engineer, and a
5 neighbor, that General Electric absolutely does everything
6 that it possibly can do to be a competent operator of
7 that reactor, and would not in any way ask you to relicense
8 it and ask for its startup if they did not feel very, very
9 deeply and very sincerely from the very best of knowledge
10 capability that this was a reasonable and safe thing
11 to do.

12 Thank you.

13 JUDGE GROSSMAN: Thank you, Mr. Ebert, and
14 thank you gentleman and lady.

15 The last speaker we have listed is Kenneth
16 Nightingale.

17 Mr. Nightingale?

18 LIMITED APPEARANCE STATEMENT OF KENNETH A.
19 NIGHTINGALE, OAKLAND, CALIFORNIA.

20 MR. NIGHTINGALE: My name is Kenneth
21 Nightingale. I live at 3912 Suter Street in Oakland,
22 within the 40-mile radius of possible contamination.

23 I do not have expertise in either medicine or
24 nuclear physics. I do have a masters in Theology, but
25 there are several things that particularly distress me.

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1 That is, that the two communities that know the most
 2 about radioactive elements are communities that have
 3 vested interests in hiding information from people.
 4 That is, the medical community and the military and
 5 power facility technicians. That is, that the medical
 6 community has interests in protecting the -- in keeping
 7 information from us about the hazards of low-level
 8 radiation, because they use low-level radiation techniques
 9 in many of their medical practices -- some of them good,
 10 some of them not. And the nuclear power people have
 11 vested interests in keeping knowledge from us about the
 12 hazards of low-level radiation because they regularly
 13 emit all kinds of radioactive materials into the air and
 14 into our water.

15 So it distresses me that the people who know
 16 the most about it have the most vested interest in keeping
 17 some of this information from us. We are often told that
 18 we have nothing to say because we are not experts, and
 19 that interests me, too, because it does not take much
 20 nuclear physics or much biology or physics to understand
 21 that a very small bit of radiation can damage genetic
 22 material in our cells, and cause many different kinds of
 23 cancers, and maybe have different kinds of birth side
 24 effects.

25 The Vallecitos is licensed to routinely emit

1 radioactive pollutants into the air and water in
2 Alameda County. These are dangerous no matter how you
3 look at them.

4 The other thing that distresses me, and which
5 is something that there is no insurance policy to protect
6 us from accidents or from exposure. Now this is the kind
7 of self-indictment that the power plants and the military
8 and other people involved in nuclear power, they indict
9 themselves by admitting that there is no insurance against
10 these kinds of things. And if there is an accident, we
11 are not covered.

12 It is the same for our health hazards. The
13 third thing I am distressed about is a government decision
14 to increase production of plutonium beyond the needs of
15 even the military projections, and what is produced
16 at Vallecitos is not -- most of what is done there is not
17 medical. Most of the things that have been said here
18 today referred to the medical, and I don't think our
19 country needs more plutonium.

20 JUDGE GROSSMAN: Thank you, Mr. Nightingale.
21 That apparently exhausts the list of persons requesting
22 to present limited appearance statements, and that
23 aspect of this.

24 Mr. Cady?

25 MR. CADY: Yes, your Honor. Barbara Shockley

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who has consolidated with Friends of the Earth as
Intervenors would like to give a statement during this
portion of the limited appearances, since she has been
involved with this issue since 1977. I feel it is
appropriate for the Board to allow her to at least get
up and give her views on the situation in these limited
appearances, and if there is no objection from the Board
or other parties I would like to ask the Board to allow
this.

(Board conferring.)

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1 JUDGE GROSSMAN: In view of the fact, Mrs. Shockley,
2 that you have in a sense submerged your intervention in the
3 joint intervention of the other parties, we would certainly
4 permit you to make your statement.

5 MR. CADY: Thank you very much.

6 LIMITED APPEARANCE STATEMENT OF BETTY SHOCKLEY.

7 MRS. SHOCKLEY: I want to thank the Board for
8 this opportunity to make a few remarks. I appreciate it
9 very much.

10 I am not speaking as an Alameda County
11 Planning Commissioner, and I am certainly not speaking for
12 the Commission.

13 However, my five years' experience as a Planning
14 Commissioner concerned with land use planning has colored
15 my thinking.

16 I want to make a recommendation to the Licensee.
17 Secondly, I want to talk about what I consider some
18 difficulties in the relicensing procedure; and then to
19 make a recommendation to the Board for the relicensing of
20 the GE-VNC.

21 That sounds like about a five-day program. I
22 plan to do it in just a few moments.

23 But first I have to go back to some of my own
24 personal history to indicate my interest and my background
25 interest in the problem.

In '43 or '44, I was working as a medical



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1 technologist at the University of Oregon Medical School, and
2 my employer was a rather well-known hematologist who, of
3 course, specialized in the diagnosis of leukemia. And on a
4 trip to the East Coast -- we all were familiar, first of
5 all, that there was a new industrial development being
6 developed in Hanford, Washington, and we were all curious
7 about it because we could get so little information.

8 On one of his speaking trips to the East Coast,
9 he had the fortune to sit beside an engineer on the train
10 and quizzed him to see what he could find out about Hanford,
11 and he did bring back this information, that if our train
12 came to a fence, the crew got off, and then the crew got
13 on and traveled a short distance to another fence, that
14 crew got off, and the third crew got on, and took the
15 train, filled with ore, into the Hanford facility.

16 We spent quite a bit of time in the laboratory
17 which was small, because this was during the war, and most
18 of the technicians and students were away fighting the
19 war, but we never did discover what was happening at
20 Hanford.

21 About a short time later he was asked by the
22 AEC or the people at Hanford to send some technicians which
23 he trained at Oregon Medical School to go to Hanford to
24 do white counts on the employees who worked there and, of
25 course, we were all interested and knowledgeable about why



1 they were doing white counts, but since then I have been
2 interested in this whole issue of public health, and I forgot
3 to bring some of my background material up to the desk. If
4 you will excuse me just a second.

5 And in coming across this Inspection & Enforcement
6 report from the Region V Nuclear Regulatory Commission, it
7 was a routine, unannounced inspection, and the dates of
8 inspection, September 15 and 23, 1976. This is for the SNM,
9 Special Nuclear Material. If I may read just a quick
10 sentence on page 6.

11 "The nuclear safety operation retains the
12 customary health physics" -- this was just a long report
13 about their safety, which was a very fine report, as far
14 as I'm concerned -- "including contamination, radiation
15 surveys, health physics, air sample records, continuous
16 iodine and continuous air monitor charts, whole body counts,"
17 and so on. And then finally, "all internal and external
18 exposure monitoring records and related correspondence
19 have been retained since the beginning of operations in
20 1957."

21 I want to congratulate GE for doing that. I
22 think that is a marvelous thing to do. I don't know whether
23 it was required. From what I read here, it wasn't. Perhaps
24 it was, but my recommendation is that it would be very
25 marvelous if this could be a model for reporting to the



1 public and to the scientific, to the medical community, the
2 effects or no effects on the employees who have worked there
3 on and off, different ones, of course. But there has been a
4 period of about 24 years, and I should think this would be
5 very interesting, and I would like to see it.

6 My second comments have to do with the way I
7 view the business of the regulatory agencies. I think there
8 is a tremendous fragmentation of the regulatory function.
9 I think it happens between agencies and within the agency,
10 and I can define the problem to some extent. I certainly
11 have no solution, but I have a couple of examples, many
12 examples, and my own experience in one was recent.

13 The San Francisco Regional Water Quality Control
14 Board issued a five-year NPDES permit -- that's a National
15 Pollution Discharge Elimination System permit -- for GE-VNC.
16 Now the Regional Water Quality Board is a state regulatory
17 agency. The state defines hazardous waste as including
18 radioactive waste.

19 However, the definition for EPA is radioactivity
20 and waste discharge effluents is not a pollutant as defined
21 in the Federal Clean Water Act. So as a result, we have
22 the NRC, we have the EPA, State Health, Regional Water
23 Quality and all others, all avoiding, in my view, the
24 problem as much as possible.

25 In the second instance, the United States

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1 Geological Survey did a short study of the Vallecitos
 2 Valley, and the report indicated that the direction of the
 3 groundwater flow -- and I think there has been a real lack
 4 of study of groundwater, not just in this valley, but
 5 everywhere, and we must be about that problem -- the direction
 6 of that flow is from the Vallecitos site to the Niles Cone
 7 which is, of course, a groundwater recharge basin for the
 8 120,000 people who live in the Tri-City area. At the same
 9 time, this was new information, apparently -- because in
 10 the past, and that would have to be since '57, the ground-
 11 water was assumed to flow in the opposite direction to the
 12 northeast instead of the southwest. That troubles me.

13 At the same time, the Alameda County Flood
 14 Control and Water Management District Zone 7, which is the
 15 agency for groundwater resource management, protection and
 16 control in the Amador-Livermore Valley, knew nothing, had
 17 no involvement in this particular study.

18 I think fragmentation is equal or greater in
 19 regulation of transport of radioactive materials, and in
 20 many other ways.

21 I believe that there has been no coordinated
 22 effort in effective waste changes.

23 Now, as a Planning Commissioner, I prefer to
 24 isolate problems. In the first place, it prevents headaches,
 25 and it also makes the solutions appear more manageable.



1 One usually discovers, however, that is planners
2 of land use in the long term, inclusion of at least the
3 obviously related issues is prudent and ultimately saves
4 time and money.

5 For example, the County of Alameda in 1956 issued
6 a conditional use permit to the GE-VNC for construction of a
7 reactor.

8 Following that, three other reactors were built.
9 There has been deactivation of two of those reactors and a
10 number of lesser construction proposals have required amend-
11 ments to that original conditional use permit. Each was
12 approved by the County as though it were a completely
13 independent unit with no relationship or effect on previously
14 approved component parts of the facility.

15 I believe that the same pattern seems to apply
16 to the NRC relicensing procedure. Perhaps the NRC should
17 consider a two-phase licensing process; phase one being for
18 a specific structure; and a phase two license for its fit
19 into the overall facility on the site. And this becomes
20 more relevant as you get structural damage caused by a
21 seismic event.

22 Is there not a need for an analysis of inter-
23 relationships among all the buildings and structure of the
24 GE-VNC?

25 Actually the Licensee and the NRC Staff have

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1 achieved the ultimate in focus by limiting consideration of
2 structure to the core section of the GETR.

3 Perhaps one should ask what would be the effect
4 of a design earthquake, one, on a 500,000 gallon water
5 tank?

6 I remember seeing photographs of the tank tower
7 at the Concannon Winery, and it had not fallen, but it wasn't
8 that sturdy at that point, either.

9 Two, on the nuclear test reactor, the boiling
10 water reactor, experimental superheat reactor, what effect
11 would this have on the security building? Is there a
12 relationship between the H-trench and the security building
13 or building 102? What is the NRC's interest in the
14 decommissioning process for the boiling water reactor?
15 One or both of which must be secured for 100 years. Does
16 that time element not introduce a new factor in light of
17 new information on earthquake potential?

18 The public is looking to the NRC to answer these
19 questions. The problem is not need or focus, it is
20 complex, and the need to address this problem is becoming
21 more acute each day.

22 I thank you.

23 JUDGE GROSSMAN: Thank you, Mrs. Shockley.

24 That concludes the limited appearance statements.

25 MR. EDGAR: Mr. Chairman, I have one item that I

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1 should call to the Board's attention. A telegram was called
2 in to the front desk by the mayor of Pleasanton. I have the
3 text of the telegram. My preference would be to show it to
4 all parties and hand it to the reporter and ask that it be
5 included in the transcript as a limited appearance statement.

6 JUDGE GROSSMAN: Well, we permitted one of the
7 parties to make a limited appearance statement. I don't see
8 why we would preclude you from reading that into the record,
9 Mr. Edgar.

10 MR. EDGAR: Fine. I'll be glad to do it.

11 "Regarding the 5-70, the City of Pleasanton
12 supports the reopening of the GE Test Reactor at Vallecitos
13 for the following reasons:

14 "One, provide employment for citizens;

15 "Two, does not appear to pose a safety threat;

16 "Three, safety regulations and inspections are
17 being constantly performed;

18 "Four, we need the energy sources.

19 "Please excuse me for not attending your hearings.

20 I am unavoidably detained at my employment. Our City
21 Council unanimously endorses the reopening of the GE Test
22 Reactor. Please help us in this matter."

23 Signed, Kenneth R. Mercer, Mayor, City of
24 Pleasanton, Post Office Box 520, Pleasanton, California.

25 JUDGE GROSSMAN: Thank you, Mr. Edgar.

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1 At the risk of being redundant, I believe that
2 finally concludes limited appearance statements.

3 We will take a five-minute recess.

4 (Recess.)

5 JUDGE GROSSMAN: The hearing is back in session.

6 The next item on the agenda is the continuation
7 of the examination of Dr. Brillinger, and I believe Mr.
8 Edgar was in the middle of that examination.

9 Before we proceed with that, I would just like a
10 clarification with regard to the agenda that has been
11 adopted by stipulation of the parties, and then Board
12 approval.

13 The program does not specify any particular
14 time for rebuttal testimony, and it was my assumption --
15 perhaps incorrect -- that rebuttal would be offered
16 immediately following cross-examination of the party; that
17 is, direct examination, in addition to what was filed, would
18 be undertaken in the form of rebuttal of what had been
19 offered by the other parties prior to that.

20 I don't know if I'm making myself clear, but
21 just to get the example, GE had a few panels testify, and
22 at the current time the Intervenor's witnesses are
23 testifying and are being cross-examined.

24 I would assume that the parties contemplated
25 that immediately following the cross-examination that the

1 redirect by the Intervenors would also encompass rebuttal
2 of what GE's people have put on.

3 Am I correct in that assumption?

4 Mr. Swanson, would you first tell me what your
5 opinion is on that?

6 MR. SWANSON: Yes, we did assume that there
7 would be an opportunity for rebuttal. The Staff intends,
8 at least on the first issue, to conduct perhaps 15 minutes
9 of oral examination of our first panel in the form of
10 rebuttal, actually at the very beginning of the presentation.

11 Redirect then would just take the form of
12 examination of issues that were hit on during cross-
13 examination. So we would intend to get rebuttal at the very
14 beginning, so that the parties and the Board would have a
15 full presentation before examination begins.

16 JUDGE GROSSMAN: I see. And that perhaps makes
17 more sense, but it appears to me that the Intervenors have
18 not yet pursued that course, at least not with Dr.
19 Brillinger, because we began the cross-examination and
20 the direct testimony. The prefiled testimony related to
21 the material that had been presented prior to the prefiled
22 testimony by GE and the Staff, and I don't believe Dr.
23 Brillinger directed any remarks to subsequent submittals
24 to the Board.

25 Isn't that correct, Mr. Cady?

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end 3

1 MR. CADY: That is correct, your Honor. We were
 2 waiting for Mr. Edgar to finish his cross-examination before
 3 going into areas that have been brought out by GE's
 4 probability expert.

5 It is our opinion, or our intent, that any
 6 rebuttal testimony that we try to elicit from Mr. Brillinger
 7 will not be as significant.

8 Getting to the other areas of seismology and
 9 offset, I believe that for us to conduct adequate rebuttal
 10 so that we don't keep flip-flopping witnesses, that we
 11 should wait for the GE, or rather, the Staff seismology and
 12 offset panel to finish their presentation before we do call
 13 our experts -- alleged expert, Mr. Barlow, to rebut any
 14 testimony.

15 So that we will not be going back and forth
 16 between parties.

17 JUDGE GROSSMAN: I understand that, though you
 18 haven't put any time in the program. And I'll tell you, I
 19 don't intend to stay here much beyond what's already been
 20 programmed. So I did want to get an idea of what the
 21 schedule would be on that. But that's fine.

22 We understand where you are now.

23 Mr. Edgar?

24 Whereupon,

25 DAVID BRILLINGER
 resumed the stand and having been previously duly sworn,
 was examined and testified further as follows:

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1 MR. EDGAR: I have no problem with the
2 procedure as Mr. Swanson suggests. I would suggest,
3 though, that if it is possible, if Mr. Cady could have --
4 I recognize the problem that he describes with
5 Mr. Barlow. I don't see any problem with parties putting
6 on oral rebuttal. There is only one that I see, and if
7 you are first you do not have anybody to rebut.

8 I am speaking of our own panels. We will
9 have a succession of witnesses following GE, and we
10 would like to reserve the opportunity to put on our
11 people. They are here, and we could do it, to put on any
12 brief responsive remarks toward the end.

13 JUDGE GROSSMAN: I am not sure I understood
14 the illusion, but perhaps it has something to do with
15 the status of the Intervenor's testimony?

16 MR. EDGAR: I am sorry if I was confusing
17 there. It is simply this: GE's panel went on first.
18 The other parties are being afforded an opportunity for
19 rebuttal. GE cannot very well rebut what other people
20 say before they say it, and thus I have no problem with
21 the procedure that the parties have suggested. But we
22 would also like to have the opportunity, and indeed it
23 is our right, to have some form of rebuttal.

24 JUDGE GROSSMAN: Right. Absolutely. And the
25 reason this has not been brought up by the Board before was

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1 that it was not ripe until this time for any of the
2 parties to offer rebuttal. That is, understanding the
3 status of GE and the fact that they had not yet had
4 testimony to rebut.

5 So the Board is cognizant of the point that
6 you are bringing up, Mr. Edgar. So now we may proceed
7 with the cross-examination of Dr. Brillinger.

8 CROSS-EXAMINATION

9 BY MR. EDGAR:

10 Q Dr. Brillinger, during the cross-examination
11 on Friday you mentioned, in response to a hypothetical
12 that I posed where one was doing coin tosses, and there
13 was a history of 128,000 "tails." I had asked you
14 whether or not one could calculate the probability of
15 a "head." You responded that you could do so, provided
16 you were given confidence limits.

17 Could you calculate the probability of a
18 "head" on the next toss in the example for three
19 confidence limits of 95 percent, 90 percent, and 63
20 percent?

21 A If the probability of the coin is a certain
22 parameter -- call it π , then there is a formula one
23 can set down for the probabilities of "heads" and "tails"
24 coming up the next toss. One can estimate the parameter
25 π on the basis of the information that has been provided.

1 Q Could you do that?

2 A Would you tell me the specific problem?

3 Q Yes. 128,000 "tails" would come up. What is
4 the probability of a "head" on the next toss?

5 A The probability of a "head" is unknown with
6 the information you have given me. That is the pi value
7 that I was referring to.

8 Q Can you calculate the probability of a "head"
9 on the next toss for a 95 percent upper one-sided confi-
10 dence limit?

11 A One can provide a range of values such that
12 the chance that the next -- I think I'll simply answer
13 that, "no."

14 Q It can't be done?

15 A Suppose one has a coin that has some
16 probability of a "head" coming up. One can then set
17 down formulas for probabilities of various events taking
18 place. So the probability of a "head" the next toss, if
19 independent tosses are going to be made and the coin is
20 not changing, is pi. It is the probability that is
21 associated with the coin.

22 If you propose a statement to me, then
23 perhaps one would be able to work out the probability
24 going along with that particular statement.

25 Q What information do you need in the statement?

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1 A. The statement will have to be what is
2 technically called an "event" that goes along with a
3 particular experiment that you are talking about.

4 Q. Would you please list for me the information
5 you would need to calculate the probability of a "head"
6 on the next toss? What kind of information?

7 A. I would need to know the probability of a
8 "head" on any single toss to compute the probability of
9 a "head" the next time.

10 Q. So you must have -- that is a given before the
11 fact?

12 A. Before I can evaluate the probability; yes.

13 Q. You find no use whatsoever of the prior history
14 that a "tail" has come up 128,000 times?

15 A. In the calculation of the probability, no.
16 In the estimation of such a probability, yes.

17 Q. Okay. Could you estimate the probability?

18 A. My estimate would be that it is very small.

19 Q. And what is it numerically?

20 A. I can't estimate it numerically. People have
21 proposed quite a variety of estimates for the probability
22 in those circumstances.

23 Q. But there is no means of providing a quantita-
24 tive estimate of that?

25 A. There are several means of providing

1 quantitative estimates, and people have proposed them.
2 Some people have proposed it as a half, because that is
3 the value that has the least deviation from whatever the
4 true value is. It is right in the middle.

5 LePlasse, as I indicated in my testimony,
6 indicated that it would be $1/N + 2$. People have proposed
7 mini/max estimates, Bayes' estimates, there are a number
8 of estimates that have been proposed for that
9 probability. There is no agreed-upon single estimate.

10 Q Well, I'm not looking for a consensus; I am
11 looking for some practical application of the problem
12 here.

13 A I indicated on the last day that if a double
14 experiment had taken place for, first of all, the coin
15 selected from a batch of coins that have probabilities of
16 a "head" being uniformly distributed between zero and one,
17 and that was then followed up by flipping that single
18 coin 128,000 times, or whatever, then one could -- then
19 the estimates of $1/N + 2$ is an acceptable estimate.

20 But, you see, there is a preliminary
21 experiment that is taking place.

22 Q You must have external information, then, to
23 determine whether or not the $1/N + 2$ is a valid
24 estimation?

25 A Yes. That estimate is derived from certain

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1 mathematical assumptions.

2 Q But you as a classical statistician would be
3 unwilling to take the information 128,000 "tails," and
4 use the LePlasse formulation without some external
5 evidence which would characterize the coin?

6 A I would start by saying how many collective
7 statisticians. I believe in using Bayes in some
8 circumstances; traditional statistics in other
9 circumstances; fiducial imprints in yet other circum-
10 stances. I strongly believe that when one is involved
11 with a scientific problem, one needs to spend a great
12 deal of time learning the background science that goes
13 along with that problem.

14 Q All right. Now so you will admit, of the
15 possibility that Bayesian techniques can have valid
16 application when accompanied by external information
17 about the process with which one is working?

18 A Yes, certainly.

19 Q Now let us suppose that we are doing the
20 coin-tossing experiment, and you approach a physicist who
21 understands some of the concepts, the physical concepts
22 that might affect the behavior of the coin. And that
23 particular physicist advised you that the coin was fixed.
24 It was lead on one end, a layer of lead and a layer of tin,
25 and further that that physicist advised you that the coin



1 would tend to stay on track. That is, it would tend to
2 create tail, after tail, after tail. Now would you be
3 willing to consider his judgment to that effect and apply
4 Bayesian techniques to the next prediction?

5 A. It would depend upon the circumstance. If it
6 was a gambling circumstance and all that was at stake was
7 my own money, then I would be quite happy to proceed in
8 such a fashion, accepting the opinion of some other
9 individual. But someone once remarked that Bayes methods
10 are used for private use, not public use; and you have
11 described what I would consider a private problem to some
12 degree.

13 Q. You wouldn't bet your money on a "head" the
14 next time, would you?

15 A. Well, I -- I don't want to say something trite,
16 but what I always tell my family is that I don't make bets.
17 So I just wouldn't get involved in that particular case.

18 Q. If you saw 128,000 tails recurring, and we
19 were ready for the next flip, would you put your own money
20 on it?

21 A. I doubt it very much, because it would be such
22 an unusual circumstance that I would be very suspicious
23 of what is going on here.

24 Q. You would become suspicious after 128,000 tails?
25 (Laughter.)

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1 A I would be suspicious at the beginning, if
2 it was a gambling situation.

3 Q All right, now, but you will admit that the
4 use of Bayesian techniques, along with the external
5 information provided by the physicist, may indeed have
6 validity?

7 A It may; yes.

8 Q Okay. And indeed you would have to then judge
9 whether the physicist was providing you with valid
10 information?

11 A Yes. It is a very subjective situation.

12 Q But nevertheless a situation that may provide
13 some full result in terms of your willingness to place
14 money on the next trial?

15 A It may.

16 (Pause.)

17 Q Now going back to the first question I asked
18 you, you indicated that given the information that I have
19 provided you could not calculate the probability of a
20 "head" on the next trial, but you believed that it would
21 be very sm-ll. Can you provide any estimation as to the
22 quantification of the probability of a "head" on the next
23 toss?

24 A I can't provide a -- there's no formula I
25 would be happy with setting down. I am very happy to



1 say it appears that it would be very small.

2 Q All right. Am I again to make sure I understand
3 it, there is no way, using classical techniques, without
4 having external information about the quality and behavior
5 of the coin, that you can predict the probability of a
6 "head" on the next toss?

7 A I think there are some things that are being
8 confused here.

9 Q All right.

10 A The specific mathematical formula for the
11 next -- for the probability of there being a "head" the
12 next time, the difficult is it has an unknown parameter
13 in it.

14 The other aspect of the problem is the estima-
15 tion of such a probability. Now you asked me a question
16 that was an estimation problem. I am happy to estimate it.
17 You can estimate it by a half.

18 Q Okay.

19 A You can estimate it by one. You can estimate
20 it by an apple.

21 Q All right. But do you believe that one-half
22 is the probability, $1/2$ is a valid estimation of the
23 probability of a "head" on the next toss?

24 A I do not, but it is an estimate. Now you're
25 talking about a "valid estimate."

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1 Q I am asking you, if you are given the problem,
2 if we have a statistical problem and there is a need for
3 a practical answer, if you tell me that there are
4 thousands of answers, how am I going to use that
5 information?

6 A The answers are classified as to the degree of
7 appropriateness, and there are various criteria that
8 statisticians have evolved for saying that this is a
9 good estimate, and this is a poor estimate. The criteria
10 that one uses depends upon the particular circumstance
11 you find yourself in, the particular assumptions that
12 seem reasonable for the following hand.

13 The half value, all that does is minimize the
14 distance to the true value among all estimate that you
15 might think of. It is the number that is right in the
16 middle. There are mean square estimates, there are
17 mini/max estimates --

18 Q So you are telling me that there are many
19 estimates, but it is just very difficult to provide a
20 practical answer? If I am asking you for advice as to
21 whether I should put a dollar on the next toss, how can
22 I use what you have just said?

23 A Well, if --

24 Q Should I do it, or not?

25 A If you've constructed a gambling situation,

1 and the stakes are a mere dollar, then -- people have
2 evolved an estimate for that particular circumstance
3 that are going to maximize the winnings of the individual
4 involved. The LePlasse formula is something like $1/N + 2$.
5 That formula, I believe, was something like a half over N
6 plus a half.

7 You see, it depends upon the particular
8 situation you find yourself in, and the particular
9 assumptions that seem reasonable for that situation.

10 Q Okay.

11 A If you just leave it as an abstract mathe-
12 matical problem, the probability is pi; and pi is unknown.

13 Q And that is abstract. In other words, it is
14 not useful in determining what one should do.

15 A I think in the present circumstances, the
16 remark that the probability of a "head" coming up is
17 very small. It lets one deal with many situations very
18 effectively. But one doesn't formalize it. One doesn't
19 give a specific numerical value for the probability.

20 Q One just cannot do that?

21 A Well, the thing is that there are circumstances
22 and there are criteria within which one can provide
23 estimates; and the estimates have described optimality
24 problems.

25 Q Now let's change the hypothetical slightly.

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1 Let's assume that we have 128,000 tails, and you are also
2 advised by a reliable observer that the counter of the
3 trials was miscounting and in fact there were more than
4 128,000 tails. That is known. And there could be as
5 many as 150,000. But the exact number is not known.

6 Now would that external fact influence in any
7 way your willingness to estimate the probability of a head
8 on the next toss?

9 A. With that change you said, I would just
10 continue to refer to it as being something of low
11 probability.

12 Q. But again you would be unwilling in that
13 instance to rely on the LePlasse formulation?

14 A. Certainly.

15 Q. To guide you on the next try?

16 A. The LePlasse formula is derived under very
17 specific assumptions. If those assumptions seem
18 reasonably approximated in practice, I am happy to use
19 it. But the circumstances you have just been talking
20 about are not of that character.

21 The LePlasse formula is a double experiment.
22 First a coin is selected with some probability of pi at
23 random. And then that coin is flipped a number of times.
24 That is the preliminary experiment that is lacking in
25 your examples.

1 Q All right. But nevertheless, in spite of
2 the information I have given you, which is to the effect
3 that there were more than 128,000 tails, you are
4 unwilling to rely on the simplification of the LePlasse
5 equation?

6 A Oh, definitely.

7 Q So that would have no bearing on your
8 willingness to risk, or to predict the next head for the
9 next toss?

10 A If you tell me that in fact there were a
11 larger number of coin flips that were continually entailed,
12 then my estimate, if I had such a thing in a formal
13 sense, but in a qualitative sense, anyway, would be
14 smaller; that there seems evidence that the probability
15 is yet smaller than what I had agreed for it to be.

16 Q Wouldn't that give you greater confidence in
17 relying in $1/N + 2$ as a prediction of the outcome?

18 A No.

19 Q It wouldn't have any bearing?

20 A No. See, that is derived under particular
21 assumptions. The assumptions simply aren't satisfied.

22 Q Have you reviewed all of the geology reports
23 which have been submitted by GE in these proceedings?

24 A I made up a list over the weekend of the
25 documents that I did review, which I have here if you

1 would like to look at it.

2 Q Oh, yes. That would be fine.

3 (Mr. Cady distributes the document to the Board
4 and the parties.)

5 JUDGE GROSSMAN: Why don't we mark that
6 docume-t as Intervenor's Exhibit No. 6, I believe we are
7 up to now, for identification.

8 (The document referred to
9 was marked as Intervenor's
10 Exhibit No. 6 for
11 identification.)

12 (Pause.)

13 BY MR. EDGAR:

14 Q All right. Okay, now Intervenor's Exhibit
15 No. 6 is a list of documents that you prepared which is
16 entitled "Some of the Documents Reviewed by David R.
17 Brillinger in connection with the Vallecitos Nuclear
18 Reactor/GETR." Is that correct?

19 A Yes.

20 Q Is this "the" list of the documents that
21 you reviewed? I am trying to figure out --

22 A The way I prepared this list, which may
23 answer your question, is I simply looked around in my
24 study and saw the documents that were there, and then I
25 just ordered them by date.

1 Q Okay. But this is what --

2 A The reason for the "some" is, one, I am a
3 statistician and everything needs to be properly
4 qualified; and two, I had gone and checked various of
5 the references that were listed in these documents by
6 going to the library and looking up the paper, and I
7 could not remember which of those, over the weekend.

8 Q And these were the matters in the literature?

9 A Yes.

10 Q I see. But in terms of submittals by GE to the
11 NRC, and the NRC reports or reports of NRC consultants,
12 this is a complete list?

13 A As far as I know, yes.

14 Q Within the limits of statistical uncertainty.

15 A Yes.

16 (Laughter.)

17 Q Is it your belief that you have reviewed all
18 of the geology reports prepared by GE and its consultants
19 and submitted to the NRC?

20 A I am not sure if you are focusing on the
21 word "review." I have read various documents to differing
22 degrees of detail. I flipped through, I would say, all
23 of the pages of all of these documents there (indicating).

24 Q Of these, and none other?

25 A That I know of.

1 Q Right.

2 What I am asking you: Is it your belief that
3 you have reviewed all of the geology reports prepared by
4 GE or its consultants for the purposes of these
5 proceedings?

6 A No. Definitely not, because I didn't ask
7 anyone the question, "Are these all of the documents?"

8 Q You didn't?

9 A No.

10 Q How did you determine which documents you
11 should review?

12 A These were the documents that were provided
13 to me.

14 Q By whom?

15 A By Lee Halderman and Glenn Cady.

16 Q Do you, or do you not know whether these
17 documents represent a complete representation of the
18 analyses performed by GE or its consultants in these
19 proceedings?

20 A I do not know that they represent -- I forget
21 the word you used -- but the whole set of what GE did.

22 Q Are you familiar with any of the studies
23 performed by GE on soil/structure interaction at the
24 GETR site?

25 A I'm not clear just what was done by GE, and

1 what was done by NRC. I read some of the material on
2 using the finite element methods to be getting at the
3 soil/structure interaction.

4 Q Have you performed any analysis, or have you
5 performed any review of the GE failure plane analysis for
6 the soil conditions at the GETR site?

7 A To the extent that it was referred to in
8 these documents, I would probably have read it. I
9 certainly saw some words that related to that, but just
10 which specific document they were in I am not sure at this
11 point.

12 Q And indeed you are not sure whether a complete
13 description of that analysis was included within the
14 documents that you reviewed? Is that correct?

15 A That there was more work? That more work had
16 been done than was referred to in these documents? I
17 certainly don't know whether there were or not. That
18 was the case.

19 Q Have you reviewed any thermal hydraulic
20 analysis for the GETR reactor performed for these
21 proceedings?

22 A No.

23 (Pause.)

24 Q On page 3 of your testimony, if you could
25 refer to the second paragraph, and in the third sentence

1 you quote a reference from a U.S. NRC Standard Review
2 Plan.

3 A. I quote the report.

4 Q. Yes. Do you see that reference?

5 A. Yes, I do.

6 Q. Okay. Is it your opinion that Bayesian
7 analyses will not satisfy the requirements set forth in
8 that standard review plan?

9 A. I think it is an interesting question what the
10 NRC meant by the word "probability" when they set down
11 that statement, whether they meant classical probability
12 that has a long-run frequency definition, or they were
13 willing to accept other types of probabilities.

14 Q. It is a question in your mind as to what they
15 meant? Is that correct?

16 A. Definitely. I doubt they meant subjective
17 probabilities, but I don't know.

18 Q. Do you know?

19 A. I certainly don't know.

20 Q. Are you aware of any instances in which
21 Bayesian techniques have been used and applied in NRC
22 regulatory practice?

23 A. No, I'm not. I have seen several papers
24 referring to the methods in the Nuclear Safety Journal.

25 Q. Are you familiar with the so-called "Rasmussen



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1 Report" that is WASH-1400?

2 A Yes. I've never read through it. I've read
3 many articles describing it, and I have read a brief
4 report of the review committee of that report.

5 Q But you have not read the report?

6 A I understand it is three feet thick. I have
7 not read it.

8 Q Do you understand that there are Bayesian
9 techniques employed in that report?

10 A From the other things I have read, I can
11 believe that. From the reports I have read, from the
12 critiques I have read of the Rasmussen Report, I can
13 believe that there are Bayesian techniques used.

14 Q I am not hearing you. I did not hear the
15 last word, the last word you spoke.

16 A "Used."

17 JUDGE GROSSMAN: I believe he said that
18 from the critiques he has read, he could believe that
19 there were Bayesian techniques used. Is that what you
20 said?

21 THE WITNESS: Yes.

22 BY MR. EDGAR:

23 Q I missed the word "used." That's what I
24 didn't understand.

25

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300 7TH STREET, S.W. REPORTERS BUILDING, WASHINGTON, D.C. 20024 (202) 554-2345



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Could you turn, or on the same page, page 3, comment 3, there is a paragraph at the bottom of the page that refers to the one-dimensional versus multi-dimensional treatment of the problem, and you suggest that the relevant probability to seek to evaluate is that of a curve; is that correct?

A Yes.

Q Can you provide any physical, theoretical or other explanation of what would cause the fault to curve or bend into the foundation?

A Curve into it?

Q Yes.

A What I meant by my statement was here we have an object and here there is a fault plane at the curve or basin. The problem is whether these two are going to run into each other.

I am not trying to imply the curve is attracted into the building somehow.

Q Are you aware of any arguments or bases to support the theory that it would curve into the building?

A Because the building was there, it would be attracted towards it?

Q Yes.

A Well, the sort of thing that comes into my mind is

1 someone is standing on thin ice and the ice starts to break,
2 will their weight attract it towards them? I don't know
3 about --

4 Q Do you think that theory applies here?

5 A The circumstances are very different, but the
6 fact that there is at least one other situation, there is a
7 possibility. I'd be very surprised. But I don't know.

8 Q On page 4, comment 4, at the top of the page,
9 the comment is the Poisson process is approved, and the
10 assumption is questioned. Would you prefer the use of an
11 alternative assumption, such as a hazard-increasing function?

12 A I would prefer a general point process description
13 of the occurrence of the event.

14 Q Would you take issue with the use of a hazard-
15 increasing function? That is, a function that makes it more
16 likely that the event will occur if it hasn't occurred in
17 the past?

18 A I think for any of the seismological models, that
19 is a reasonable assumption.

20 Q Would it be a reasonable assumption here?

21 A I personally now believe that it's a lot more
22 reasonable than having constant hazard as the Poisson, as a
23 decreasing hazard, as the Bayesian argument.

24 Q All right. So you would prefer the hazard-
25 increasing function and believe that to be an appropriate



1 assumption?

2 A Prefer it to which?

3 Q For the application of the GETR site.

4 A I would prefer to make as few assumptions as are
5 necessary and to take a general point process description of
6 the phenomenon. The hazard function is a parameter that
7 goes along with this particular sorts of models.

8 Q Would you object to the assumption?

9 A No.

10 Q Are you aware that GE performed an analysis
11 using a hazard-increasing function?

12 A Yes.

13 Q Are you aware that the results of that analysis
14 did not differ significantly from the results with the
15 Poisson assumption?

16 A I disagreed with the assumptions on which the
17 hazard analysis was based. They chose a particular sort of
18 point process, namely renewal process, with which to carry
19 through that analysis, and in the renewal process the times
20 between successive events remained statistically independent
21 of each other. They had that in common with the Poisson
22 process. It's the assumption of independence that I object
23 to especially.

24 Q Would the assumption of independence be at all
25 affected in your mind if you were advised by geologists,

1 seismologists and soils engineers from their experiments on
2 site that there is a very high likelihood that the shears
3 found at the GETR site would continue to exhibit movement
4 in the future on the shears and not off the shears?

5 A That seems a totally separate issue.

6 Q Well, whether it's total or not, would that
7 influence your view of the analysis?

8 A If the scientists were saying this is their
9 opinion, I would certainly take note of it.

10 Q You would?

11 A Yes, I would listen closely and think about it.

12 Q And would that have any influence upon your view
13 of the validity of the analysis?

14 A The validity of carrying through the Weibel and
15 normal analyses that have the increasing hazard functions?
16 No. Because it's a totally separate concept.

17 Q On page 4, comment 5, you indicate, and I quote,
18 "I sense a belief on the part of the report's authors that
19 any new movement is a lot more likely to take place on
20 one of the existing shears.

21 "If this is the case, why is there more than one
22 shear at the site?"

23 Have you examined the soil conditions and rock
24 mechanics at the site?

25 A No.

ar5-5

300 7TH STREET, S.W. REPORTERS BUILDING, WASHINGTON, D.C. 20024 (202) 554-2345

1 Q Is it possible that the shears formed at the same
2 time?

3 A I would think, yes.

4 Q Are you aware of any evidence to the effect that
5 they didn't?

6 A No.

7 Q Do you have any reason to believe that there is a
8 high probability of a shear forming off of an existing shear
9 in the future?

10 A The material that I have made -- excuse me, that
11 I have read concerned with fracturing processes and things
12 of that character, all indicate that it's a very, very
13 complicated matter, and I have seen seismologists referring
14 to the formation of shears and strands of faults and things
15 of that sort as being very complicated matters, and they
16 are continually surprised by what they find.

17 Q Well, I'm asking you for your view. Would you
18 prefer not to express an opinion on that point? Is that
19 what you're telling me? My question is this:

20 Do you have any evidence to suggest that there is
21 a substantial likelihood that the displacement in the future
22 will occur off of the shears?

23 A I think the possibility of it occurring off the
24 shears is to be considered very seriously.

25 Q And what evidence would you present or can you



1 advance to support the proposition that it is likely that
2 it will occur?

3 A Simply the remark that these are very complicated
4 matters, that the shearing can have a very complicated
5 structure, that it's not understood by the scientist.

6 Q Well, is it understood by you? I take it you're
7 not expressing an opinion here as a seismologist or geologist
8 about the site?

9 A No, I'm behaving as a statistician, seeing
10 certain statements made and asking does the evidence justify
11 the statements that have been made.

12 Q Could I ask you to turn to page 5, and would you
13 refer to the first paragraph, and the two sentences in
14 question are:

15 "Certain distributional assumptions are made.
16 These may be checked with" -- and I'll have to spell the
17 author's name, I'm not sure of the correct pronunciation --

18 A Sieh.

19 Q And that's spelled S-i-e-h, and the sentence
20 reads:

21 "These may be checked with Sieh's data. Why
22 wasn't this done?"

23 Is your concern here, I take it, that the
24 assumption should have been checked against Sieh's data?

25 A Yes, there was the Poisson talked about, a

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1 normal distribution talked about, a Weibul distribution.
2 The data was there, but there was no evidence they had put
3 these hypothetical distributions up against the data.

4 Q Do you have any reason to believe that the data
5 would be relevant to the analysis at the GETR site?

6 A I think it was a fine idea that they turned to find
7 alternative data to bring to bear on the problem. There
8 will be the difficulty of scaling and the necessity, the
9 degree to which the circumstances are comparable.
10 But searching out data rather than applying the Bayesian
11 argument, I think is the appropriate way to proceed.

12 Q Well, I guess I don't understand. You on page 5
13 make the comment that the distributional assumptions should
14 be checked with Sieh's data and raise the question as to why
15 wasn't this done. But at the same time I assume you also
16 recognize that there was some comparison of Sieh's data
17 with the GE analysis?

18 A Yes.

19 Q Do you believe that Sieh's data is relevant to
20 the GE analysis?

21 A Yes, I do.

22 Q Would you agree that Sieh's data is from the
23 San Andreas Fault?

24 A Yes.

25 Q Would you explain to me why on page 6, comment 9,



1 in that paragraph, you say:

2 "I regard the numerical values determined in
3 this approach one as totally unjustified and as based on a
4 procedure subject to easy manipulation. The authors are to
5 be commended for seeking out data. However, why should San
6 Andreas results be relevant? The fault is so very different."

7 Now would you agree that in the context of paragraph
8 9, the authors used Sieh's data?

9 A That they sought other seismological data I
10 thought was very commendable.

11 Q Included that within Sieh's data; is that correct?

12 A Yeah.

13 Q And yet here you comment that San Andreas
14 results are not relevant; is that true?

15 A You're talking about paragraph --

16 Q Paragraph 9.

17 A No, I say, "However, why should San Andreas
18 results be relevant?" I don't say they are not relevant.

19 Q Well, then, you go on down to the sentence,
20 "The fault is so very different."

21 A That makes the relevance a scientific question
22 that has to be debated. The faults are different. Maybe
23 the data is relevant, maybe the data is not relevant. One
24 has to go into the matter.

25 Q On page 5, at the end of the first full paragraph,

1 you make the comment that there is no account taken of the
2 measurement error and biases in the data analyzed. Would
3 a parametric sensitivity analysis be useful in this regard?

4 A If because of the fact you use parameter, you
5 mean to imply that only the parameter values of the Poisson
6 model will vary, it wouldn't be complete. I'm asking that
7 the measurement here -- values -- they would have to be
8 varied as well. You said would a sensitivity analysis be
9 relevant. I would say yes.

10 Q Okay. And would that be -- but is it your
11 opinion that a parametric sensitivity analysis should be
12 performed in this particular case?

13 A I think performing such analysis would be very
14 worthwhile.

15 Q And I take it it is your position that because
16 you have not seen such analyses, then that is regarded as a
17 short-cut in the analysis?

18 A I did see some parametric sensitivity analysis,
19 I saw the results of them described.

20 Q Okay. Have you reviewed those?

21 A To the extent that they were described in the
22 various reports, yes.

23 Q All right, fine. And if they are not described
24 in the report, obviously, or in the list that you have handed
25 out, obviously then you haven't reviewed them? Can I take

1 that as a fair assumption?

2 A In this particular case, yes.

3 Q Yes. Thank you.

4 On page 6, comment 5, you indicate that the
5 dates are subject to substantial measurement error, and
6 that more ruptures may have taken place. Further, the last
7 value is given by him, that is referring to the author, as
8 545, not the 575 of the table.

9 Now in regard to that particular comment, are you
10 aware of the measurement errors or the measurement errors
11 that exist on the soil age-dating techniques for the GETR
12 site?

13 A The specific values for the levels there?

14 Q Yes.

15 A No, I'm not.

16 Q And have you performed any independent analyses
17 of the characteristics of the measurements of soil ages at
18 the GETR site?

19 A No, I haven't.

20 Q And are you in a position to express any opinions
21 on whether these are valid measurements of soil ages at the
22 GETR site?

23 A I know that nothing can be measured exactly, so I
24 know that there would be measurement errors attached to
25 whatever values he was considering.

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1 Q If we got back to an earlier set of questions,
2 the other day we discussed the question or your question
3 that you posed concerning the implications of making
4 conservative assumptions. In the case of the shears at the
5 GETR site, if I continually underestimate soil ages, is it
6 true that I would tend to underestimate the -- or, excuse
7 me, that I would tend to overestimate the probability of
8 a shear occurring under the GETR foundation?

9 A No, not necessarily.

10 Q Why?

11 A Suppose that shears, quakes, whatever you would
12 like to call them, are taking place in some periodic
13 fashion. Then they are taking place here, here and then
14 here again, and if now you have confused all your measurement
15 errors, then it may well be the case -- say you've lost
16 track of the actual time scale on which things are taking
17 place -- it may well be the case that the event is taking
18 place and your estimation procedure has lost track of the
19 period with which these are occurring, and so your calcula-
20 tions are too low.

21 Q Let me pose the question in a little more
22 specific way.

23 You had made certain gesticulations that won't
24 show on the record, but let's start with this, so that it
25 will be a little easier to answer:

1 Let's assume that I have two shears which have
2 been discovered at the GETR site, and that the reactor is
3 located between those shears.

4 Let's further assume that I have underestimated
5 the age of the soils at the GETR site. Won't -- isn't it
6 true that having made that underestimation of the soil, that
7 I tend to bias the probability analysis in terms of over-
8 estimating the probability of offsets between the shears?

9 A I don't believe so, because of the example I
10 just quoted. It depends upon the process by which earthquakes
11 and movement on the shears is taking place.

12 Q Well, if you have a history of those shears and
13 you know also that all of the movement has occurred along
14 the shears and not between the shears, doesn't conservatively
15 estimating soil ages bias the analysis in terms of increasing
16 probability?

17 A Mathematically there are counterexamples to that.

18 Q How could you have a counterexample of the GETR
19 site under the circumstances I have just specified?

20 A Because you didn't specify the earthquake process
21 that the -- you didn't describe the sequence of original times
22 of the events that were taking place.

23 Q Why would that be important?

24 A The example I'm trying to bring out is one --
25 suppose you have a phenomenon that takes place every 24

1 hours at noon. You are collecting information in a 24-hour
2 period. What you are saying now is that you are not
3 observing the exact times at which things take place. You
4 are observing -- well, maybe you have observed them, but
5 you are not going to treat them as if they are the exact
6 times. You are biasing them by pulling them in closer to noon.

7 Now when it comes time to compute some probability
8 and use the time scale, your time scale will no longer be
9 the true time scale, and noon will come along, and your
10 projector will have put itself on an inappropriate time
11 scale.

12 Q Well, if I'm trying to predict the future
13 recurrence of events and I use the example you just gave
14 me, and if my phenomenon is in fact as you suggest, you are
15 measuring within a 24-hour period -- if indeed I measure
16 over a longer period, but I only count 24 hours, am I not
17 going to overestimate the frequency of events within that
18 period?

19 A If your -- you're saying if you measure over a
20 longer period than 24 hours, are you going to get more events
21 than if you measure within a 24-hour period?

22 Q Yes.

23 A If other events take place.

24 Q Doesn't that follow?

25 A If extra events take place, certainly.





1 Q Well, if events are occurring over a long period
2 of time, can't I assume that if I underestimate the time
3 period in which they are occurring, and overestimate the
4 number of events, I am going to have a higher frequency?

5 A See, the thing that has to be specified is the
6 particular procedure you are going to use to estimate the
7 probability of the event that you are interested in, and this
8 is not being specified in this question.

9 Q Is it your opinion that there is no place for
10 subjective judgment in risk analyses for the GETR site?

11 A All analyses have certain subjective elements to
12 them.

13 Q Well, is it your opinion that there is no place
14 for a subjective judgment in the analysis of risk at the GETR
15 site?

16 A I think subjective judgment will be the way
17 the decision will have to be arrived at.

18 Q All right. And if you had your preference, would
19 you not prefer that any subjective judgments have a
20 conservative bias?

21 A By that, you mean that utmost caution should be
22 adhered to? Certainly.

23 Q Well, what do you mean by "utmost caution"?

24 A One should be very careful. One should not do
25 anything reckless.

1 Q All right. Are you familiar with engineering
2 practices and the use of conservative assumptions in
3 engineering practice?

4 A In -- I'm not sure in a formal sense, but
5 certainly in an informal sense.

6 Q Okay. And could you just clarify what you mean
7 by the distinction between formal and informal?

8 A Well, if you asked if I was familiar with. I
9 have certainly read many textbooks, many journals, been at
10 many engineering seminars and heard people talk of doing
11 things in a conservative fashion, and I would support that.

12 Q All right.

13 I am just still a little bit confused, but as I
14 understand it, your basic concern about Bayesian techniques
15 is that they involve the use of subjective knowledge and
16 experience; is that correct?

17 A No, I object to the specific way that information
18 is made use of. A curve is drawn, it is multiplied against
19 another curve, and a decision is made on the basis of
20 the resulting curve.

21 Q But the fundamental objection is that it employs
22 subjective knowledge and experience?

23 A It's of the fashion in which that subjective
24 knowledge is employed.

25 Q And your concern, I believe the other day, in

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1 response to a question, you indicated that the difficulty
2 for the statistician -- the classical statistician -- is
3 that the answers are dependent upon the quality of the
4 judgment; that is, if a subjective statistician is broad
5 enough, the answer is going to be good. Is that --

6 A Yes.

7 Q Am I fairly characterizing it?

8 A I think that's true.

9 Q All right. And it's further your belief that
10 the role of the statistician should be purely objective, and
11 that bringing in subjective information fights against the
12 "natural role of the statistician," is that correct?

13 A In a matter of this sort, most definitely.

14 JUDGE GROSSMAN: I believe, Mr. Edgar, it's
15 about time for the lunch break. And rather than force you
16 to conclude before, why don't you review the matter at
17 lunch and see if you have a few more questions?

18 MR. EDGAR: We'd appreciate that.

19 JUDGE GROSSMAN: We'll recess for lunch now
20 and come back at 1:30.

21 (Whereupon, at 12:00 noon, the hearing was
22 recessed, to reconvene at 1:30 p.m., this same
23 day.)

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AFTERNOON SESSION

Whereupon,

(1:30 p.m.)

DAVID BRILLINGER

resumed the stand and, having been previously duly sworn, was examined and testified further as follows:

JUDGE GROSSMAN: The hearing is in session. We have had a couple of more requests to make limited appearance statements. And if there is anyone else in the audience who intends to, or wants to make a limited appearance statement, now is the time to speak up. We will entertain these two limited appearance statements: Rebecca Gardner, and Phil Gardner. Hereafter, we do not intend to entertain any further ones, so now is the time to speak up.

Would the Gardners please come here, and you can sit at the witness table, both of you.

Dr. Brillinger, you may remain there.

As you know, by the way, we limit these statements to five minutes a piece, but don't feel that you have to take all five minutes.

(Laughter.)

LIMITED APPEARANCE STATEMENT OF PHIL GARDNER

MR. GARDNER: I very likely won't. Somehow I feel that we are here this afternoon to play "Truth or

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1 Consequences," so let's at least keep it on that level.

2 I have some information that is not site-
3 specific, but I would like to draw your attention to it.
4 It is an article that appears in the April 1981 edition
5 of Scientific American. The article is entitled
6 "Catastrophic Releases of Radioactivity," authored by
7 Steve Vepser and Costa Siepas (phonetic), that deals
8 with the subject that I think will very shortly
9 become a matter of national strategy planning in dealing
10 also with nuclear reactors on all the sites.

11 In January 1971, I was in, oh, approximately
12 85 miles northeast of Los Angeles when that earthquake
13 occurred. I am embarrassed to tell you, but it is the
14 truth, it did knock me out of bed. Should such an
15 occurrence happen underneath the Vallecitos reactor, we
16 can well imagine a total release of whatever the scintillating
17 inventories are that are contained there.

18 But to continue with national policy, I am
19 interested in knowing how you and the operators of this
20 site intend to replace us consumers. It takes some time.
21 In July, I expect -- I hear that I am to be a grandfather.
22 So I am concerned about these people being victims, and
23 they have no voice here, and their children will have no
24 voice here, and all other forms of life which have no
25 voice here.

1 I am wondering what the devil are you people
2 doing? We are on the cliff's edge, and our toes are
3 hanging over. And the name of the game is: We have to
4 take a step.

5 Now I ask you: In which direction would a
6 wise person step?

7 JUDGE GROSSMAN: Thank you, Mr. Gardner.

8 Ms. Gardner?

9 LIMITED APPEARANCE STATEMENT OF MS. GARDNER

10 MS. GARDNER: I found something this afternoon
11 that I feel a great deal of sympathy with. It is a
12 paragraph written by someone else, but I would like to
13 read it here:

14 "The NRC is not ensuring the public health
15 and safety of the five million Americans who live near
16 the GETR, and as the ASLB knows Californians cannot purchase
17 any insurance policy that will insure their health and
18 property against damages suffered from future California
19 earthquakes that will damage NRC-licensed nuclear reactors
20 and release radiation.

21 "The NRC licensing process is the public's
22 only insurance, yet the NRC does not have any insurance
23 policy with God to protect Californians against earth-
24 quakes near the NRC-licensed nuclear reactors. Earthquakes
25 are acts of God. Nuclear reactor licensing is an act in

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1 the NRC. May God protect us from the NRC."

2 I have two feelings. I am very pleased to
3 be here. I have talked with many people who have traveled
4 over the world, and I understand that in three-quarters of
5 the countries of the world I could be put in jail and
6 would not be allowed to be talking here. And I am really
7 pleased that I have this opportunity.

8 It is an incredible country we live in that
9 allows this.

10 The other thing that I feel is -- and I mean
11 this as no threat -- I hold everyone here responsible
12 for any suffering that I may ever experience from nuclear
13 isotopes leaking from a reactor; and I hold myself
14 responsible, and that is why I am here.

15 Thank you.

16 JUDGE GROSSMAN: Thank you, Ms. Gardner and
17 Mr. Gardner.

18 (The limited appearance statements of
19 participants hand-delivered to the NRC but not presented
20 orally follow:)

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1 JUDGE GROSSMAN: Mr. Edgar, over lunch did
2 you think of anything further?

3 MR. EDGAR: We have concluded our questions.

4 JUDGE GROSSMAN: Thank you.

5 Mr. Swanson?

6 MR. SWANSON: We have no questions of
7 Dr. Brillinger.

8 JUDGE GROSSMAN: I have a few questions.

9 BOARD EXAMINATION

10 BY JUDGE GROSSMAN:

11 Q Dr. Brillinger, I note from your prefiled
12 testimony that you have raised a number of questions, and
13 a number of very general questions, very few specific
14 questions, and almost no answers.

15 Who did you expect would be supplying the
16 answers to the questions that you have raised?

17 A I guess the way in which I proceeded would
18 be as follows: I reviewed the matter the way I would --
19 the way I review papers submitted to technical journals
20 that I am asked to referee. That is the style of my
21 testimony. I don't claim to have the facilities or the
22 background knowledge to produce answers for these things
23 myself, but they are the things that went through my
24 head as I was reading the material.

25 I think many of them are things that have been





1 neglected that should not have been neglected.

2 Q You are here in the role of an expert statis-
3 tician who is critiquing some probability studies, and
4 you are raising some very general questions. Did you
5 believe that the Board would have some more expert
6 statisticians on it who could supply all those answers?

7 A No. In my testimony I ended up saying that
8 I thought the matter needed to be investigated in much
9 greater detail, and I would suggest to the Board that
10 they consider having a panel that includes statisticians
11 as well as geophysicists, seismologists, and engineers.
12 I think there are a number of important statistical
13 questions that are raised, data sets are analyzed, and
14 conclusions are drawn from the data sets, and probability
15 models are built. It is a statistician's role to validate
16 the conclusions that are drawn.

17 I was very discouraged when I looked through
18 all of this material in finding absolutely no trace that
19 any statistician had ever been involved with this
20 material. That was a criticism that the people made of
21 the Rasmussen Report.

22 Q But don't you think that there is a final
23 process where the answers ought to come in, that after
24 years of investigation and critiquing of what has been
25 done, that people ought to show up at the hearing itself

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1 with finally the answers as to -- or at least with
2 specifics as to why something is invalid, rather than
3 merely pointing out in sort of an academic frame that
4 there might be other ways of doing things without
5 having a specific method of doing it correctly if you
6 considered that what was done was invalid?

7 A Yes, I agree with all that. I think part of
8 what I was saying was that scientists cannot be expected
9 to make political decisions; and that a specific formula
10 cannot be provided for this probability. This probability
11 cannot be demonstrated to be less than 10^{-6} . It comes
12 down to a subjective decision being made.

13 I was concerned that quite a few fancy-looking
14 scientific arguments were provided, but really that it
15 comes down to an opinion at the end of that.

16 Q Okay. As to the specifics of something you
17 have raised, you are answering some questions with regard
18 to hazard increasing function. And you indicated that
19 you considered an assumption of independence to be
20 objectionable. And I believe this was in the context of
21 whether events would occur off the shears, rather than on
22 them. Was that the context in which the --

23 A That was the context, that it was a general
24 point about the distribution of the times between
25 successive events.

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1 Q Well, my question is really with regard to
2 the assumption of independence and whether you were
3 referring to its being objectionable based on the local
4 conditions? Or whether you were referring to some
5 extraneous condition that might not require an assumption
6 of independence such as the theory of seismic gap that we
7 had heard mentioned. Was that what your reference was?

8 A That's part of the same thing. But I meant
9 in the context of the particular simulation studies that
10 were carried out. The times between the successive events
11 were modeled as statistically independent, weibels and
12 normals. It was that assumption I was objecting to.

13 Q So you think there might be a possibility
14 of some association of frequencies of events that were
15 ignored in the study? Is that basically it? In other
16 words, some sort of formula that would tie the different
17 intervals of events together?

18 A Yes.

19 Q That may not have been --

20 A Not a formula, but a formula that says
21 something equals something else, but probabilities are
22 connected between two different times between events.

23 Q But again we are in the realm of what might
24 happen. You don't have any evidence that there is any
25 such thing, do you?

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1 A. I have done quite a number of empirical
2 studies of times of earthquake occurrence, and I have
3 yet to find any that correspond to a renewal process.
4 That is, that the times between successive events are in
5 fact statistically independent. I have a remark in here
6 that I hadn't found any that were poisson distributed.
7 That is an even stronger assumption.

8 So I have studied earthquakes in northern
9 California. I have studied large earthquakes around the
10 world, and in several other collections of earthquake
11 data, different -- I have looked at sequences of origin
12 times of earthquakes and probably 40 different such
13 sequences, and never have I found evidence that they
14 are independent.

15 Q. Have you found evidence that they are
16 interdependent?

17 A. Yes that they are. That is what I mean.
18 That they are dependent -- there is strong evidence that they
19 are dependent statistically. They tend to be clustered.
20 It shows up in aftershocks in its simplest form, but they
21 tend to be clustered together beyond that. And then on
22 some occasions, there is some suggestion of pyradicities
23 appearing even beyond the clustering.

24 (Board conferring.)

25

1 BY JUDGE FERGUSON:

2 Q Dr. Brillinger, I have a few questions I hope
3 you will be able to answer. It will help me understand
4 some of the testimony we have before us.

5 I would direct your attention to Intervenor's
6 Exhibit No. 5, which is in fact your testimony. Let me
7 at the outset say that the thrust behind the questions, the
8 few questions that I have, it will be my attempt to
9 clarify, if I possibly can, some things that at least you
10 suggest but have supplied little evidence as regards
11 the depth that you have gone to make the statement. So
12 that is the whole purpose of my line of questioning: If
13 possible, to further understand the depth that you have
14 gone into in making the statements that you have made.

15 So let me call your attention to page 1 of that
16 exhibit. I would like you to focus your attention to the
17 bottom of that page, and I will read the part that I am
18 concerned about and then I will raise the question.

19 "It appears to me that too many simplifying
20 assumptions have been made. The problem has been
21 condensed too far. It has been treated as one-dimensional
22 instead of its actual three-dimensional nature. It has
23 been treated as static instead of its actual dynamic
24 nature. Important variables have been omitted." I will
25 stop there.

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1 Now the thing that I would like you to comment
2 on, if you can briefly, is what important variables have
3 been omitted in the analyses that you have investigated
4 which led you to make the statement.

5 A. Yes, sir.

6 Now my remarks I will make refer specifically
7 to the reports that are listed at the top of the page.
8 One thing that caught my eye, and that I chased about in
9 the literature a bit, was the business of finding a
10 maximum acceleration that was then to be applied against
11 a response spectrum; to then be put up against the models
12 of the building and the things within the building. In
13 other words, a single number, the 8.65, whatever, that
14 finally ends up being agreed upon, was to be used to pass
15 on all of the dynamic information that was to be made use
16 of with the building.

17 Now I would view that what is really needed
18 there is the record in time and space of the earthquake
19 as impinging upon the building. For example, the
20 duration of such a record; the relative phasing of the
21 various frequency components within the record; the
22 duration of a maximum sort of acceleration. Also, I view
23 the fashion in which the engineers and seismologists have
24 produced the maximum acceleration as suspect in the sense
25 that they have only made use of the maximum accelerations

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1 that were actually observed in practice, where there
2 happened to be seismometers located.

3 The true maximum is almost certainly going to
4 occur at someplace where there did not happen to be a
5 maximum. So there is no use made of a correction factor
6 for that effect, or of the sample -- I'm talking about --
7 this number that comes up has margins of error attached to
8 it, and this margin of error has to be propagated through
9 the analysis, as well.

10 Another aspect that concerned me was what I
11 called the simplistic nature of the study. When you
12 look through the reports, you see very elementary pictures
13 of the GETR sitting on the earth, and then sitting tipped
14 at an angle. The whole three-dimensional character of
15 this object, and the three-dimensional character of the
16 earthquake wave and the fault are not made use of.

17 I think I say in here that simplicity is
18 certainly a virtue. However, I think things have been
19 simplified too far. That the mathematical models that
20 have been set down simply are approximations; and the
21 degree of approximations have not been studied.

22 I am not sure if that is answering your
23 question, sir.

24 Q Let me see if I understand what you have said,
25 if I can, with of course understanding the risk of making

1 it simple. Let me see if I can paraphrase what you have
2 said.

3 Your concern here is essentially that a one-
4 dimensional model was treated. And in treating that one-
5 dimensional model certain parameters were presumably
6 investigated. You feel that this is a three-dimensional
7 situation.

8 A. Yes, sir.

9 Q. And all variables that would be associated
10 with say the other two dimensions have been neglected?
11 Is that a way of paraphrasing essentially what you --

12 A. I wouldn't say they have been neglected.
13 They have been crudely approximated.

14 Q. I see.

15 A. And also, there is another dimension of time
16 that is treated as a static situation, except for the
17 spectral analysis that gets carried out at a later stage.

18 Q. Have you, either in detail or to any degree,
19 investigated the effect of including two more dimensions
20 as they would affect the results of the one-dimensional
21 analysis? Do you feel that the result would be different?

22 A. Yes, I do, sir.

23 Q. Vastly different?

24 A. I don't know "vastly different," but the
25 difference would be such that, assuming it was one



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1 dimension it was not conservative, that the -- for
2 example, the chance of the fault plane which has
3 curvature to it intersecting the building is greater
4 than having a straight line, or a single point go there,
5 just because the curve is now longer. It has a greater
6 chance of actually encountering the building.

7 Q I think you've made that clear. What I was
8 trying to get at was how much different. I am trying to
9 get a feel for what new information we would gather, if
10 we did in fact do the analysis, someone did the analysis
11 in the multi-dimensional case.

12 A I don't know, sir, but I think it is a fair
13 question to put to a civil engineer.

14 Q You have no feel for whether or not this would
15 make a large difference or a small difference?

16 A I feel there would be examples one could
17 construct where it would make a huge difference, and
18 examples where it would not make much difference at all.

19 Q These examples would be specific to the GETR
20 site?

21 A No. I have in mind mathematical examples.

22 Q Do you feel that you could develop reasonable
23 examples at this site that would lead to large differences?

24 A On my own, certainly not. But I think a
25 multi-disciplinary group could.

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1 Q And what leads you to that statement, sir?

2 A I think it is simply my experience as a
3 statistician that so often one thinks one knows what is
4 going on in a situation, and when one looks at it in
5 greater detail one finds that one has missed an important
6 part of the problem. I have the feeling that this
7 particular field is evolving incredibly rapidly right
8 now. The sort of things people are saying this day are
9 quite different from what they were saying 10 years ago,
10 and they will be totally different 10 years into the
11 future. Each earthquake seems to bring a wealth of new
12 knowledge into the subject.

13 Q I see.

14 Let's turn quickly to page 2. I would like
15 to gain -- and this question is very much related to
16 what I just asked. Near the top of page 2, you state:
17 "Other values and physical models fit the data equally
18 well, and some undoubtedly lead to quite different end
19 numbers."

20 Have you actually done that? Or is that a
21 feeling that you have?

22 A No. I made one attempt at doing that with the
23 C data. I made some hazard probability plots of the
24 sequences of the sequence of times between the successive
25 events that C reported, and also I included on the hazard





1 probability plots an indication of the measurement error
2 that C attached to them. And I made these for the
3 traditional distributions. There are five traditional
4 distributions. And on the basis of these plots, there
5 was no way to say that one distribution was preferred to
6 any other distribution.

7 Q This is one calculation that you made as an
8 example? Is that correct?

9 A Yes, it is.

10 Q Again I continue with the second paragraph on
11 that same page, page 2. You say, "The authors neglect
12 phenomena that have small probability of occurring." Have
13 you specified what those phenomena are anywhere?

14 A By "authors," now I mean the authors of that
15 letter.

16 Q Yes.

17 A Could I pull that letter?

18 Q If you would like.

19 (Pause.)

20 A Actually, just let me try to answer without
21 having to do a search. The sort of thing I have in mind
22 is that in a deterministic study one would set up a set
23 of differential equations of some sort, for example, and
24 one would include certain variables in the differential
25 equations. One makes value judgments as to which

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phenomena to include, which phenomena not to include.
One might have a nonlinearity, a quadratic or a cubic
term, and one chooses to neglect the nonlinearity in
the analysis because one thinks it is not important.
Because what one calls a "deterministic analysis" is
based upon in fact their experience, and they have made
conscious decisions to include certain things, and not
to include other things.

///

(Testimony continues on next numbered page.)



1 JUDGE FERGUSON: Is that a valid approach, do you
2 feel for getting realistic numbers that will be useful?

3 WITNESS BRILLINGER: It's of greater value, but I
4 think one also has to try to assess how accurate the end
5 results are that come out of the deterministic analysis.
6 Sometimes the probabilistic analysis, actually typically it
7 is very complicated and one can't communicate the conclusions
8 that one has come to too easily to non-experts. So a deter-
9 ministic approach is very useful under the circumstances.

10 JUDGE FERSUON: I get the feeling as you answer
11 that you would personally feel that this analysis had more
12 merit if the probability numbers had a range that's located
13 with them. Is that correct?

14 WITNESS BRILLINGER: Unquestioned.

15 JUDGE FERGUSON: Have you undertaken to, say,
16 determine the range that one would reasonably expect to
17 occur on the numbers that have been given by the licensee to
18 determine if that range based on the assumptions that were
19 made were small in your opinion or large in your opinion?

20 WITNESS BRILLINGER: I found myself objecting to
21 the assumptions made so quickly in the analysis that I never
22 could carry myself that far along in the analysis. I think,
23 given the knowledge that I have, the probability seems to be
24 small, but a specific statement that it's less than ten to
25 the minus six is no way justified.

1 JUDGE FERGUSON: What I was focusing on the range
2 of values around ten to the minus six. Based on your readings
3 of the assumptions that were made to get the number ten to the
4 minus six, do you feel that range would have been large or
5 small, if you had carried out the calculations? I assumed
6 you did not.

7 WITNESS BRILLINGER: No, I didn't. I just didn't
8 have the time or the resources. I really have no way of
9 knowing. It could be a huge, literally huge, range, but I
10 don't know.

11 JUDGE FERGUSON: Could it be also very small?

12 WITNESS BRILLINGER: Yes, it could. I'd be amazed,
13 but, yes it could.

14 JUDGE FERGUSON: At the bottom of that same page,
15 page two, you say, one final, and I quote, "One final comment.
16 It seems that in a probabilistic approach, ratios of
17 probabilities of alternatives are relevant as well as absolute
18 probabilities. In particular, are not the risks associated
19 with other sites clearly less than those of Vallecitos,"
20 unquote.

21 Did you -- I guess I have difficulty understanding
22 that last statement you made. Are not the risks associated
23 with other sites clearly less than those at Vallecitos? Give
24 us some feel for what you were thinking about in making that
25 statement?

1 WITNESS BRILLINGER: What I had in mind is one sub-
2 ject of special interest to me -- is constructing risk maps
3 for geographical areas. There's a whole area concerned with
4 siting of nuclear facilities. I've seen any number of risk
5 maps for the United States and one sees that in North Dakota,
6 say, the level of risk is very small. It's estimated by
7 virtually every author. Whereas, in the Bay Area, the risk
8 is extremely large. I guess I'm really saying, why in the
9 world is that reactor in the Bay Area when where there are
10 these added problems, when there are other safer places for
11 it to be sited.

12 JUDGE FERGUSON: I see. That's very helpful. In
13 these risk maps that you have referred to, are benefits also
14 considered?

15 WITNESS BRILLINGER: I'm trying to think. Certain-
16 ly one sees the marks going along with them that having power
17 generating stations near the place where the demand for power
18 and that other facilities don't have to be located near the
19 location where there is demand. They can be located anywhere.

20 JUDGE FERGUSON: I'm just ignorant on this fact
21 and perhaps you can enlighten me. Are there benefit maps,
22 also? I don't know.

23 WITNESS BRILLINGER: I don't know a specific example.
24 I think there are, sir. I think in England, they concern
25 themselves a great deal with where they are going to store

1 fuels and things like that near London.

2 JUDGE FERGUSON: Well, let's assume that if they
3 don't exist, they could presumably.

4 WITNESS BRILLINGER: Yes, they certainly could, yes.

5 JUDGE FERGUSON: Would you feel that the proper
6 decision or a decision should be properly based on looking at
7 both maps than simply the risk map?

8 WITNESS BRILLINGER: Oh, yes, certainly.

9 JUDGE FERGUSON: I draw your attention to page
10 three, now. The bottom of page three of your testimony.
11 And here, I would like to focus again on what you have done
12 to make the statement that you in fact make. And I'll read
13 part of your statement there.

14 Quote, "In a one-dimensional approach, the widest
15 prospect should be employed. I would argue that a relevant
16 probability to seek, to evaluate, is that a curve (not
17 straight line) intersecting a box of length, breadth, and
18 depth of the situation. The probability, actually evaluated
19 is less than this probability and hence, not conservative,"
20 unquote.

21 I'd like to raise a brief question regarding your
22 statement, the probability actually evaluated is less than
23 th's probability. Is this they hypothetical situation that
24 you dealt with earlier or is it -- has anything to do with
25 the site that we are considering in these hearings?

1 WITNESS BRILLINGER: I'm just trying to see for a
2 moment if I haven't written that sentence the wrong way
3 around. The probability actually evaluated is less, yes --
4 excuse me. I'm referring to the thing you asked me a moment
5 ago, once again. If you have a plane going through a three
6 dimensional object --

7 JUDGE FERGUSON: I recall that, sir, quite clearly
8 and my question is, have you actually calculated this or
9 is this a feeling that you have or is it based on the --

10 WITNESS BRILLINGER: It's simply based on the know-
11 ledge that the area of a curve is in three-dimensional space
12 -- a surface is greater than the area of a plane. The plane
13 has the smallest area.

14 JUDGE FERGUSON: So, that's the only bases on which
15 this statement is made. Correct?

16 WITNESS BRILLINGER: Yes. The geometry of the situa-
17 tion.

18 JUDGE FERGUSON: Again, all of my questions I hope
19 you are able to detect have to do with my attempt to under-
20 stand the bases of the statements that you make and some of
21 them are very, very positive. I'm now on page five and I
22 would direct your attention to that and the statement is at
23 the end of the first paragraph on page five of Exhibit No. 5.

24 And you state, "Once again, results that are far
25 from so, are described as conservative and even very conser-

1 vative."

2 The thing that is of interest to me is that you say
3 that you say that this statement seems anything to me that
4 there is something in your mind that makes you feel that these
5 results are not conservative. Is that based on a calculation
6 that you have done or is it based on a feeling that you have?

7 WITNESS BRILLINGER: It's based on a logical argu-
8 ment. I would argue that the fewer assumptions that one
9 needs to make use of in deriving results, the more conserva-
10 tive the end results are going to be; the more confidence
11 one can have in the end results. In the derivations of these
12 probabilities, many, many very specific assumptions were made.
13 There are many, many places at which the assumptions could
14 be incorrect and therefore the final result that was -- was
15 really not conservative -- not as conservative as it could
16 have been.

17 JUDGE FERGUSON: Could you tell me what you would
18 -- if you can, perhaps, you can not. In terms of probability,
19 what would you consider a value to be to represent a conserva-
20 tive probability?

21 WITNESS BRILLINGER: It depends on the situation,
22 I would sense.

23 JUDGE FERGUSON: Well, let me suggest a situation.
24 And that is the probability of a fault intersecting the base
25 of the GETR?

1 WITNESS BRILLINGER: No, I can't. I wouldn't do
2 that as the role of a statistician plays a part. The politi-
3 cian or the person in charge decides what is an acceptable
4 probability for the situation and then the statistician's
5 role is to evaluate that probability.

6 JUDGE FERGUSON: What I'm trying to get at is that
7 presumably a number has been gotten either correctly or
8 incorrectly that does represent the probability and some have
9 suggested that this is conservative and at least as I under-
10 stand your statement, you feel that it is not conservative
11 and my question is, what number would they have gotten in
12 order to meet your criteria for conservative.

13 WITNESS BRILLINGER: I don't know if the number
14 would be that important. The thing that disturbs me is the
15 analysis that produced the number. I don't have any confi-
16 dence in the final number at all, because I see many assump-
17 tions made that make me nervous. That I think are probably
18 incorrect.

19 JUDGE FERGUSON: You think the answer is wrong or
20 it could be wrong?

21 WITNESS BRILLINGER: Well, if the answer is going
22 to be some figure with six significant figures or something
23 like that, then it's wrong. The true answer will be --
24 require an infinite number of digits to derive it. I don't
25 know. If you're willing to allow some leeway around the

1 answer, it may be right, but goodness, it may be very, very
2 wrong.

3 JUDGE FERGUSON: You're correct again. It may be
4 right and it may be wrong. It seems to me that you think it
5 is, at least, not conservative or it may not be conservative
6 and I'm just trying to understand why you --

7 WITNESS BRILLINGER: I don't think there's any
8 bases on which one can describe the answer provided as con-
9 servative. I don't know what the opposite word is to conser-
10 vative, but a lot of very specific assumptions have been made
11 that have all sorts of possibilities of being incorrect and
12 so one is really at the mercy of anyone of these assumptions
13 being false and not being able to say just of what use the
14 final number is.

15 JUDGE FERGUSON: Then, am I correct in believing
16 that you are not saying that the final answer is wrong. It's
17 just that you don't have confidence in the final answer. Is
18 that correct?

19 WITNESS BRILLINGER: I don't believe that the final
20 answer has been justified.

21 JUDGE FERGUSON: We're on page six, now, of your
22 testimony. Here, again, I think in being consistent with
23 my other line of questioning, I again, just ask you to tell
24 us what it is that you are thinking of when you make the
25 statement that you make. This statement is found in the

1 third paragraph of page six.

2 You say, in part and I quote, "In summary, the
3 authors of this report made many highly specific assumptions
4 and yet spend little time justifying the assumptions. Many
5 of the assumptions are wrong." Unquote.

6 Now, am I to interpret that to mean that you have
7 looked at all of these assumptions and you have come up with
8 a list of assumptions that many of which you have found to
9 be wrong and if they are, in fact, wrong, could you tell us
10 what was wrong about them?

11 WITNESS BRILLINGER: The general intention that I
12 had there is, for example, a certain random variable is
13 suppose to have a certain distribution. A distribution would
14 never hold exactly ever the normal distribution people believe
15 is some sort of law, but it's very arguable that there has
16 ever been a single normal random variable in the world's
17 history. So, the precise assumptions are incorrect and what
18 one has to do, therefore, is one has to examine the degree
19 to which a precise property of the normal distribution, say,
20 can be violated and the conclusions not be changed.

21 Some residence distributions have very special
22 mathematical properties that one could not expect to hold
23 in terms of practical data, practical numbers and I'm just
24 concerned about very precise assumptions being made and these
25 assumptions are never going to be true and there have been

1 no strong attempt to investigate the fact of the effect of
2 moving away from the assumptions slightly.

3 JUDGE FERGUSON: You haven't done much yourself.
4 You --

5 WITNESS BRILLINGER: In this study --

6 JUDGE FERGUSON: Excuse me. You make the statements
7 that you do, namely that many assumptions are wrong together
8 with the other positive statements that you have made based
9 on logical arguments primarily. Is that correct?

10 WITNESS BRILLINGER: Yes. And experience with
11 similar things. But, for example, that GETR is one-dimension-
12 al. We all know that that's not true. We know it's a three-
13 dimensional object.

14 JUDGE FERGUSON: We explored that earlier and I
15 think it was stated that we should do it in three dimensions.
16 You're not certain what the results would be. That is how
17 different they would be from the results obtained thus far.
18 but you just feel it should be done.

19 WITNESS BRILLINGER: Yes, sir.

20 JUDGE FERGUSON: Dr. Brillinger, I certainly
21 appreciate your helping us with these matters. I wonder if
22 in closing, so far as my line of questioning is concerned,
23 whether you could in your own words, as briefly as you can
24 tell us what you think the hazards are, if you can, if the
25 GETR were allowed to restart.

1 WITNESS BRILLINGER: I don't think I can claim
2 any special knowledge to answer that other than as a person
3 who reads books and things of that sort. I would simply be
4 concerned, I guess, with the release of radioactive material
5 effecting the quality of life in the Bay Area. The way I
6 view it that lets me not have to answer such a question is
7 -- well, if there is some chance of some damage being done,
8 is there not somewhere it could be where that chance could
9 be less and would seek to put it somewhere where the chance
10 is less.

11 JUDGE FERGUSON: I think everyone here. I emphasis
12 everyone, is very concerned about health and safety. It's
13 one of the prime purposes of this hearing. You have said
14 that if some damage could occur to the reactor, that may be
15 a subsequent release of radioactivity. Is that your state-
16 ment?

17 WITNESS BRILLINGER: Yes. I'm now just thinking
18 of articles I've read. I haven't gone --

19 JUDGE FERGUSON: About the GETR?

20 WITNESS BRILLINGER: No.

21 JUDGE FERGUSON: About other?

22 WITNESS BRILLINGER: About other reactors.

23 JUDGE FERGUSON: Have you had an opportunity to
24 look at all of the systems that have been designed into the
25 plan to mitigate such a release in the event of any hypothe-

1 tical incident that would include those that you can imagine?

2 WITNESS BRILLINGER: All of them certainly not --
3 The only one that I really read about in any detail was
4 the SCRAM system. That sort of system.

5 JUDGE FERGUSON: Is that system designed to mitigate
6 the release of isotopes into the atmosphere?

7 WITNESS BRILLINGER: I would say in several logical
8 steps, it is. It tries to move the reactor to a safer posi-
9 tion so that if some damage does occur, that isotopes wouldn't
10 be released, but it's not directly designed for that.

11 JUDGE FERGUSON: Thank you very much, Dr. Brillinger,
12 I have nothing further.

13 JUDGE FOREMAN: I have very little to ask. I
14 think my colleagues raised a number of points that I was
15 concerned about. The only thing that I would suggest, Dr.
16 Brillinger, is that for the record, you tell us a little bit
17 more about who you are. I think you were described as chair-
18 man of the department of statistics at the University of
19 California at Berkeley?

20 WITNESS BRILLINGER: Yes, sir. You just want me
21 to go through that --

22 JUDGE FOREMAN: Yes, very briefly. I think it would
23 be good to have it on the record for everybody.

24 WITNESS BRILLINGER: Excuse me.

25 JUDGE FOREMAN: I don't know whether that was

1 passed out, but I didn't receive one.

2 WITNESS BRILLINGER: Yes, sir. I was born in
3 Toronto. I studied mathematics, physics, chemistry as an
4 undergraduate and graduated in pure mathematics. I did my
5 Ph.D. at Princeton University in Mathematics, but my thesis
6 was concerned with qualms of propogation of error. I taught
7 at Princeton and was a lecturer in mathematics half-time and
8 was a member of the technical staff at the Bell Telephone
9 laboratories, half-time.

10 During that period, I was concerned with the problem
11 of discriminating nuclear explosions from earthquakes. I was
12 a computer programmer for my thesis advisor and then I was
13 doing independent research on the project.

14 I then taught at the London School of Economics
15 for six years as a lecturer and then reader in statistics and
16 then consulted with the U.K. Atomic Energy Authority on the
17 problem of discriminating nuclear explosions from earthquakes.

18 In 1970, I moved to Berkeley and became professor
19 of statistics, there. I'm in my second year as Chairman of
20 the statistics department. I've been a research associate
21 of the seismicgraphic station there since 1975 and done re-
22 search on various topics in seismology and geophysics and
23 consulted with the other workers at the seismographic station.

24 My field of expertise is time series analyses that
25 is analyzing transients and signals as functions of time.

1 More recently, I've worked a great deal of point process data.
2 I've moved there from analyzing single earthquake records to
3 analyzing collections of time -- origin times and locations
4 of earthquakes. I've been on a number of national statistical
5 committees. The National Research Council has two statistics
6 committees. One in the social science section and one in the
7 science section. I've been on both of those committees. I'm
8 presently on the science committee.

9 I recently have been doing a great deal of work
10 in seismic risk. I'm in a second year of a three- year grant
11 from the NSF concerned with earthquake applications of point
12 and process methodology. I was awarded a Gugenheim to study
13 -- to do comparative studies of earthquakes in California and
14 in New Zealand several years ago.

15 I guess at the beginning of all that, I was inten-
16 ding to become an actuary, so I became an associate of a
17 society actuaries while I was a graduate student, but then
18 I went down the statistics route, so that's why studying
19 failure rates and things of that sort has been a natural thing
20 for me to do in seismology.

21 JUDGE FOREMAN: Thank you.

22 CHAIRMAN GROSSMAN: Mr. Cady?

23 REDIRECT EXAMINATION

24 BY MR. CADY:

25 Q I believe that Mr. Edgar, Mr. -- Judge Grossman

1 and Judge Ferguson have tried to elicit information from you
2 concerned with how you view General Electric's treatment of
3 their probabilistic risk assessment and I'm going to -- I
4 also want to add that they have also brought out a lot of
5 points that I wanted to elicit from you on redirect, but the
6 one question that I don't think that you've answered -- you
7 may have done in a round-about fashion. Would you please
8 tell us what you would have done if you would have been
9 hired as a consultant for General Electric in preparing their
10 probabilistic risk assessment along the matters that we've
11 discussed over the last four days. How would you have
12 conducted such a study?

13 A I think the principle thing I see lacking in the
14 reports I've seen so far is the critical examination of the
15 assumptions. As the analysis proceed assumptions are made and
16 then further steps are carried through. The statistician's
17 training and purpose in the scientific world, really, is to
18 be challenging to various assumptions. Examining the degree
19 to which they are reasonable. I don't feel that enough
20 criticism was directed at the body -- the people who prepared
21 the reports at the various assumptions as they were making
22 them.

23 Statistics, as key parts in it, making models of
24 situations and then criticizing the models of those situations.
25 I don't feel that sufficient criticism is carried out. So, if

1 I had been involved, I have the image that as various proce-
2 dures were suggested, alternatives to those procedures should
3 have been examined and the degree of dependence of the final
4 results on the assumptions would have been investigated in
5 great detail. As a result, there would have been many quali-
6 fying words in these reports. That was one thing that espe-
7 cially caught my eye. That there was very few qualifications
8 put in. That nothing is ever true all the time and one has
9 to qualify these statements that are being made.

10 Q You feel that this was not done by GE. Is that
11 true?

12 A At least in the materials that I saw. That there
13 were quite a number of occasions on which assumptions could
14 have been examined. The goodness of fit of assumed distri-
15 butions testing for example and this apparently wasn't done.

16 MR. CADY: Thank you. I have no further questions.

17 JUDGE GROSSMAN: Do you suggest, Dr. Brillinger that
18 you have gone along through GE's studies and pointed out to
19 us step-by-step where each specific assumption was not looked
20 at critically enough by GE?

21 WITNESS BRILLINGER: Could I have done this in my --

22 JUDGE GROSSMAN: Yes, for us. Have you done that
23 for us?

24 WITNESS BRILLINGER: No, not for each of them. For
25 some of them.

1 JUDGE GROSSMAN: For a large number of assumptions,
2 specific assumptions where you think that the material should
3 have been tested?

4 WITNESS BRILLINGER: I think there were a large
5 number of -- I think there were -- I'm not sure what the
6 definition of large is. A surprisingly large number, to me,
7 of cases in which things could have been examined and appa-
8 rently they weren't.

9 JUDGE GROSSMAN: Have you pointed out where you think
10 a critical analysis would have come to a different conclusion
11 with regard to these specific assumptions?

12 WITNESS BRILLINGER: I can't say if a different
13 conclusion would have been reached. I think one can't have
14 confidence in the conclusion that was reached.

15 JUDGE GROSSMAN: On what you've given us, do you
16 think that we could have more confidence in your conclusions
17 with regard to the GE studies not being valid than the
18 confidence we would have in the GE studies themselves?
19 Do you follow my question?

20 WITNESS BRILLINGER: Could you rephrase it, perhaps

21 JUDGE GROSSMAN: Well, to rephrase it, do you
22 think we ought to -- on what you've given us, do you think
23 that we ought to have more confidence in your overall conclu-
24 sions with regard to the GE studies -- that is their invalidity
25 than we should have in the degree of confidence we should

1 have in the GE studies, from what GE has given us in the way
2 of specific assumptions?

3 WITNESS BRILLINGER: I don't claim with the amount
4 of time I had available to produce report that was as --
5 that I couldn't criticize myself. Can I put it that way? I
6 think you're trying to have me say that I think the things
7 I say have to be properly qualified. Another statistician
8 asked me about them -- challenge me about them. I think that's
9 true. Relative to the level of material one sees in the
10 scientific literature, I think these reports aren't up to
11 -- they aren't that good. They aren't that complete and I
12 guess part of it, too, is I'm concerned that the business
13 -- This is what I was trying to talk to on Friday -- That
14 it's been compartmentalized too much. People set themselves
15 the time of finding the maximum acceleration and then within
16 -- within one box and then they think that everything in that
17 box is now more or less dealt with so we can just multiply
18 that acceleration into some response spectrum and go on now
19 to worry about what goes on inside the plant.

20 I think an overview of it all needs to be taken and
21 I just make that critical study of the overall -- the whole
22 procedure, the whole analysis has to be tried too, where
23 feedbacks between various of these boxes. I'm not sure if
24 that's answering your question, sir.

25 JUDGE GROSSMAN: Mr. Edgar?

1 MR. EDGAR: I have nothing further. Can we take
2 a short break?

3 JUDGE GROSSMAN: Sure.

4 MR. EDGAR: If this is a convenient time.

5 JUDGE GROSSMAN: Yes, that is convenient. Why don't
6 we come back at twenty minutes of three. That's ten minutes.

7 MR. SWANSON: Mr. Chairman?

8 JUDGE GROSSMAN: Oh, I'm sorry.

9 MR. SWANSON: We just had a general question which
10 arose as a result of a Board question. I admit it could have
11 come up earlier. It's a general one. Just one final question
12 of Dr. Brillinger.

13 RE-CROSS EXAMINATION

14 BY MR. SWANSON:

15 Q Dr. Brillinger would you agree it is useful or
16 reasonable to use a probabilistic hazard or risk study to
17 supplement a deterministic or empirical finding?

18 A Very definitely.

19 MR. SWANSON: Thank you.

20 JUDGE GROSSMAN: Off the record.

21 ///

22 (Testimony continued on the next numbered page.)

23

24

25

1 JUDGE GROSSMAN: Mr. Edgar, do you have anything
2 further for Dr. Brillinger?

3 MR. EDGAR: No, Your Honor.

4 JUDGE GROSSMAN: The witness is excused.

5 THE WITNESS: Thank you.

6 JUDGE GROSSMAN: The next item on the agenda, I
7 believe, is Mr. Barlow's testimony. Are we still going in
8 that order?

9 MR. CADY: That's right, Your Honor, and I believe
10 once we attempt to introduce him as an expert, there will be
11 objections from the staff and from GE, and we would like a
12 ruling on the objections prior to having Mr. Barlow testify
13 either as an expert or in lieu of that, that we just have an
14 offer of proof of his proffered testimony.

15 JUDGE GROSSMAN: We have already had Mr. Barlow
16 summarize his qualifications when it was sought- that he be
17 a technical examiner, and we have also had his qualifications
18 submitted to us in the form of answers to interrogatories.
19 Do you have anything further now to add with regard to Mr.
20 Barlow's qualifications?

21 MR. CADY: Yes, Your Honor. I would like Mr. Barlow
22 to put forth additional qualifications that he has that
23 would qualify him as an expert.

24 JUDGE GROSSMAN: Mr. Barlow, would you take the
25 stand?

1 Whereupon,

2 JAMES BARLOW

3 a witness, having been duly sworn, took the stand, was
4 examined and testified as follows:

5 BOARD EXAMINATION

6 BY JUDGE GROSSMAN:

7 Q Would you state your full name?

8 A My name is James Lynn Barlow.

9 Q And you have already stated some of the matters in
10 your background. Could you go further in response to what
11 Mr. Cady has requested?

12 A Yes, sir. In addition to what I said during the
13 hearing last week, I have other statements as to my qualifi-
14 cations that I would like to explain. Also, in addition to
15 what was said in the discovery process and the answers to
16 interrogatories.

17 Exactly five years ago, in May of 1976, I received
18 a phone call from Miss Barbara Shockley, who is the Alameda
19 County Planning Commissioner, regarding a report on new geologic
20 mapping of earthquake faults near the Vallecitos nuclear
21 center in Alameda County. I had been working for several
22 years as an investigative reporter in the broadcast media in
23 the Bay area, and I had specialized in analyzing earthquake
24 hazards near nuclear facilities. Miss Shockley asked me if
25 I would like to review the report on Vallecitos and the

1 faults there and I said yes. She sent the report to me, which
2 was done by the KALDVEER Geotechnical Associates relating to
3 the Vallecitos plutonium lab, which is licensed by the NRC
4 at Vallecitos to handle 330 pounds of plutonium. Following the
5 review of that report, I continued for the past five years to
6 review all documents that have been produced in this proceeding
7 both by the NRC, the USGS and the licensee and their consultant.
8 In addition to following the Vallecitos documentation and
9 proceedings, I became interested in the NRC licensing pro-
10 ceedings at Diablo Canyon and San Onofre, California, and
11 specifically the earthquake hearings in regard to those sites.
12 In 1978 and 1979 I attended the NRC licensing board hearings
13 on Diablo Canyon's seismic hazards. At the meeting in 1978
14 I had the occasion to meet and talk with Dr. Carl Stepp, who
15 was at that time the director or chief scientist with the
16 geosciences branch of the NRC staff. In the conversation
17 with Dr. Carl Stepp, he said that it is possible for a person
18 to become a geophysicist by exposure by attending these NRC
19 licensing hearings, and he went on further to explain that in
20 the NRC licensing hearings on earthquake hazards to reactors
21 in California, at least, we are exposed to what he called the
22 evolving forefront of the state of the art of the sciences of
23 geophysics and seismology. And based on that communication
24 with Dr. Carl Stepp and my continuing interest for the past
25 five years in attending these meetings and reviewing the

1 documents, I believe that I have become a geophysicist by
2 exposure, by the definition of the chief of the geosciences
3 branch of the staff.

4 That same year, or actually the preceding year, 1977,
5 I had the pleasure of meeting other geoscientists from the
6 geoscience branch of the NRC, and the scientists from the US
7 Geological Survey, all of whom are here today, including Dr.
8 Bob Jackson, who is now the chief of the geosciences branch,
9 and in 1977 and 1978 I had many occasions to attend field
10 trips with Dr. Jackson and Dr. Herd and Dr. Brabb and Dr.
11 Morris of the NRC and the USGS, and many other scientists
12 who attended those field trips at the Vallecitos site, and
13 I did inspect the trenches that were dug at the Vallecitos
14 site and in the surrounding areas. I attended those field
15 trips and the meetings that accompanied those trips, and
16 have many off-the-record, in the field, discussions with
17 these scientists who are here to day and who will be testi-
18 fying on behalf of the staff.

19 In addition to those experiences, I had occasion
20 in August of 1979, to attend the International Conference on
21 Eartquake Engineering at Stanford University which was
22 sponsored by consultants to the licensee in this proceeding.
23 Also, since the shutdown of the GETR in 1977, I have had
24 extensive studies of seismology and geophysics with Dr.
25 James Brune, who is a professor of seismology and has

1 testified in the Diablo Canyon hearings and who will be
2 testifying in the San Onofre hearings. Under his guidance I
3 attended, as I mentioned before but for a different reason,
4 and I will mention it here, three annual meetings of the
5 American Geophysical Union in 1978, '79 and '80, a meeting
6 of the Geological Society of America in 1979, and the annual
7 meeting of the Seismological Society of America in March 1f 1980
8 and at each of these conferences I had the education experience
9 of attending perhaps hundreds of seminars and lectures and
10 presentations by scientists from many universities from
11 throughout the world, especially Cal Tech and Stanford and
12 UC Berkeley, and several other universities that have top
13 seismologists and geophysicists who gave presentations. I
14 read their abstracts and I discussed with them areas that are
15 definitely being discussed in this proceeding by the scientists
16 from all three parties, and the US Geological Survey.

17 In addition to all of that, in January 1980, the
18 Vallecitos site was shaken by a series of earthquakes in the
19 Livermore Valley, and as a result of those earthquakes,
20 Dr. Bruce Bolt, who is a consultant to the licensee and who
21 is the chief seismologist at the University of California's
22 seismological laboratory in Berkeley, Dr. Bolt conducted a
23 seminar at the University of California, which was attended by
24 approximately two hundred scientists. I attended that seminar
25 and I discussed that earthquake with many scientists who were

1 there, and I have carefully studied all of the publications
2 that I can find by the scientists who were there, and other
3 publications by Dr. Bolt regarding the seismicity in the
4 area. I have also made many field trips down to Menlo Park
5 to the USGS headquarters there, and studied their documentation
6 extensively. I attended NRC staff meetings regarding the
7 Imperial Valley earthquake of 1979, which has become an
8 important data set in the Diablo Canyon and San Onofre pro-
9 ceedings, and specifically regarding those proceedings, I
10 attended a meeting in Los Angeles on July 24 1980 in which
11 NRC staff seismologists discussed for many hours with seis-
12 mologists from the Terra Corporation that earthquake and the
13 data set, from the Imperial Valley earthquake.

14 I testified as an expert witness and conducted
15 cross examination at the Department of Energy's hearing board
16 and that transcript is available. In addition to all of that,
17 I have testified at various county, region and state agency
18 hearings regarding the Vallecitos site, but much to our dis-
19 may we discovered that the county, regional and state govern-
20 ments are preempted by the federal government, and that the
21 public's only available insurance and participation and
22 decision-making is the NRC licensing process, so I have con-
23 tinued to concentrate my efforts on understanding the NRC
24 licensing process, and specifically this proceeding.

25 In regards to this, I am representing the Friends

1 of the Earth, Miss Barbara Shockley, who is an Alameda County
2 planning commissioner, and three congressmen from the area:
3 Congressman Ron Dellums, Congressman John Burton and
4 Congressman Phil Burton. Thank you.

5 JUDGE GROSSMAN: Mr. Edgar, any further voir dire?

6 MR. EDGAR: Yes, I would like to ask some, if I may.

7 VOIR DIRE EXAMINATION

8 BY MR. EDGAR:

9 Q Mr. Barlow, I am referring to the answers to
10 interrogatories dated April 10, 1981, and in particular, page
11 four, response number seven.

12 A Excuse me, could you give the the page number?

13 Q Four -- at page four there is a paragraph or response
14 numbered seven.

15 A Yes, sir.

16 Q Are you responsible for providing the answer to that
17 interrogatory?

18 A Yes, I am.

19 Q Do you have a baccalaureate degree from an accredited
20 university?

21 A Yes, I do.

22 Q And in what year was that received?

23 A 1980.

24 Q Excuse me?

25 A 1980

1 Q From what institution?

2 A University of California at San Diego.

3 Q What was you major?

4 A Communications. I specialized in science
5 communications.

6 Q Who is your current employer?

7 A Friends of the Earth.

8 Q And you title?

9 A I am a research consultant. I am also employed by
10 Greenpeace as a research consultant.

11 JUDGE GROSSMAN: Sir, could you speak up so we can
12 all hear you?

13 THE WITNESS: Certainly. I'm sorry.

14 MR. EDGAR: I will try to let you know if I don't
15 hear you. I have been having problems all morning.

16 THE WITNESS: Is it this microphone?

17 JUDGE GROSSMAN: I believe it is the microphone
18 at the witness table.

19 THE WITNESS: Is this one any better?

20 BY MR. EDGAR:

21 Q Could you get it a little closer to you maybe?

22 A I guess it doesn't matter which one it is.

23 Can you hear me better now?

24 Q Yes. Do I understand that you have taken calculus
25 as an undergraduate?

1 A Yes, sir, at Yale University.

2 Q In what year was that taken?

3 A 1965 and '66.

4 Q Have you taken any mathematics beyond calculus?

5 A No, I have not.

6 Q Okay. What -- you mentioned in the interrogatory
7 answer that you took a course in environmental geology. Could
8 you explain what the subject is -- environmental geology --
9 and elaborate somewhat on the course content?

10 A Certainly. The environmental geology course, which
11 is in the earth sciences department of the University of
12 California at Santa Cruz, covers somewhat of an interdisciplinary
13 approach to geology. We studied aerial photography and fault
14 mapping, and the characteristics of faults. We went on field
15 trips to the San Andreas Fault and did field mapping. We
16 studied tectonics, geophysics and seismology as part of the
17 environmental geology course, because it was more related to
18 what faults and faulting processes can do. In particular,
19 at Santa Cruz, we were encouraged to do independent study. I
20 chose as my project the Vallecitos nuclear center geology
21 review, or geosciences review, and during the time when I was
22 taking the class, which was in September through December
23 1978, I was going on field trips to the Vallecitos nuclear
24 center, analyzing the trenches and looking at the trench logs
25 and the reports by the consultants to the licensee, and my

1 final paper, which I produced for the class, was in regards
2 to the earthquake hazards to the Vallecitos nuclear center.

3 Q Other than that course, have you taken any other
4 formal courses in the subject of geology?

5 A Not geology. I studied seismology formally with
6 Dr. Brune.

7 Q Okay. Did you take any courses in seismology from
8 Dr. Brune, for credit?

9 A I took a course which was an independent study
10 with him, and I studied seismology.

11 Q And did you receive academic credit for the course?

12 A I did, from the University of California in San
13 Diego.

14 Q And that was one course?

15 A Yes, although I audited many of his graduate courses
16 in seismology in the past three years.

17 Q And what does the term "audited" mean?

18 A I attended the lectures and the lab work that goes
19 along with those courses, and I have spent countless hours
20 with Dr. Brune on a one-to-one level studying seismology
21 with him in the context of the Diablo Canyon and San Onofre
22 proceedings.

23 Q Have you ever taken any courses in physics?

24 A No, I have not.

25 Q Any courses in geophysics?

1 A No, except with Dr. Brune. I have audited courses
2 in geophysics.

3 Q Any courses in statistics?

4 A No.

5 Q Any courses in stress analysis?

6 A No.

7 Q No courses in structural engineering?

8 A No, although I attended the earthquake engineering
9 conference at Stanford.

10 Q Have you ever published a paper in a professional
11 journal?

12 A Could you define professional journal?

13 Q An established journal in the field of either
14 geology or seismology.

15 A No.

16 Q Are you a member of any professional society in
17 regard to geology or seismology?

18 A Not currently. No, I'm not.

19 MR. EDGAR: Could I have the reporter read that
20 back?

21 (Whereupon, the answer was read back.)

22 BY MR. EDGAR:

23 Q Are you registered or licensed as a geologist in
24 any state?

25 A No.

1 Q Are you registered or licensed as a seismologist in
2 any state?

3 A No.

4 Q Are you registered or licenses as a geophysicist in
5 any state.

6 A No. My answer was no to those three questions.

7 Q Have you ever testified as an expert in any
8 adjudicatory proceeding before the NRC?

9 A I have testified to the DOE on the earthquake
10 hazards to a nuclear facility, but not in the NRC proceedings,
11 no.

12 Q All right. Has any registered or licensed geologist
13 ever sought your advice concerning matters of geology?

14 A Yes. I have discussed geology and seismology reports
15 with several scientists who asked my opinion and asked me to
16 guide them to certain references they were interested in
17 researching geological and seismological hazards.

18 Q And they asked you for your geological opinion of
19 the reports? Is that correct?

20 A They asked me for -- well, the situation was that I
21 had read geological and seismological documents which they
22 had not read, and in areas in which they were doing research,
23 and they asked my advice about where to find certain informa-
24 tion.

25 Q Okay, but they have never asked you for any opinion

1 as to the geology of a particular site or region?

2 A No, I would not say that. Actually I have been
3 asked for my opinion by professional scientists, yes.

4 Q And who might that be?

5 A Several scientists at the Scripps Institute
6 in San Diego County have asked my advice on research, and if
7 you gave me time to think about it, I could probably come
8 up with a longer list than I right now have on the tip of
9 my tongue.

10 Q All right. In any of your visits at the GTR site
11 did you have occasion to take any field measurements?

12 A Yes, as a matter of fact, I happen to have discovered
13 one of the faults that was in trench A, I believe it was.
14 No one else had noticed it, and having attended several of
15 the field trips to the D trenches and trench E, and the ones
16 that occurred prior to the tour of trench A, I had learned the
17 techniques of recognizing faulting in the trenches, and during
18 the tour of trench A the scientists from the NRC and the
19 applicant, or licensee, had passed by a fault, and I pointed
20 this out to one of the scientists and they brought the group
21 back to that point and decided that it was a fault and it is
22 now in the documents in the proceeding.

23 Q And they will verify that, I assume?

24 A I assume they would. I believe that was in 1978
25 and I would have to think hard about exactly who all was there.

1 Q What is meant by the term -- this is in reference
2 to the state of the art in seismology -- what is meant by
3 the term "dislocation" across a fault plane?

4 A The bedding or stratigraphy on the layers of soil
5 and rock types on either side of a fault are dislocated in
6 respect to the beds on the opposite side of the fault.

7 Q How would you define the term "dispersion" in
8 regard to the movement of seismic waves?

9 A I do not have a precise definition for that term.

10 Q Do you know what it means?

11 A I assume that it means the movement of seismic waves
12 in a certain pattern, and I believe that it is associated
13 with random movement, or random direction.

14 Q Okay, but you don't know?

15 A I do not have a precise definition.

16 Q Do you have any definition?

17 A I have associations with the term.

18 Q Do you know whether the term has anything to do
19 with the relationship between the frequency components of
20 seismic waves and the manner in which they travel?

21 A I'm sorry, could you repeat that, please?

22 Q Do you know whether it has anything to do with the
23 frequency components of seismic waves and the manner in which
24 such waves travel?

25 A I believe that it has a lot to do with the manner

1 in which such waves travel, yes, dispersion does.

2 Q But you don't know whether it depends on the
3 frequency or not?

4 A In most analyses of seismic waves, frequency is very
5 important, the analysis of the frequency.

6 Q No, I am asking about this particular definition.
7 Do you know?

8 A I assume that in all studies of seismic waves that
9 frequency is important, because a lot of characteristics are
10 frequency-dependent.

11 Q But do you know whether the phenomenon of disper-
12 sion has associated with it a frequency-dependence? Do you
13 know?

14 A I do not specifically know that, but I assume that
15 it does.

16 Q How do you define the term attenuation as it is used
17 in regard to seismic wave movement.

18 A Well, attenuation is a very important concept,
19 especially when you are analysing nuclear reactors and soil
20 structure, interaction analyses. For example, attenuation
21 is different in the eastern states than it is in California,
22 and attenuation has to do with damping effects, or the way
23 in which seismic waves are modified, either amplified or
24 increased in amplification, or lowered in amplification as
25 they travel through layers of soil or rock, and also in

1 terms of the soil structure interaction.

2 Q How is that distinguished from dispersion of seismic
3 waves?

4 A Dispersion is the manner in which seismic waves travel
5 from the source, whether it is a point source or a linear
6 source, and attenuation is the manner in which the seismic
7 waves are either increased or decreased in amplitude as they
8 travel. Attenuation also involves soil structure interaction
9 analysis, and I do not believe that dispersion does.

10 Q And attenuation can only occur if indeed there is
11 a structure present? Is that what you are telling me?

12 A No, you can have attenuation withou a man-made
13 structure.

14 Q What causes that?

15 A It depends on the characteristics of the soil or
16 rock that the seismic wave is traveling through.

17 Q What characteristic?

18 A The amplitude.

19 Q The amplitude of the soil or rock?

20 A No, of the seismic wave.

21 Q What characteristic of the medium does it depend
22 upon?

23 A I'm not sure.

24 MR. EDGAR: That is all I have for the moment.

25 JUDGE GROSSMAN: Mr. Swanson, do you have anything on

1 voir dire?

2 MR. SWANSON: Yes, we do.

3 VOIR DIRE EXAMINATION

4 BY MR. SWANSON:

5 Q I just want to get a clarification on courses you
6 have taken in the sciences. My question is a little narrower
7 than Mr. Edgar's. I want to know courses you have taken for
8 credit and received a passing grade. Maybe I can skip over
9 some of these. As I understand it, you have not taken a
10 course beyond calculus or environmental geology, is that
11 correct, in the field of mathematics and of geology?

12 A That's correct.

13 Q And you do not claim to have taken a course in
14 geophysics, is that correct?

15 A The course which I received a passing grade on from
16 the University of California at San Diego was in seismology.

17 Q That's the --

18 A The professor is a professor of geophysics.

19 Q And that's the one you mentioned where you worked
20 with --

21 A Dr. James Brune at Scripps Institute.

22 Q Okay, you were tested specifically on your knowledge
23 on geophysics or seismology? Is that correct?

24 A It was a course in seismology.

25 Q I mean, you were given an exam? Where you were

1 tested on the quantity of knowledge you obtained in that
2 subject?

3 A There was no specific exam. It was a one-to-one
4 relationship, and my work had to do with the NRC licensing
5 proceeding on San Onofre.

6 Q I see.

7 A And my paper depended on my research regarding the
8 documents in that proceeding.

9 Q And it is your testimony that Dr. Brune specifically
10 examined the amount of knowledge you had obtained in this
11 subject? In seismology or geophysics?

12 A Could you repeat that question or have it read back?

13 Q Are you indicating that you were examined then as
14 to the amount of knowledge you obtained during that experience,
15 on either the subject of seismology or geophysics?

16 A Well, I would say that the examination consisted of
17 a continuous process on a one-to-one basis between myself and
18 Dr. Brune. It has continued for three years.

19 Q But, ah --

20 A I believe that he is quite satisfied with my under-
21 standing of the sciences.

22 Q You believe that there was no single examination
23 which actually tested the knowledge you obtained in seismology.

24 A There was no single examination, but I produced many
25 papers which are on the record in the San Onofre proceeding

1 if you would like to examine them. They were reviewed by
2 Dr. Brune.

3 Q Did you take the credit or receive a passing grade
4 in any kind of engineering course?

5 A No. My experience with engineering has been
6 limited to the NRC licensing proceedings at Diablo Canyon,
7 San Onofre, Vallecitos and my attendance at the earthquake
8 engineering conference.

9 Q Excuse me. I was just asking about courses. The
10 answer is no? Is that correct?

11 A Could you repeat the question?

12 Q I asked if you had taken for credit and received
13 a passing grade any course in engineering.

14 A No.

15 Q Thank you.

16 Have you taken any course for credit and receives a
17 passing grade in probability analysis or statistics?

18 A No, I have not.

19 Q How about soil mechanics?

20 A No.

21 Q When you were in the trenches, you indicated you
22 had gained some experience by studying the trenches at
23 Vallecitos were you under the direct tutelage or supervision
24 of any expert who checked your examination of the trenches to
25 know whether or not you made correct interpretations?

1 A Well, I would say that my teachers in those field
2 trips and those trenches were Dr. Jackson, Dr. Herd and
3 Dr. Brabb. I had extensive discussions with them. Also I was
4 formally enrolled in a course at the time and my teacher, and
5 that was Professor Gary Griggs at UC Santa Cruz, and I did
6 receive a passing grade for the work that I did in that
7 quarter involving the trench analyses on those field trips.

8 Q Did that professor go in the trenches at Vallecitos?

9 A No, he reviewed the trench logs and my work.

10 Q So he doesn't know if you saw a piece of rock in the
11 trench and interpreted it correctly, is that correct/

12 A I am not sure what you mean.

13 Q Well, if he was not in the trenches then he really
14 couldn't tell whether or not you perceived the information
15 in the trenches and interpreted it correctly, could he?

16 A Most of my work regarding the trenches was reviewing
17 the work that was being done by the licensee's consultants
18 and the US Geological Survey and the NRC staff. I was
19 reviewing their reports and their work, and observing their
20 work, and commenting on it.

21 Q Okay, and the results are in your testimony, is that
22 correct?

23 A To some extent. I did not deal extensively with
24 the trench field trips in my testimony. But I wrote many
25 interrogatories and responses to interrogatories in the dis-
covery process regarding those. That was back in 1978, '79.

1 Q Is it your contention, Mr. Barlow, that you could
2 satisfy the requirements of a geologist and apply to become
3 a registered geologist in the State of California.

4 A Well, it has been suggested to me that I might get
5 an honorary degree -- a graduate degree in either geophysics
6 or seismology, based on my experience.

7 Q I'd like you to look at a document entitled Geologist
8 and Geophysicist Act with Rules and Regulations. It's a com-
9 pilation of regulations issued by the Board of Registration
10 for geologists and geophysicists in the State of California.
11 It specifically refers to a section 7841, which indicates the
12 requirements for application of registration as a geologist.

13 (Pause)

14 A Did you say 7841?

15 Q That's correct.

16 (Pause)

17 And I would like you to indicate to me whether or
18 not you satisfy any of the specified requirements, dealing
19 with technical knowledge.

20 A How far do you want me to go?

21 Q Well, let's start with the first one. The first
22 one, "must meet one of the following educational requirements
23 fulfilled at a school or university whose geological curri-
24 culum meet criteria establishes by rules of the Board. One
25 of the options is graduation with a major in geology."

1 Now, it's already your testimony that you did not
2 do that. Is that correct?

3 A That's correct.

4 Q The other alternative is to complete 30 semester
5 units in geological science courses leading to a major in
6 geology of which at least 24 units are in the third or fourth
7 year of graduate courses. Would you say that you meet that
8 criteria?

9 A No.

10 Q Have you completed at least seven years of profes-
11 sional geological work which shall include either a minimum
12 of three years of professional geological work under the
13 supervision of a registered geologist or a registered civil
14 or petroleum engineer?

15 A No.

16 (Pause)

17 Q Feel free to amplify that answer.

18 A The next phrases are a minimum of five years' exper-
19 ience in responsible charge of professional geological work.
20 Professional geological work does not include routine sampling,
21 laboratory work or geological drafting.

22 Q I assume that you're referring to the phrase that
23 says except that prior to July 1, 1970, professional geological
24 work shall qualify under this subdivision?

25 A I didn't realize that was under that. I was going

1 to say the idea of five years experience in analyzing geologi-
2 cal work at Vallecitos.

3 Q Is that what you mean when you say you are working
4 as an employee for Friends of the Earth and Greenpeace?

5 A When I began analyzing the geological documents
6 regarding Vallecitos, I was working as an investigative repor-
7 ter and the document by Kaldverr Geotechnical Associates was
8 sent to me five years ago this month by Ms. Barbara Schockley
9 from the Alameda County Planning Commission.

10 Q So, that your work was as a reporter that you're
11 referring to as opposed to a geologist?

12 A I began working on it as a reporter and later became
13 a consultant for Friends of the Earth and the Congressman.

14 Q A consultant as a geologist?

15 A A consultant as an expert in the area of geological
16 and seismological hazards to nuclear facilities in California.

17 Q It was your contention that you were hired to pre-
18 pare geologic analysis and to prepare reports for Friends of
19 the Earth and Greenpeace?

20 A I was definitely specifically hired by them because
21 of my experience in geological and geophysical and seismologi-
22 cal analysis of nuclear reactors that have earthquake hazards.

23 Q To prepare analysis and reports for those groups?

24 A To be specific, I was hired to participate in the
25 discovery process, writing interrogatories and answering

1 interrogatories between Friends of the Earth, the Congressman,
2 the NAC Staff and the Applicant and Licensee in the proceedings
3 that I've mentioned before.

4 Q But not to perform geologic analysis and prepare
5 reports for those groups?

6 A Well, my work involved reviewing all of the geolo-
7 gical reports that were produced by anyone regarding the sites
8 and I did read those and write reports on them.

9 Q During that period, were you under the direct
10 supervision of a registered geologist or geophysicist?

11 A I've worked with many registered geologists and
12 geophysicists during the past five years consulting with them
13 and asking their opinions of various documents that I was
14 studying and also submitting my written papers to them for
15 review.

16 Q But when you're working with Friends of the Earth
17 preparing these conclusions, were you actually working under
18 the direct supervision of a registered geologist or a geo-
19 physicist?

20 A I consulted with many scientists including engineers
21 of various disciplines and geologists, geophysicists and
22 seismologists.

23 Q And they double-checked each review that you did?

24 A I would communicate with them either by phone, in
25 writing or in person, on the work that I was doing, the docu-

1 ments I was reviewing and the results of my written analysis.

2 Q So when you prepared conclusions or reports for the
3 testimony in this proceeding, you were just parroting infor-
4 mation obtained from these other specialists?

5 A I'm sorry, could you repeat that?

6 Q When you formed your conclusions which are contained
7 in your testimony for this proceeding, were you just repeating
8 the information that was given to you by other geologists or
9 seismologists?

10 A Well, a lot of the material in my testimony is
11 repeated from reports from the USGS and the Licensee's con-
12 sultants. Although, in addition, a lot of my testimony
13 is -- was independently arrived at through my study of docu-
14 ments and earthquakes and through my attendance at the various
15 conferences of the Seismological Society of America and the
16 American Geophysical Union and the Geological Society of
17 America and the Earthquake Engineering Conference that I went
18 to.

19 Q Let's look at the bottom of page one of your testi-
20 mony where you conclude, "thus to be conservative, at a
21 minimum, the GETR design bases should include a t.4 surface
22 displacement."

23 A Yes, sir.

24 Q I'd like you to indicate which of those groups you
25 said you relied upon to make that conclusion that the GETR

1 design bases should include a 2.4 meter surface displacement.

2 A Well, this statement is a result of an analysis
3 of several documents. The data is taken from --

4 MR. CADY: Excuse me, Your Honor. If we're going
5 to get into the substance of Mr. Barlow's testimony, I think
6 we should have a ruling as to whether or not he is an expert.
7 I realize it may be proper voir dire in this situation, but
8 to avoid redundancy upon cross examination, I wish he would
9 limit his quesitons to educational background and experience
10 and try to stay away from his testimony.

11 JUDGE GROSSMAN: We do have a very real issue here
12 as to qualifications and I believe this is for the purpose
13 of voir dire, not for cross examination. I'll allow that to
14 proceed, Mr. Swanson.

15 MR. SWANSON: I'll be quite candid. In this line,
16 I'm really trying to find out who the author of that conclu-
17 sion is.

18 BY MR. SWANSON:

19 Q Are you saying that that was done by you?

20 A I'm saying that -- Well, yes, I wrote that statement,
21 but I arrived at that statement through the study of several
22 documents regarding the San Fernando earthquake of 1971. By
23 an extensive review of 10CFR a part 100 of Appendix A which
24 defines seismic design criteria for nuclear reactors in the
25 NRC licensing process.

1 Q So, it was also, then, your conclusion as to the
2 proper acceleration value, then, in your testimony? You --
3 It's your testimony and you are sponsoring the conclusion
4 regarding acceleration value as opposed to just repeating what
5 someone else told you. Is that correct?

6 A I'm having a hard time understanding what you're
7 saying.

8 Q You recommend -- At the bottom of page three, you
9 state -- the last sentence, again. "It is the opinion of the
10 Intervenors again that the vertical acceleration could easily
11 exceed 2Gs during the magnitude 7 to 7.5 quake."

12 Let's just take that conclusion. That is your
13 conclusion, then, I assume as opposed to someone elses.

14 A No, sir, that is not my conclusion.

15 Q That is not your conclusion?

16 A I did not arrive at that independently.

17 Q Who provided that conclusion for you?

18 A Dr. James Bern and it is in the NRC docket on Diablo
19 Canyon in his testimony there. The same issue is discussed
20 and the same words are used.

21 Q Are there any other conclusions in this testimony
22 that you did not prepare?

23 A Well, in a sense I excerpted a lot. I think now
24 I understand your former line of reasoning on page one and
25 I would say that that statement which you quoted, "thus to

1 be conservative at a minimum, the GETR design bases should
2 include a 2.4 meter surface displacement," was primarily
3 derived from an NRC Staff document that was written by --
4 Well, it was distributed to all parties on the service list
5 with a cover letter from Harold Denton and signed by Edson
6 Case. Which had the Staff SCR input of 1979 and the conclu-
7 sions of the Staff, the USGS and Harold Denton and Edson
8 Case was that a conservative design bases for the GETR should
9 include a 2.4 meter surface displacement. That's where I
10 derived that statement from.

11 Q You didn't arrive at it independently, then, is
12 that correct?

13 A I read it and I wrote it. I read it in your report
14 and I wrote it in this testimony.

15 Q You didn't --

16 JUDGE GROSSMAN: I'm not sure that we're all travel-
17 ing the same road here. Mr. Swanson is interested in deter-
18 mining whether it was your opinion that went into these
19 statements here. Perhaps, your opinion based on an applica-
20 tion of certain materials to this case. As opposed to some-
21 one else's opinion that you merely put in there and the whole
22 gist of this examination is to determine the method by which
23 these statements came in there. I don't -- We're not on
24 cross examination now and we're not -- the point is not criti-
25 cal of the statements, but the means of which they were

1 derived. Whether it was your opinion or someone else's opinion
2 and I think if you keep that in context, you could probably
3 give the responsive answers to Mr. Swanson's question.

4 BY MR. SWANSON:

5 Q Do you understand the point the Board Chairman made?
6 What I want to know is what conclusions in this testimony
7 were not arrived at by you independently through your judg-
8 ment and analysis as opposed to conclusions that you are
9 merely just repeating and setting in argumentative --

10 A Well --

11 Q Excuse me -- in setting down in testimony in the
12 form of a conclusion, but which you did not actually analyze
13 yourself.

14 Q Well, that's the way -- the way you put that ques-
15 tion is complicated I would like to explain the way that I
16 arrived at my testimony. First of all, let me say that my
17 degree work is in science communications and the way that
18 I arrived at my testimony is through studying the scientific
19 documents that have been presented in this proceeding by the
20 various parties and their consultants and also through
21 scientific documents by independent scientists and many of
22 the statements that I make in my testimony are definitely
23 excerpts and derived from scientific documents that I have
24 read and that I am communicating about. The answer is two-
25 fold. In one sense I did not independently arrive at this

1 statement, because they were arrived at by other scientists
2 who published them in document and therefore I am quoting
3 and excerpting from various documents based on the expertise
4 of other scientists.

5 Q This could take a little bit of time by going in
6 to detail, but perhaps that could wait for the actual cross
7 examination if we get to that. I definitely intend to pursue
8 the matter. First it might be useful to reflect on what
9 parts you did arrive at by yourself and which you --

10 A I could point to an example of something I arrived
11 at by myself.

12 Q Well, I'm really interested in the -- okay, go
13 ahead.

14 A Let's see, on page four, section seven. This
15 section in one and a half pages long in my testimony and it
16 deals with the Intervenor's contention that the NRC Staff and
17 Licensee have not complied with the requirements of 10 CFR
18 part 100 Appendix A in terms of required investigations for
19 the evaluation of seismic and geologic siting criteria for
20 nuclear reactors in California and it goes on, but based on
21 my experience, during the past five years, and my analysis
22 of all the research that has been done at Vallecitos Site,
23 by the NRC Staff and it's consultants and the USGS and by
24 the -- especially the research by the Licensee and it's
25 consultants, I conclude that neither the Staff nor the

1 Licensee have complied with the requirements of the Federal
2 Regulations and they have not done the required investigations
3 for surface faulting.

4 Q That's the one section that comes to mind that you
5 prepared as opposed to someone else?

6 A That's correct. I prepared that, independently.

7 Q You claim that you testify as an expert at the
8 Department of Energy hearing regarding the Livermore site.
9 Do I infer correctly that you're claiming to have been con-
10 sidered an expert by the preceding board.

11 A I assume so. My testimony was accepted into the
12 transcript. There were no objections and I was allowed to
13 cross examine seismologists, geologists and engineers from
14 the nuclear facility there and in fact, the cross examination
15 went on for quite a long time and is rather extensive and
16 specific.

17 Q Are you claiming that the Board chairman made a
18 specific finding that you were an expert?

19 A I do not recall that he did that or not. I don't
20 think that that question was even raised. I know that in the
21 Board order or report, at the beginning of that transcript,
22 the Board, out of all the hundreds of pages of testimony that
23 were presented on many different subjects there, the DOE
24 Hearing Board decided that the geologic and seismic hazards
25 to the nuclear facility were the main problem and they recom-

1 mended what has turned into a three year multi-million dollar
2 research investigation of the earthquake hazards in the Liver-
3 more Valley adjacent to the GETR site.

4 Q Mr. Barlow, I have a copy of the transcript of
5 that hearing. Are you referring to the hearing that occurred
6 on April 12, 1979 in the multi-purpose room of Granada High
7 School in Livermore, California?

8 A That's correct.

9 Q I'd like to show you a copy of the transcript.

10 (Pause)

11 Q Take your time if you want to look at it.

12 A I'm familiar with the document.

13 Q Does that appear to you to be a transcript of the
14 same proceeding that you're claiming that you were allowed
15 to examine on as a --

16 A It appears to be. I'm not sure it's complete.
17 There were many attachments and documents submitted that I
18 helped to prepare.

19 Q I would just like to read from a portion of a page
20 and ask you if that sounds familiar. If you think that properly
21 set the frame work for questioning in that proceeding. I'm
22 reading from the opening statement of the Chairman, a Mr.
23 Farmakides, on page two, which indicated that "the notice
24 also announced that this hearing would be a legislative type
25 hearing and not an adjudicative one. Therefore, we will not

1 use formal procedures such as testimony under oath, cross
2 examination of experts and so on. However, we will permit
3 questions provided they are relevant to the draft statement
4 which we are now considering. If anyone wishes to raise a
5 question, please do so, by writing out your question on a
6 sheet of paper or on a card." It goes on.

7 Is that -- Does that appear to you to be the frame-
8 work of the proceeding in which you have referenced?

9 A Well, that was the general framework for most of the
10 participants, however, Friends of the Earth was treated
11 differently than the other participants, of which there were
12 many dozens. We were specifically given a two hour block of
13 time and allowed to present expert testimony and in the process
14 of that, we were allowed to cross examine scientists from the
15 Livermore Lab and that did not occur in any of the other --
16 with any of the other participants. As you see, there, the
17 process for other participants questioning witnesses or the
18 DOE was a written procedure. Whereas, when I was examining
19 and questioning the scientists from the nuclear facility, it
20 was a direct form of questioning rather than a written form
21 of questioning.

22 Q Are you contending then that a special exceptions
23 was made for Friends of the Earth and the Board went out of
24 its way to make a finding of expertise on your part?

25 A That was a dual question. I would prefer if you

1 would separate --

2 Q Glad to. Are you claiming that the Board made a
3 ruling that you were an expert cross examiner in that proceed-
4 ding?

5 A The Board recommended and allowed me to cross
6 examine scientists from the nuclear facility.

7 Q That was not the question. I was asking if the
8 Board made a special ruling that you were an expert examiner
9 in that proceeding.

10 A Well, I'm -- it depends on your definition and
11 their definition and it could take quite a long time to go
12 into a discussion of that.

13 Q If you could just point quickly to the transcript
14 where you think they might have made that ruling, that would
15 simplify things.

16 A Well, there was a period when I was referring to
17 the various reports that were performed by the Terra Corpor-
18 ation and Dr. Larry White who is a consultant to the NRC
19 in this proceeding and Dr. Don Bernreuter and some of the
20 other scientists in which we were discussing various earth-
21 quakes that we also discussed in this proceeding and the
22 horizontal and vertical accelerations from those earthquakes
23 which we have also been discussing in this proceeding and
24 which I cross examined about last week and the Board granted
25 Friends of the Earth extensions of time because they were

1 very interested in this area of questioning and they recommen-
2 ded that the Livermore Nuclear Facility bring forward their
3 experts and their scientists to discuss the horizontal and
4 vertical ground accelerations and the parameters that were
5 used in arriving at their position in their various papers
6 about earthquake hazards to that nuclear facility.

7 Q I'll ask you again, can you point to any place in
8 the transcript that would indicate that the Board made a
9 ruling that you were an expert as you claimed in your intro-
10 ductory statement?

11 A It's difficult to define that. I think you would
12 have to ask the DOE Hearing Board what their definition of
13 expert witness is.

14 Q Okay, thank you.

15 (Pause)

16 Mr. Barlow, other than the pre-filed proposed
17 testimony for this proceeding submitted by the Licensee and
18 the Staff and its consultants, are there any published papers
19 which contain conclusions specific to GETR that you are relying
20 on in your testimony?

21 A Well, as I pointed out before, I have reviewed all
22 of the documents that I could find since five years ago,
23 exactly, regarding the geologic and seismic hazards to the
24 GETR site.

25 Q I was asking for published papers. I was wondering

1 if you could indicate any --

2 A I'm --

3 Q Specific to GETR, is my question.

4 A I would need you to define published papers in that
5 context, because let me ask you this -- If a document is
6 submitted by the Licensee or the NRC Staff or the USGS,
7 is it considered a published paper. It isn't being published
8 in the formal sense.

9 Q I was saying other than that. Let me use a phrase
10 used by used by the licensing board in the Clinton proceeding
11 that will be P 75-59. Academic journals and scientific
12 articles containing works of other experts. Does that
13 phrase help?

14 A Do you mean outside of the NRC proceedings and
15 discovery process?

16 Q Well, the purpose of the question was to find out
17 what you relied on. I think we have certain documents which
18 are going to be in the record in this proceeding which have
19 already been prefiled -- proposed testimony by the Staff and
20 Licensee. I was wondering what other documents specific to
21 GETR and which are publicly available published scientific
22 articles or journals that you relied on?

23 A Well, in my testimony there is a list of references.
24 Some of them are outside of this proceeding and some of those
25 are not specific to the GETR site and yet they deal with

1 some of the regional seismic hazards and regional geologic
2 concerns.

3 Q Yes, but your conclusions are related specifically
4 to GETR, do they not? Your conclusions regarding the proper
5 seismic and geologic design bases?

6 A My testimony is directed to the GETR on the sites
7 specific bases.

8 Q I was wondering what published scientific articles
9 or journals you relied on specific -- that contained articles
10 specific to GETR in formulating your conclusions which are
11 specific to GETR.

12 A There is one document that I can think of that is
13 very relevant that may not be formally in this proceeding
14 and that is a document by Dr. Bruce Bolt, Dr. Thomas McEvilly
15 and Dr. Robert Urhanner who are all from the U.C. Berkeley
16 Seismological Laboratory regarding the Livermore earthquake
17 sequence of January 1980 and I have not seen that document
18 presented by either the Licensee or the Staff in their
19 analysis of the GETR seismic hazards and I do consider it a
20 very significant site specific document that is not being used
21 in this proceeding and I do depend on it for some of my ana-
22 lysis.

23 Q You interpret as being relevant to the proceeding.
24 The authors present the numbers that you present in your tes-
25 timony in terms of geologic and seismic design bases for the

1 GETR, not someother site, but for the GETR?

2 A Well, one of the authors, Dr. Bruce Bolt did per-
3 form a consulting study for the Licensee in this proceeding,
4 entitled, Seismicity of the Livermore Valley in Regard to the
5 GETR Site and in that document, he specifically excludes
6 data from the January 1980 Livermore earthquakes and so it's
7 an ambiguous situation, because on the one hand the Licensee
8 has hired this professor of seismology as a consultant to
9 look at the earthquakes in the area and yet they have excluded
10 the largest earthquake that is closest to the reactor.

11 Q That wasn't my question, though. Does this article
12 that you just referenced contain seismic or geologic design
13 bases for the GETR that you relied on to appear in your
14 testimony? Or can we assume that you made the interpreta-
15 tions that appeared in your testimony?

16 A I'm not sure what you're asking.

17 Q Originally I had asked you about published papers,
18 scientific articles and journals. You indicated this one
19 paper by Mr. Bolt, Dr. Bolt, which you thought was relevant
20 to the site. You indicated that you interpreted that as having
21 relevance to the GETR site. What I'm trying to find out is
22 that then an article which you relied on which you took
23 geologic or seismic design bases for the GETR from and incor-
24 porate that in your testimony?

25 I think I understand what you're saying. Let me

1 try answering your question and you can tell me if it's
2 complete. In that article by the three professors, they
3 do not specifically mention the GETR site, but they do
4 analyze seismicity in the Livermore Valley and it did shake
5 the GETR site, so I extrapolated from their report.

6 ///

7 (The testimony will continue on the next numbered page.)

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1 MR. SWANSON: I think that is all the questions I
2 have that would fall within the definition of voir dire.
3 As I indicated, I do intend to pursue the line of questioning
4 about authorship of certain portions.

5 JUDGE GROSSMAN: We are not going into cross
6 examination right now.

7 MR. SWANSON: I understand.

8 JUDGE GROSSMAN: Nor have we yet heard arguments
9 from you with regard to this. We wanted the voir dire of the
10 witness first, and we will permit you a chance to argue the
11 point before we make a ruling. Mr. Cady, did you have some-
12 thing further with regard to the voir dire?

13 MR. CADY: Your Honor, the only thing that I
14 wanted to add was that certain references were made to the
15 Greenpeace organization, and I want it understood on the
16 record that Greenpeace in no way has helped in the pursuance
17 of this action on behalf of Friends of the Earth. The only
18 support that we have received from them is that of a concerned
19 economic, or ecological conservation organization. But any
20 references to Mr. Barlow being associated with Greenpeace
21 had nothing to do whatsoever with his participation as an
22 employee of Friends of the Earth, and helping us go forth with
23 this proceeding, and I want that completely understood.
24 Thank you.

25 JUDGE GROSSMAN: Do you have any questions of Mr.

1 Barlow before we go further?

2 MR. CADY: No, I don't.

3 BOARD EXAMINATION

4 BY JUDGE FERGUSON:

5 Q I have just a few very brief things that, if you
6 can help me understand, I think it will help the record.
7 On page 4 of the Intervenor's answers to Licensee's Interroga-
8 tories, to Intervenor's second set, you suggest that you were
9 at one time working with Friends of the Earth and congressional
10 offices as an assistance in their OC/OSC intervention proceed-
11 ings on the Vallecitos GETR. Now my question is simply, can
12 you tell me in your own words, what qualifications were re-
13 quired of a person to work as an intern for Friends of the
14 Earth and the congressional offices discussed here? What
15 did you have that made them select you as an intern, and
16 what, in fact, is an intern?

17 A Well, I think that my qualifications for those
18 positions were based on my experience, and the decisions
19 were made on an individual basis in each case.

20 Q There were a number of people available and certain
21 people were selected as interns because of their qualifica-
22 tions?

23 A No, sir. It was based on interest. My interest
24 in the proceeding and my interests in those offices, and my
25 personal individual communications with individuals in the

1 offices mentioned. There was no advertised job position
2 open or anything like that. It was on my own interests and
3 initiative.

4 Q You were there as an interested person and then
5 your interests were so great that they selected you as an
6 intern. Is that a fair statement?

7 A No, I would say I suggested it.

8 Q Oh, I see.

9 A And they agreed. I took the initiative.

10 Q Thank you. I would assume that those persons who
11 are associated with Friends of the Earth, and surely the con-
12 gressional people that you represent, as well as members of
13 city council, are reasonable people, and they would at some
14 time feel that an event such as the one that we are now
15 experiencing would come about. That is, someone would raise
16 questions as regards your qualifications. Now what has gone
17 on before has relied heavily on your formal education, and
18 maybe I should say traditional education. And there have been
19 some several concerns about a lack of overwhelming abundance of
20 special traditional education. But you have been very help-
21 ful to us in indicating that you have a vast wealth of
22 experience, relevant experience. Now as I listen to you
23 speak, it just seems to me that perhaps something is being
24 missed, and that it -- and again I say that the people that you
25 represent are, I assume, very reasonable people -- it seems

1 to me that they must have made some judgment at some time,
2 and perhaps based on that judgment selected you out of perhaps
3 a group of other persons who would have had a different
4 history of traditional experience. Now my question is, do
5 you know of any unique feature that you would have that would
6 lead this reasonable group of people to select you out of a
7 perhaps large groups of people who would not have this de-
8 ficiency that is trying to be identified at this particular
9 time?

10 A Yes, sir, I would say that I do know --

11 Q Without repeating all of the experiences that you
12 have told me about, is there anything that is very unique
13 about you and your experience that would cause these reasonable
14 people to select you out of all who would be available.

15 A I think that it is based on an interdisciplinary
16 approach that I have taken. It would be very hard to find
17 someone who has the range of experience in a variety of fields
18 and be able to integrate them and do what I have done. For
19 example, if you depended on the traditional approach to this,
20 rather than an approach based on experience, you would need,
21 in order to do what I have done for these offices, the
22 three congressional offices and Friends of the Earth, and
23 Miss Shockley, you would need to hire a group of people --
24 you would need to hire a geologist, a geophysicist, a
25 seismologist, a structural engineer, an earthquake engineer,

1 a solid engineer, a media person, a professional science
2 writer, and a legal intern or a lawyer or a group of lawyers
3 to analyse the NRC licensing process, and to analyse the dis-
4 covery process that the NRC uses for parties to gain information.
5 And you would have to have maybe seven or eight people working
6 together in their special fields to do what I have done. And
7 what I did was start as an investigative reporter, and I
8 communicated with scientists and lawyers and the NRC people
9 and the scientists and licensee's consultants involved, and
10 I began to specialize in earthquake hazards to nuclear facili-
11 ties that are licensed by the federal government. And I
12 analyzed the way the federal regulatory agencies handled this
13 and the various kinds of scientific disciplines involved,
14 because there are many scientific disciplines involved, and
15 I was able, through communications and consulting with
16 scientists and lawyers, and NRC staff people, I was able to
17 bridge the gap between these various disciplines and specialize
18 in an interdisciplinary approach. And because I trained
19 myself through five years of experience doing that, I am of
20 the opinion that, and I believe that these groups of people
21 that you are referring to share this opinion, that it would
22 be extremely difficult, if not impossible, to find another
23 single individual who had these same qualifications. It might
24 be possible to find a group of people to replace me.

25 Q That is very enlightening. You are sort of

1 equivalent to seven or eight experts in specialized fields.

2 A I might add that it would cost a lot more money
3 for these offices to hire seven or eight experts in these
4 fields than it costs them to hire me.

5 Q But did you hear the question that I just asked?

6 A Maybe I misunderstood. I am sorry. I thought you
7 were making a comment.

8 Q Do you agree with the comment that I made

9 A Yes.

10 Q Just one brief thing. You indicated that you
11 attended and participated in several events. The one that I
12 am particularly concerned with are the ACRS hearings. What
13 was the level of participation?

14 A Well, I attended ACRS meetings regarding Vallecitos
15 in the GETR site, I did not formally participate in those
16 meetings in any way. I just observed and listened and
17 studied the transcript. However, in another ACRS proceeding
18 which was conducted this year, I believe it was January 31st,
19 1981, in Los Angeles, I did participate, and I could describe
20 that for you if you like.

21 Q No, that is not necessary at this time. It also
22 says that you participated -- attending and participating in
23 meetings of ASLB's appeal board. What was your level of
24 participation in that?

25 A Those appeal board hearings were in regards to

1 the Diablo Canyon site, and my participation was supportive,
2 I would say. I tape recorded the entire proceedings in
3 October 1980, in which Governor Brown and other intervenors --

4 Q (Interjecting) Without getting into the details of
5 the hearing, just tell me the level of participation. You
6 said that you recorded the sessions?

7 A I tape recorded the sessions and I made myself
8 available to assist scientists and lawyers who were partici-
9 pating in terms of consulting and conferences.

10 Q Did scientists and lawyers avail themselves of
11 your availability?

12 A Yes, sir.

13 JUDGE FERGUSON: I have nothing further.

14 JUDGE GROSSMAN: Before we get into the arguments
15 on this, I did have one or two brief questions for Mr. Swan-
16 son with regard to something that he said. Assuming that we
17 do not admit Mr. Barlow as an expert, at least at this time,
18 was it your intention not to conduct cross examination with
19 regard to the offer of proof? Or was that something that
20 would depend on the particular Board ruling that was made?

21 MR. SWANSON: Well --

22 JUDGE GROSSMAN: Do you follow my question?

23 MR. SWANSON: I think so. Were there an offer of
24 proof, I think it is likely right now that we would not as
25 cross examination questions, other than to pursue the line
that I indicated, to find out the source of various parts

1 of the testimony.

2 JUDGE GROSSMAN: Even if the Board allowed you to
3 cross examine on the offer of proof?

4 MR. SWANSON: As I indicated, we are quite interested
5 in the source of the answers. If it turns out the source was
6 Mr. Barlow, and it was his judgment, we probably would not
7 probe into that. That is correct.

8 JUDGE GROSSMAN: And would you intend to put on any
9 rebuttal evidence or anything that would cover these points,
10 whether you categorize it as rebuttal or if you just assume
11 this is an offer of proof and it does not need any further
12 discussion or any further evidence?

13 MR. SWANSON: As Mr. Barlow pointed out, he in-
14 tended to rely substantially on USGS people. We do intend
15 to ask some questions in rebuttal of the USGS witnesses,
16 as well as some staff witnesses, staff employees, in response
17 to questioning that Mr. Barlow and Mr. Cady have conducted thus
18 far of the General Electric panel. We intend to do it in
19 the form -- many of the issues are also brought up in Mr.
20 Barlow's testimony. To that extent we do intend to ask some
21 orla rebuttal when the staff panel comes on.

22 JUDGE GROSSMAN: Mr. Edgar, can I ask you the same
23 questions, as to whether if we permitted merely the offer of
24 proof, and not this as admitted expert testimony, whether
25 you would pursue cross examination?

1 MR. EDGAR: We would have some. Yes.

2 JUDGE GROSSMAN: And would you also attempt to
3 rebut matters that were raised?

4 MR. EDGAR: No.

5 JUDGE GROSSMAN: Now let me also clarify the
6 question of exhibits here. It was my understanding that the
7 parties had agreed on exhibits, and I see a list of exhibits
8 attached to Mr. Barlow's testimony. Were those agreed upon
9 exhibits, that the parties would not object to?

10 MR. CADY: No, they were not, Your Honor. One of
11 the parties submitted objections to those exhibits. The
12 exhibits that were filed in conjunction with Mr. Barlow's testi-
13 mony are incorporated in our intended list of exhibits that we
14 filed on, I believe, May 12th.

15 It was GE or the NRC did file objections -- I believe
16 it was the NRC did file appropriate and timely objections to
17 certain of those exhibits.

18 JUDGE GROSSMAN: Can you tell me quickly what they
19 are?

20 MR. SWANSON: I have a copy of objections for both
21 GE and the NRC. Briefly, the NRC's position is that, to the
22 extent of course that they propose to introduce exhibits
23 that we are, in fact, introducing, obviously we do not object.
24 But we intend to sponsor them ourselves. As to remaining
25 documents, the staff would object on the basis that Intervenor

1 have proposed no sponsoring witnesses for the documents who
2 would be available for cross examination by the Board and other
3 parties, nor do Intervenors offer anyone who could defend the
4 documents as expert treatises and respond to questioning about
5 them. In the absence of a sponsoring witness, there is no
6 basis whereby the Board could make a finding as required by
7 10CFR, Section 2743C, that the documents are reliable, relevant
8 and material.

9 JUDGE GROSSMAN: One of the purposes of stipulation
10 is to overcome the formal requirements of admitting documents
11 such as having a sponsoring witness, and the question I had
12 was whether you are waiving those formal requirements.

13 I'm sorry. Mr. Edgar?

14 MR. EDGAR: May I point out on page 8 of the stipu-
15 lation, we covered this, and the parties have discussed this.
16 In paragraph (d)(2), what we had contemplated was a two-
17 step process. It is actually paragraphs (1) and (2). On
18 May 12th, 1981, all parties would present lists of exhibits,
19 which they intended to offer into evidence. This is above
20 and beyond written, prepared direct. And all parties did
21 that. And the second step was that the parties would file
22 any objections as to admissibility, and we then stipulated that
23 if there was no objection, it could be received without
24 formal authentication. So I suppose what we have done is
25 tried to shortcut the authentication process, but reserved

1 anyone's right to object to a document. And both the staff --
2 well, Mr. Cady made a filing of his exhibits in a timely
3 manner, and both Mr. Swanson and I objected in a timely manner.
4 So I don't think there is a waiver and indeed I think all
5 counsel will confirm that this was contemplated. It is totally
6 consistent with what the parties had agreed upon.

7 JUDGE GROSSMAN: I wasn't suggesting that there was
8 a waiver. I wanted to see what the consequences were of
9 either admitting Mr. Barlow as, say, an expert or not admitting
10 them and permitting his testimony as an offer of proof. Then
11 apparently the bulk of exhibits also would not be admitted
12 or they would be objected to on the grounds of having no
13 sponsoring witness and inadequate foundation.

14 MR. EDGAR: Our objections really stand somewhat
15 apart from that in that our objections go to the character of
16 the documents in many instances. We have tried to be specific
17 but if the Board, for the sake of completeness of the record,
18 were inclined toward an offer of proof, we would conduct
19 brief cross examination and that would be it. I think inde-
20 pendent of that, there is a separate issue about documents.
21 I am not sure that our grounds are co-extensive either. I
22 understand the point you made, but I think we have grounds
23 which are independent of the witnesses presence, himself.

24 MR. CADY: Your Honor the Intervenor would have no
25 objection to a motion to strike the referenced exhibits in

1 Mr. Barlow's testimony, since they are covered in the list
2 of proposed submitted exhibits that we did file on May 12th.
3 At that time, should the staff's objections, and NRC's objec-
4 tions be sustained at that time, we could offer them into
5 evidence subject to any possible route of appeal that we have
6 to have them actually introduced as evidence. But as I said
7 before, we would not object to a motion, to avoid this pro-
8 cedural problem, to a motion to strike the portion of Mr.
9 Barlow's testimony referring to these documents.

10 JUDGE GROSSMAN: But I understand one of the objections
11 is the lack- of foundation or the lack of a supporting witness
12 so that we are not obviating the problem by striking the
13 documents from his proposed testimony. We still would
14 lack a supporting witness in order to get those documents in,
15 and that depends on whether Mr. Barlow is permitted to be
16 an expert witness who can lay a foundation for those documents.
17 Is that your understanding, too, gentlemen? Mr. Swanson?

18 MR. SWANSON: I think the Board correctly charac-
19 terized the problem. I was not sure that Mr. Barlow would
20 be offered as a sponsor by the Intervenor. That point was not
21 clear. Or if there was going to be anyone offered, for that
22 matter.

23 MR. CADY: If Mr. Barlow is accepted as an expert,
24 he would be offered to support these documents.'

25 JUDGE GROSSMAN: How much in the way of time do you

1 believe it would take to argue this point of admitting or
2 not admitting Mr. Barlow, so that we will know what our
3 schedule is?

4 MR. EDGAR: Mr. Chairman, I can speak for myself.
5 I would need very little time, I would need five minutes.

6 JUDGE GROSSMAN: Mr. Swanson:

7 MR. SWANSON: I think a similar time. I think the
8 issues are simple enough to be briefly addressed.

9 JUDGE GROSSMAN: Okay, Mr. Edgar, proceed on that.

10 MR. EDGAR: Mr. Chairman, the governing standard
11 starts with the proposition that the parties sponsoring the
12 witness has the burden of demonstrating his expertise. We
13 recognize that the expertise can be demonstrated either by
14 a showing of professional training or relevant experience.
15 Or some combination of the two. The important thing for the
16 Board to examine is the nature of the training or experience,
17 and more significantly what form of contribution to the
18 record that this information might make. Mr. Barlow raised a
19 very telling point in connection with a response to one of
20 Dr. Ferguson's questions. He said in order to replace him
21 one would need seven or eight people, and included within
22 the group of seven or eight was, to my surprise, a lawyer.
23 It is my view, based on examination of Mr. Barlow's testimony
24 and what he has to offer this Board, that everything and anything
25 he says is a matter that can be addressed in proposed findings.

1 The information is presented as second-hand. Mr. Barlow is
2 a communicator. He passes along to you the views of other
3 experts, if you will. But the source is never presented.
4 I will be the first to admit that the exclusionary rules of
5 evidence do not have direct application in administrative
6 proceedings. I am not talking about a hearsay objection.
7 What I am talking about is the reliability and the probative
8 value of the evidence, that if you have a communicator coming
9 on to give you the opinions of other experts, the same in-
10 formation can be gleaned from all of the experts in this pro-
11 ceeding and presented to the Board in the form of proposed
12 findings of fact and conclusions of law. That is where the
13 lawyer comes in in this eight-way person who can provide you
14 with an expert view.

15 Mere experience in the context of NRC proceedings,
16 whether it is observation, assistance or participation, does
17 not an expert make. The simple fact is that Mr. Barlow is not
18 a geologist, he is not a seismologist, and he is not a geo-
19 physicist. We think the Board should recognize the facts
20 for what they are and decide accordingly. We would suggest to
21 the Board that Mr. Barlow is not an expert, and indeed not
22 qualified to sponsor the testimony in question.

23 JUDGE GROSSMAN: Mr. Swanson?

24 MR. SWANSON: I will not repeat the arguments
25 regarding the qualifications except to add one other point.

1 There are portions of the testimony which deal perhaps in
2 the engineering field, and I would also add that he is not
3 an engineer, nor does he claim to have taken any courses in
4 that field. The standards, I think, for admitting experts,
5 and allowing them to rely on other published articles have
6 been set forth at various times in NRC Board decisions. One
7 decision by the Biablo Canyon licensing board indicated that
8 an expert who was attempting to testify in the area of
9 security plans, for example, should have technical competence
10 to evaluate the components of a security plan which would
11 ideally require practical knowledge flowing from the assembly
12 of the nuts and bolts -- the various components. At least
13 to the extent of being able to design an overall system.
14 That is certainly not directly transferrable to this pro-
15 ceeding, but it gives a perspective as to the type of ex-
16 pertise that is required.

17 As the appeal board recognized in the Hartsville
18 decision in ALAB 367, when you have a non-expert and that
19 expert is attempting to rely on the opinions of others who
20 are perhaps experts, you have a serious question of reliability.
21 In that proceeding you did have an extreme case where the
22 expert we relied on was unknown, but I think the concern is
23 there. I think this Board chairman recognized that concern
24 recently in a summer decision that reliability becomes a key
25 question in determining whether or not an individual can

1 rely upon hearsay, whether or not hearsay is admissible in
2 administrative proceedings. I think the record indicates
3 that Mr. Barlow, although he has been actively involved in
4 this proceeding, has simply not had the type of direct super-
5 vision nor check on the knowledge that he has obtained to
6 give this Board assurance that he indeed has expertise in the
7 fields in which he wishes to testify.

8 As Mr. Edgar indicated, it does appear from the
9 testimony that the facts or arguments that he wished to make
10 could well be done in proposed findings, since they seem to
11 rely almost completely on information that will be presented
12 in this proceeding at one point or another. To the extent
13 that he wishes to rely on information from GE consultants,
14 he has had his opportunity, the Intervenors have had their
15 opportunity to cross examine, and they of course will have an
16 opportunity to cross examine the United States Geological
17 Survey consultants who have worked on this case, the staff of
18 geologists and geophysicists and other consultants who will
19 be relied upon, have been relied upon, to form the staff
20 opinion. Our conclusion simply is that he does not satisfy
21 the requirements of an expert in the meaning of the Commission's
22 regulations, and should not be afforded the special privilege
23 of forming expert opinions nor relying on scientific articles
24 and journals, in forming his own interpretations of the
25 conclusions stated in those documents.

1 JUDGE GROSSMAN: Mr. Cady?

2 MR. CADY: The Board has heard Mr. Barlow's
3 qualifications from reviewing our answers to interrogatories
4 dated February 25th and April 10th, 1981. It is our position
5 that Mr. Barlow, through his extensive experience and
6 involvement in this proceeding has immersed himself enough
7 into the issues involved and into the fields of seismology
8 and geology, and in doing his research and analysis on behalf
9 of the Intervenors, to qualify himself as an expert in these
10 fields. We feel that his testimony should be taken as such
11 and weighed accordingly with that of the experts employed by
12 GE and the NRC. Beyond that it is a matter of Board decision
13 as to whether or not Mr. Barlow is qualified as an expert,
14 and I will just leave it as that.

15 JUDGE GROSSMAN: We will take a ten minute break u
16 until 4:25.

17 (Brief recess)

18 /////

19 (Continued on the next numbered page.)
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1 JUDGE GROSSMAN: On the record.

2 The Board has considered very carefully both sides
3 of the question. We could not help but take note of the fact
4 that Mr. Barlow does lack formal training. He does lack
5 field training. He, in fact, does lack a background that
6 would afford him the means of coming to independent opinions
7 such as the backgrounds of others who have already testified
8 have. On the other hand, he has done a prodigious amount of
9 work with regard to the particulars of the seismic problems
10 relating to GETR and the seismic material -- the seismological
11 material that has been published and presented in the last
12 few years which might have some application to the seismic
13 problems around the Pleasanton Livermore area.

14 He does, in fact, have some expertise in a sense
15 with regard to that cataloguing of materials and both with
16 particular in the GE test reactor case and the seismic area
17 generally which relate to it. But, on balance, we can't at
18 this point in time admit Mr. Barlow as an expert. We will
19 at the present time permit only the offer of proof. We will
20 reconsider though his status as an expert and perhaps find
21 that he is some sort of more limited expert than he had been
22 presented to be. We are not making any such determination
23 right now. We hope, however, that the ruling will have a
24 certain effects with regard to the way the parties present
25 their respective cases.

1 With regard to the Intervenor, we would expect
2 that this ruling would stimulate your attempt to get the
3 materials in that Mr. Barlow was to present through testimony
4 of -- not materials, but opinions through testimony of others
5 and that by the way goes to the exhibits that are attached
6 to Mr. Barlow's pre-file testimony since certainly nothing
7 precludes you from having another witness apply the foundation
8 for those documents.

9 On the other hand, I would expect that in view of
10 the possibility that we may reverse our ruling after the record
11 is closed that both adversary -- that both of the other parties
12 would attempt to test the foundation for Mr. Barlow's testi-
13 mony in cross examination and also present their own witnesses
14 to cover the areas in which he is attempting to present expert
15 testimony.

16 So, we will now permit the offer of ^F to go
17 further and allow the parties to cross examine. Does, Mr.
18 Cady or Mr. Barlow have any preliminary remarks to make?

19 MR. CADY: We wish to introduce as written testi-
20 mony or rather, have it marked as an exhibit pursuant to the
21 rules as an offer of proof and then allow the GE and the NRC
22 to cross examine upon the written testimony of Mr. Barlow.

23 WITNESS BARLOW: Could I ask a question?

24 JUDGE GROSSMAN: Yes, sir.

25 WITNESS BARLOW: You said that nothing precludes the

1 Intervenor having another witness and I didn't catch the
2 rest of the sentence.

3 MR. CADY: I've got it Glen.

4 WITNESS BARLOW: Well, I had a specific question
5 relating to that. Since, some of my documents that I've
6 referenced refer to Dr. Bruce Bolt who is a consultant to the
7 Licensee, would it be possible for us to have the Board
8 subpoena Dr. Bolt?

9 JUDGE GROSSMAN: I believe that -- Well, you certainly
10 ly could attempt to have the documents introduced through
11 other witnesses other than Mr. Bolt. There are others who
12 I presume are going to testify who are experts with out
13 question and may have some familiarity with the document and
14 may be able to indicate that Mr. Bolt is an authority and
15 that the documents do have some authoritative weight in the
16 area and that's a method of getting those documents in.

17 WITNESS BARLOW: But the Intervenor have no other
18 witnesses on geology and seismology. How could we do that?

19 JUDGE GROSSMAN: That's correct, but the Staff does
20 and I assume that GE may have other witnesses and if they
21 are familiar with the document, it's possible to get them in,
22 but if they're not, then there is a problem.

23 Now, I assume that the problem of authenticity is
24 not there. Is that so, Mr. Swanson?

25 (No response)

1 JUDGE GROSSMAN: So, that to the extent that they
2 are referred to as documents published or papers published
3 or unpublished but presented by Dr. Bolt, I don't think we
4 would have that special problem.

5 MR. SWANSON: Most of the documents they propose
6 are apparently published documents. I think that probably
7 would not be the case. However, there are a couple of instan-
8 ces where the term is used. All of the material, etcetera,
9 for example. Number one, all documents prepared by USGS
10 scientists are relevant to this proceeding. Number two, all
11 NRC Staff reports regarding seismic and geologic factors --
12 Sometimes terms like that make it a slightly different problem
13 as we indicated in our response.

14 I believe that for -- I don't think I could give
15 you a detailed answer, but I think for most of them, if not
16 all of the detailed items, there would not be that problem.

17 JUDGE GROSSMAN: I ignored those documents, because
18 I don't see any problem of getting those documents in, in the
19 first instance. Those are documents produced by a party to
20 the proceeding here and certainly they're admissable as
21 admissions of a party. If we're referring to NRC documents,
22 I don't believe there is any problem.

23 My concern was with the papers issued by independent
24 persons who -- where they constitute hearsay and not admissions
25 and so Dr. Bolt's documents are one of that kind. I don't have

1 the list in front of me, so I don't see the others.

2 Mr. Edgar, do you agree?

3 MR. EDGAR: Yes.

4 JUDGE GROSSMAN: That with regard to NRC documents,
5 we don't have any problem.

6 MR. EDGAR: NO question. Although, there is one
7 qualification and that is some of the descriptions of this
8 body of documentation were so broad, we couldn't tell what
9 they were. If they're the USGS reports and Dr. Herds map
10 and things like that which are the specific items of descrip-
11 tion, but it's sort of described as including but not limited
12 to, but all these documents that we know of in that category
13 we have no problem with. They're going in anyway. The Staff
14 is putting them in.

15 MR. SWANSON: I think maybe there was a miscommuni-
16 cation. I was referring to some of the other articles by
17 non Staff personnel. I believe that we would not have a
18 problem as to authenticity. There is -- And of course, we're
19 going to staff documents. In fact, it's referring to the
20 inputs of the safety evaluation, meaning the four documents
21 that we intend to introduce. That problem, of course, is
22 mute there.

23 I don't think all of the documents they intend to
24 introduce fall neatly into a category of being accessible
25 to being introduced one way or another. Perhaps portions,

1 otherwise, but most might fall under that category.

2 JUDGE GROSSMAN: In any event, I think that explains
3 the question you had, Mr. Barlow and I think.

4 WITNESS BARLOW: Well, there is one problem. There
5 was a reference to an interview with Dr. Bolt which the other
6 parties objected to and I think that it leaves open the ques-
7 tion of whether or not Dr. Bolt should be subpoenaed into this
8 hearing.

9 (Pause)

10 MR. EDGAR: May we approach the bench?

11 JUDGE GROSSMAN: Yes, counsel. Would you approach
12 the bench.

13 Off the record.

14 (Discussion off the record.)

15 JUDGE GROSSMAN: On the record.

16 Okay, Mr. Edgar are you prepared to proceed now?

17 MR. EDGAR: Yes.

18 CROSS EXAMINATION

19 BY MR. EDGAR:

20 Q Mr. Barlow, can I call your attention to page six,
21 paragraph nine of your testimony?

22 A Paragraph nine?

23 Q It's paragraph numbered nine on page six and if you
24 will read up five lines from the bottom of that, you have the
25 statement and I quote, this is in regard to GETR, "No modifi-

1 c tions are adequate. No one, including the Licensee and the
2 NRC Staff can assure or guarantee in anyway that GETR could
3 withstand the effects of surface faulting and displacements
4 beneath it."

5 Now, my question is, first, you have previously
6 testified, am I correct, that you have no background in struc-
7 tural engineering. Is that correct?

8 A Other than by experience and research.

9 Q Have you ever taken a course in stress analysis?

10 A No.

11 Q Have you ever taken a course in any discipline
12 connected with structural engineering?

13 A I attended an earthquake engineering conference at
14 Stanford.

15 Q And how long was that engineering conference?

16 A It was either three or four days.

17 Q And it dealt entirely with structural engineering
18 subjects?

19 A Earthquake engineering, included structural.

20 Q What portion of it dealt with structural engineering?

21 A I'm not sure of the percentage of proportion.

22 Q Can you approximate it?

23 A No, not at this time.

24 Q Not even roughly?

25 A Perhaps a fourth or a third of it.

1 Q A third of it. So, it would be a day. A day. Am
2 I correct?

3 A Yes. That statement --

4 Q Does that constitute your experience in structural
5 engineering? One day?

6 A No, sir, I have consulted with perhaps a dozen
7 structural engineers in regards to GETR and other nuclear
8 reactors with earthquake hazards.

9 Q Does that include Mr. Rutherford, the Intervenor's
10 witness in this proceeding?

11 A He's one of them, yes.

12 Q Do you base your opinion on Mr. Rutherford's opin-
13 ion?

14 A To some extent, I do. And also other structural
15 engineers who we have consulted with including Gary Gray and
16 Jim Caid, who we listed as witnesses, but in addition to that
17 there is one other person who comes from the list of references
18 and that is reference number nine, Peter Yanev and Piece of
19 Mind in Earthquake Country. Peter Yanev works for one of the
20 consultants for the Licensee, John Blume and URS Associates.

21 In that book he makes a statement that no building
22 can be guaranteed against surface rupture in California.

23 Q Let me ask you this. When you speak of the term,
24 guarantee, do you equate that with the standard that you used
25 in your interrogatory responses of May 4th? Do you equate the

1 guarantee with the standard of, quote, perfect safety, unquote?

2 A In regards to the GETR reactor and the earthquake
3 hazards to it, yes, I believe that there has to be a perfect
4 standard of safety because of the risk that is involved.

5 Q All right.

6 Are you a registered structural engineer in the
7 State of California?

8 A No, I'm not.

9 Q Do you consider yourself engaged in the practice of
10 structural engineering?

11 A I consider myself engaged in the practice of analyz-
12 ing earthquake hazards to nuclear reactors in California.

13 Q Answer my question. Do you consider yourself engaged
14 in the practice of structural engineering in the State of
15 California? Yes or no.

16 A No.

17 Q Have you ever engaged in the practice of structural
18 engineering in any state?

19 Q I've consulted with structural engineers in
20 California about the earthquake hazards.

21 Q Would you answer my question yes or no? Have you
22 ever engaged in the practice of structural engineering in
23 any state?

24 A Do you define engaged in the practice of -- inclu-
25 ding consulting with practicing instructional engineers?

1 Q I'm asking you whether you are a structural engin-
2 eer. Are you or are you not?

3 A No.

4 Q Now, in regard to your testimony, could I call your
5 attention to pages four and five and in particular -- if you
6 bear with me, I'll find the statement of interest here.

7 On page five, would you turn to the second paragraph,
8 which reads as follows, "Thus the Licensee has failed to
9 conduct adequate investigations into the possibility of surface
10 faulting beneath the GETR that would be a result of earth-
11 quakes on the Calaveras Fault."

12 Do you see that statement?

13 A Yes, sir.

14 Q Now, if you will, would you tell me whether or not
15 you have read all of the GE reports which deal with the geolo-
16 gical investigations for the GETR?

17 A Could you provide a list of those?

18 Q Do you believe that you've read them all?

19 A I believe that I've read most of them. I'm not
20 sure about every little one.

21 Q But, it's your belief that you've read them all?

22 A Most of them over the past four years or so.

23 Q Is it most or all? What is your belief? I'm just
24 trying to be straight forward with you.

25 Q Unless you provide to me a list, I can't say whether

1 it's most or all.

2 JUDGE GROSSMAN: Well, Mr. Edgar, this came up with
3 Dr. Brilinger, too. I think the question is unfair. The
4 witness can't tell whether what he's seen is all. He might
5 have some general idea, but it's hard for someone to say that
6 he's seen everything there is. He only knows what he's seen
7 and not what he hasn't.

8 MR. EDGAR: I understand.

9 BY MR. EDGAR:

10 Q Based on your knowledge of GE investigations, did
11 those investigations include an evaluation of the tectonic
12 structures underlying the site?

13 A They did not consider the possibility of a
14 Calaveras earthquake epicenter beneath the reactor.

15 Q Other than that, did they evaluate the tectonic
16 structures underlying the site?

17 A I believe the investigation was not adequate.

18 Q Let me rephrase the question, then. Other than the
19 Calaveras and whether or not the investigation was adequate,
20 did the investigation evaluate the tectonic structures under-
21 lying the site?

22 A No, sir, because it did not do a complete investi-
23 gation of whether the Verona Fault is tectonically related
24 to the Las Positas Fault, the Williams Fault or the Pleasan-
25 ton Fault.

1 (Pause)

2 Q Do you understand the basic physical theory which
3 governs the hypothesis of seismic focusing?

4 A Yes, sir, very thoroughly.

5 Q Could you explain that theory? Well, if you have
6 a seismic wave in which -- If you have an earthquake, the
7 rupture propagates sometimes in all directions, but it can
8 also propagate in one direction unilaterally and that is the
9 case in which you have seismic focusing. In which the rupture
10 in propagating in a directional way in one direction and in
11 that way it builds up a wave similar to the sound wave that
12 would proceed a jet plane when you hear it breaking the sound
13 barrier.

14 Q What are the important physical parameters that
15 govern focusing?

16 A Well, the parameter that is of most interest in
17 this proceeding or similar proceedings is that seismic fo-
18 cusing can cause increase in the amplitude of ground acceler-
19 ations and thus cause higher G values for vertical and horizon-
20 tal values.

21 Q It's your belief that the important aspect of
22 focusing has to do with the accelerations. Is that correct?

23 A Yes, sir.

24 Q And not necessarily with other parameters.

25 A Well, there are definitely other parameters, but

1 when you are looking at seismic design criteria for reactors,
2 the accelerations are of the most interest. The response
3 factor is also of interest.

4 Q Fine. But in terms of what governs focusing in
5 physical theory, you've just told me what the effects might
6 be in your opinion. Now, let me ask you what physical
7 parameters or variables would influence the degree of focusing
8 or character of focusing?

9 A Well, the fault geometries are very important.

10 Q Is that it?

11 A That is an important part when you're doing a site
12 specific analysis. The fault geometry is very important.
13 There are other characteristics such as stress drop and soil
14 characteristics.

15 Q What is stress drop?

16 A Stress drop is a variable in seismic analysis that
17 is the subject of a lot of papers. It's measured in bars
18 or kilo bars and typically an earthquake in California has
19 about one hundred bars of stress drop, although, it may range
20 up to a thousand bars or kilo bars are greater and the ground
21 accelerations and response factor are effected by the size of
22 the stress drop.

23 Q And it's your opinion that that's an important
24 parameter or variable in focusing? Is that what you told me?

25 A It is one of several parameters, yes, sir.

1 MR. EDGAR: We have no further questions.

2 JUDGE GROSSMAN: Mr. Swanson?

3 MR. SWANSON: As I indicated before, I just really
4 wanted to pursue one line of questioning. That was to deter-
5 mine the authorship of the various conclusions in the testi-
6 mony.

7 CROSS EXAMINATION

8 BY MR. SWANSON:

9 Q Now, earlier when I asked you what parts you had
10 developed, you pointed to section seven on pages four and five.
11 Are there any other conclusions contained in the document
12 that you authored as opposed to someone else?

13 A I authored the entire testimony. I would say that
14 the first paragraph is one that I authored. That's inde-
15 pendent.

16 Q Let me clarify that. Authored is a poor choice of
17 words. Did you formulate the conclusions on your own. That
18 is a question as opposed to actually penning the words.

19 A I'm a bit confused. I might need some advise from
20 my lawyer or you about what exactly you mean.

21 Q I certainly don't mean to imply any technical con-
22 notation to the term -- I'm just interested in what parts
23 you developed as a result of your own independent analysis
24 and what conclusions are yours as opposed to conclusions that
25 you took from others that you consulted with.

1 A Well, I could could go through sentence by sentence
2 and tell you?

3 A Is that necessary. Is it likely that there are a
4 number of sentences that are going to -- What I'm really in-
5 terested in is conclusions. The bottom sentence on page one
6 is where you indicate that to be conservative a minimum that
7 the GETR design bases should include a 2.4 meter surface
8 displacement. I believe you said that you took that from
9 other documents.

10 A Yes, they were documents by the USGS and the NRC
11 Staff.

12 Q So, you didn't sponsor that.

13 I'm now just trying to skim over to get to the
14 conclusions rather than to take time with each sentence.

15 A If you want examples --

16 MR. CADY: Excuse me, Your Honor. May I recommend
17 that we break until tomorrow morning so that I can confer
18 with Mr. Barlow so that he can be more responsive to the
19 questions without having to go through sentence by sentence
20 and word by word on his testimony. I believe that once I
21 talk to him we can just whip through this thing early tomor-
22 row morning and we can proceed on it.

23 JUDGE GROSSMAN: It was the Board's intention. I
24 didn't want Mr. Swanson to skim over it either. So, I
25 think maybe an evenings preparation would do us all some good.

1 Why don't we adjourn now and meet again tomorrow
2 at 9:30.

3 (Where at 4:58 p.m., the hearing in the above-
4 entitled matter was adjourned until 9:30 a.m. Tuesday, June
5 1, 1981.)

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This is to certify that the attached proceedings before the
US NUCLEAR REGULATORY COMMISSION

in the matter of: GENERAL ELECTRIC COMPANY (VALLECITOS NUCLEAR CENTER)

Date of Proceeding: Monday, 1 June 1981

Docket Number: 50-70 SC

Place of Proceeding: SAN FRANCISCO, CALIFORNIA

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Ann Riley

Official Reporter

Jane M. Beach

Official Reporter

John V. Brown

Michael Connell

Official Reporter

POOR ORIGINAL