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NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

PACIFIC GAS & ELECTRIC COMPANY

(Diablo Canyon Units 1 and 2)

50-275
50-323

Place - Avila Beach, California

Date - 11 January 1979

Pages 8354 - 8544

Telephone:
(202) 347-3700

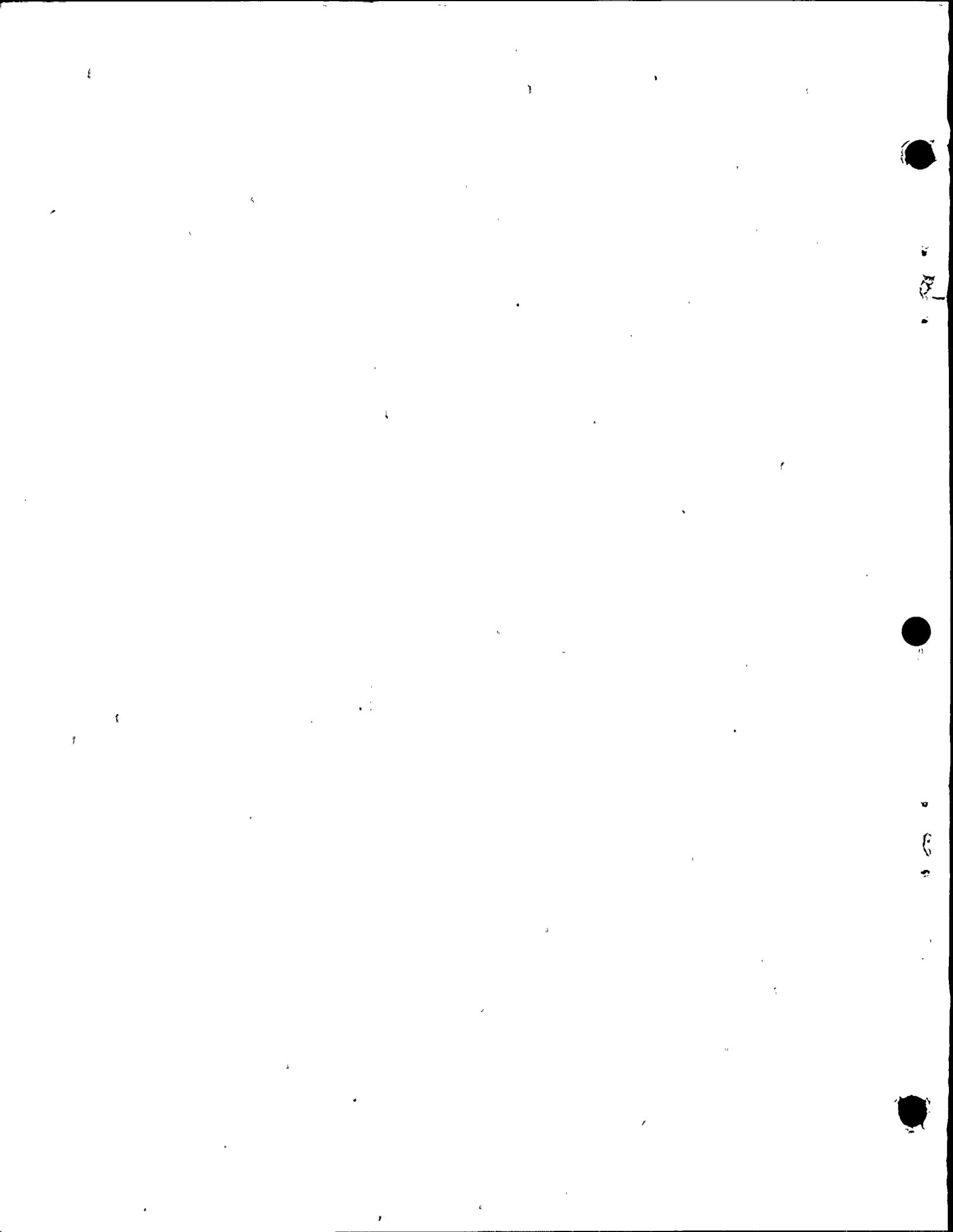
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

CR1936

In the matter of:

PACIFIC GAS & ELECTRIC COMPANY, Docket Nos. 50-275
(Diablo Canyon Units 1 and 2) 50-323

Cavalier Room,
San Luis Bay Inn,
Avila Beach, California

Thursday, January 11, 1979.

The hearing in the above-entitled matter was reconvened, pursuant to adjournment, at 8:30 a.m.

BEFORE:

ELIZABETH BOWERS, Chairman,
Atomic Safety and Licensing Board.

DR. WILLIAM E. MARTIN, Member.

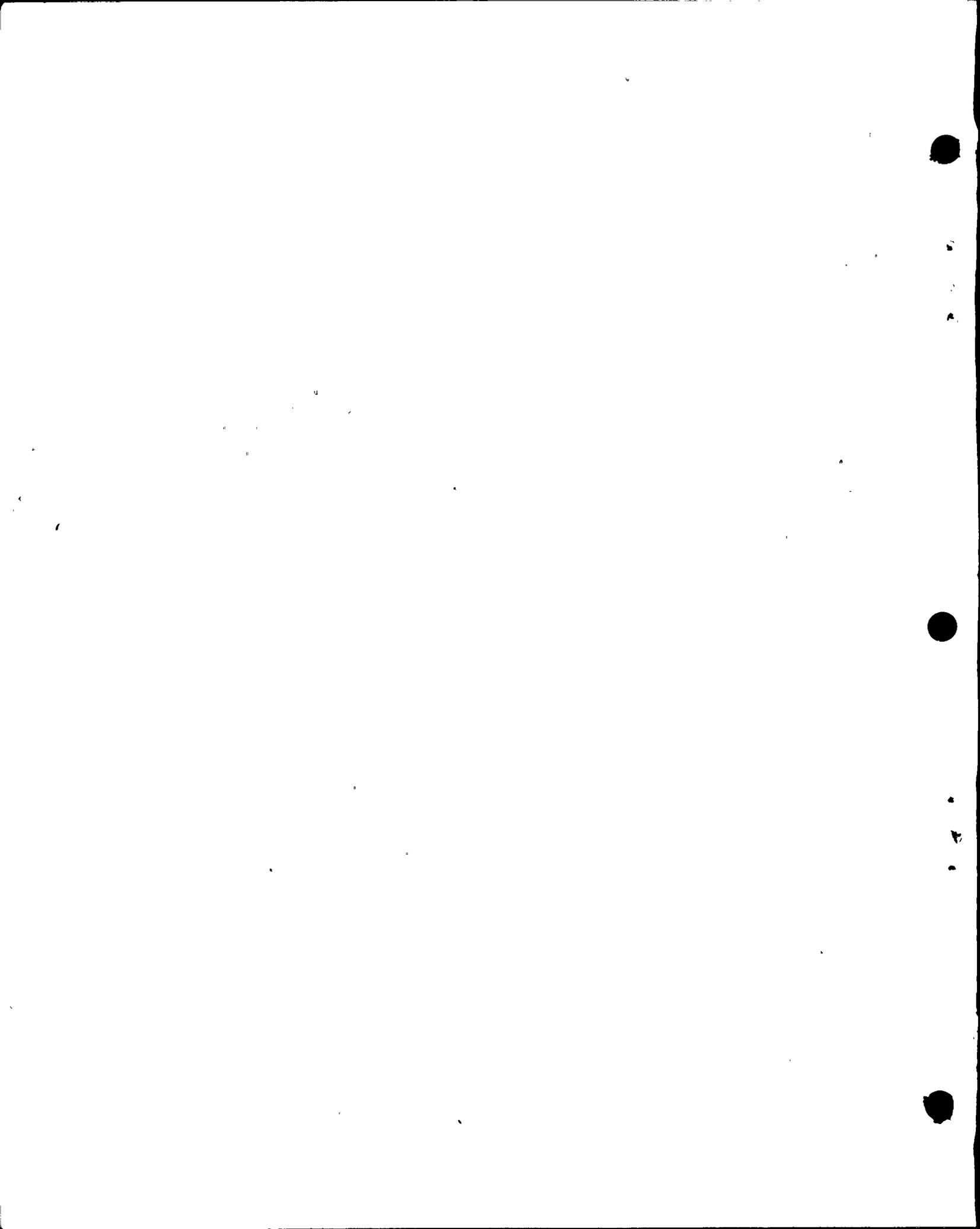
GLENN O. BRIGHT, Member.

APPEARANCES:

On behalf of Applicant, Pacific Gas & Electric Company:

BRUCE WORTON, Esq., 3216 No. Third Street,
Phoenix, Arizona 85012.

MALCOLM H. FURBUSH, Esq. and PHILIP CRANE, Esq.,
Legal Department, Pacific Gas and Electric
Company, 77 Beale Street, San Francisco,
California 94106.



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APPEARANCES: (Continued)

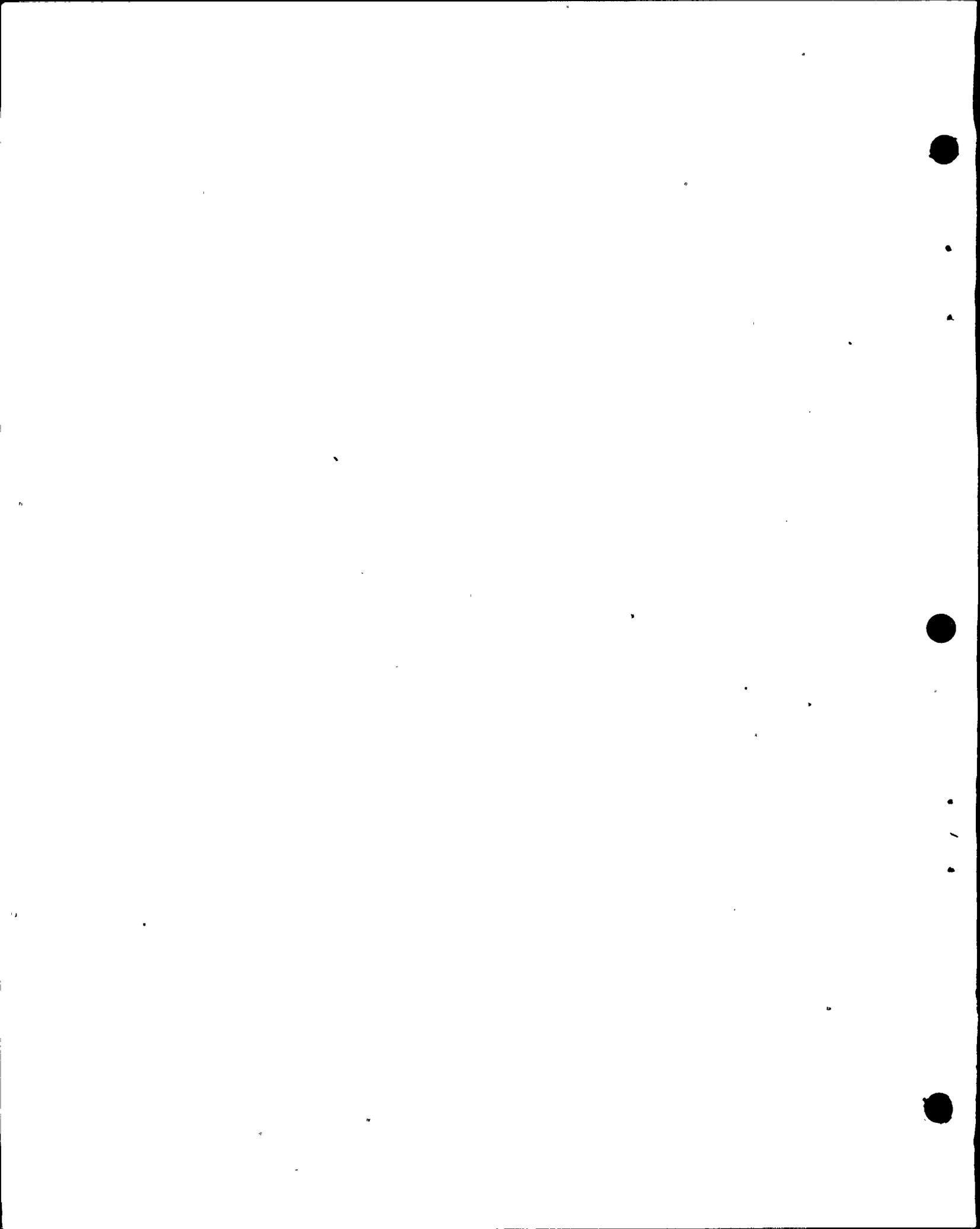
On behalf of Joint Intervenors:

DAVID S. FLEISCHAKER, Esq., Suite 602,
1025 15th Street, N.W., Washington, D. C.

STEPHEN KRISTOVICH, Esq., Center for Law in
the Public Interest, 10203 Santa Monica Blvd.,
Los Angeles, California 90067.

On behalf of the Regulatory Staff:

JAMES R. TOURTELLOTTE, Esq., EDWARD KETCHEN, Esq.,
and MARC STAENBERG, Esq., Office of Executive
Legal Director, U. S. Nuclear Regulatory
Commission, Washington, D. C. 20555.



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WITNESSESDIRECT CROSS REDIRECT RECROSS BOARD BOARD

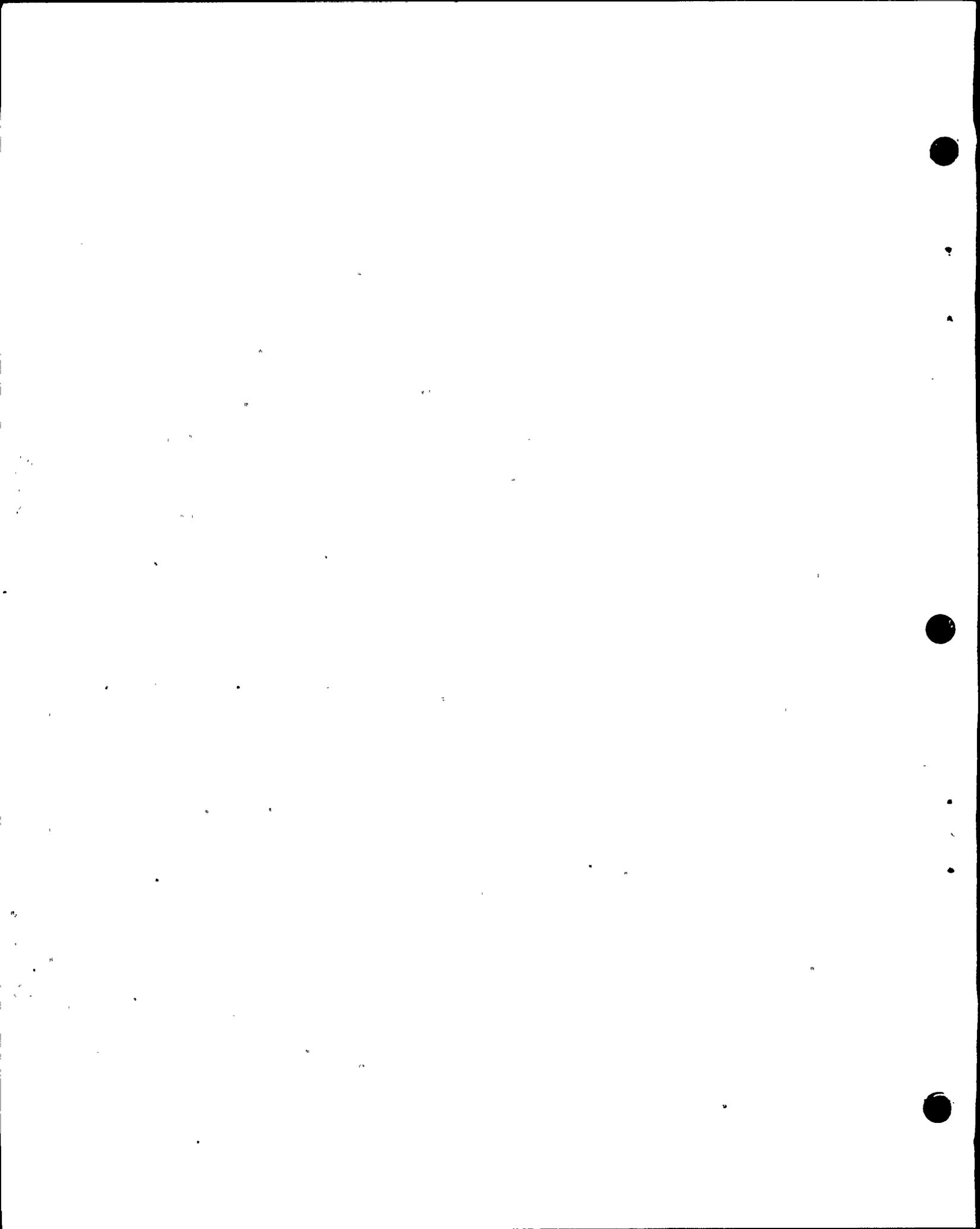
Dennis P. Allison	8359	8458	8471	8474
J. Carl Stepp Richard B. McMullen	8478	8485	8514	
Renner B. Hofmann	8517	8539	8541	8536

EXHIBITSFOR IDENTIFICATION IN EVIDENCEIntervenors:

70 (Fraley memo to Rusche dated 12-20-75)	8392
67 (DeYoung note to Giambusso dated 2-20-75)	8392
68 (Program to Establish Basis to License Diablo Canyon. dated 1-12-76)	8393
69 (DeYoung memo to Giambusso dated 2-11-75)	8393

G & H (Documents previously received
and withdrawn as Board
Exhibit 2.)

8403



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NRB/agbl

P R O C E E D I N G S

MRS. BOWERS: We'd like to begin.

whereupon,

DENNIS P. ALLISON

resumed the stand as a witness on behalf of the Regulatory Staff, and, having been previously duly sworn, was examined and testified further as follows:

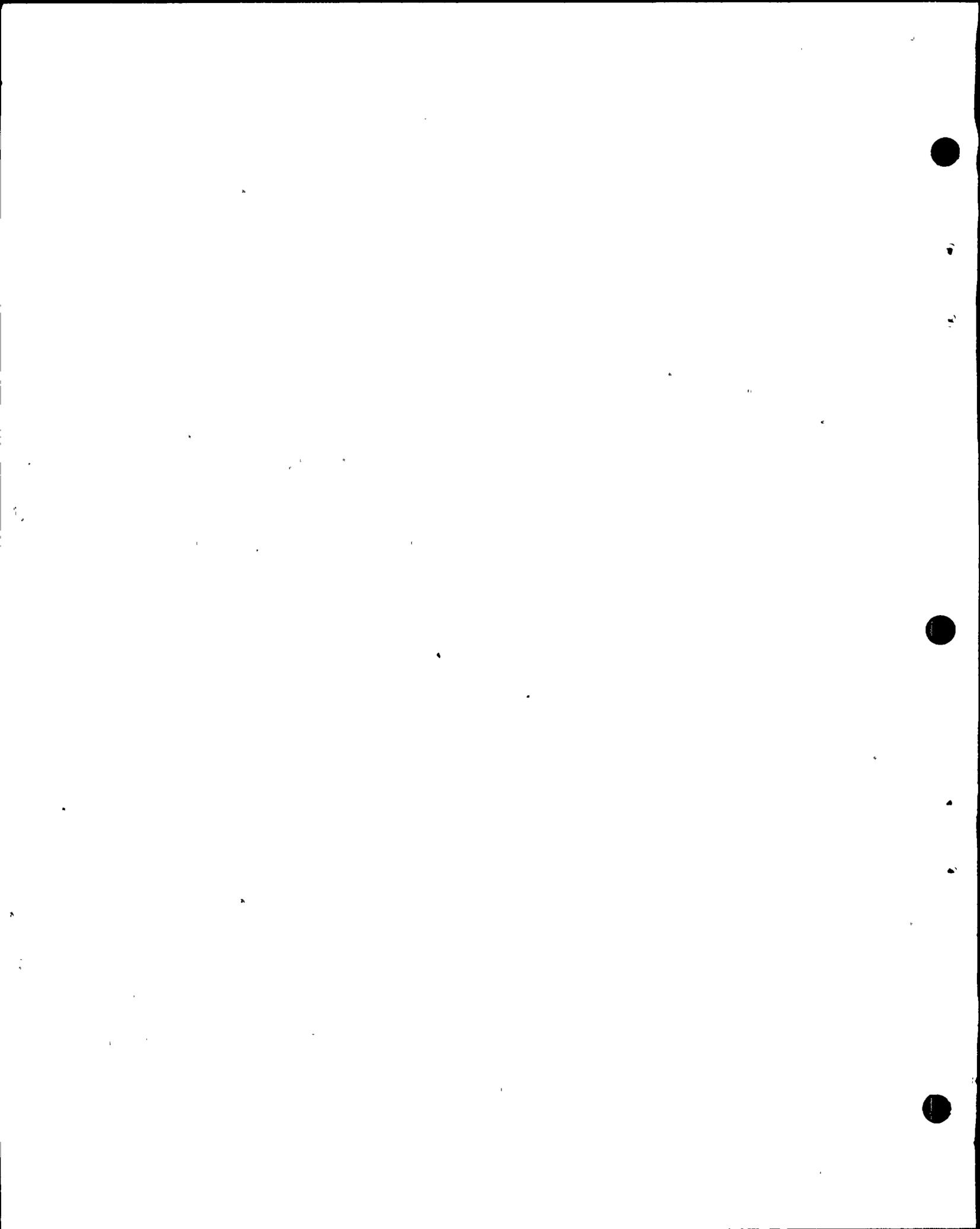
MRS. BOWERS: Are you ready, Mr. Fleischaker?

MR. FLEISCHAKER: Yes, Ma'am.

Before we proceed, one preliminary matter. I just wanted to note for the record that I have informed both counsel for the Applicant and counsel for the Staff that the Intervenor sent to the Appeal Board copies of the transcript from here in California, and I have given to both the Staff and Applicant counsel the page numbers of the transcript that were forwarded to the Appeal Board.

MRS. BOWERS: Well, as of 9:00 Bethesda time, my office had not seen a copy of your supplemental motion but was pursuing it with the security people in the Appeal Board, and we'll get a call if, for some reason, they are unable to locate it.

MR. FLEISCHAKER: I talked to my secretary at 8:00 this morning, which would be 11:00 Washington time, and she informed me that she had forwarded a copy to the Commission to the building on East-west Highway last night, and that she



WRB/agh2

1 had also forwarded a copy to your office this morning, I think
2 by messenger.

3 MRS. BOWERS: The fact that it's snowing badly may
4 have something to do with the delivery, but we'll see.

5 MR. FLEISCHNER: Good morning, Mr. Allison.

6 THE WITNESS: Good morning.

7 CROSS-EXAMINATION

8 BY MR. FLEISCHNER:

9 Q Mr. Allison, when did you take over the duties
10 as Project Manager for the Diablo Canyon Nuclear Power Plant?

11 A In the fall of 1974. I think early November, 1974.

12 Q Was this the first facility upon which you had
13 served as Project Manager?

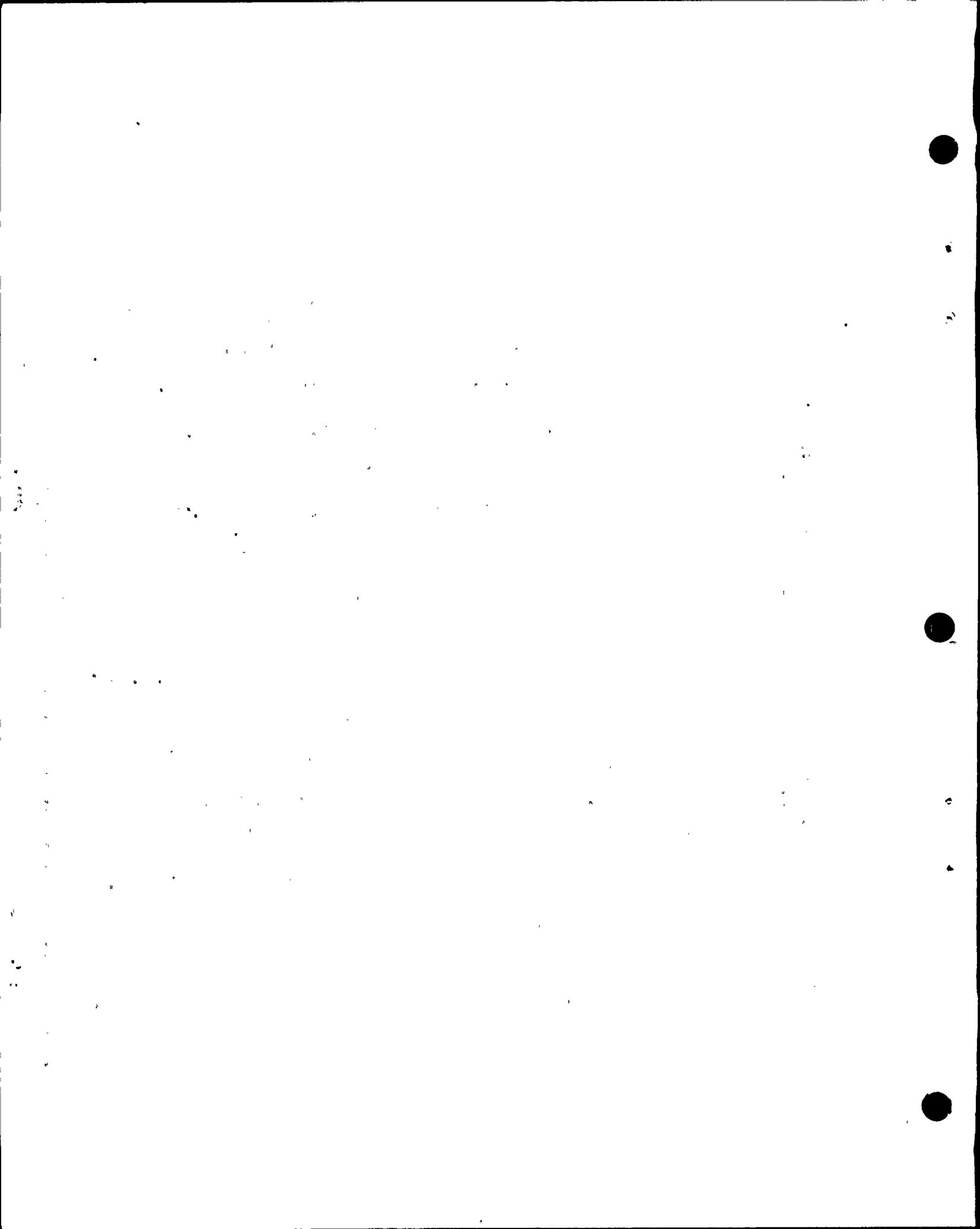
14 A Yes. Well, yes and no. I took over Palo Verde
15 in August of 1974, so I had been working on that. I had had
16 that project for a few months when I took over Diablo Canyon.

17 Q Since the fall of 1974, has Diablo Canyon been the
18 sole project upon which you've been Project Manager?

19 A No, I was Project Manager for the Palo Verde
20 review from its beginning to end. But it did end in the spring
21 of 1976.

22 I've also had some small projects, future projects
23 like the South Dade site, which didn't take any significant
24 amount of time.

25 Q Could you briefly describe the duties of a Project



WRB/gab3

1
2 Manager?

3 A Yes. The Project Manager's job is to -- has several
4 parts. One is to coordinate the review, namely, to see that
5 the information that's needed to be reviewed comes in from
6 the Applicant, to see that the Staff personnel that need to
7 review it are aware of it and are working on it. That's
8 primarily the job, to coordinate the review and to see that
9 the right people do the right things during the review.

10 One big element of a Project Manager's job is to
11 keep things moving to get the review done when there's a
12 bottleneck of some kind, to make something happen, to get the
13 Applicant to do something, to get the Staff to take a position
14 or whatever.

15 Q So in a sense, you're a coordinator and an expediter.

16 A Right.

17 Q Do you coordinate with the various branches
18 that are reviewing the actual substantive material?

19 A Yes.

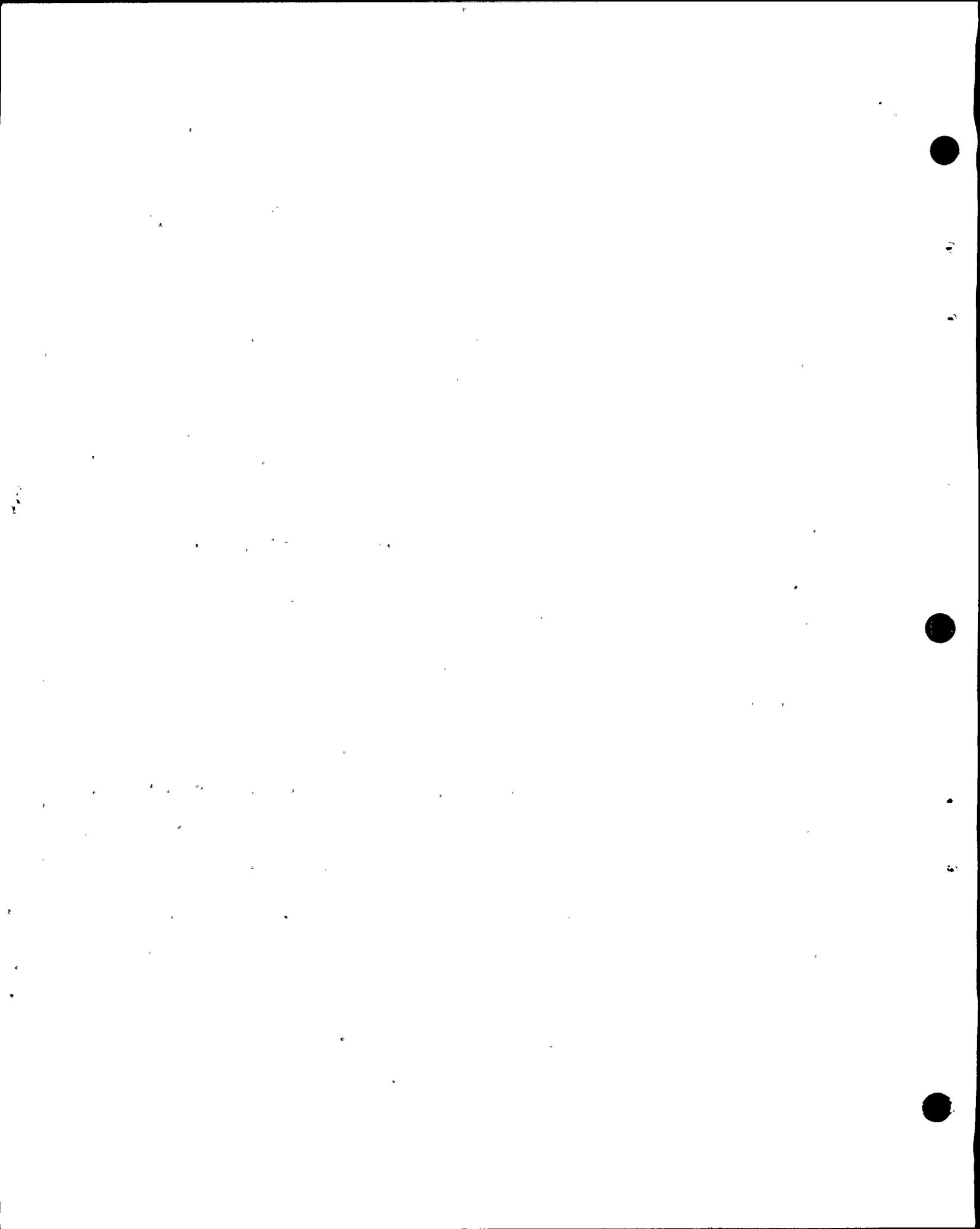
20 Q And I guess, as an expert, you also monitor the
21 problem areas as they develop?

22 A Yes.

23 Q Do you also assure coordination with the Appli-
24 cant?

25 A Yes.

Q Do you coordinate with the ACRS?



WRB/agb4

1 A Yes.

2 Q Do you serve as the coordinator between the OELD,
3 Office of Executive Legal Director, and the various branches?

4 A Yes.

5 Q And how about as coordinator between the staff,
6 lower level staff, the branches, and the upper level management,
7 the Director of Operations, for example?

8 A Yes, I do that, too.

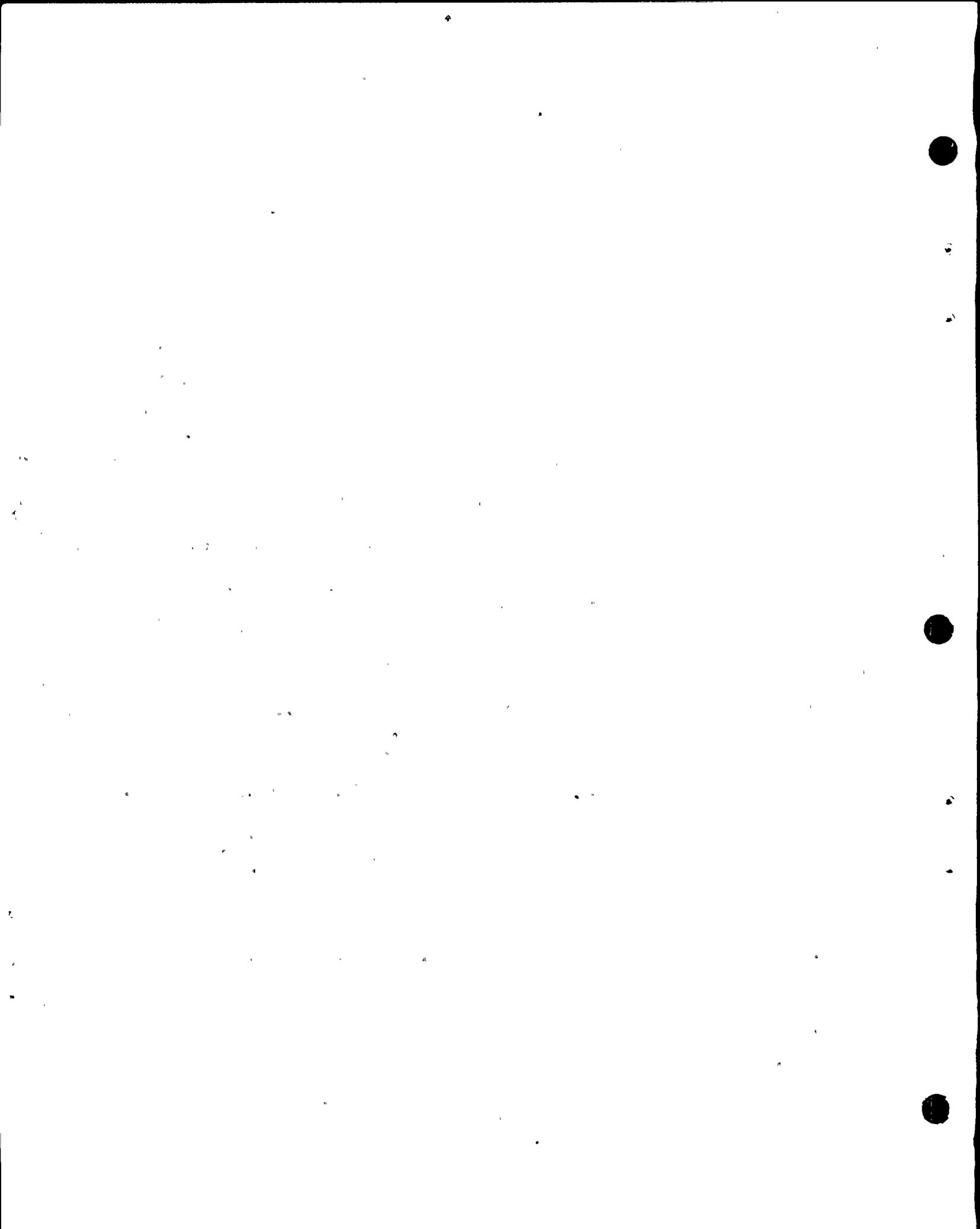
9 Q So basically all information flows through your
10 office, most information?

11 A Almost all, yes. Not necessarily flows through.
12 For instance, the lawyers may prepare a response to a pleading
13 without my reviewing it. On the other hand, they most often
14 do have me look at it, or at least tell me what they're going
15 to say before it goes out.

16 Q Do you actually write the SER?

17 A No. The normal procedure which occurs, most of
18 the sections I receive an input from a Technical Review Branch,
19 which I then look over, revise, and usually go back and talk
20 to the reviewer about it and find out what he's done and
21 what he hasn't done and find out what's behind the words there,
22 revise, and put into a draft document.

23 Sometimes the procedure is reversed. Sometimes I
24 write it and go see the people involved and have them review
25 it to make sure that it's accurate.



WRS/agb5

1 In any case, I then end up with a draft SER,
2 which is reviewed several times by a bunch of different people
3 before it goes out, and revised during that process.

4 Q Do you actually participate in the revision of the
5 SER?

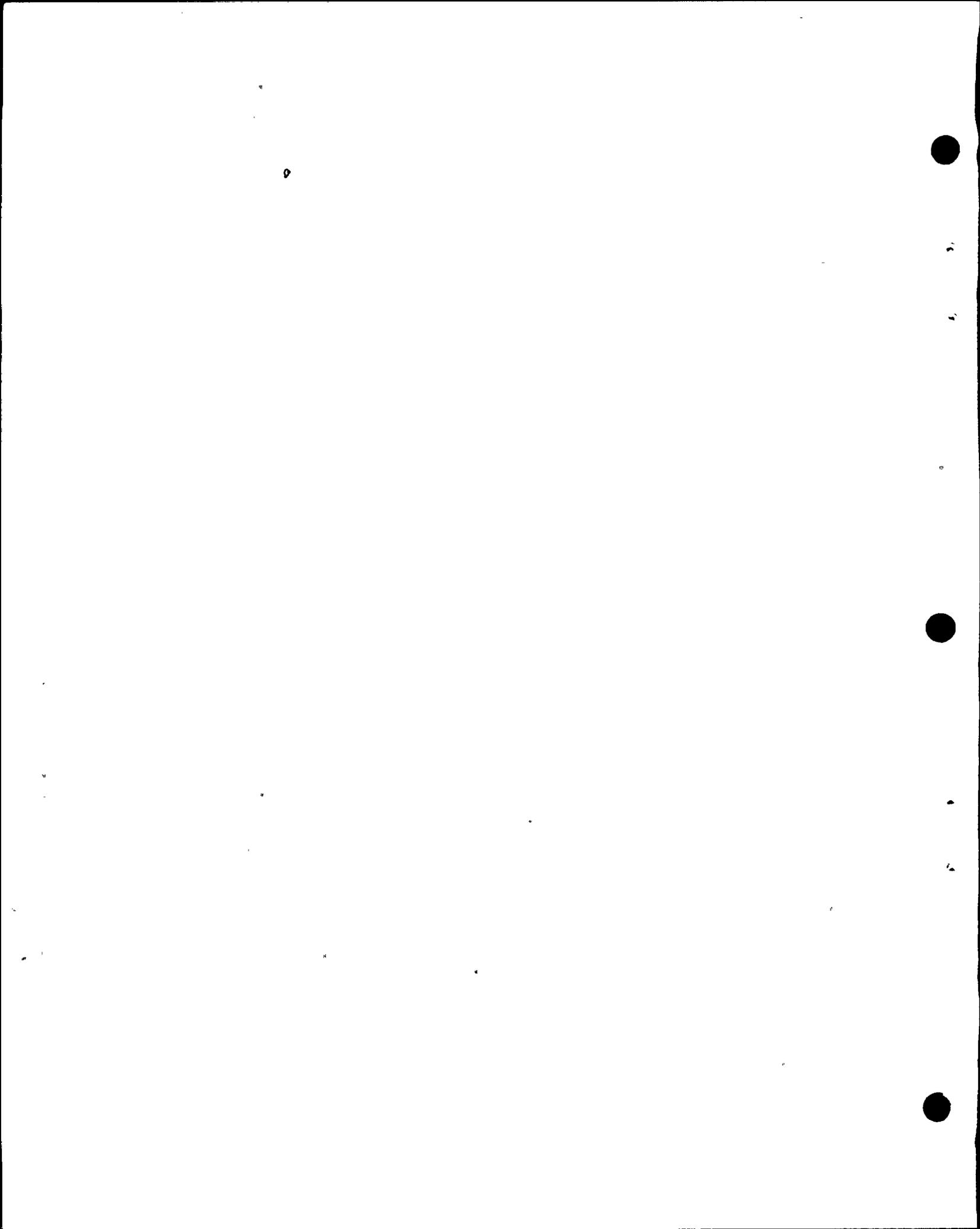
6 A Yes, it's all -- really, once I reach the stage
7 of having a draft document, I control the whole thing in the
8 sense that I give it to my boss to review, he gives me his
9 comments back -- or give it to the lawyers' review and they
10 give me their comments back, but I then go through those
11 comments and either make whatever suggested revision they have
12 or find out the answer to whatever their question is. But
13 any changes to the words or whatnot I do myself and have typed
14 and proofread myself.

15 Q So you actually participate in the writing of the
16 review in the sense that you rewrite?

17 A Yes. When I said I don't actually write it, I
18 just meant to emphasize that somebody else did a particular
19 review, for instance, Pal-Ying Chen reviewed the mechanical
20 engineering aspects and is equally responsible for the words
21 in that particular paragraph that describes it.

22 The words you see there have actually been pro-
23 cessed by me about five or six times, and they are more likely
24 my way of saying it than his.

25 Q So you decide both what information should



NRB/agb6

1 go in -- you participate in the decision of what information
2 goes in and what form it goes in?

3 A That's right.

4 Q I notice you have the SERs up there on your desk.
5 Can you give me the date of Supp. 4?

6 A Yes. Supplement 4 was issued on May 11, 1976.

7 Q And Supp. 5?

8 A Supplement 5 was September 10, 1976.

9 Q And Supp. 7?

10 A Supplement 7 was May 26, 1978.

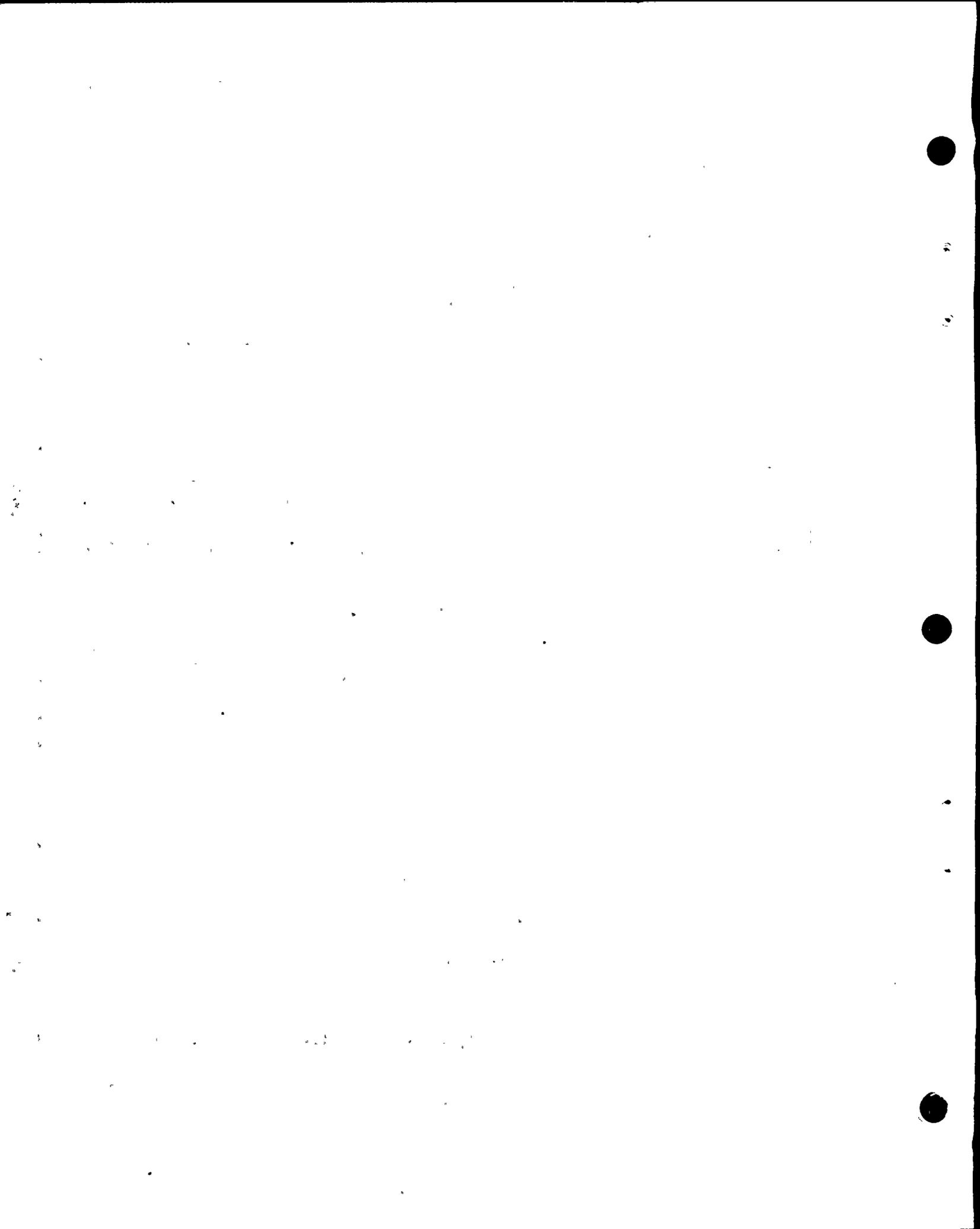
11 Q Could you briefly explain the purpose of the SER?

12 A Yes. The purpose of the SER is, it's a report
13 that basically describes the Staff's review, what the Staff
14 has done and what its conclusions are and the basis for those
15 conclusions.

16 That may be more like what it is than its purpose.
17 I guess its purpose is the Staff's primary -- one purpose,
18 and the purpose we're concerned with here, it's the Staff's
19 primary testimony in a contested hearing, or in a hearing.

20 Mr. Fleischaker, I might add just a little bit:

21 The purpose, I said it's the Staff's primary
22 testimony for a hearing. The second purpose, equally important,
23 I guess, is it's the Staff's report to the ACRS or anyone else
24 who is interested. Those can be, and sometimes, are separate
25 documents sometimes.



WRB/agb7

1 The Staff issues a report. It doesn't call it
2 a Safety Evaluation Report. It looks similar. There it is.
3 Go to the ACRS, discuss it, do whatever you want to, and then
4 revise it and get it in final form in a slightly different
5 document and it goes to the Hearing Board.

6 Q Do you consider that your sworn statement?

7 A The SER?

8 Q Yes.

9 A Yes.

10 Q I'd like to talk to you a little bit about the
11 development of the Staff's -- well, let me see if I understand
12 the SER, what it is.

13 It contains, as I understand it, a description of
14 the Staff's efforts in addressing a problem. It may give a
15 short chronology of the way information develops?

16 A Yes.

17 Q -- on occasion?

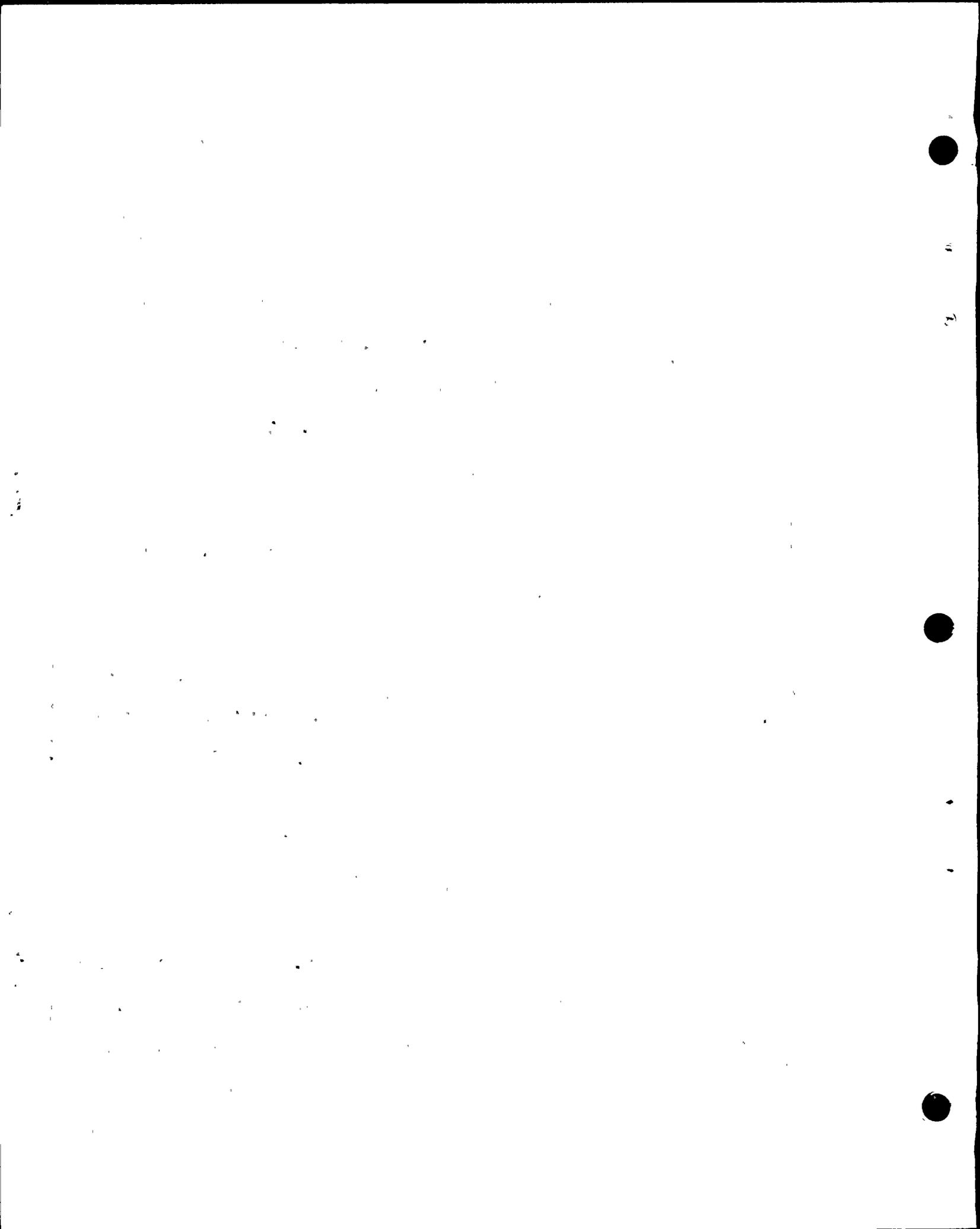
18 A Yes.

19 Q It sets out the proposed means by which the Staff
20 may analyze a problem?

21 A Yes, this one does.

22 Q Okay.

23 It sets out, perhaps, a program that will be
24 followed in the future, the results to be reported in a future
25 SER?



WRB/agb8

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A Yes.

Q And it contains the Staff's conclusions with respect to certain safety items, the basis for those conclusions?

A Yes.

Q When did you first become aware of the development of new information concerning the Hosgri Fault?

A Well, that was in August 1974.

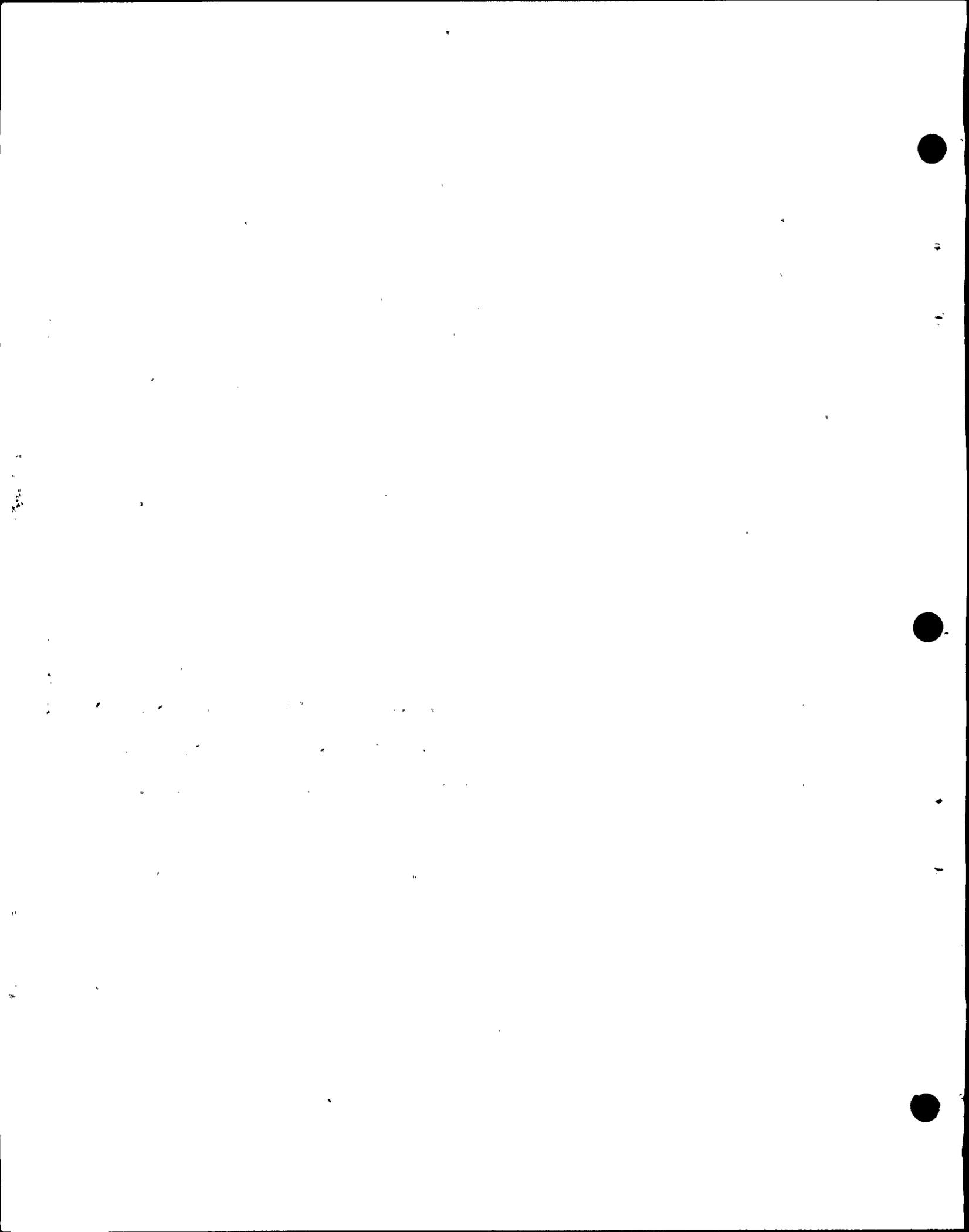
Are you speaking of me, personally?

Q Correct.

A I went to work for the Commission in August of 1974, a few months before I took the project over. And I immediately took over -- Dr. Hiron was the Project Manager for design for Palo Verde, and he was going back to Los Alamos, so I immediately took over Palo Verde from him because it was just beginning. And he continued to work until late-October on Diablo Canyon, at which time he transferred it to me and left.

So in any case, the new information, namely, the Hosgri Fault was known when I went to work for the Commission in August of 1974, and had been discussed extensively.

There had been stop work motions, newspaper articles and whatnot about it, and in fact, that was the -- Dr. Hiron published the original SER in October, 1974 as the last thing before he turned the project over to me, and that was the big open area in the SER. There was no evaluation of geology and



WRB/agb9

1 seismology.

2 Q So that in the supplement -- What's the number
3 of that supplement? Is that Supplement 3?

4 A That's not a supplement number, that's the original.

5 Q Okay.

6 A Or Supplement Zero, you might call it.

7 Q The original SER, which was issued on October 16,
8 1974?

9 A That's right.

10 Q -- had an open item which was geology and seismo-
11 logy.

12 A That's right.

13 Q And I guess engineering design, no?

14 A No, engineering was not open in that the review
15 had been completed for the original design in that section
16 which I said were done. Of course, when geology and
17 seismology changed the basis, the engineering had to be
18 done over.

19 Q Now was the Staff planning to issue an SER in
20 January of 1975?

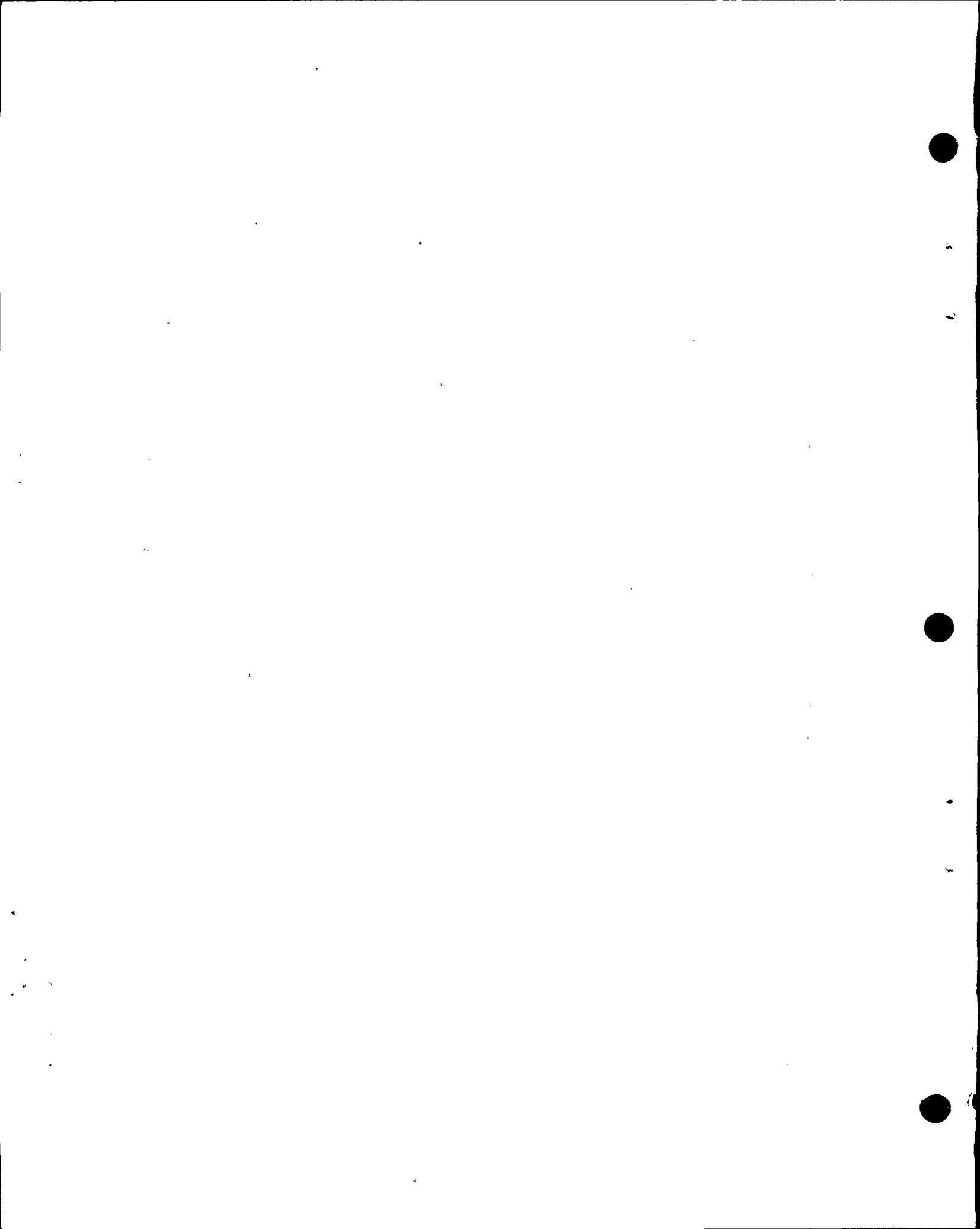
21 A Yes.

22 Q And was that SER to have addressed questions of
23 geology and seismology?

24 A Yes.

25 Q And did the Staff have some tentative conclusions

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WRB/ab10

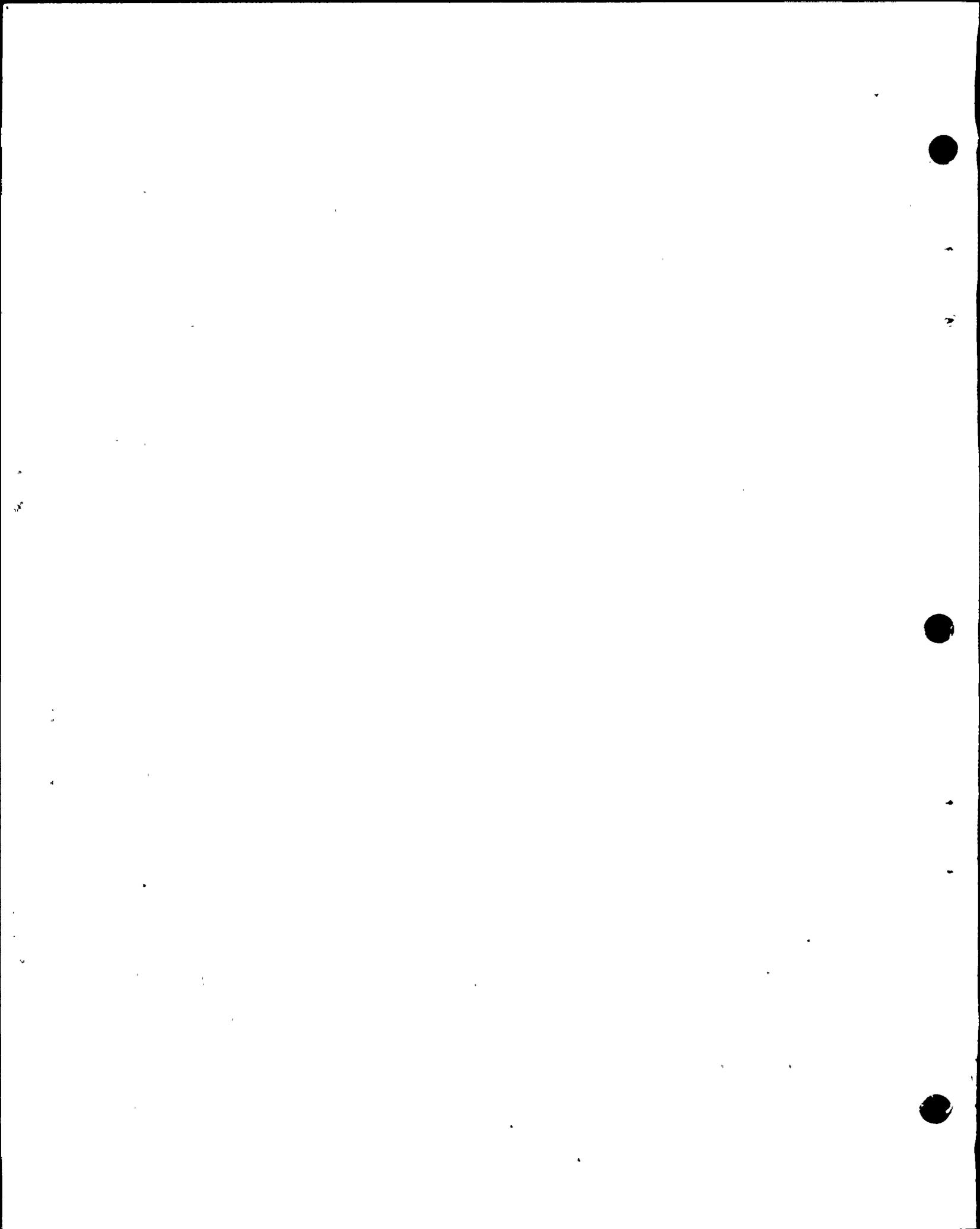
1 that it was preparing to put into that?

2 A Yes, we did.

3 Q What were those conclusions?

4 A The tentative conclusions were that the Hosgri
5 Fault would result in raising the zero period acceleration
6 at that site from 0.4g, which had been the original value,
7 to 0.5g, and that the Applicant had shown by some typical
8 calculations that the plant was adequately designed initially
9 for 0.5g zero period acceleration. I can't say that we were
10 actually planning to write up the engineering section, but
11 we were pretty well along in that direction on the adequacy
12 of the plant.

A



1B

1 Q So the tentative conclusion, or the preliminary
2 conclusion that the Staff had and intended to include in the
3 SER was that the as-built design of the facility had adequate
4 margin of safety to be able to withstand 0.5g?

5 A That's correct.

6 Q ---as the zero period limit for the design response
7 spectra?

8 A That's correct.

9 Q And that design response spectra would look like, have
10 the shape of the Reg. Guide 1.60 design response spectra?

11 A No; the spectrum had the shape of two particular
12 earthquakes we had selected, Parkfield and Castaic.

13 I guess those are the names of the record, not
14 the names of the earthquakes, the Parkfield record and the
15 Castaic record.

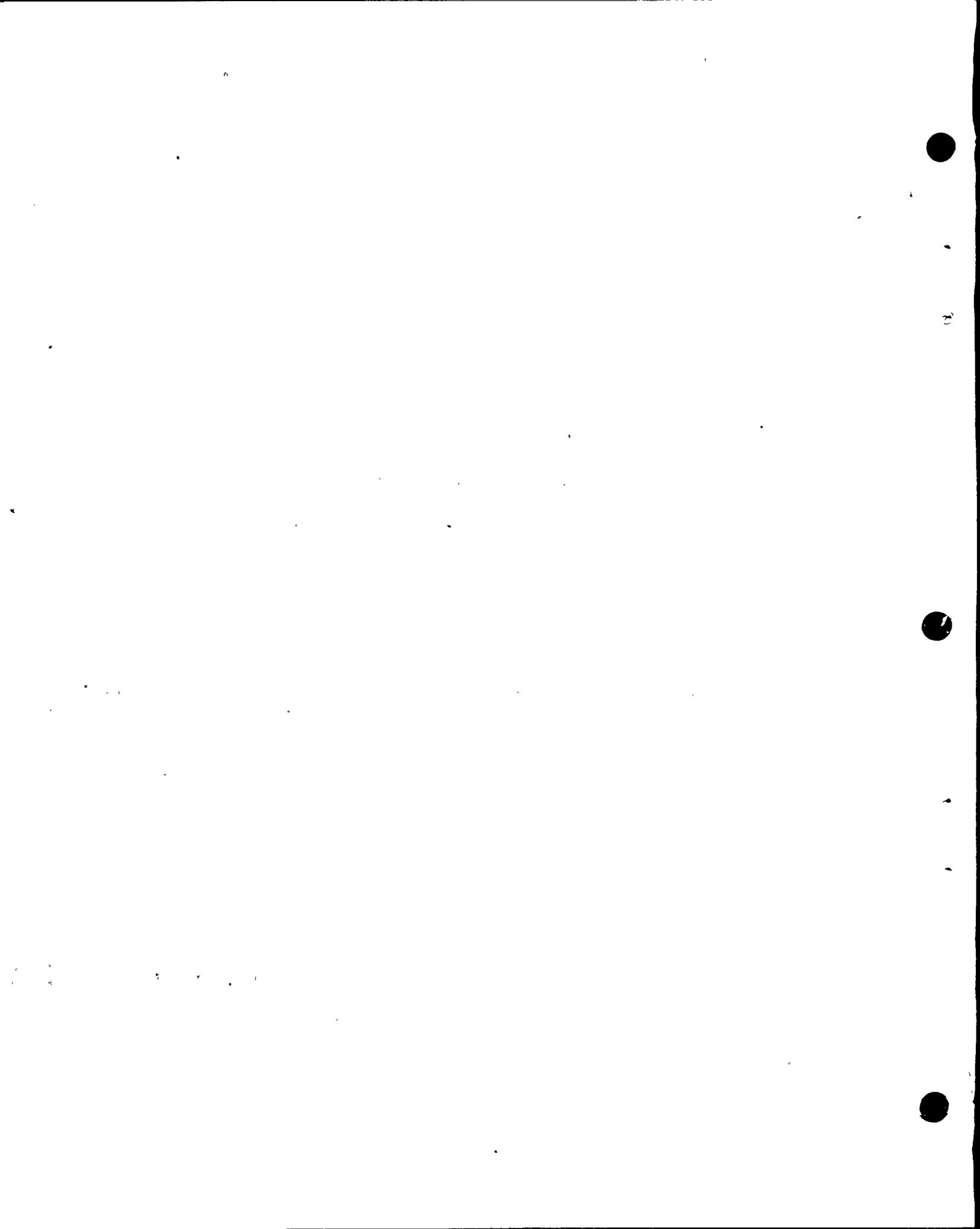
16 Q Is that Ferndale?

17 A I don't know.

18 Q I don't remember, either.

19 A I've forgotten the name of the earthquakes now.
20 But there were two records at .5g taken one at a time. And
21 basically the change in damping values pretty much washed out
22 the increase in acceleration. It changed from the original
23 damping values to the Reg. Guide values which are now
24 accepted.

25 Q Was that change in damping from 5 percent to 7



1 percent?

IRB/wb2 2 A Yes; and some others as well. The 5 and 7
3 percent--

4 Q --was for structures?

5 A Reinforced concrete values.

6 Q And you had change in damping for steel?

7 A Yes. And I don't know what those were.

2.240 8 Q Do you know the date Reg. Guide 1.61 was adopted?

9 A No, I don't. It was prior to that time.

10 Let me correct something, Mr. Fleischaker.

11 The 5 and 7 percent numbers are the numbers that

12 were in fact used with the response spectra. You could see

13 by inspection, you could plot the spectra, the original at

14 5 percent and the new one at .5g at 7 percent, you could see

15 by inspection that that was not a great problem for the plant

16 without even doing the typical analyses.

17 Q What was the basis for designating .5g for the
18 new event? I guess that was-- Well, strike that.

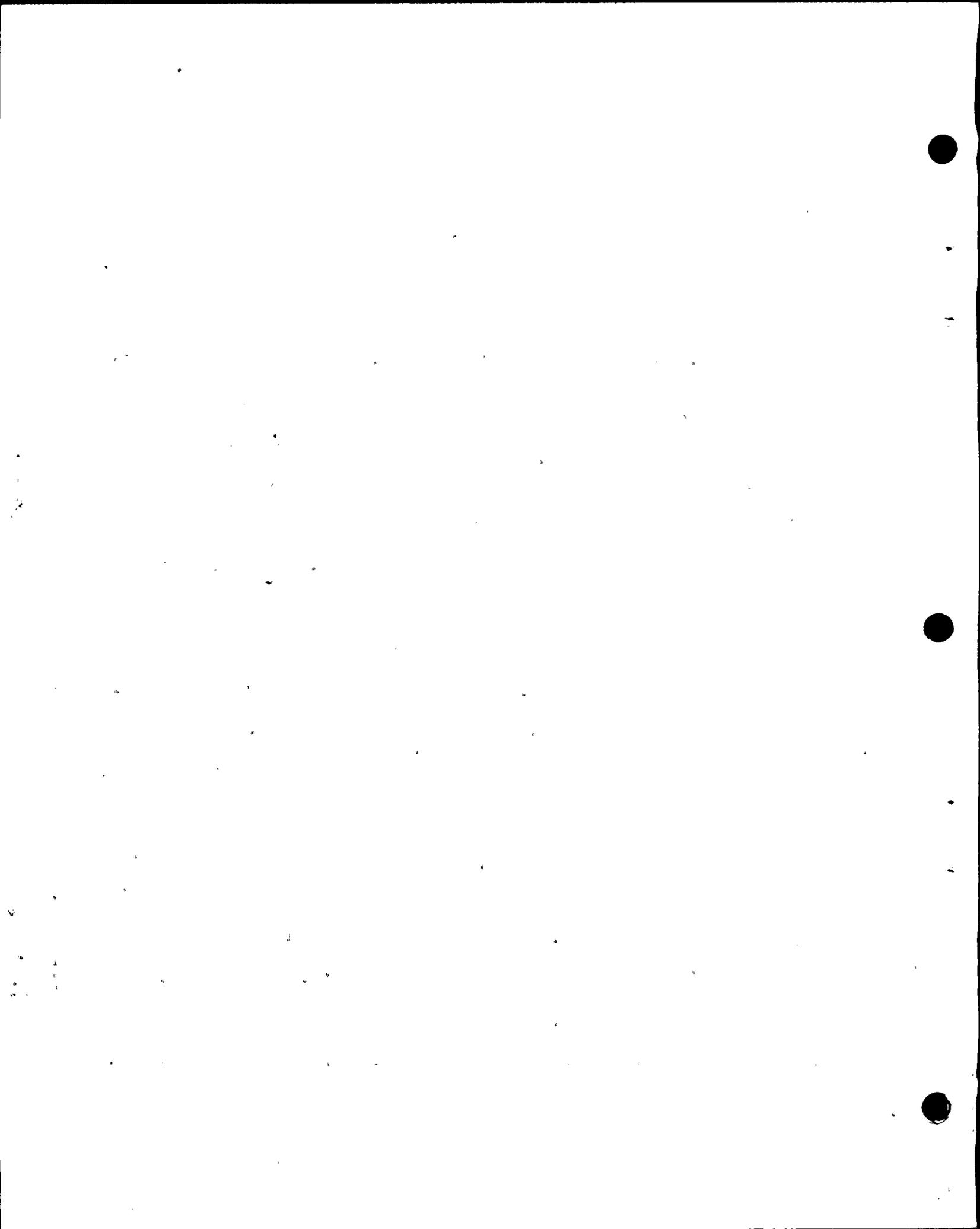
19 I assume, therefore, that the Staff was anticipat-
20 ing to designate a new SSE equal to 0.5g?

21 A That's correct.

22 Q What was the basis for that, what was the
23 geological and seismological basis for that?

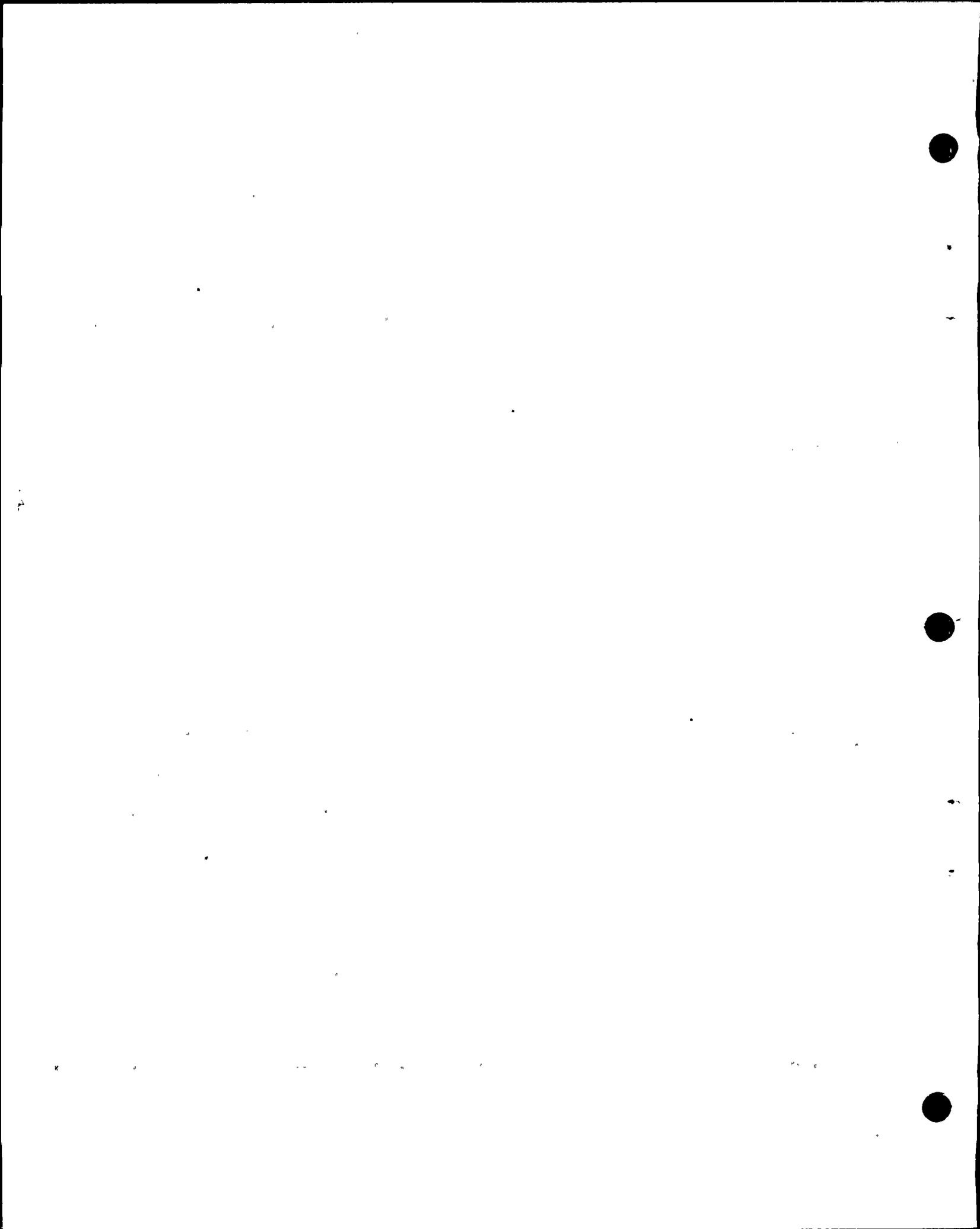
24 A Let me think just a second.

25 (Pause)



1 MR. NORTON: Excuse me, Mrs. Bowers. It seems
2 to me that that testimony should come from the Staff witnesses
3 who are the geologists and the seismologists on the Staff,
4 as opposed to one who has just described his duties as being
5 a synthesizer of information, and so on and so forth. Rather
6 than his relying on his memory as to what the geologists and
7 seismologists' reasons were, I would think those questions
8 would be better asked of the people who made the decisions.
9 If they're stated in the SER, that's fine: I don't have any
10 problem with that. If they're in an SER Sup or something
11 he can refer to that and read them: that's one thing. But
12 for him to try and remember back -- we're talking four years --
13 as to what the geologists and the seismologists' thinking was
14 at that time, and the structural people such as Dr. Newmark,
15 what his thinking was, I think is -- I suppose it could be
16 used to impeach the testimony of those people, but I don't
17 think that's the purpose for which Mr. Fleischaker is asking
18 the question.

19 MR. FLEISCHAKER: That's correct. And I will
20 ask that question of Mr. Stepp and Mr. Hoffman. But as I
21 understand Mr. Allison's duties and his responsibilities,
22 basically all the information flows through his office. The
23 Staff was at one time planning to issue an SER in January of
24 '75, and perhaps I can recouch my question to ask him whether
25 he had received the Staff view with respect to the designation



1 of the .5g.

2 MRS. BOWERS: Before you go on;--

3 Mr. Tourtellotte, does the Staff have a position
4 on this matter?

5 MR. TOURTELLOTTE: No.

6 MRS. BOWERS: We have here, of course, Mr. Allison
7 sponsoring the SER. But I also think of his testimony some-
8 what in the same way as Mr. Hoch, an overview.

9 Is that correct, Mr. Allison?

10 THE WITNESS: Yes.

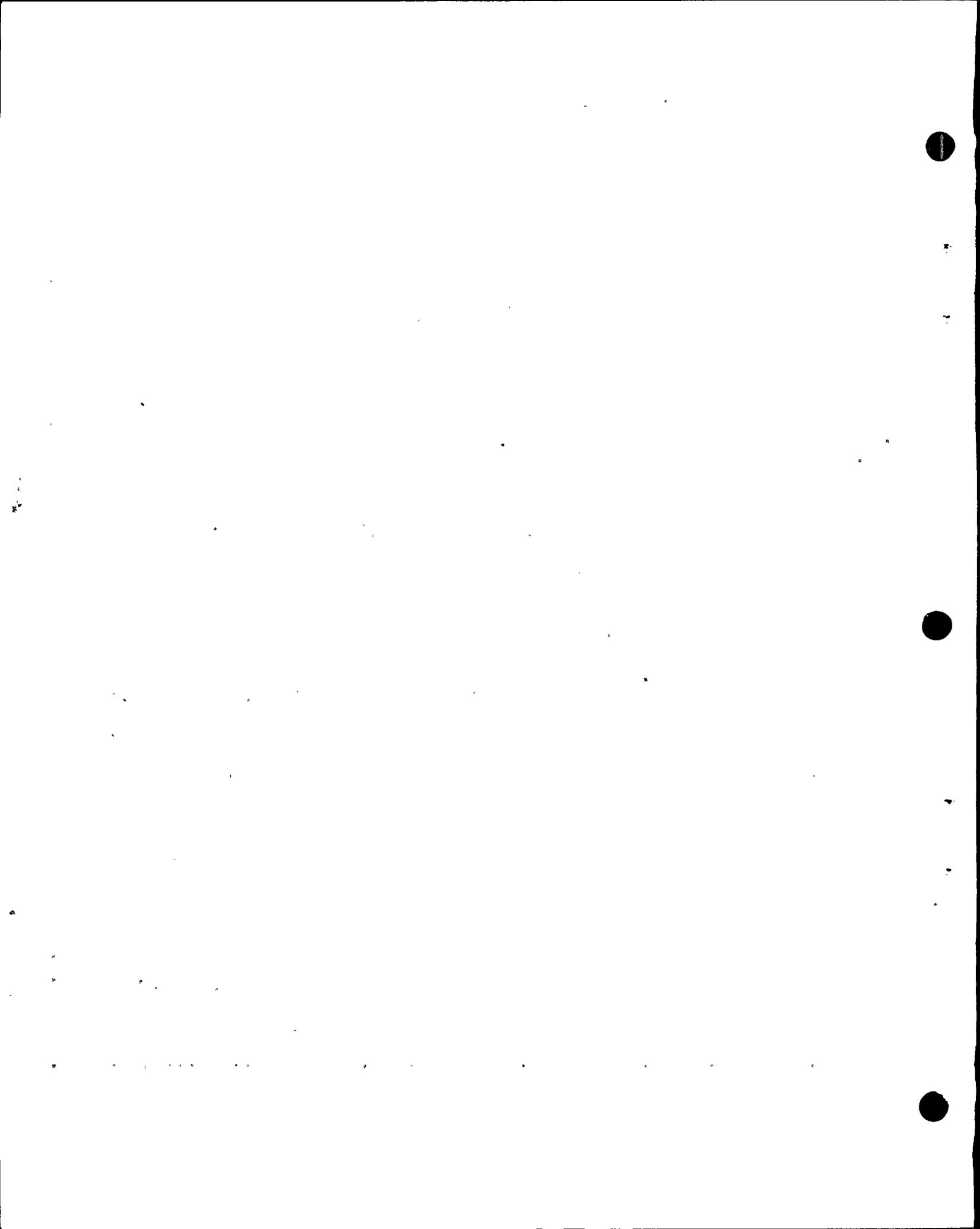
11 MRS. BOWERS: And so when specifics are asked,
12 do you feel comfortable in referring to the fact that later
13 panels will have more definite specific information?

14 THE WITNESS: Right. I feel comfortable giving a
15 summary answer to the question.

16 MR. FLEISCHAKER: That's all I want. I'm not
17 going to cross-examine him as a geologist or seismologist.

18 THE WITNESS: Well it was based on something like
19 this:-- And you can ask Mr. Hoffman and Dr. Stepp for further
20 details later.

21 A certain fault length less than 90 miles, as I
22 recall; I believe it was 60 miles; we had gone through a chain
23 with that fault length. Now with a 60-mile fault you can
24 assume half of it might slip in a single rupture, and that
25 would give you perhaps a magnitude 5, perhaps greater if it

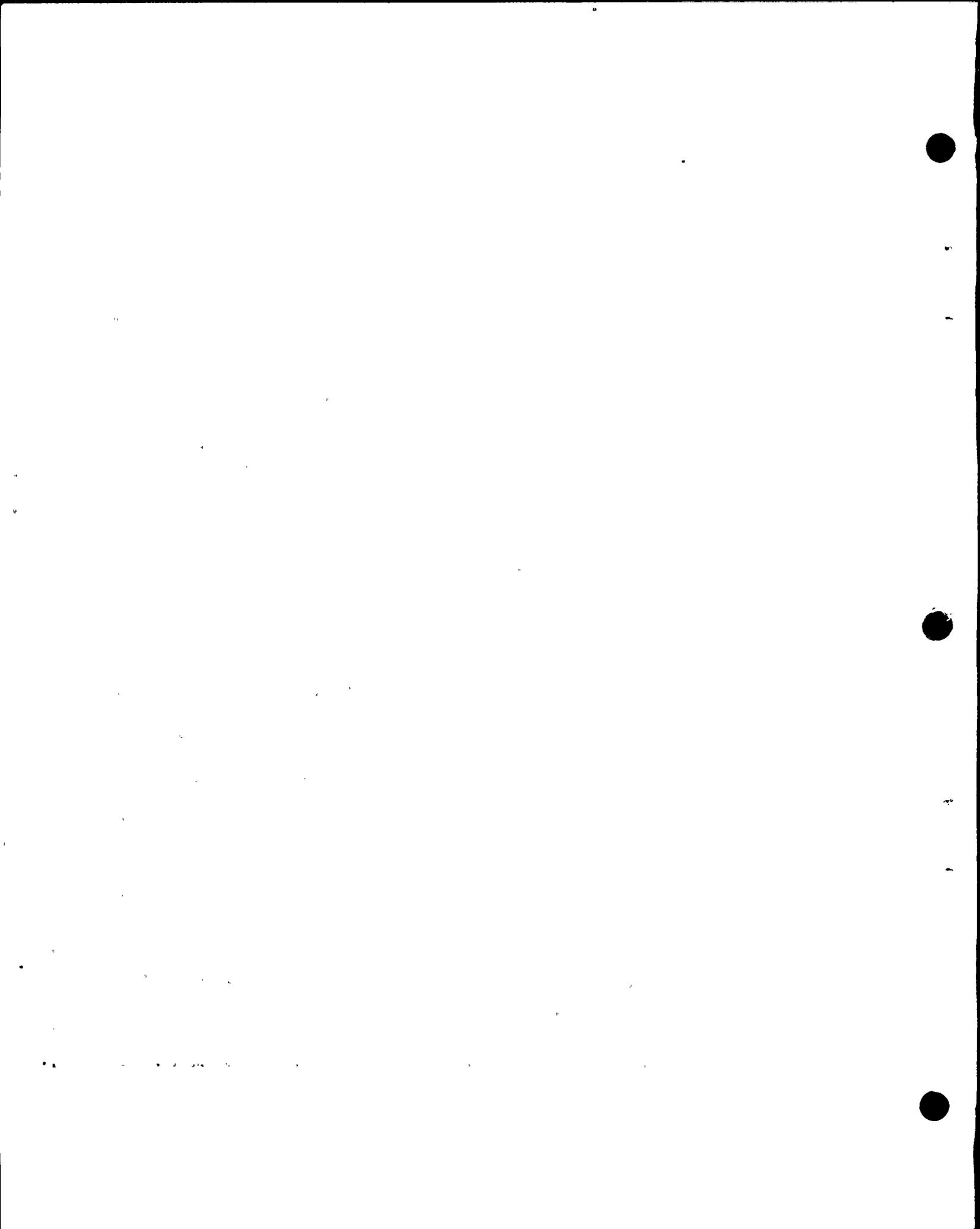


1 weren't a strike-slip fault. But the dangerous thing about
2 the Hosgri Fault here is the strike-slip mode; it's not the
3 dip-slipping that formed the fault originally, not the dip-
4 slip motion or the basin bounding original formation of the
5 fault. So for a given-- As you know, for a given length of
6 rupture you might expect -- you might not, too, but you might
7 expect a higher magnitude. But I think we gave some credit
8 for the fact that it was a strike-slip fault. A magnitude of
9 6 or maybe 6.5. And some curves on peak acceleration versus
10 distance. I don't know exactly what those curves are.

11 All of this was kind of tentative in the sense
12 that I had not received an input. Perhaps Mr. Hoffman had
13 worked out something preliminarily, but I'm not sure: it
14 certainly had not gotten to the point of writing up an SER
15 input and having Dr. Stepp and Harold Denton review it before
16 it came over to us. And it might have changed a little bit:
17 it may have changed 10 percent or the other, I would expect.
18 We hadn't gotten that far with it.

19 The big thing, of course, is, we were waiting
20 for the Survey's report which would have taken care of most
21 of that had the Survey decided that .5g was adequate.

22 MR. NORTON: Excuse me, Mrs. Bowers. I have,
23 again, no real objection to this line of questioning as long
24 as the questions are phrased "What is your recollection of
25 what you were told the geology or seismology thinking was?"



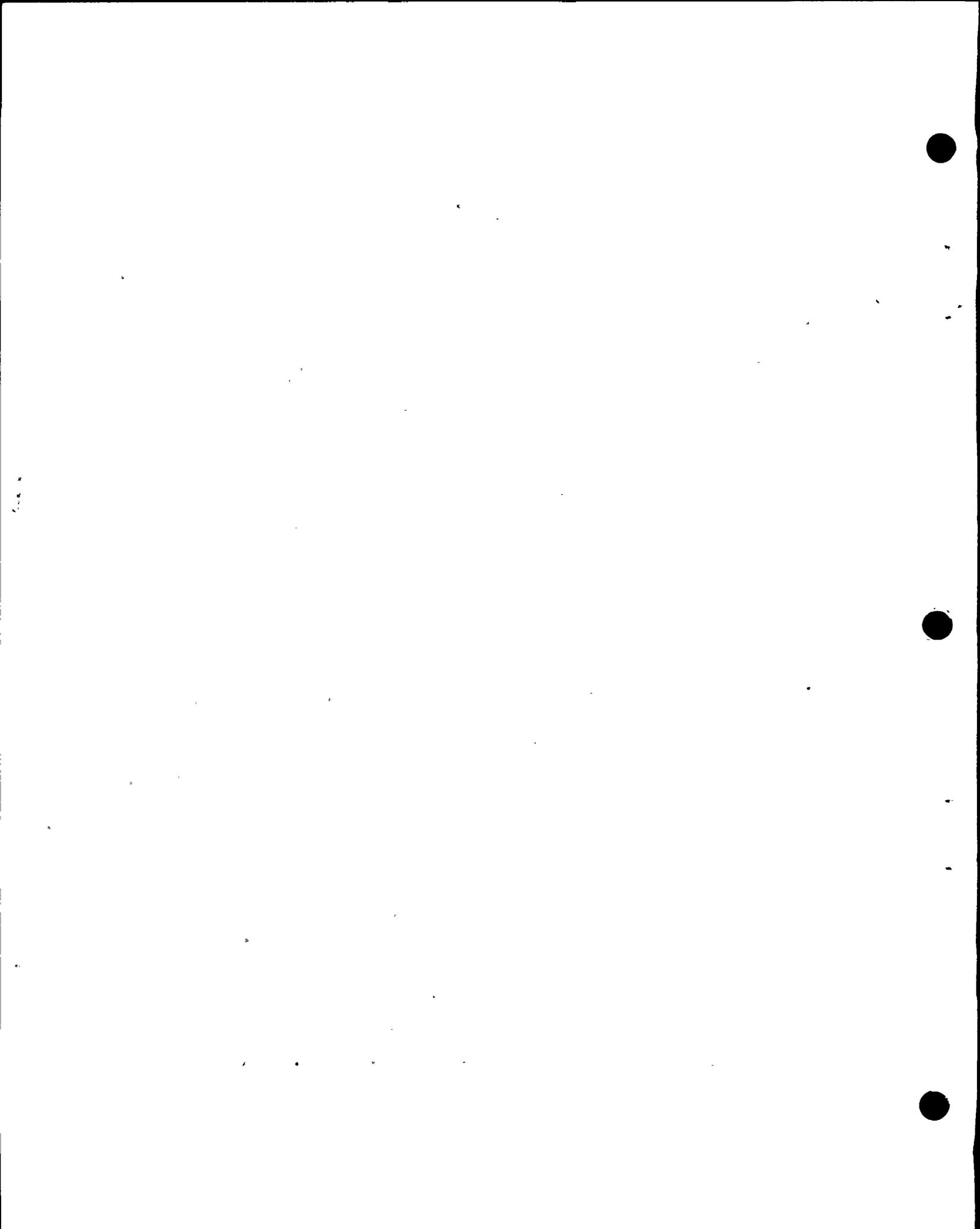
1 Because if you say "What was it?" and then he testifies, those
2 facts become evidence that what he is saying about fault
3 length and length of rupture and magnitude, and so on, become
4 evidence in and of themselves, where, if he is asked "What
5 is your recollection of what you were told?" then what he
6 says about fault length and magnitude and so on is not evi-
7 dence of those facts or the truth of those facts; it's just
8 what he recollects. And that's my objection.

9 Because really what he's saying is geology and
10 seismology testimony. And I have no problem with his recol-
11 lection of what his understanding was. But I want to be very
12 sure that what he is saying isn't evidence of those geologic
13 facts and seismological facts.

14 MRS. BOWERS: Mr. Fleischaker?

15 MR. FLEISCHAKER: I don't understand this as an
16 objection. I don't disagree with Mr. Norton. I think the
17 evidence is going to be clear that this is the Project
18 Manager and he's not testifying to geological and seismological
19 facts per se, and that it's also clear that he's recalling
20 from the best of his recollection. So I don't know if we
21 have an objection or what.

22 MR. NORTON: Well, I believe the question was
23 "What were the geologic reasons?" and I object to that ques-
24 tion. I don't object to the question "What is your recol-
25 lection as to what you were told the geologic reasons were?"



1 I have no objection to that. But when he is asked "What
2 were the geologic reasons?" then that's a different question.
3 And it's just the way the question is phrased.

4 MRS. BOWERS: Mr. Tourtellotte?

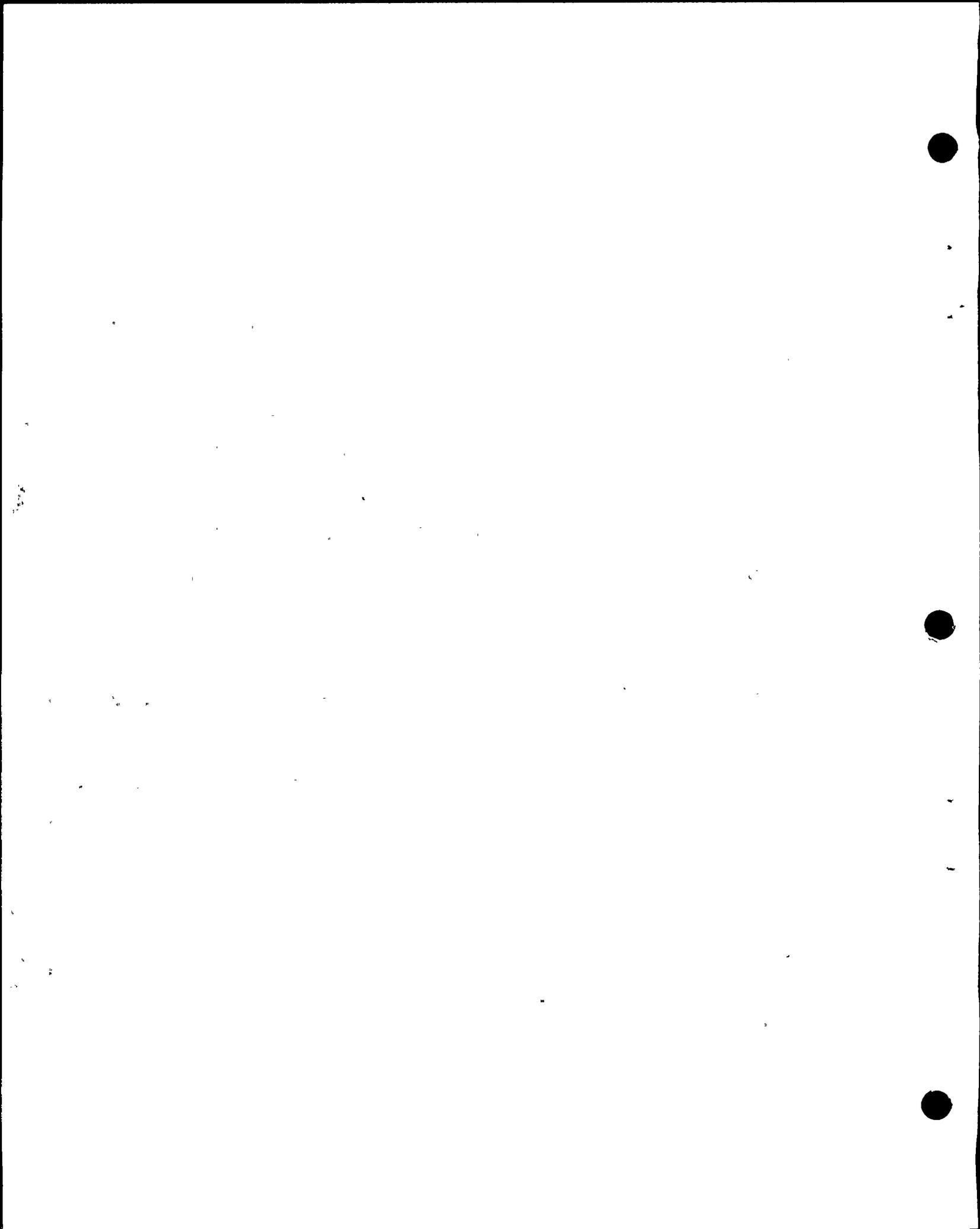
5 MR. TOURTELLOTTE: I suppose the objection is
6 on the ground that this witness is not competent to testify
7 as to what specifically the seismological and geological
8 values are. And I would have to agree that that is correct.

9 However it also, I guess, is my understanding
10 on the basis of what Mr. Fleischaker has represented, that he
11 is not intending to use this part of his cross-examination
12 for the purpose of eliciting facts about seismology and
13 geology but is, in fact, going after what Mr. Allison's
14 understanding is.

15 Perhaps the question was not properly worded.
16 But I think the record is clear right now as to what was
17 intended by both the person who's asking; I don't know that
18 it's clear by what was answered. But maybe it's just something
19 to look out for.

20 MR. FLEISCHAKER: What I'm seeking is the
21 information available to Mr. Allison, the information that
22 Mr. Allison can recall.

23 MRS. BOWERS: Well I don't think there's any
24 disagreement among the parties as to the purpose of the
25 questioning.



1 Hopefully a reviewer of the record would not
2 pick it up piecemeal and not have this understanding.

3 MR. FLEISCHAKER: Well I think each of the
4 parties is in a position to educate a reviewer as to the
5 nature of this testimony. We all seem to be fully aware of
6 Mr. Allison's qualifications, and the purpose of the question-
7 ing I think is clearly stated in the record.

8 MR. NORTON: Well my experience has been that
9 it's sometimes very difficult to educate a D.C. Circuit
10 Court Judge or a United States Supreme Court Judge as to
11 how they should view the record. And I just don't want to
12 run into a situation where I see an opinion someday saying
13 something about fault length and magnitude and it's plucked
14 out of Mr. Allison's testimony; that's all. And that's my
15 only concern. I think the record is clear. I just wanted
16 to make sure we weren't getting geology and seismology
17 testimony as to those subjects. I think the record is clear.

WEL fls

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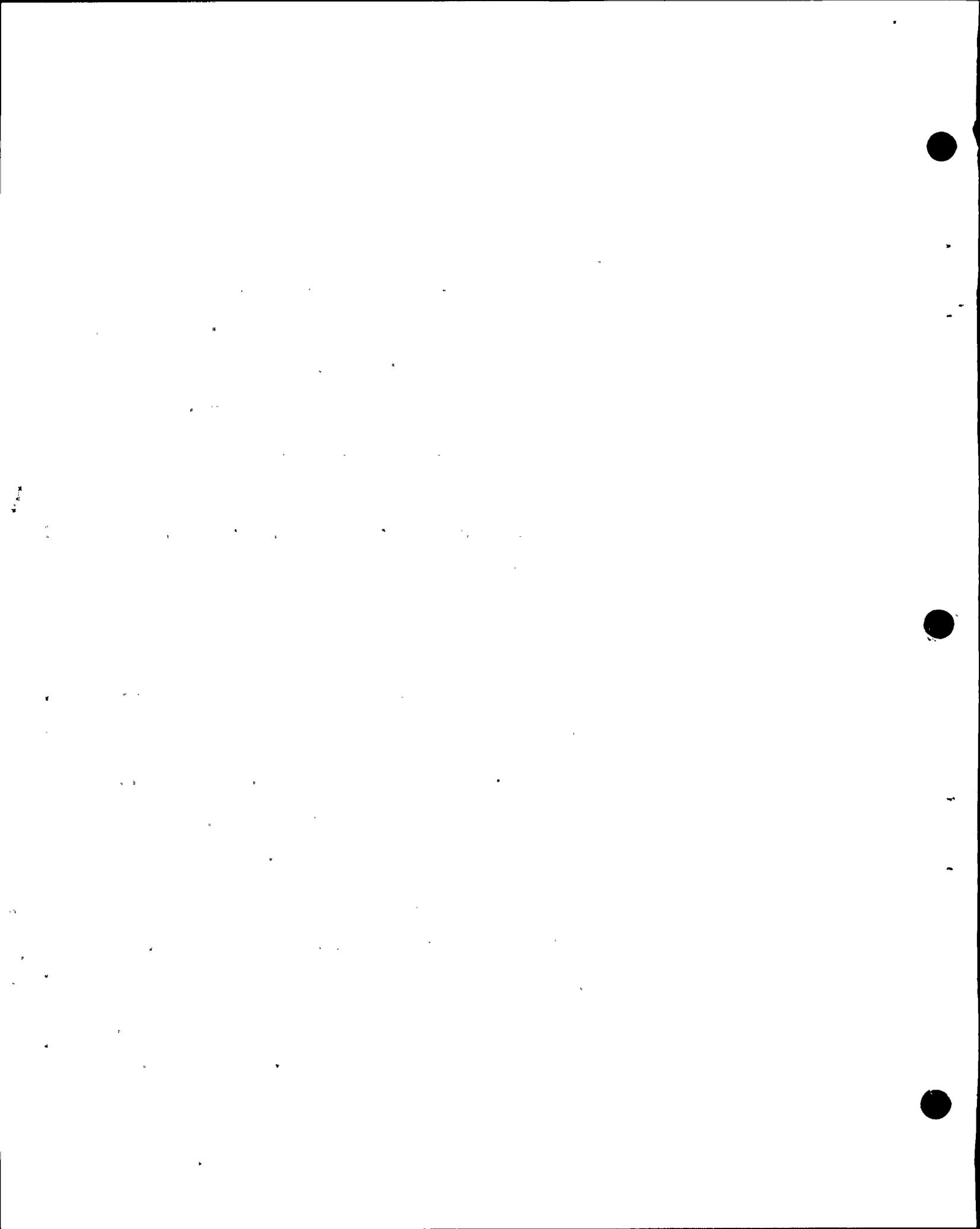
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1 MRS. BOWERS: Do you want to proceed, Mr.
2 Fleischaker?

3 BY MR. FLEISCHAKER:

4 Q So, as I understand your testimony, the information
5 that you recall as the project manager was that the Seismology
6 and Geology Branch had formulated some tentative conclusions
7 regarding possible fault waves and values of the fault wave
8 magnitude relationship for deriving some tentative conclusions
9 regarding possible accelerations at the site?

10 A That's correct.

11 MR. FLEISCHAKER: Enough qualifications in there?

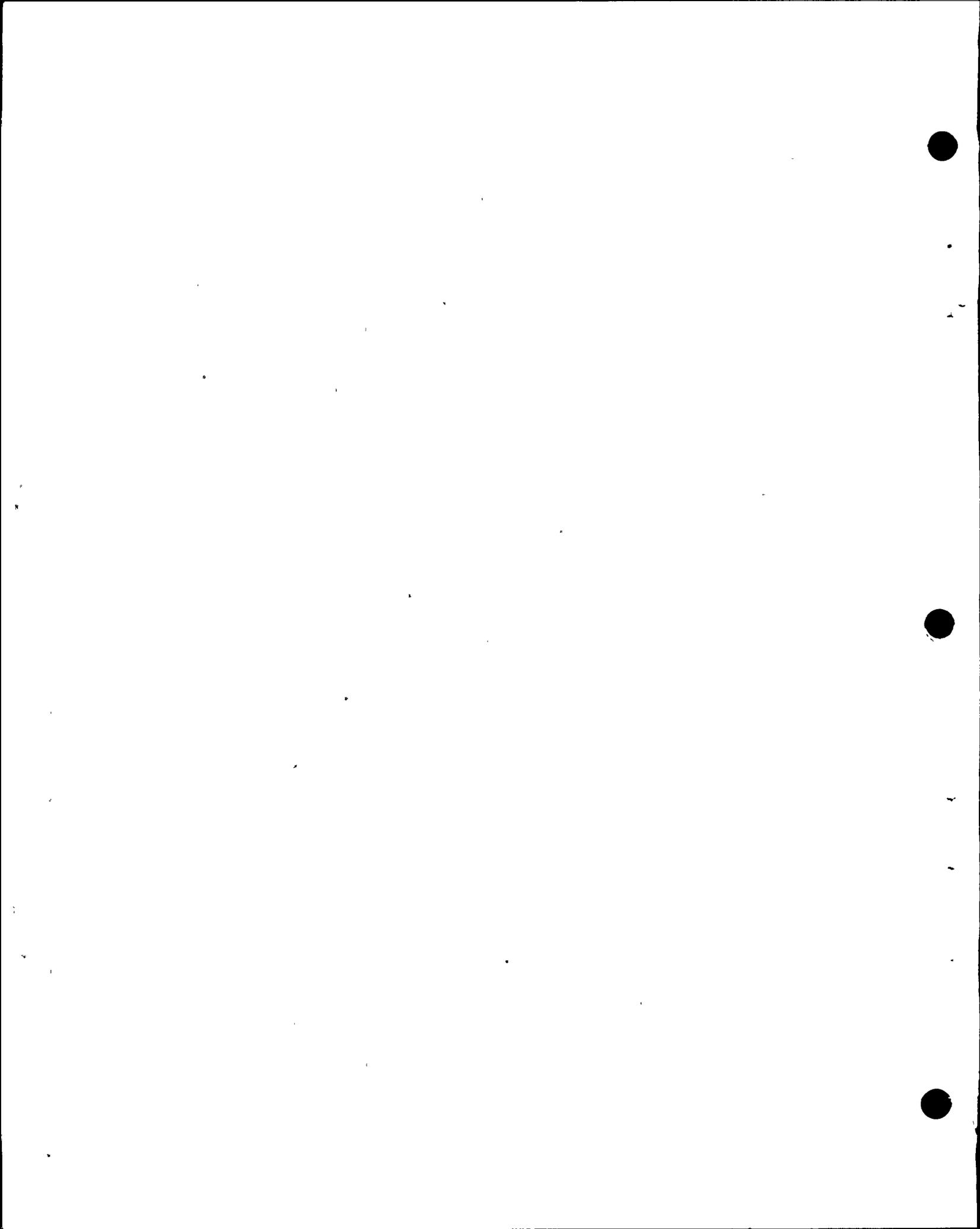
12 BY MR. FLEISCHAKER:

13 Q Why wasn't that SER issued?

14 A Well, as I mentioned before, we were waiting for
15 the USGS recommendation which was to come in in time for us
16 to publish the supplement in January.

17 When the recommendation came in, it stated that
18 based on the information -- and I'm paraphrasing here -- based
19 on the information that was then available, the Survey could
20 not conclude that .5g was an adequate value for that site.

21 We discussed the recommendation with the Survey
22 quickly and published Supplement Number 1, which contained that
23 Survey recommendation. And we stated in Supplement Number 1
24 that geology and seismology was, accordingly, still an open
25 item and further work had to be done to resolve the issue.



wel 2

1 Q At the time that you published Supplement Number 1,
2 had you discussed with the USGS as to firm their conclusion
3 was?

4 A I did not, no. The Survey's report was dated
5 January 28. Sometime between January 28 and January 31, when
6 the report was issued, Dr. Stepp and I think some other people
7 from his branch, met with the Survey in Denver and discussed
8 the report.

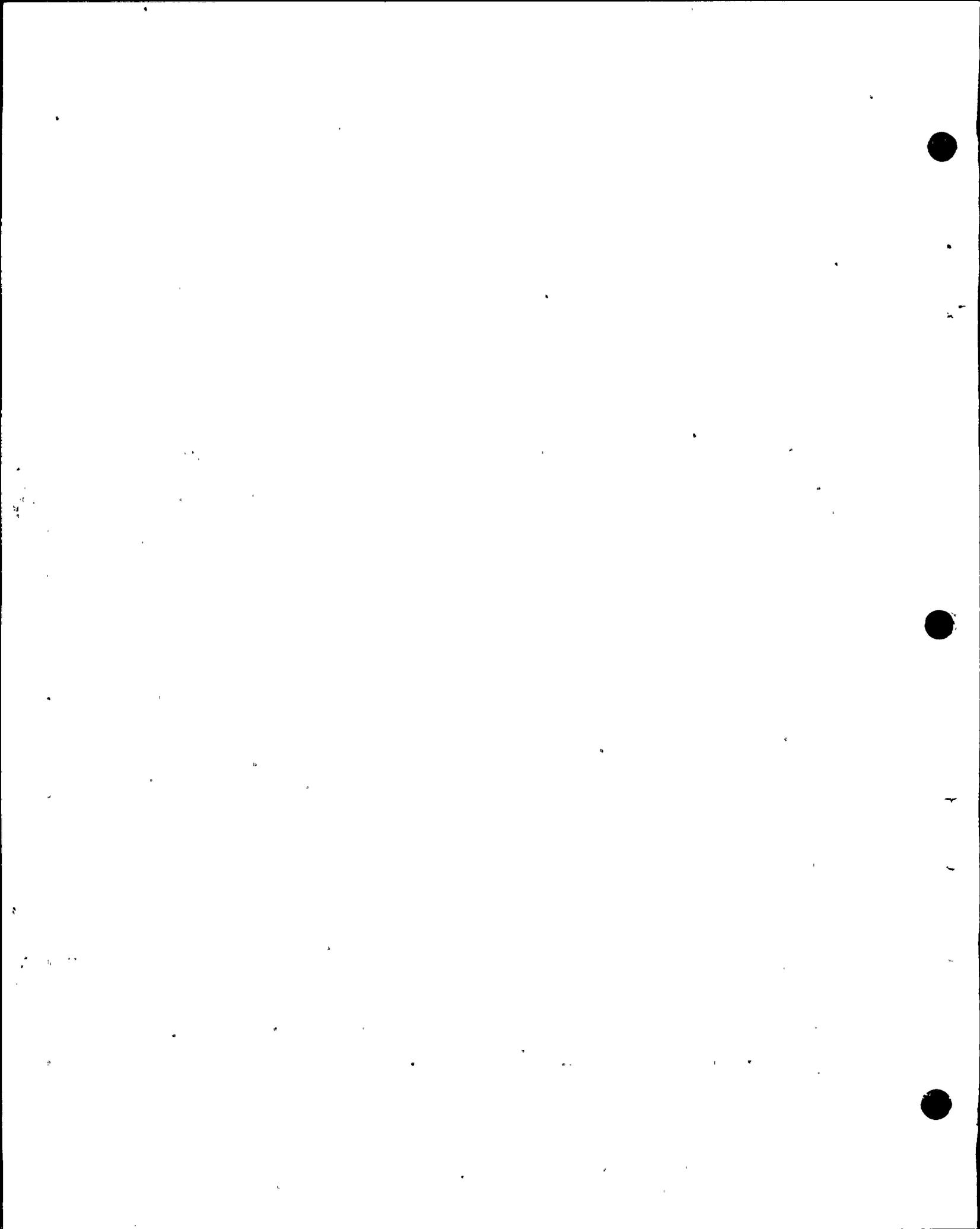
9 The one thing I do recall is that Dr. Stepp
10 called back and mentioned that there was some new information,
11 namely the Gawthrop report, and advised us that we should
12 publish the SER basically in the form that you see it.

13 Q Did the USGS give you any estimates as to what
14 zero period limit they thought would be appropriate for the
15 accelerations you would see at the site?

16 A No, not that I can recall.

17 Q At the time that you got the USGS report, did you
18 consult with the Structural and Mechanical Branch or receive
19 information from the Structural and Mechanical Branch regarding
20 the adequacy of the design and the possible accelerations that
21 the design could withstand?

22 A I don't recall asking the engineering branches
23 anything about that. You say when we received the report? I
24 guess you're speaking of the period between January 28 and
25 January 31?



wel 3

1 Q No. Let me ask it differently:

2 At any time during the period, say, January through
3 March, did you become aware of some structural and mechanical
4 engineering branch estimates or guesses regarding the
5 adequacy of the design vis-a-vis expected levels of accelera-
6 tion at the site?

7 A Oh, yes.

8 Q And what was that information?

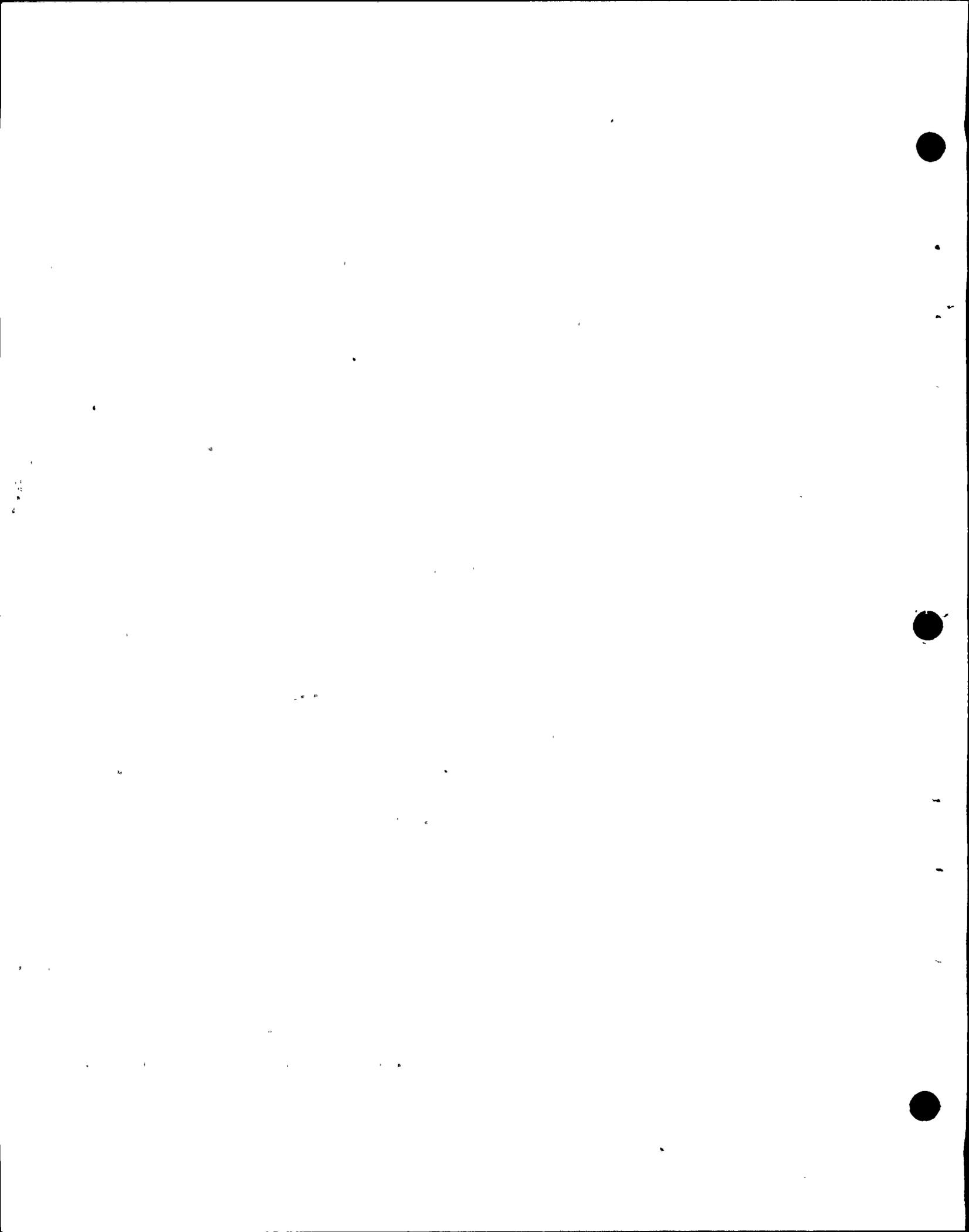
9 A My recollection is aided a little bit by reading
10 the documents you gave me yesterday, but I think it's pretty
11 fair to say that at that time, once we knew that the Survey
12 had a problem, they didn't agree with us -- or we had a
13 problem --

14 (Laughter.)

15 -- whoever -- that there was a problem with .5g, that it might
16 be higher, one could assume, and we did assume, or we knew
17 we could make the assumption, that the acceleration would go
18 up to .6, .7 or possibly higher.

19 During those times we asked the Structural Engineer-
20 ing Branch, primarily, not the Mechanical Engineering Branch,
21 how much farther could the plant be taken, how much more margin
22 did it have?

23 Now, when I speak of margin in this context I'm
24 not talking about true margin, I'm talking about margin to still
25 meet some design code, or what have you. And there is a



wal 4

1 difference.

2 If I would say the plant is good for .5g, but
3 something will have no margin left if you go any further, I
4 don't mean that something would be at the failure point. I
5 mean it would be beyond the code limits.

6 And there's a real difference between margin to
7 the code limits and margin of failure.

8 Q Let me see if I can clarify that:

9 Do you mean you were talking about margin with
10 reference to the Staff's normal manner of analysis?

11 A That's right.

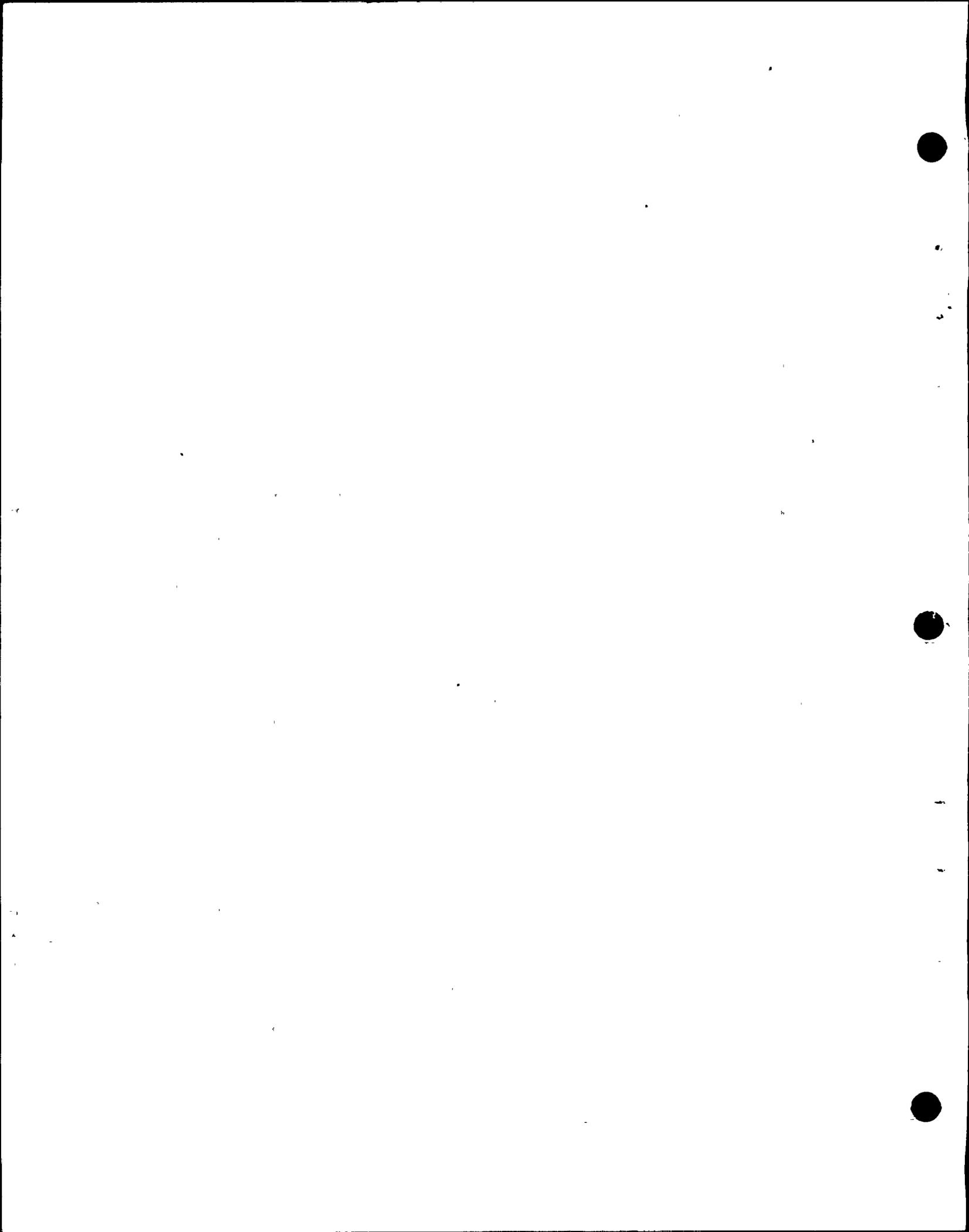
12 Q Normal manner of analysis of --

13 A Either normal or a pretty equivalent alternate,
14 not a failure analysis.

15 So with margin defined that way, right now anyway,
16 it's clear that as we went beyond .5g we would start running
17 out of margin with some components. We didn't know what those
18 components were, where they might be. And not knowing what
19 they were or where they might be, we didn't know that they
20 could be fixed. It could have been the containment base slab.

21 As you know, later on it didn't turn out to be
22 that way, but we didn't know at that time what would run out
23 of margin at .6, what would run out at .7, and so on.

24 In a failure mode you might have been able to say
25 the plant was originally good for .7, but that wouldn't have



wel 5

1 been based on analyses, it would have been a guess.

2 Q Was that kind of analysis done at the time, to
3 your recollection?

4 A Failure mode analysis?

5 Q Back in January?

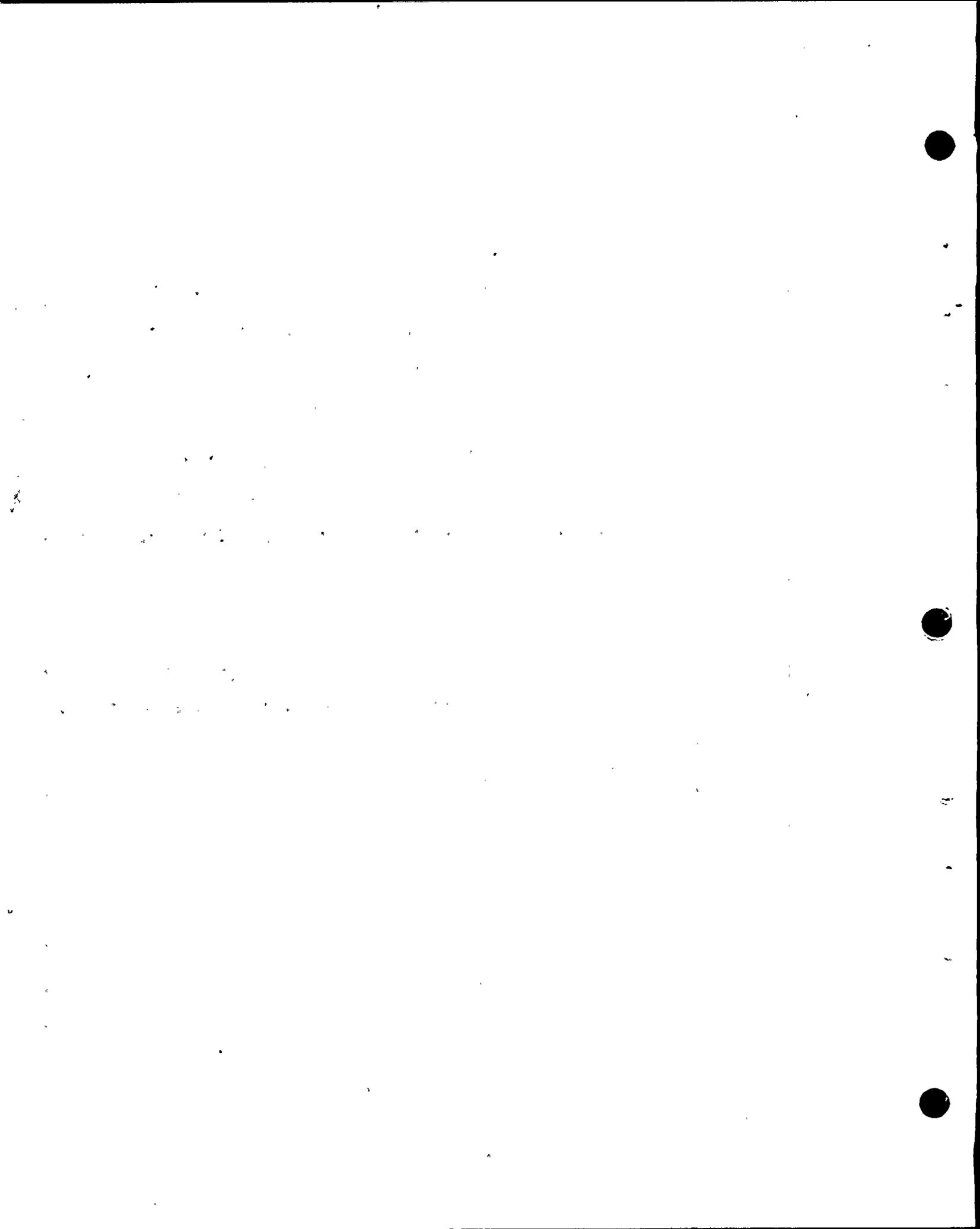
6 A No, it wasn't.

7 Q Were there any best guesses or judgments as to the
8 practicability of bringing the design up to a .6 or a .7g
9 back in that period?

10 A Yes, there were. And I remember the one that I
11 read in the documents that you gave me yesterday, which was --
12 the guess was that something that was impractical to fix would
13 probably run out of margin at .6 or .7, say the containment
14 base slab, and we would be faced then with a decision of
15 whether to accept it not being designed in a normal manner
16 the way we were talking about a minute ago, or not operating
17 the plant.

18 Q During that period were you aware of any informa-
19 tion from your structural and mechanical branch -- tentative
20 lists, for example, with regard to what kind of components and
21 what kinds of structures would have -- for which the design
22 would be questionable in the .6 to .7g range? I'm not asking
23 you to list, but rather were you aware of such lists being
24 made?

25 A No, I can't recall any listing of that nature, nor

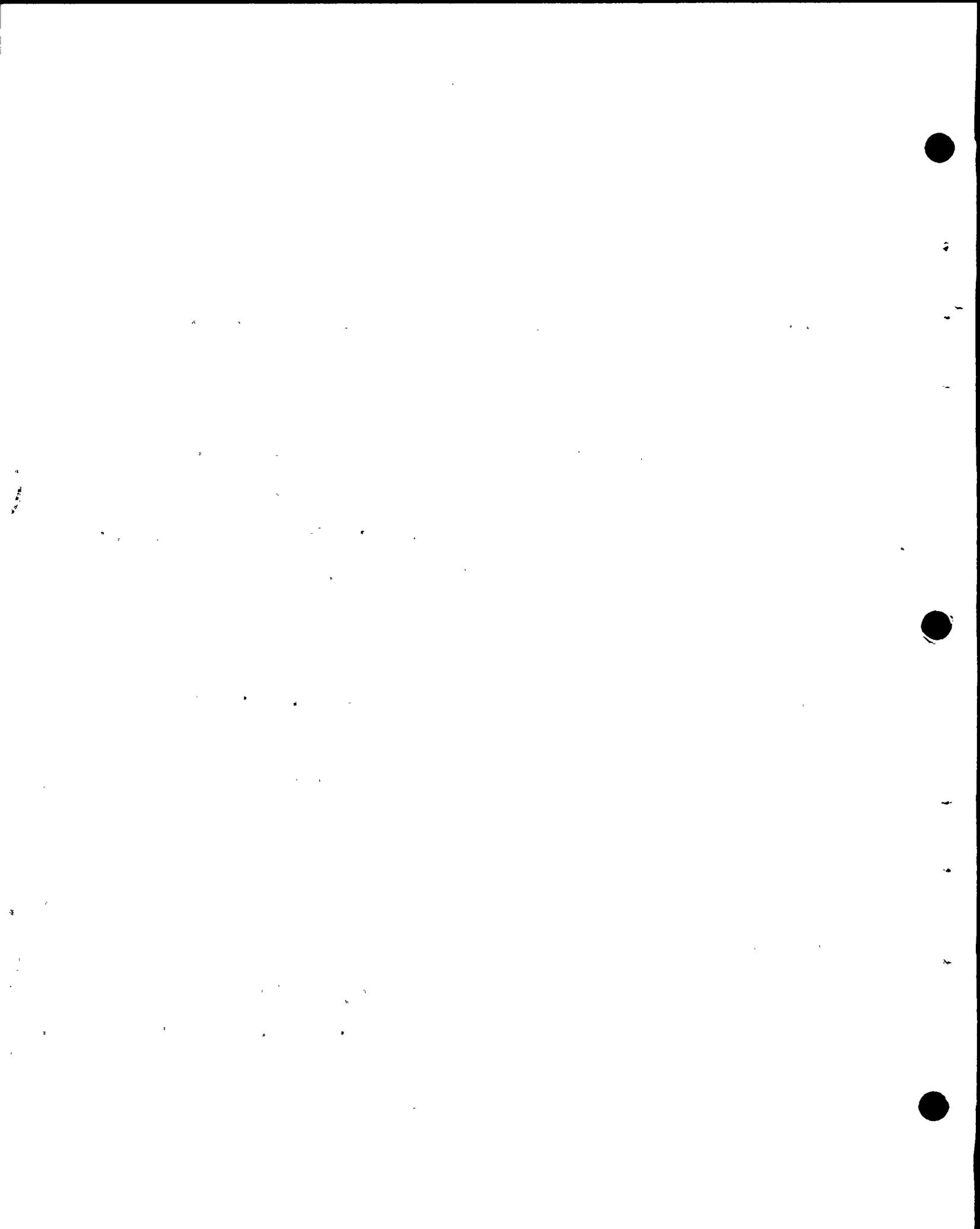


1 can I recall anyone having any knowledge of that nature,
 2 because we were at that time really going on two things:
 3 (1) Our base point was the simplified calculation
 4 where you take the Parkfield and Castaic record at 7 percent
 5 damping and compare it with the original record at 4 percent
 6 damping. You see, there's not much difference. And the
 7 Applicant had, just to show that there wasn't much difference,
 8 run those through some structures to determine the response
 9 and, indeed, what you thought by looking at the records was
 10 true. There wasn't much difference. So that was our base
 11 point, and that was not going to take you much farther. .5g
 12 was the end of that.

13 For the rest of it, though, we didn't have any
 14 analyses. We were going strictly on the guesses or the
 15 judgments as to what might be done, what might happen when we
 16 went back and did a detailed analysis which would take years
 17 to do.

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Q What were those guesses, though? What was the nature of those guesses and analyses -- excuse me, those guesses?

MR. NORTON: Object.

Why do we want guesses as to something that wasn't -- I don't understand the probative value of that at all. Guesses.

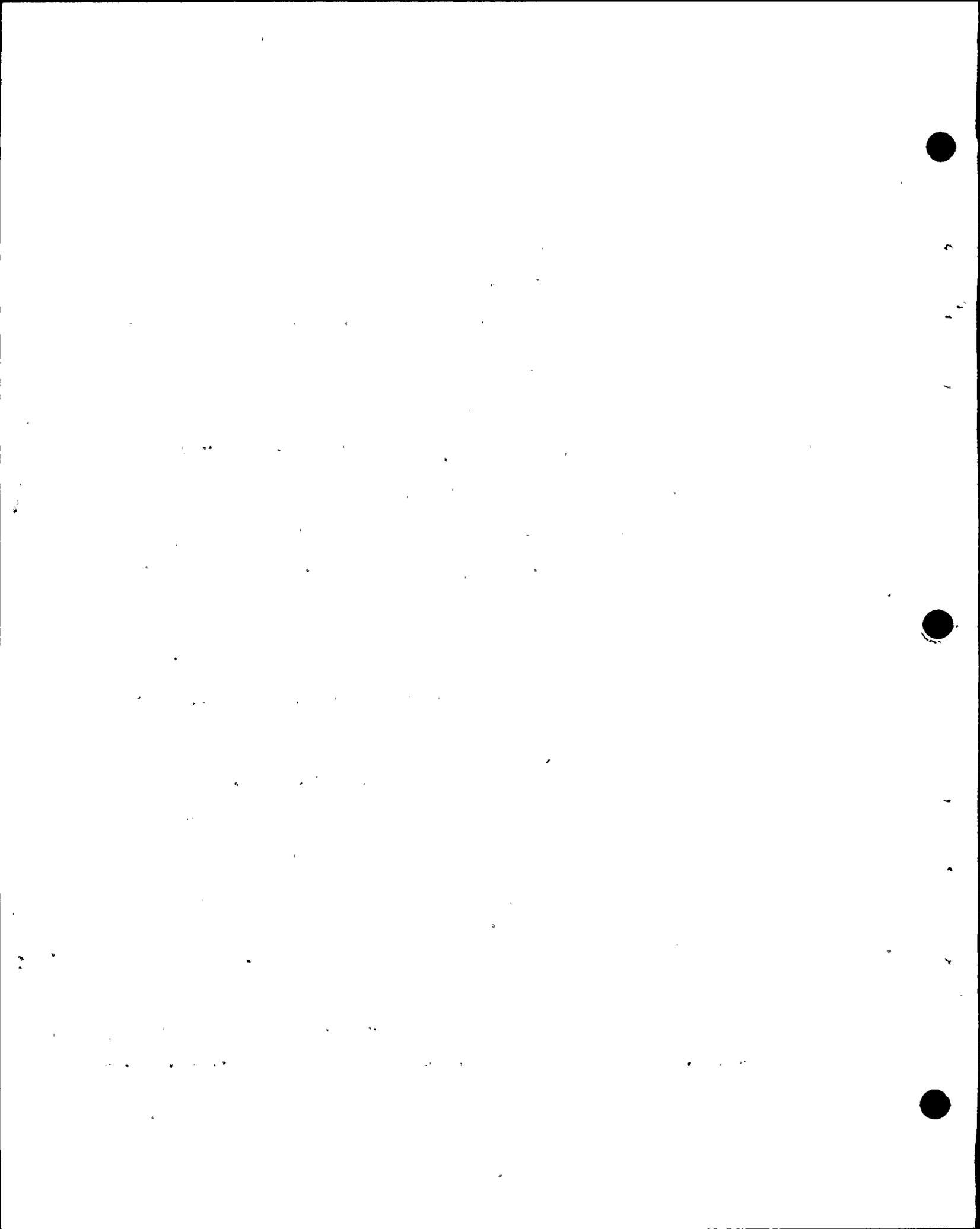
MR. FLEISCHAKER: Well, I am trying to develop for the record the step by step manner in which the Staff proceeded to analyze and develop its program for analysis, reanalysis of the design of this facility. And I think it's an important point to have in the record.

MR. NORTON: The analyses are important, but guesses before any paperwork was ever done, before any spectra were done, guesses is not important at all. Whose guesses?

You know, I heard the question what were your guesses. Well, if Mr. Allison is not one who is a geologist, seismologist, or one designing response spectra, I don't really care what his guesses were, and I don't think the Board really should care what his guesses were.

If the guesses were those of others, I don't see the value of Mr. Allison saying Well, this is what so-and-so's guess was.

What's the probative value of any of that?



mpb2

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MR. FLEISCHAKER: There's a great deal of proba-

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tive value in all of this, because, again, whether Mr. Norton

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cares or not, I think we have the right to develop the manner

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in which the Staff proceeded in its analysis. And one of the

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things it apparently did was do some thinking about the kinds

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-- during this January to March period, do some thinking about

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the kinds of modification problems that they would have

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to the acceleration values of the site exceed .5g.

9

And I'm trying to determine the nature of that

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thinking among the Staff people.

11

MRS. BOWERS: Mr. Tourtelotte?

12

MR. TOURTELLOTTE: Well, I have to agree with Mr.

13

Norton in the use of the term "guess". I think if Mr.

14

Fleischaker wants that kind of information, what he should

15

be asking for are engineering estimates, if any, that this

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witness knows about.

17

MR. FLEISCHAKER: I'll accept that.

18

MR. TOURTELLOTTE: You know, the use of the term

19

"guess" is just a little bit beyond what is acceptable.

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MR. FLEISCHAKER: All right. I will amend my

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question.

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MRS. BOWERS: Fine.

23

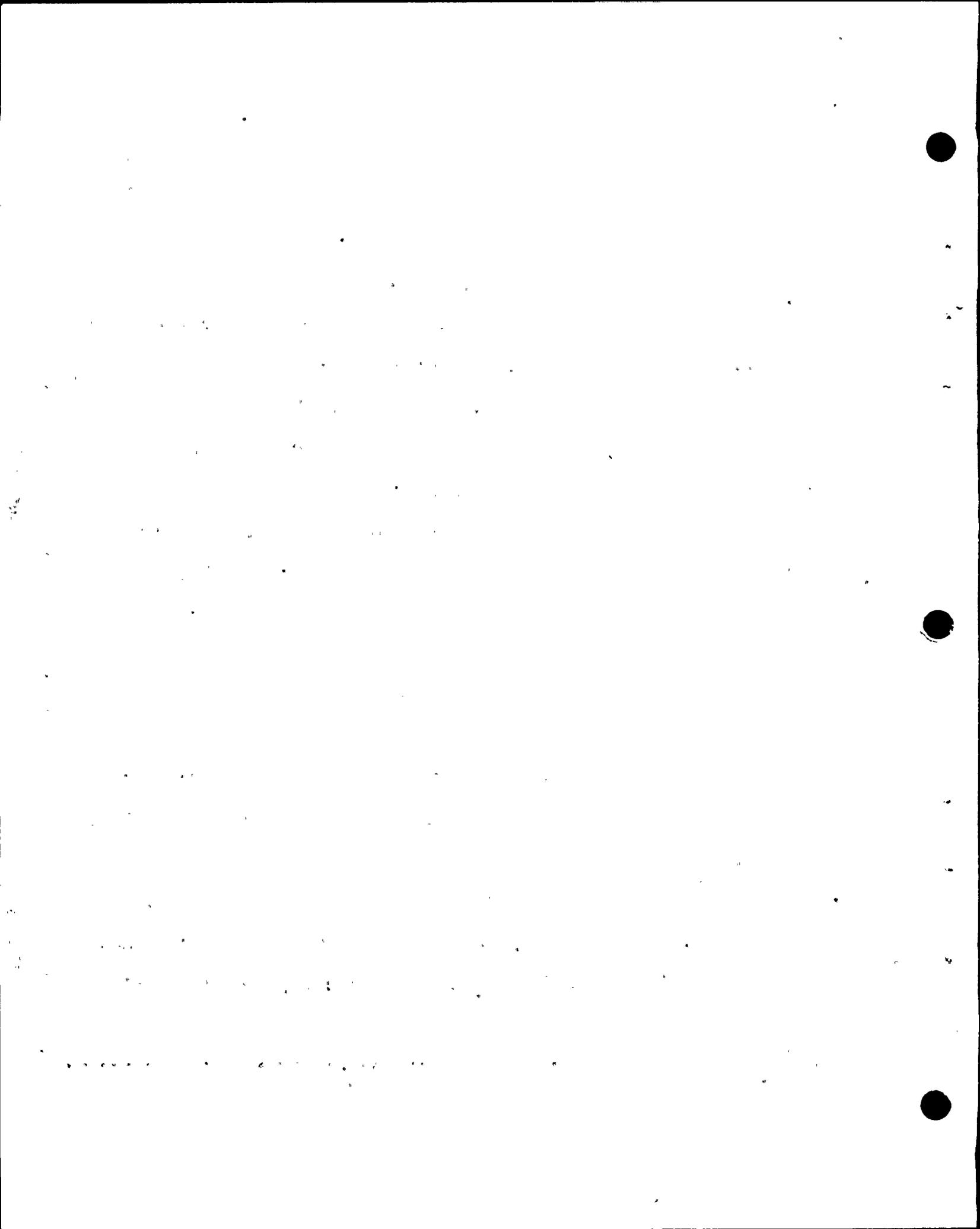
We've had this come up before when witnesses

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have said, Well, I'll guess so and so. And it doesn't have

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any probative value.



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MR. FLEISCHAKER: Okay.

MRS. BOWERS: So if you will amend it.

MR. FLEISCHAKER: Okay.

BY MR. FLEISCHAKER:

Q What was the nature of the engineering estimates with respect to the structures and components and systems that might have problems if accelerations at the site exceeded .5g during this period, January through March?

A This question goes to what would be the components that would have a problem?

Q What were the nature of the engineering estimates and what kind of information were you receiving from your structural and engineering branch?

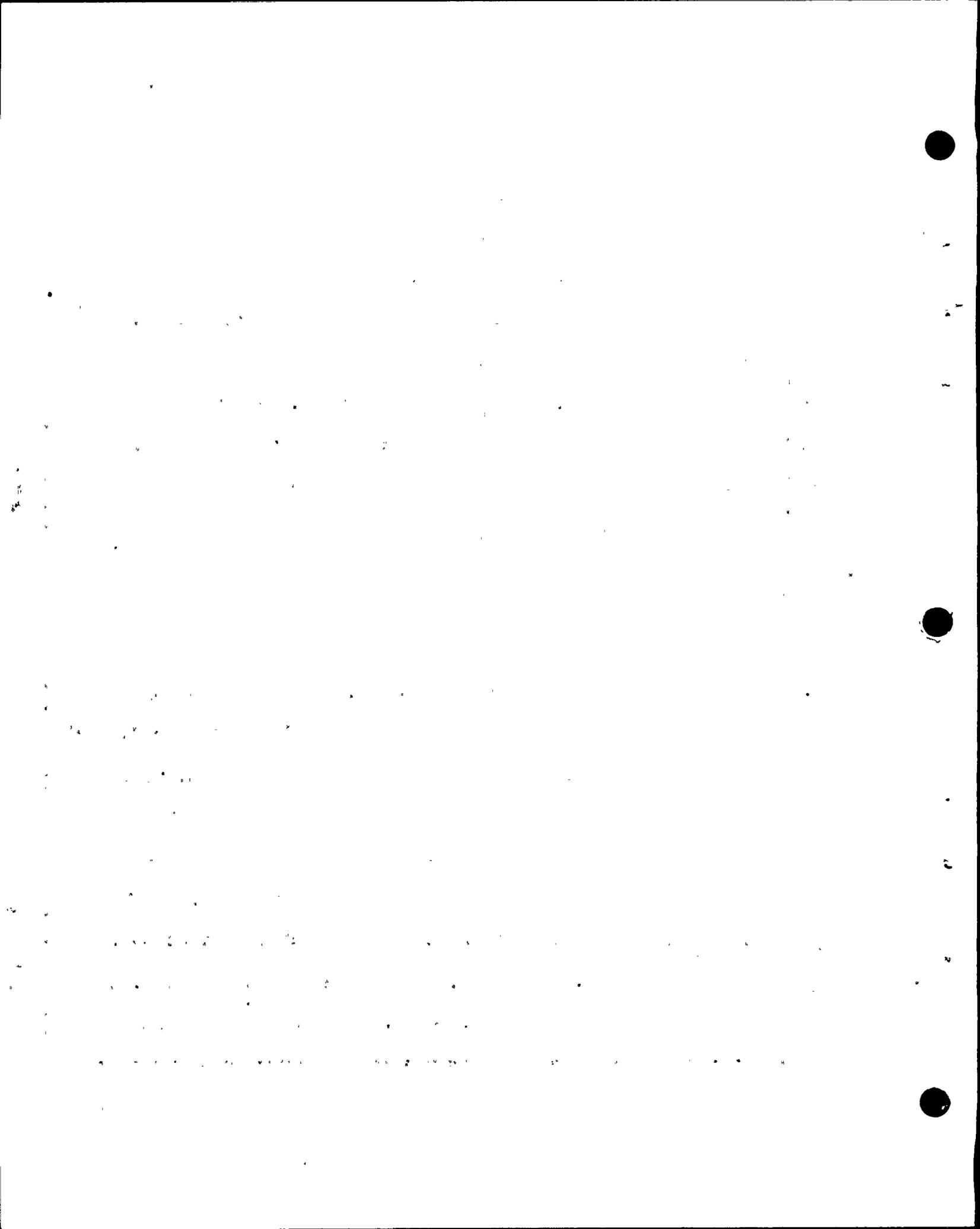
A Okay.

Excuse me just a second.

(Pause.)

The advice that we received from the structural engineering branch was that to go beyond .5g to .6 or .7 or .8, one would have to do an extensive reanalysis. That would take years. Many components would be able to pass such an analysis without any problem. Some would run out of margin in the sense of a margin to a design code, and not margin to failure.

Some would run out at .6, some would run out at .7, and so on. We made the assumption at that time -- we



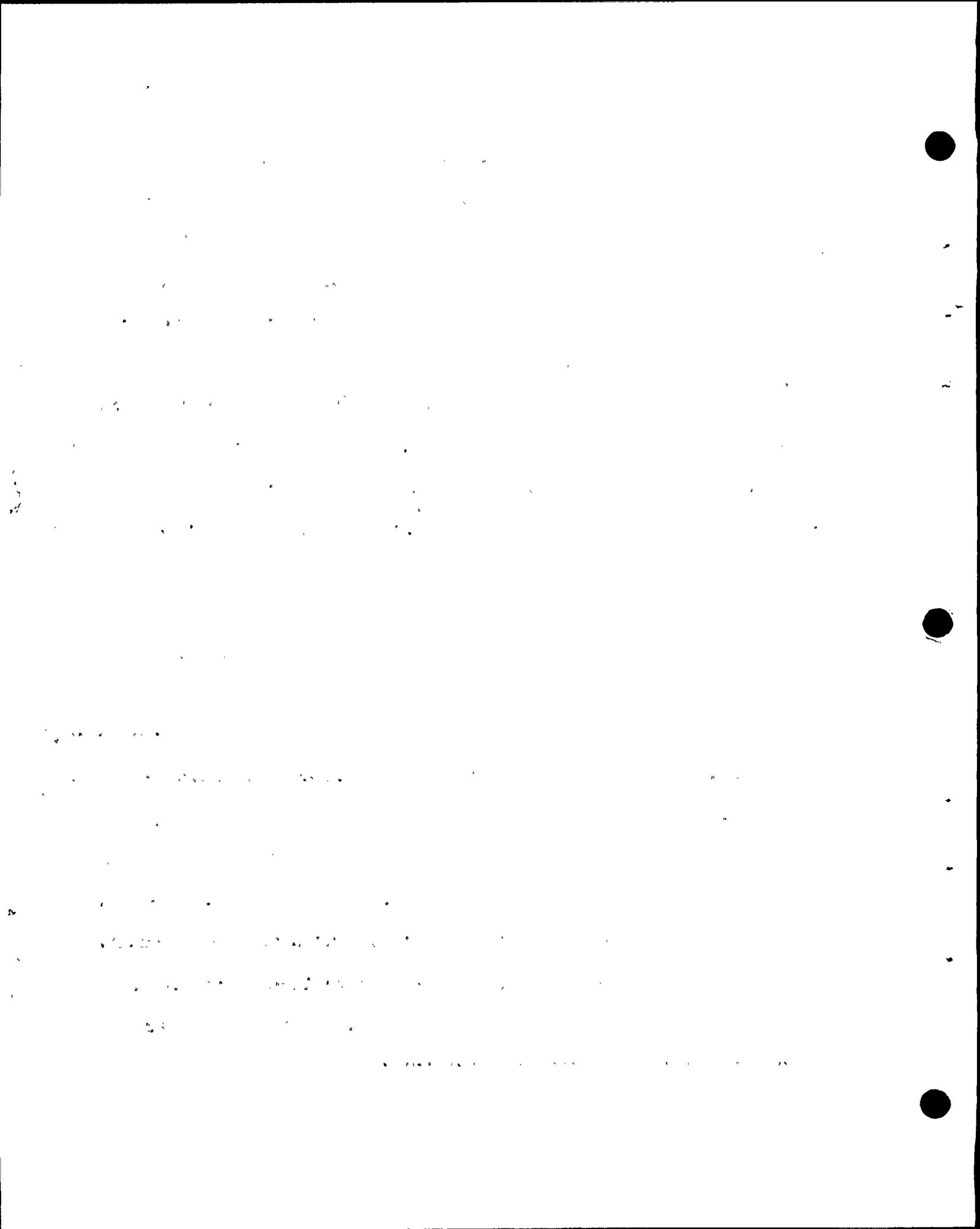
mpb4 1 being project management, I and my bosses, and perhaps the
2 structural engineers made the same assumptions. I'm not sure,
3 that not knowing what those components were, some of them --
4 some component that would be literally impractical to fix
5 might run out of margin at .6 or .7 or .8. Without doing
6 those analyses one could not know -- or we didn't know. We
7 didn't consider that we knew.

8 Q So now we're in the period of the spring of '75.
9 What steps did the Staff then take to resolve the
10 uncertainty that was existing at that time?

11 A Okay.

12 Well, I'm not sure we have the right time se-
13 quence. The first thing we did was we had a meeting with the
14 Applicant and the Survey, and it was on February 7, 1975,
15 shortly after the SER was published. We had a meeting with
16 the Applicant and the Survey to discuss what were the Survey's
17 questions, what were their problems with the Applicant's
18 interpretation which went -- the Applicant's interpretation
19 indicated that .5g was an adequate value for the site.

20 We found out what those problems were, and we
21 cast them in the form of five questions that we sent to the
22 Applicant on February 12, 1975. Those five questions are
23 basically five pretty basic questions about the Hcsgrri fault.
24 Things like how far does it run to the north, how far does
25 it run to the south, what's its ranking in the order of faults



mpb5 1 in California, and so on.

2 Q When did you get answers -- so basically the
3 Applicant, the ball's in your court. You gave them some
4 questions. When did they return with some answers?

5 A In the fall of 1975. I think the answers started
6 coming in about August, 1975. But they weren't completed
7 until about October.

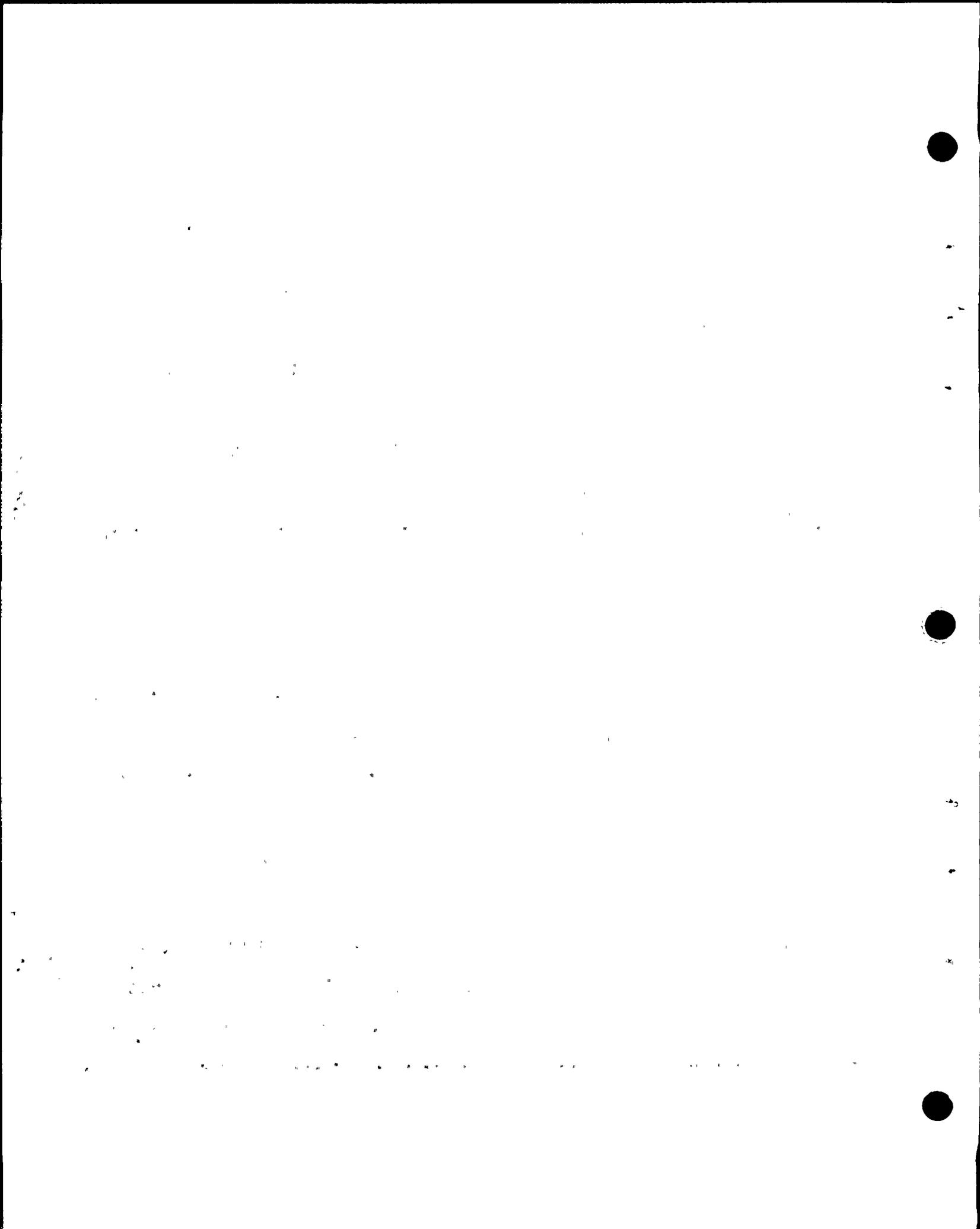
8 So -- now when we started this, I might mention,
9 I believe the Applicant's estimate or somebody's estimate was
10 that it would take three months to answer those questions,
11 but in the end it took a lot longer. It took about ten months
12 to answer them.

13 And there was an awful lot of data that the
14 Applicant gathered and interpreted and put together to answer
15 them.

16 Q When did the USGS come in with its firm recommenda-
17 tion to the NRC regarding the recommended safe shutdown earth-
18 quake for the Hosgri?

19 A Well, if you'll permit me to make a long answer,
20 the Survey sent us a draft letter December 24, 1975, after
21 having reviewed the Applicant's responses to the questions
22 that we just talked about. That draft letter was forwarded
23 with a cover sheet that said, Here's a letter, a draft
24 letter for the purpose of discussion.

25 That December 24 draft letter repeated the



mpb6 1 conclusion that .5g was not adequate for the site. I don't
2 believe that it stated what the safe shutdown earthquake
3 should be. I can't remember the exact words in it. So it
4 may have been the second draft which came on January 12, 1976
5 that told us what the safe shutdown earthquake should be.

6 Anyway, one of those two letters gave us a
7 magnitude and acceleration values by reference to Circular
8 672.

9 Q Did they give you a 7.5 magnitude in that
10 January 12, 1976 letter?

11 A Either that or words to the effect of a magnitude
12 greater than 7.

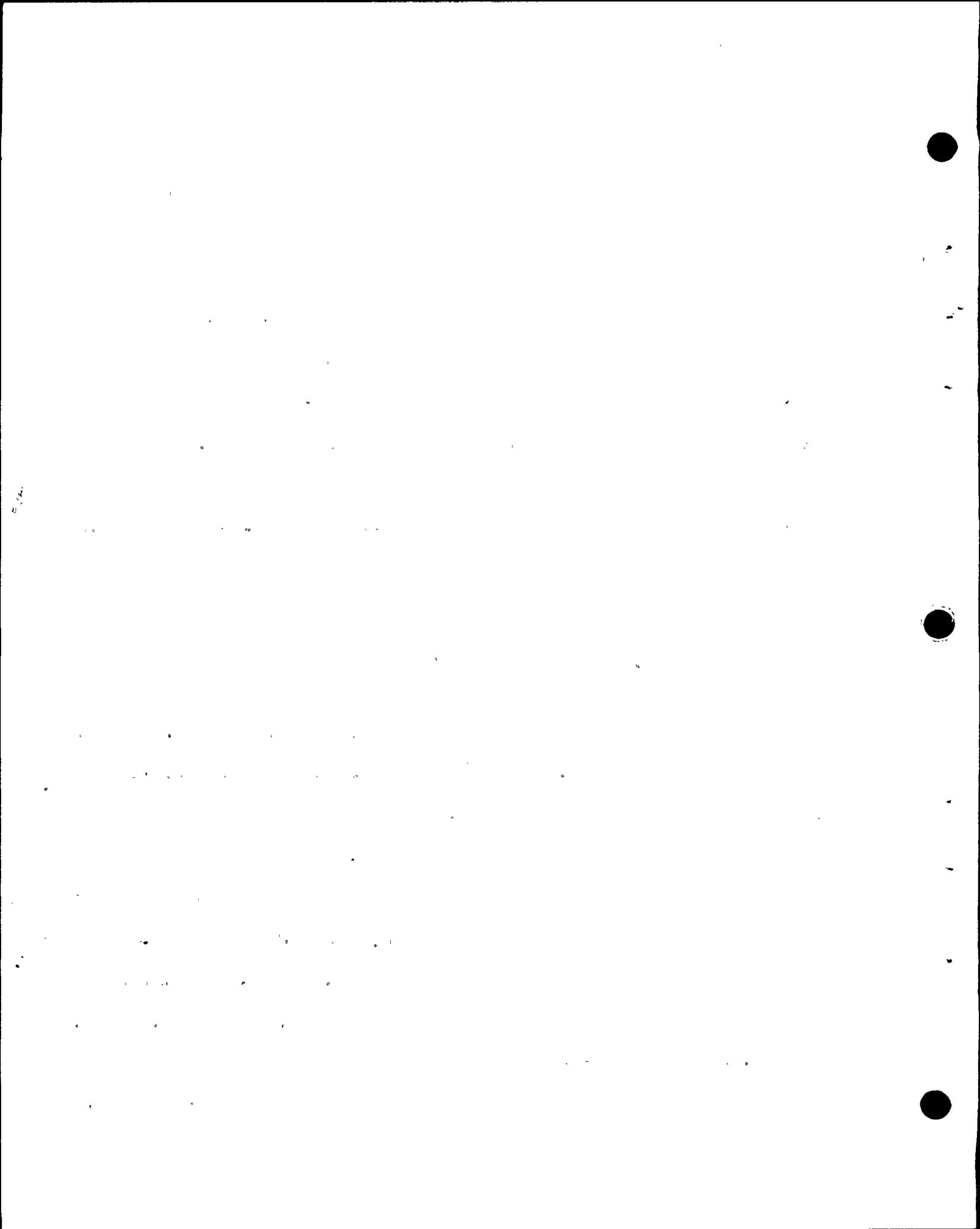
13 Q All right.

14 They then referred you to 672?

15 A Right. The final form said magnitude 7.5, but
16 some of the drafts just said greater than 7.

17 Q What action did the NRC take at that time after
18 receiving that recommendation, or the draft recommendation
19 from the USGS?

20 A Well, we did -- we met with the Survey on a number
21 of occasions and discussed it with them. As you know,
22 some of the Staff people didn't feel that it was necessary
23 to be that conservative. So we discussed -- you could say
24 "argued" -- we met with the Survey and discussed it. And we
25 got not just the reviewers, but we had meetings with Dr. Coulter,



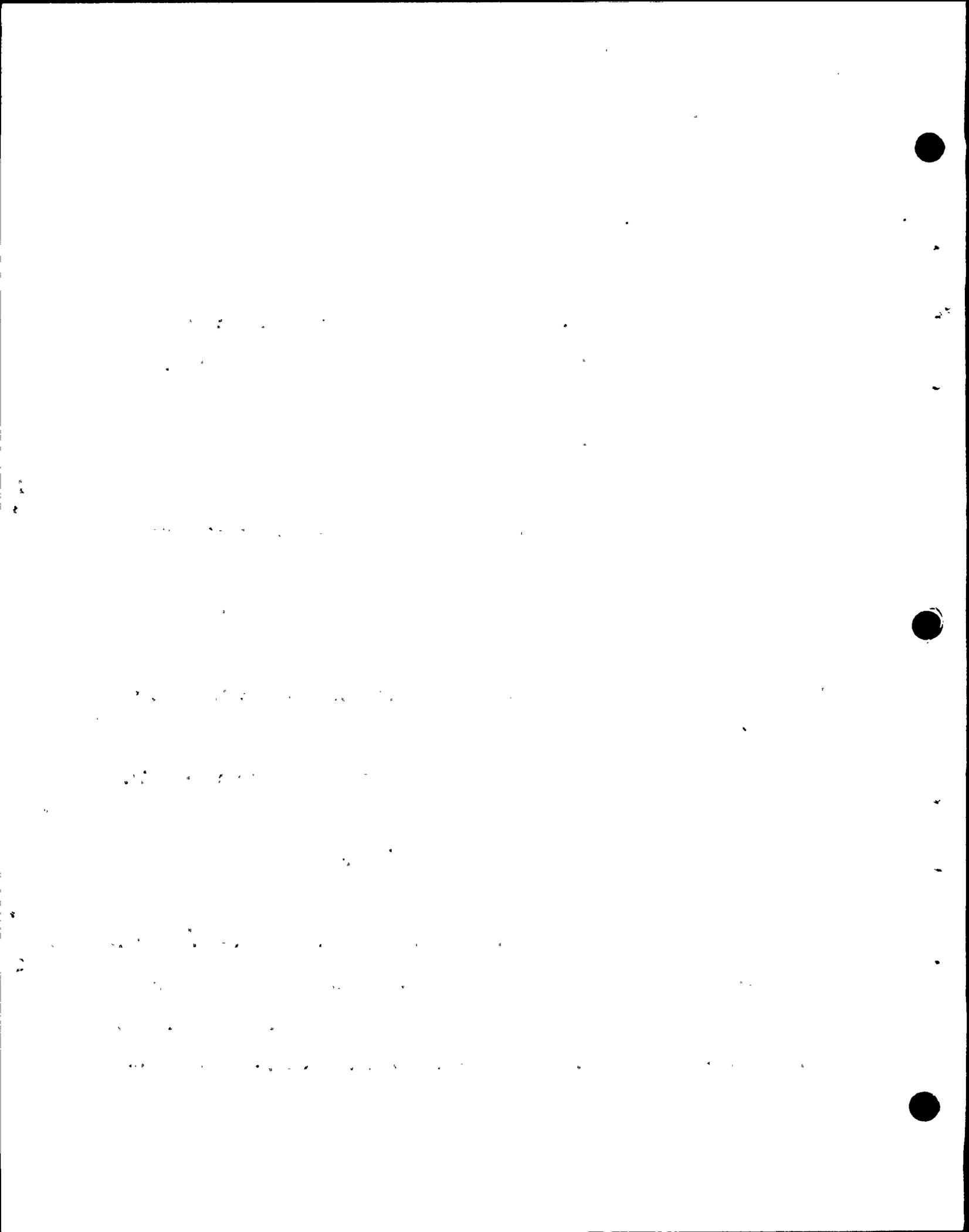
mpb7 1 along with Mr. Devine and Mr. McKeown, to talk the position
2 over.

3 And we also talked to Dr. Newmark because of the
4 form of this recommendation. It was to determine -- you know
5 when you read the form of the survey, the recommendation, it
6 says here is Circular 672 and some values, but these are
7 really to be used to derive an effective engineering accelera-
8 tion. And Dr. Newmark had done that before, and he'd been
9 our consultant -- he was our consultant, so he was the logical
10 choice.

11 So we talked to Dr. Newmark about what should that
12 be, what does that recommendation mean. What should the
13 effective acceleration and what should the response spectra
14 be like, and we started talking to him about that at that
15 time.

16 Then, by April, I guess, Dr. Newmark had settled
17 on what he felt the effective acceleration should be and we
18 received the final Survey report. So we published Supplement
19 4, which contained the Survey's recommendation. That was
20 on May 11, 1976, and it contained the simple statement about
21 the effective acceleration, saying that Dr. Newmark had told
22 us that this was the value, and we agreed with it, and we'd
23 provide the basis in the form of Dr. Newmark's report in a
24 future supplement.

25 So that Supplement 4 gave the effective acceleration,



mpb8

1 but without the basis.

2 Q At about this time, Mr. Allison, the Staff and
3 the Applicant began meetings with the ACRS, isn't that correct,
4 on this matter?

5 MR. TOURTELLOTTE: Excuse me.

6 About what time, Mrs. Bowers? About this time,
7 we've been talking about a range of time for a couple of
8 years.

9 BY MR. FLEISCHAKER:

10 Q Okay.

11 In May of 1976, did the Applicant and Staff
12 meet with the ACRS?

13 A Yes.

14 Q Okay.

15 This is with the Subcommittee, is that correct?

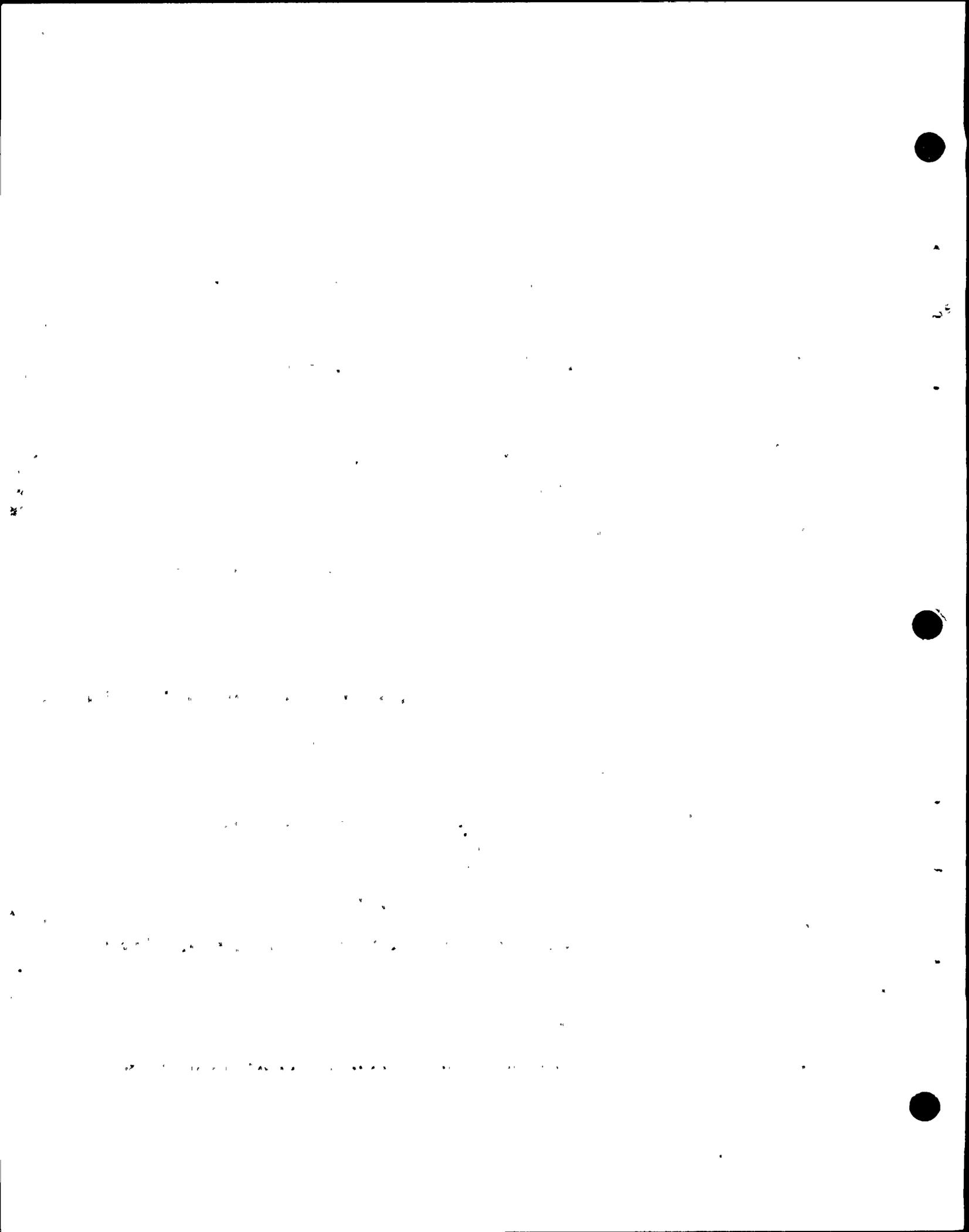
16 A That's right.

17 Now that wasn't the first meeting we had with the
18 ACRS --

19 Q You had one in February of '76?

20 A February of '75.

21 I guess February of '75 had been the last one.
22 There was one in September of '74 too. But, yes, right
23 after Supplement 4 was issued, saying this is the seismic
24 design basis, and this is the effective acceleration, we had
25 a meeting with the ACRS.



mpb9

1 Q And at that meeting -- that was a meeting before
2 the Subcommittee, correct?

3 A That's right.

4 Q And at that meeting you discussed -- the Applicant
5 and the Staff discussed the design basis that was --

6 A That's correct.

7 Q -- identified in Supplement 4.

8 Were Drs. Trifunac and Luco there?

9 A Yes, they were.

10 Q Was Dr. Newmark there?

11 A No.

12 Q Now moving on to June, when was the next meeting
13 of the ACRS Subcommittee?

14 A In June.

15 Q And who was present -- Was the purpose of that
16 meeting also to discuss the design basis?

17 A Yes.

18 Q And who was present at that meeting?

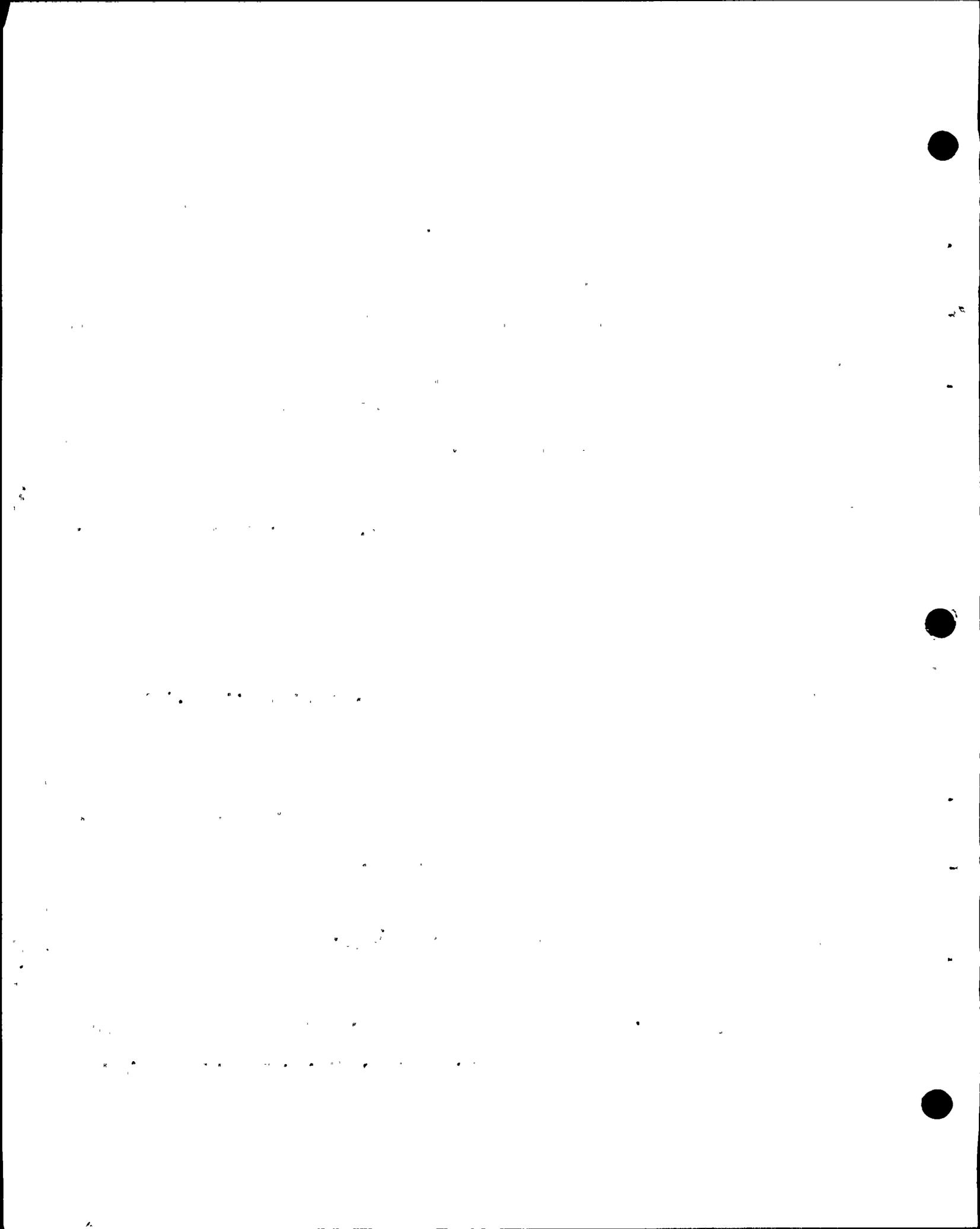
19 A Dr. Newmark was there, Dr. Trifunac was not.

20 Now I have a correction to something I just said.

21 Going back that far I don't believe Dr. Luco was working on the
22 case yet.

23 Q Right. Okay.

24 Now, so you'd had these discussions with the
25 ACRS in May and in June?



mpb10 1

A Right.

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Q And the thrust of those discussions was the basis

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of the Staff's conclusions about the design basis and the

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SER.

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A That's right.

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Q Now the next supplement issued September 10, 1976.

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A Right.

8

Q And that supplement contains Appendix C, which is

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Dr. Newmark's explanation of the 0.75g --

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A That's right.

11

Q -- and also contains his design response spectra

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to be utilized in the reanalysis or to establish minimum

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values for the reanalysis?

14

A That's right.

15

Q And when was the next meeting of the ACRS?

16

A October 11.

17

Q Okay.

18

Now were Dr. Newmark and Dr. Blume and Dr. Trifunac

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and Dr. Luco all present at that meeting?

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A Yes, they were.

21

Q How long was that meeting?

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A One day.

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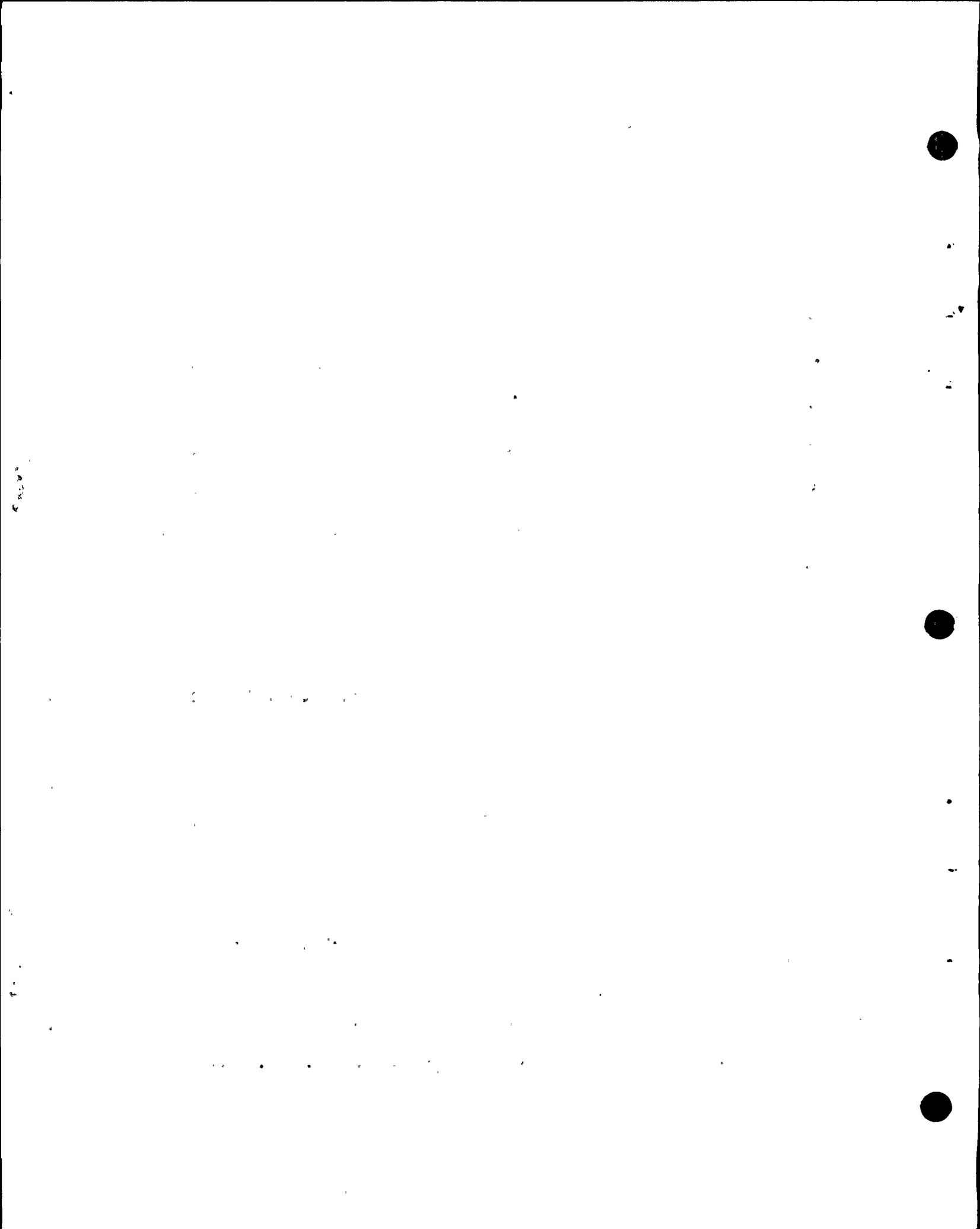
Q And then you met with the Subcommittee, correct

24

-- excuse me, the full Committee in November, November 13?

25

A That's right.



mpb11 1 Q And likewise, Dr. Blume and Dr. Newmark, the Staff
2 was there, Dr. Trifunac and Dr. Luco were there, is that
3 correct?

4 A That's correct.

5 Q And other consultants, of course, were there.

6 A Yes.

7 Q Did you discuss with the full Committee meeting
8 in some detail the adequacy of the design, of the design
9 analysis, the Newmark spectra?

10 A Yes, we did.

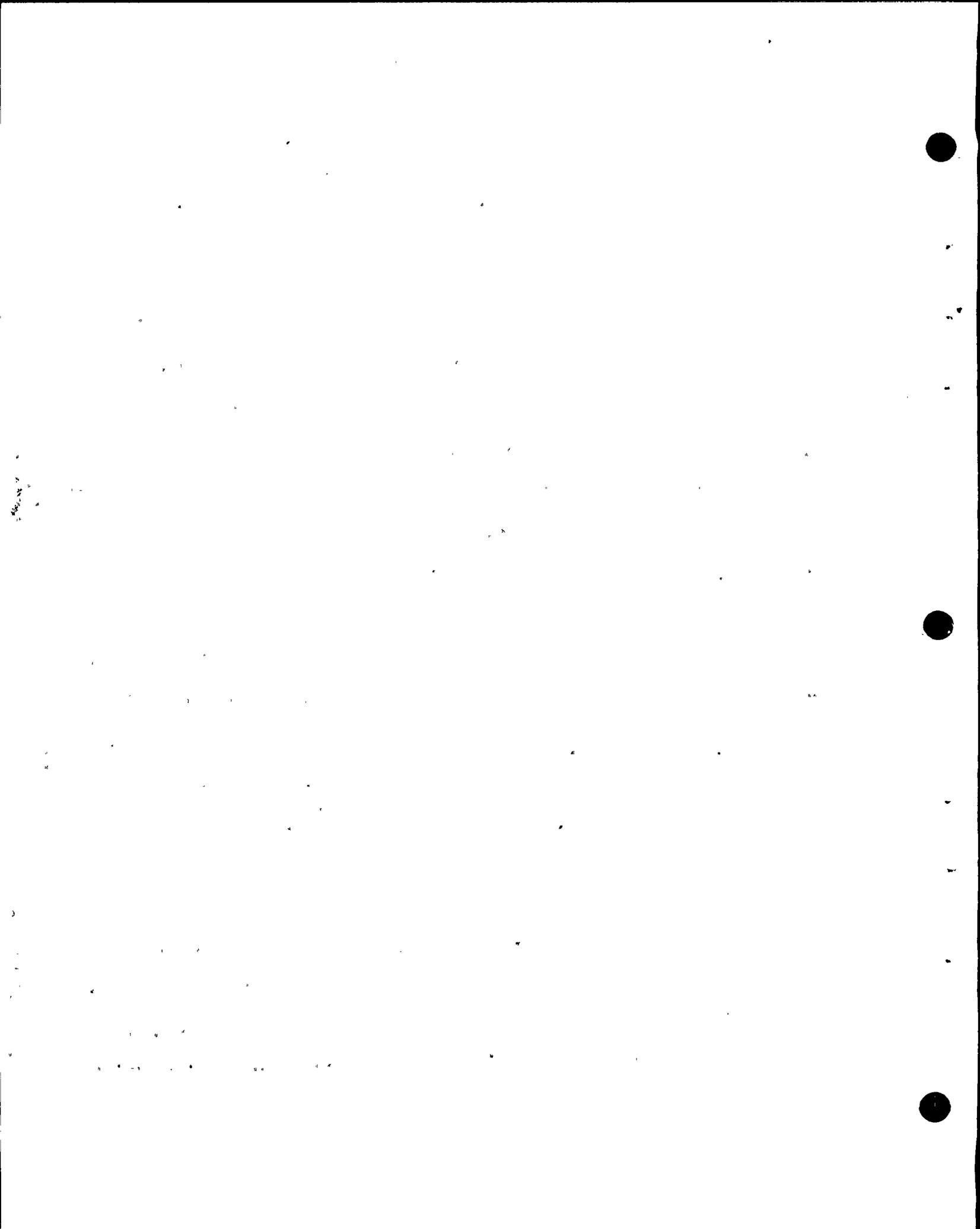
11 By "in some detail" I mean Dr. Newmark made a
12 presentation to the Committee explaining it. The Survey
13 was there and they made some statements and explanations as
14 to their position.

15 So we did present the full Committee with the
16 seismic design basis on November 13.

17 Q Okay.

18 Now on December 20, did you receive a letter
19 from the ACRS, or are you aware of correspondence between the
20 ACRS and Dr. Rusche -- Mr. Rusche, who was at that time the
21 Director of the Office of Nuclear Reactor REGulation?

22 A Yes, that was a memo from Ray Fraley, who is the
23 Executive Director of the ACRS. It was not a recommendation
24 from the chairman of the Committee to the Commission; there
25 is a little difference. But, yes, we did receive that letter.



mpb12 1

Q Okay.

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MR. FLEISCHAKER: We have copies of that. I'd like to mark it and provide it to the members, because I'm going to ask Mr. Allison some questions about that, that memorandum from Mr. Fraley to Mr. Rusche.

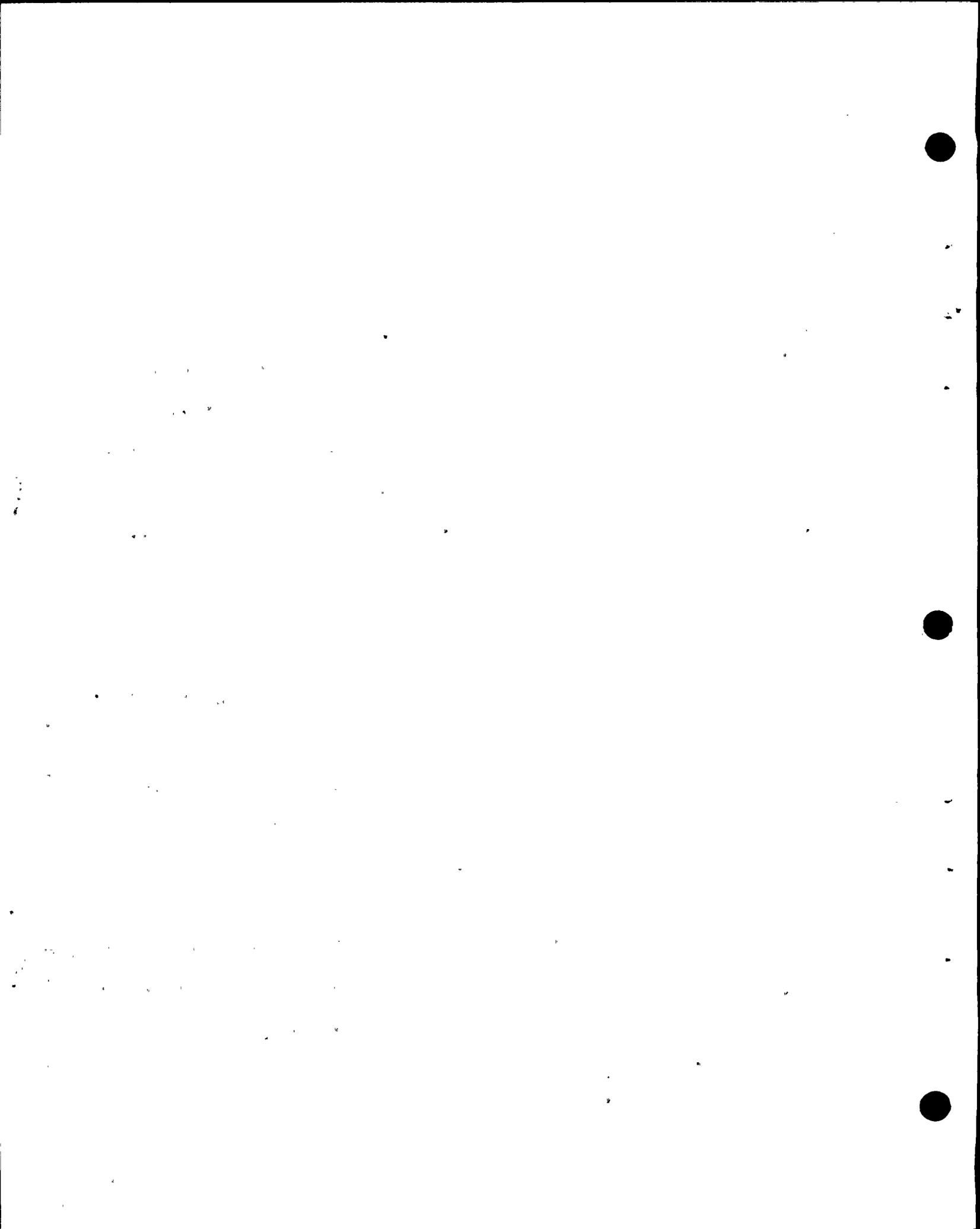
Mrs. Bowers, we are distributing to Counsel and to members of the Board and three copies to the record a memorandum from Ray Fraley, Executive Director of the Advisory Committee on Reactor Safeguards to Mr. Bernard C. Rusche, Director of the Office of Nuclear Reactor Regulation, dated December 20, 1976.

This is marked as Joint Intervenors Exhibit number 70.

(Whereupon, the document referred to was marked as Intervenors' Exhibit 70 for identification.)

MR. FLEISCHAKER: We had distributed yesterday and marked for identification the following three memoranda: one dated February 20, 1975, a note to A. Giambusso from R. C. DeYoung. That was Joint Intervenors Exhibit number 67.

(Whereupon, the document referred to was marked as Intervenors' Exhibit 67 for identification.)



mpb13 1

2 MR. FLEISCHAKER: We have a memorandum which is
3 entitled Program to Establish Basis to License Diablo Canyon,
4 January 12, 1976. We have no author -- or no apparent author
5 on it, and this is marked as Joint Intervenors' number 68.

6 (Whereupon, the document
7 referred to was marked as
8 Joint Intervenors 68
9 for identification.)

10 MR. FLEISCHAKER: And we have a third, which is
11 marked as Joint Intervenors number 69, which is a memorandum
12 to A. Giambusso, Director, Division of Reactor Licensing,
13 from R. C. DeYoung.

14 (Whereupon, the document
15 referred to was marked as
16 Intervenors' Exhibit 69
17 for identification.)

18 MR. FLEISCHAKER: And I would like to withdraw
19 those, but we'll leave the numbers the same.

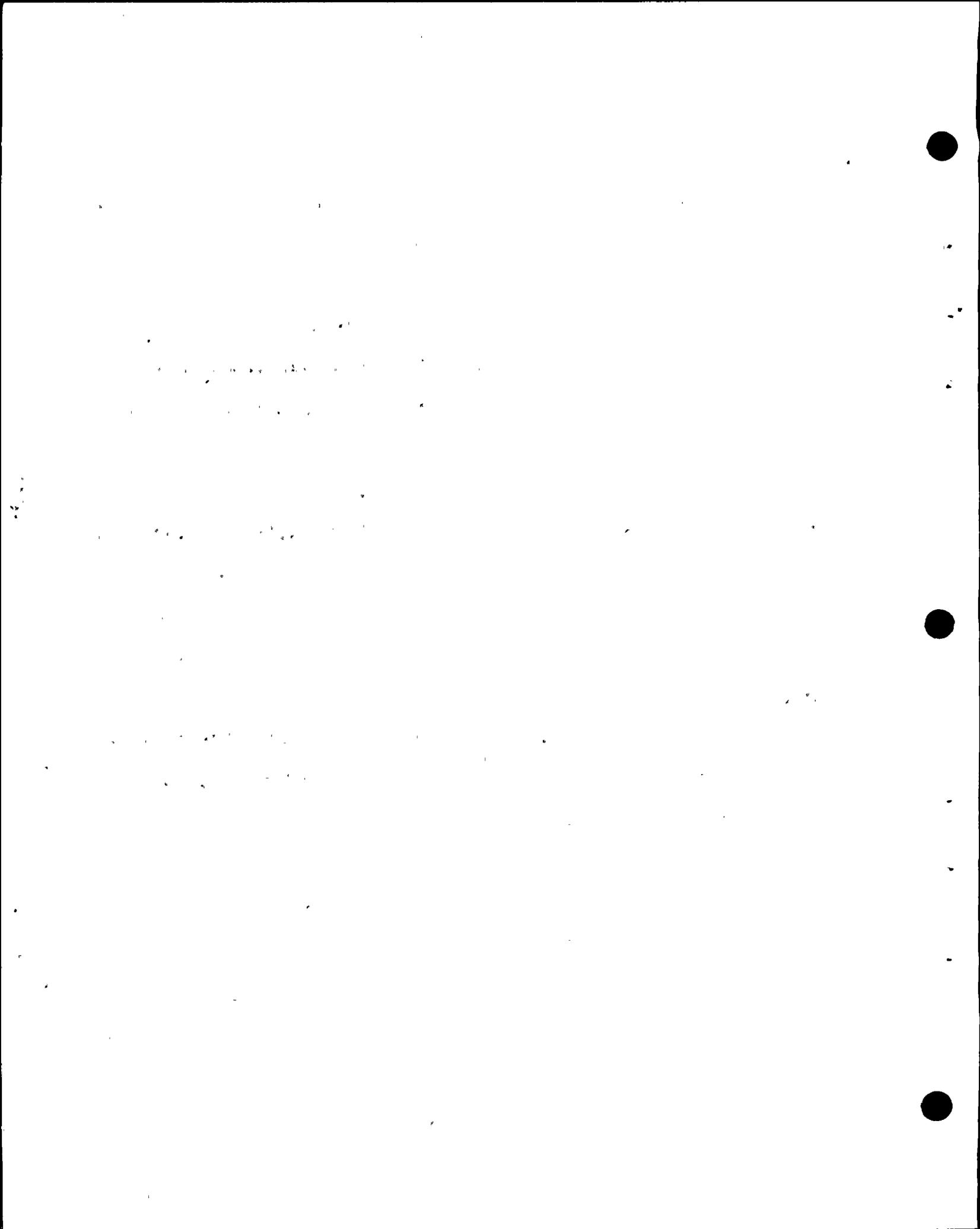
20 MRS. BOWERS: You'd like to withdraw them. And
21 what about the numbers?

22 MR. FLEISCHAKER: Well, since they've been marked

23 MR. NORTON: Well, what do you mean "withdraw"?

24 MR. FLEISCHAKER: Well, they can remain in the
25 record. That's fine.

We haven't asked that they be introduced. And I



mpb14 1 haven't specifically cross-examined Mr. Allison on the basis
2 of those. And depending upon the Board's desire, and Counsel
3 for the other parties, we can either withdraw those or leave
4 those documents marked with the Reporter and in the record as
5 they presently are.

6 MR. NORTON: Well, excuse me.

7 I think anything that's marked is marked. And
8 that's it. It's not withdrawn because it never was in evi-
9 dence.

10 MR. FLEISCHAKER: I'm sorry.

11 MRS. BOWERS: Well, and Mr. Allison referred to
12 the fact that you furnished documents yesterday afternoon.
13 So they will remain part of the docket file.

14 MR. FLEISCHAKER: Okay. Fine. I agree, that's
15 the best way to treat it.

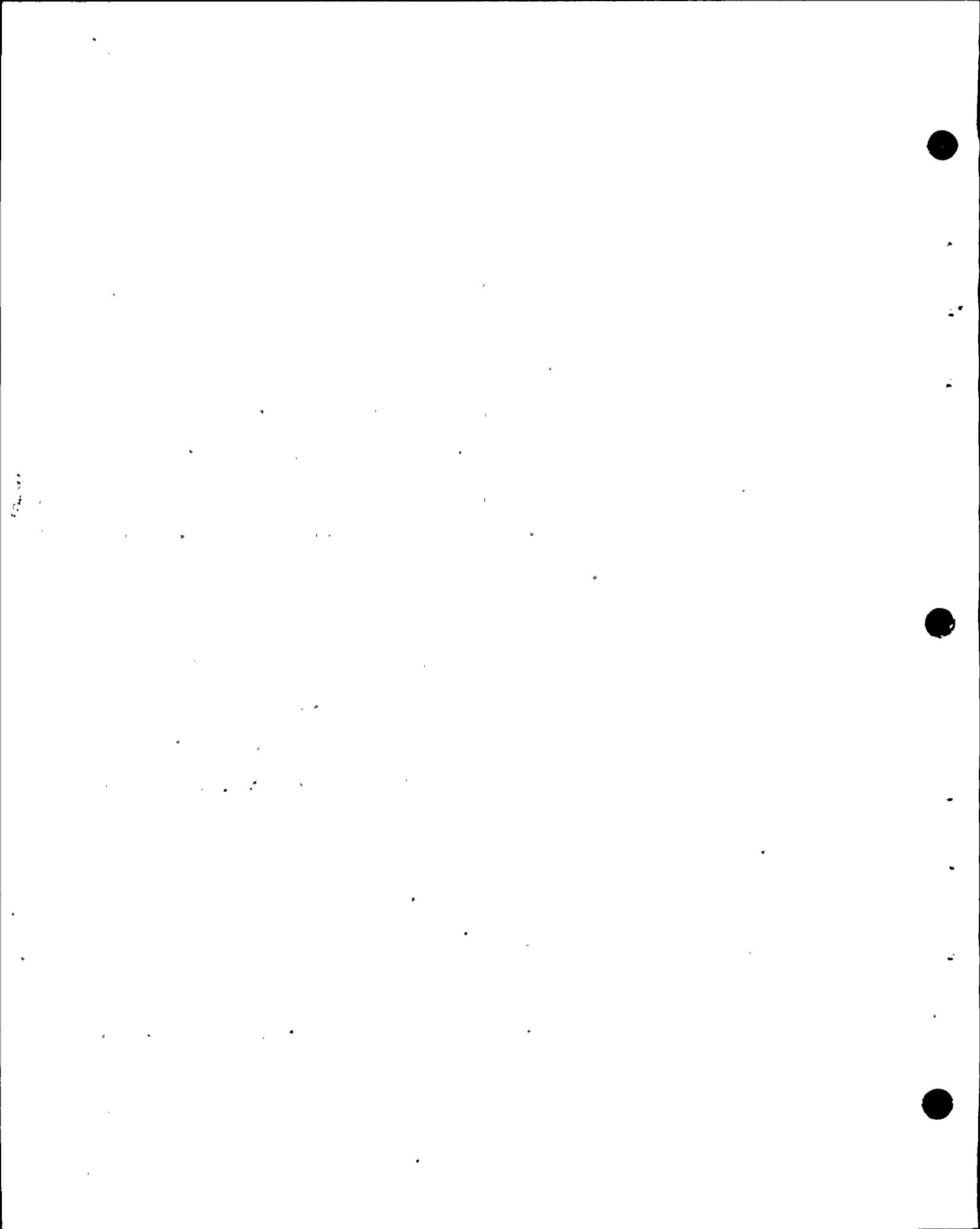
16 If it would be convenient at this point, could we
17 have the ten minute morning break? I just want to get some
18 other records out.

19 MRS. BOWERS: Fine.

20 MR. FLEISCHAKER: Thank you.

21 (Recess.)
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end MPB1
MPB2 flws



MPB2

MPB/agbl

C3

1 MRS. BOWERS: Mr. Fleischaker, we've been handed
2 Joint Intervenors' G and H. Now what do these go to? I mean,
3 did you think it was part of that original group of Trifunac
4 and Luco?

5 MR. FLEISCHAKER: It was part of the original
6 group.

7 MRS. BOWERS: Well these already go down to J.

8 MR. FLEISCHAKER: That's correct. I'm only going
9 to ask about these particular two, because they are the
10 documents, I believe, that I referenced in the December 20,
11 1976 letter, and what I am doing is for convenience I am
12 providing to the Board and to counsel copies of the documents.
13 that I will be asking questions about which documents have
14 already been distributed which are already in the record.

15 MRS. BOWERS: All right. Fine.

16 MR. FLEISCHAKER: Are we ready to proceed?

17 MRS. BOWERS: Are we ready to proceed?

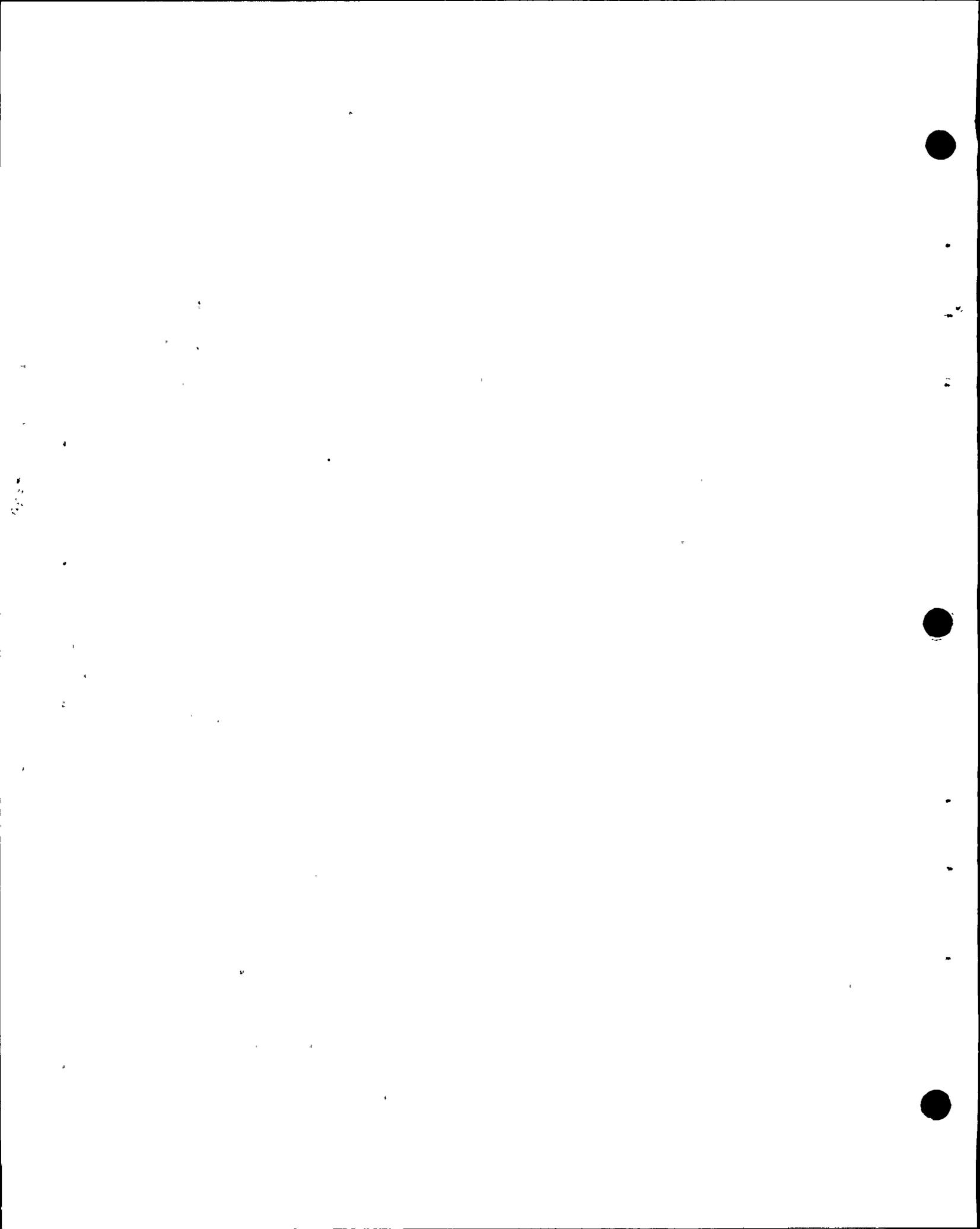
18 MR. TOURTELLOTTE: Yes.

19 BY MR. FLEISCHAKER:

20 Q Mr. Allison, I'd like to direct your attention to
21 Joint Intervenors' Exhibit Number 70.

22 A Yes.

23 Q Now paragraph two of this letter--excuse me, of the
24 memorandum of Mr. Frayley to Mr. Rusche indicates the Sub-
25 committee, the ACRS Subcommittee believes that it would



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MPB/sgb2

be useful for the Full Committee to have NRC Staff and Applicant examine the consultant reports which were attached, and to provide written responses to the technical issues raised in them.

And you have before you what has previously been marked as Licensing Board's Exhibit Number 2, Attachments G and H, which are comments by Mihailo Trifunac dated November 11, 1976 and Enrique Luce dated November 12, 1976.

Were these among the comments that were forwarded to the NRC Staff, which are referred to here in the second paragraph of the December 20, 1975?

A Yes, they were.

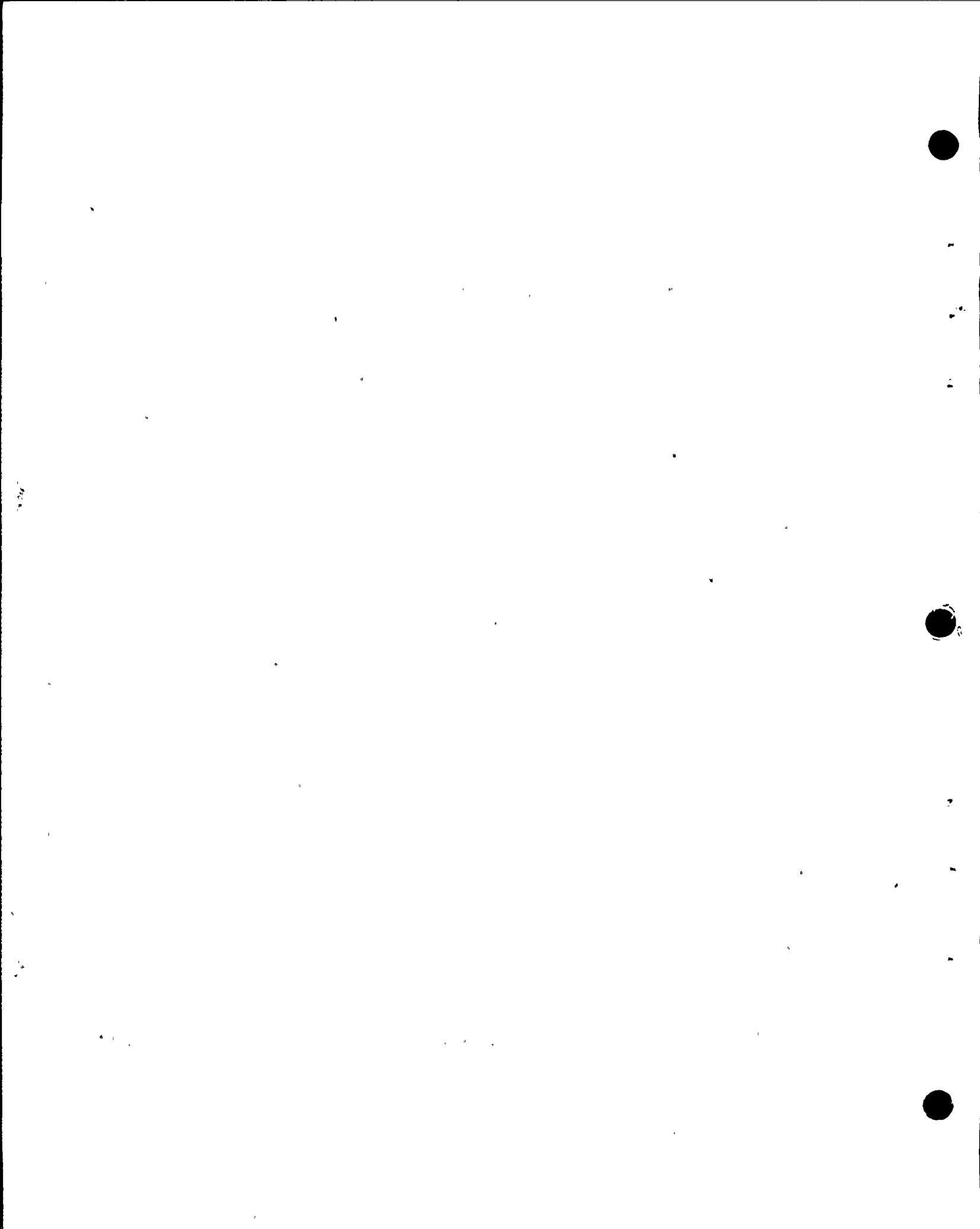
Q Okay.

Now, has the NRC Staff provided the ACRS Committee with written responses to the technical issues raised in the Trifunac and Luce papers?

A No.

Q Now moving on to paragraph three, there the Subcommittee states that it would be useful for the Full Committee to have the NRC Staff and the Applicant perform some of the sensitivity studies suggested, that he suggested, I guess in these reports. And it says:

"(e.g., less damping, higher accelerations, modified velocities or displacements, vertical or horizontal seismic waves at the site,



MPB/agb3

1 et cetera.)"

2 Now again were they referring specifically to the
3 recommendations proposed by Drs. Trifunac and Lucco?

4 MR. NORTON: Excuse me, I have an objection about
5 that question, I don't know whether that means only or among
6 others or et al. I don't understand the question, because
7 the letter itself says attachments, and there are 10 listed.
8 And counsel has unfortunately -- well, not unfortunately
9 but not surprisingly supplied only two.

10 And the document speaks for itself as to what
11 they're referring to, and it's speculation for this witness
12 without the other attachments to know whether this letter
13 addresses just Trifunac and Lucco or the eight other attachments.

14 MR. FLEISCHAKER: It's not speculation, he can
15 give us his knowledge.

16 BY MR. FLEISCHAKER:

17 Q What is your understanding with respect to --

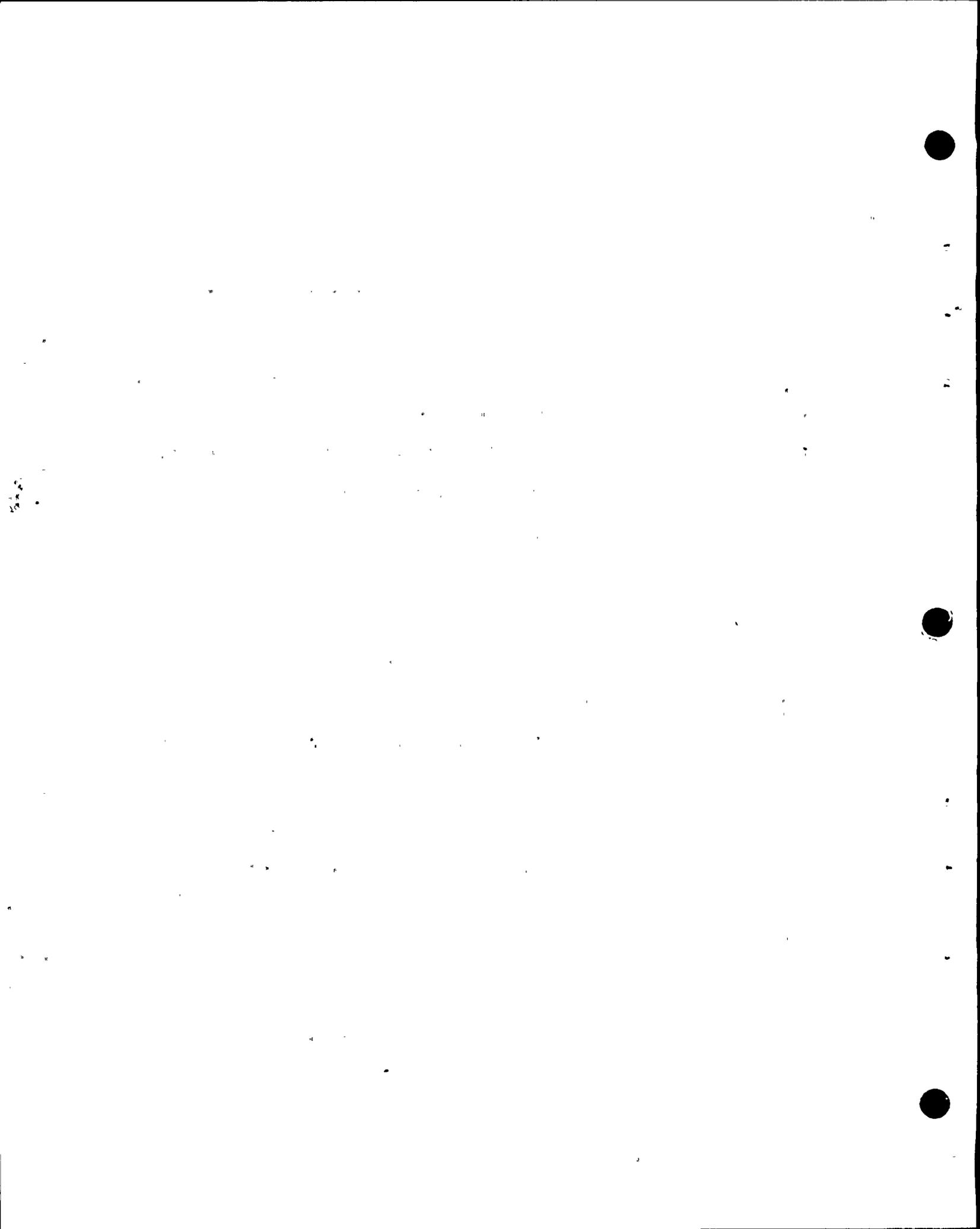
18 MR. NORTON: Objection.

19 MRS. BOWERS: Just a minute.

20 Mr. Tourtelotte, does the Staff have a position
21 on the pending objection?

22 MR. TOURTELLOTTE: I guess I don't have any
23 difficulty with whatever the question that was asked, as it
24 was asked.

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(The Board conferring.)

MRS. BOWERS: The objection is sustained in part and denied in part. We think there should be a clarification and that the witness should be asked about what Drs. Trifunac and Luco have said and what is their relationship to this paragraph 3 and the items recited.

C7

MR. FLEISCHAKER: Okay. Thank you.

BY MR. FLEISCHAKER:

Q Were Drs. Trifunac and Luco's recommendations among the ten that were attached there?

A Yes, they were.

Q Is it your understanding that the reference here to some of the sensitivity studies suggested included those suggested by Drs. Trifunac and Luco?

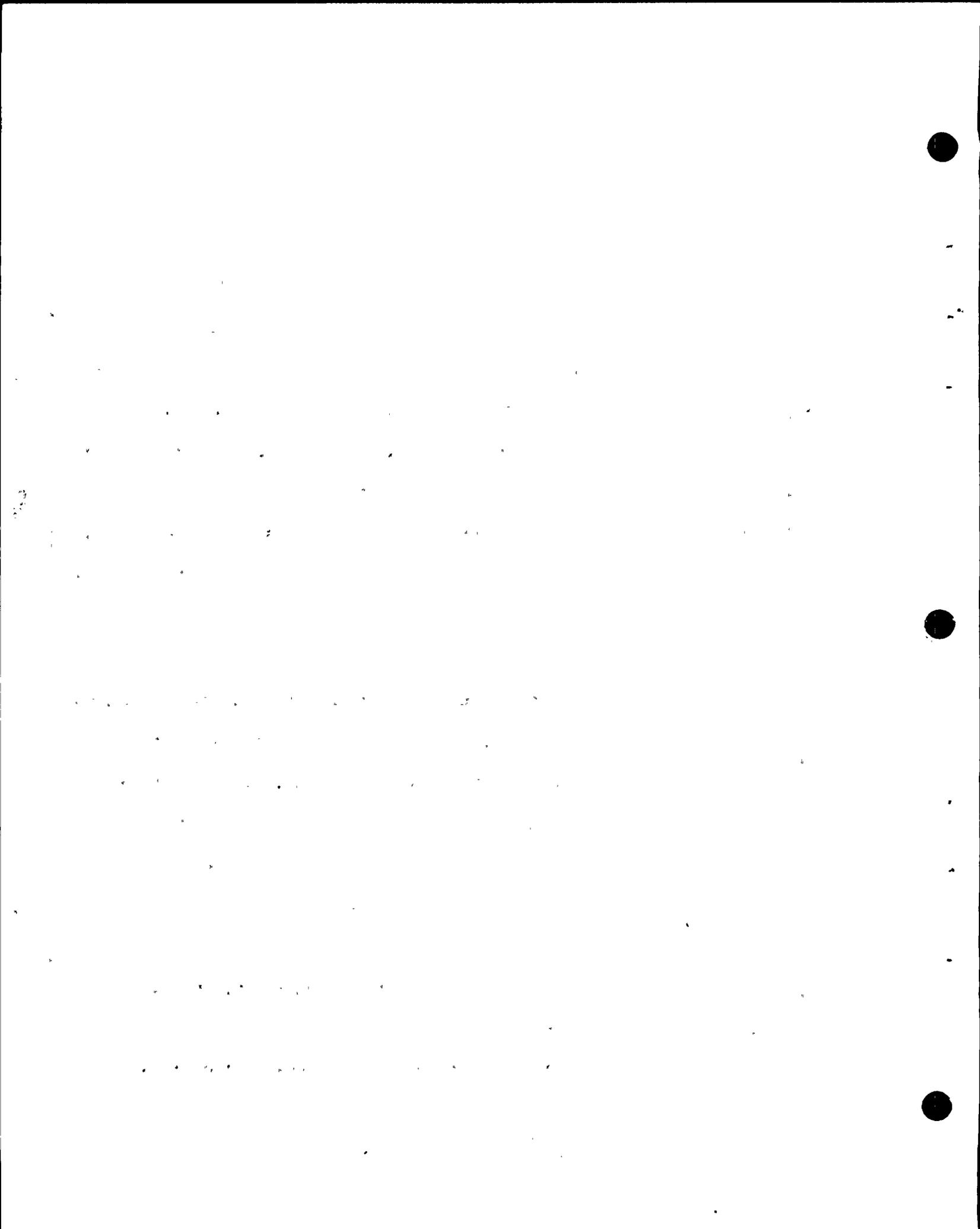
A Yes, it is.

Q What were those studies -- recommendations -- by Drs. Trifunac and Luco?

A I would have to read these documents to answer.

Q Okay. Let me suggest that you might turn -- first with respect to Dr. Trifunac -- to page . . . the second to the last page --

MR. NORTON: Excuse me, Mrs. Bowers. If the document is going to be read it should be offered into evidence and then read. Actually it speaks for itself, and I have no objection to its being read as long as it's being



wel 2

1 offered into evidence.

2 MRS. BOWERS: It's not in evidence now. It was
3 for awhile Board Exhibit 2 and was then withdrawn.

4 MR. FLEISCHAKER: I'm not offering the document
5 into evidence. I'm asking Mr. Allison to state what the
6 Trifunac and Luco recommendations were, and I believe he has
7 a document before him which permits him to state those recom-
8 mendations. I'm not asking him about the merit of the
9 recommendations, I'm just asking him to state what they were.

10 MR. NORTON: Mrs. Bowers, at this time we would
11 move what appears to be Joint Intervenors' G and H -- that's
12 how they're labeled on my copies that I was furnished,
13 JI-G and H -- into evidence.

14 MRS. BOWERS: I think the identification may be
15 misleading. They are now called Joint Intervenors' G and H,
16 but they're in the docket file as Board Number 2, G and H.

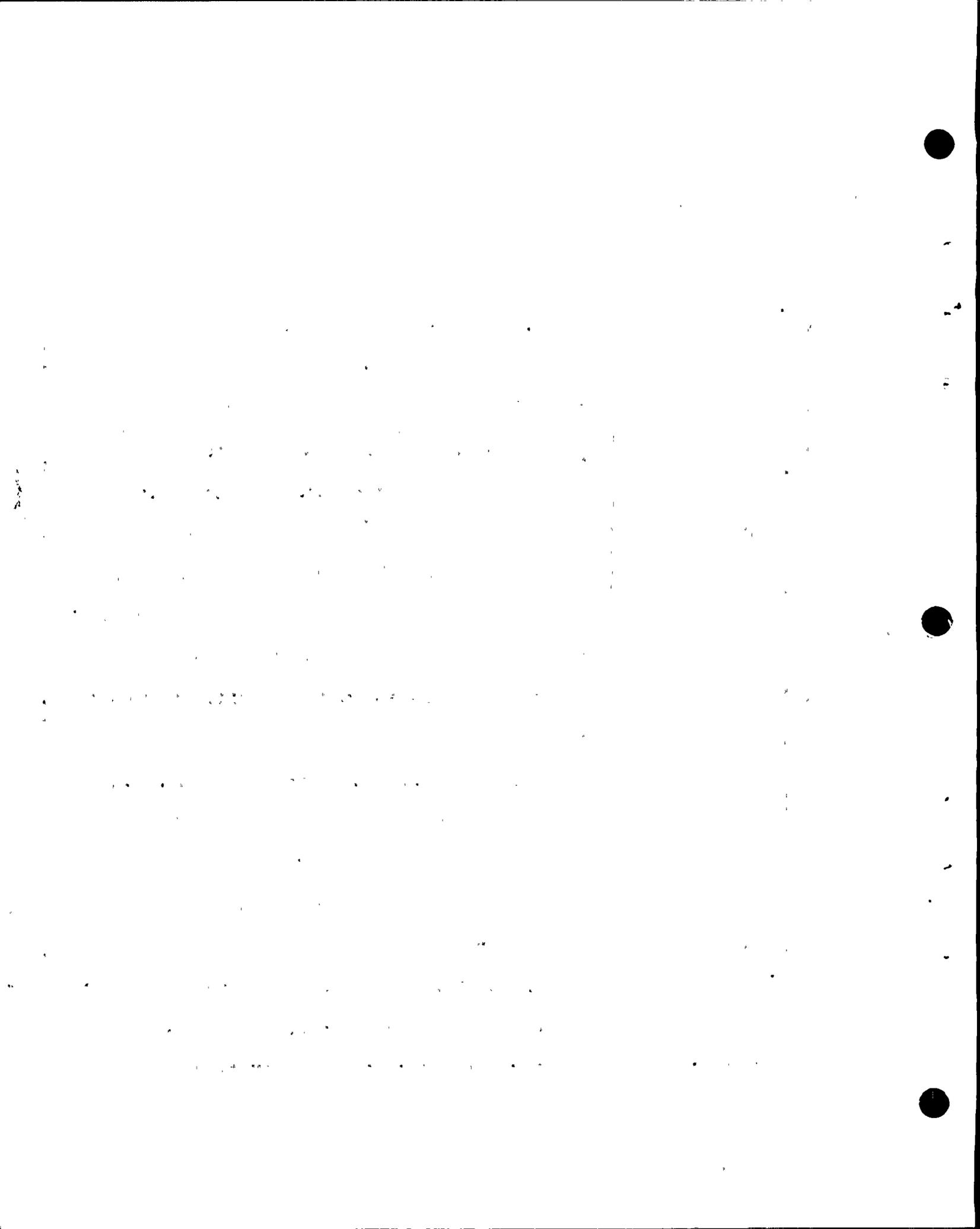
17 But now, the renumbered -- well, I don't know
18 that JI-G and H would have any meaning, because there's
19 nothing prior in the alphabet for Joint Intervenors.

20 MR. TOURTELLOTTE: I've got a whole can of worms
21 of problems.

22 One is, I thought Board Exhibit Number 2 was
23 excluded from the record.

24 MRS. BOWERS: It remains in the docket file.

25 MR. TOURTELLOTTE: I understand that, but it is --



wel 3

1 MRS. BOWERS: It's not in the record.

2 MR. TOURTELLOTTE: It's not in the record. That's
3 one problem I have.

4 Therefore, unless Mr. Norton is going to offer
5 up the necessary copies to make them exhibits, I don't really
6 see how that can be done, and --

7 MR. NORTON: Well, they've already been furnished.
8 The necessary copies have already been furnished.

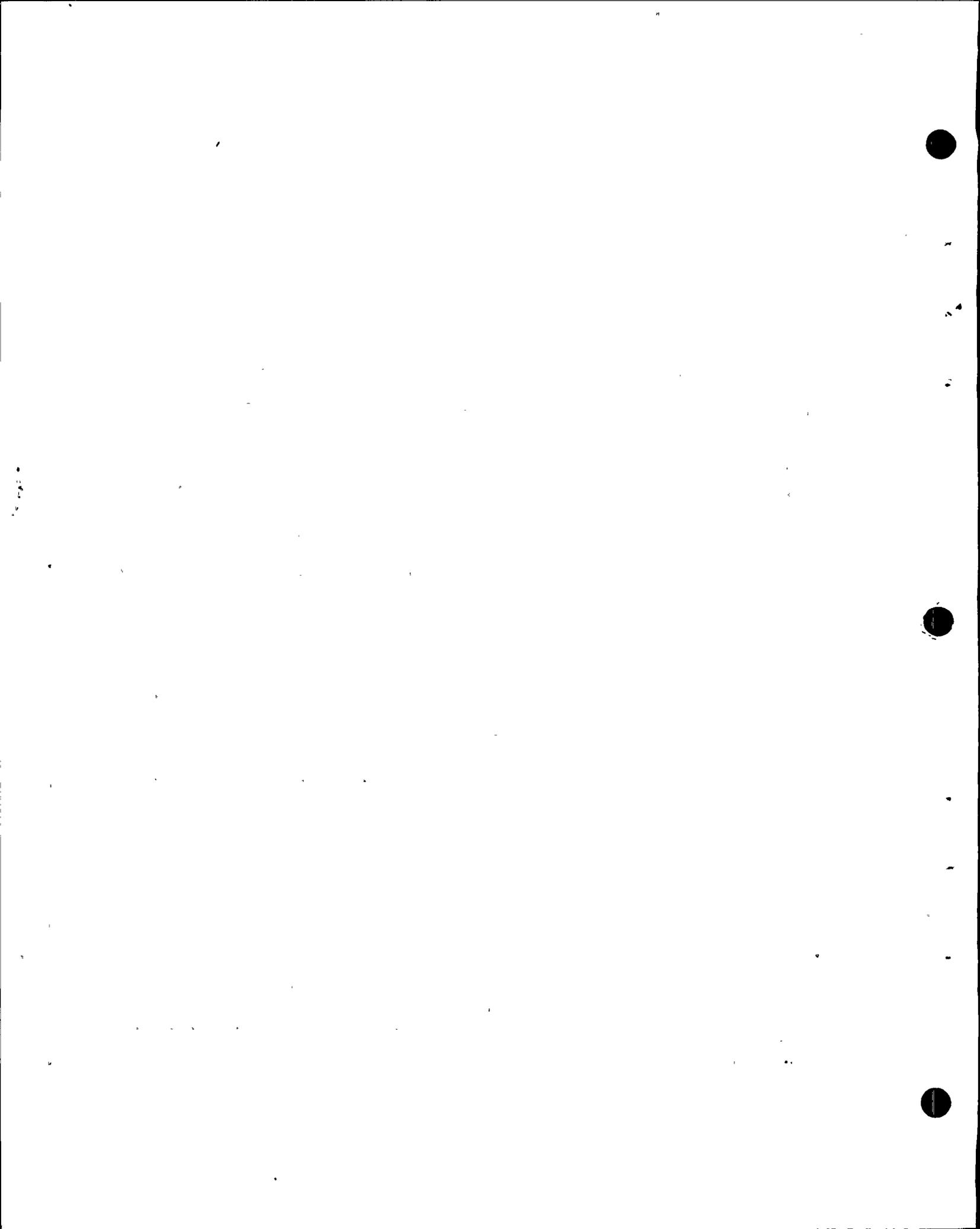
9 MR. TOURTELLOTTE: Well, it's an unusual
10 procedure. I don't have too much difficulty with that. But
11 it's peculiar.

12 The other thing that bothers me is that I thought
13 that a question was asked of this witness as to whether he
14 knew what the views of Trifunac and Luco were, and he said
15 he didn't know. Then he was asked to open a piece of paper,
16 to read that paper.

17 The purpose of having this witness on the stand
18 is to probe what he knows, not his ability to read somebody
19 else's opinion. And I think that's objectionable.

20 MRS. BOWERS: Is he just refreshing his recollec-
21 tion that these are the --

22 MR. TOURTELLOTTE: Well, he hasn't been asked to
23 refresh his recollection. When he said he didn't know, that
24 was as far as it went. Whether he ever knew or not, or
25 whether he ever paid any attention to that or not, was



wel 4

1 something that wasn't established.

2 So there's no foundation for doing whatever in the
3 world he's doing. And I guess I object to his being required
4 to read something into the record which he says he didn't
5 know in the first place. It's of no real probative value in
6 terms of what this witness knows.

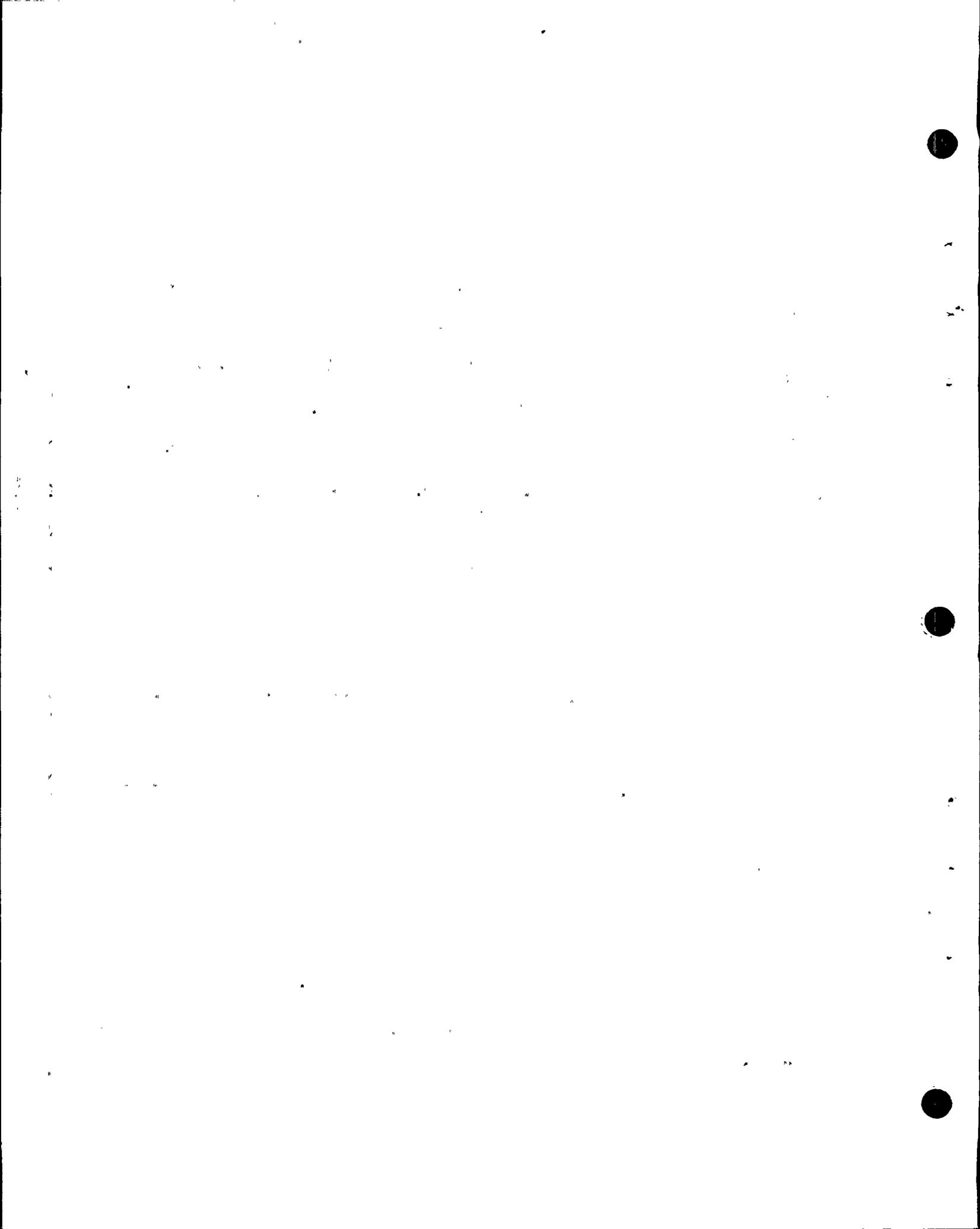
7 MRS. BOWERS: Well, if I followed everybody, Mr.
8 Norton has now offered these two documents into evidence.

9 MR. TOURTELLOTT: Even if he offers them into
10 evidence, what I'm saying is that whether they're in evidence
11 or not, the purpose of cross-examination is to probe what is
12 in Mr. Allison's mind, not to put something else in his mind
13 and then probe whatever it is.

14 MR. NORTON: Mrs. Bowers, I didn't offer them
15 into evidence. I'm moving them into evidence. They were
16 originally offered to be marked by Joint Intervenors, of
17 course, and it's our position that if they're going to be
18 used in these proceedings for purposes of cross-examination,
19 that there has been a foundation laid, the letter has been
20 identified that they were attached to, and we're now moving
21 that they be placed into evidence.

22 Maybe Mr. Fleischaker wants to object to these
23 documents of Trifunac and Luco going into evidence, I don't
24 know.

25 MR. FLEISCHAKER: Well, you know, this is becoming



wel 5

1 kind of a circus, this Trifunac and Luco thing. Mr. Norton
2 has changed his position three times now with respect to
3 whether this document has adequate -- twice -- with respect
4 to whether this document has adequate foundation.

5 I'd like to think for a minute. I believe that I
6 can request this witness to refresh his recollection on the
7 basis of the document before him, and then he can state for
8 the record what the recommendations were.

9 I'd like to have a moment to think about what
10 position I want to take with respect to Mr. Norton's moving
11 this document into evidence. May I have a moment?

12 MRS. BOWERS: Fine.

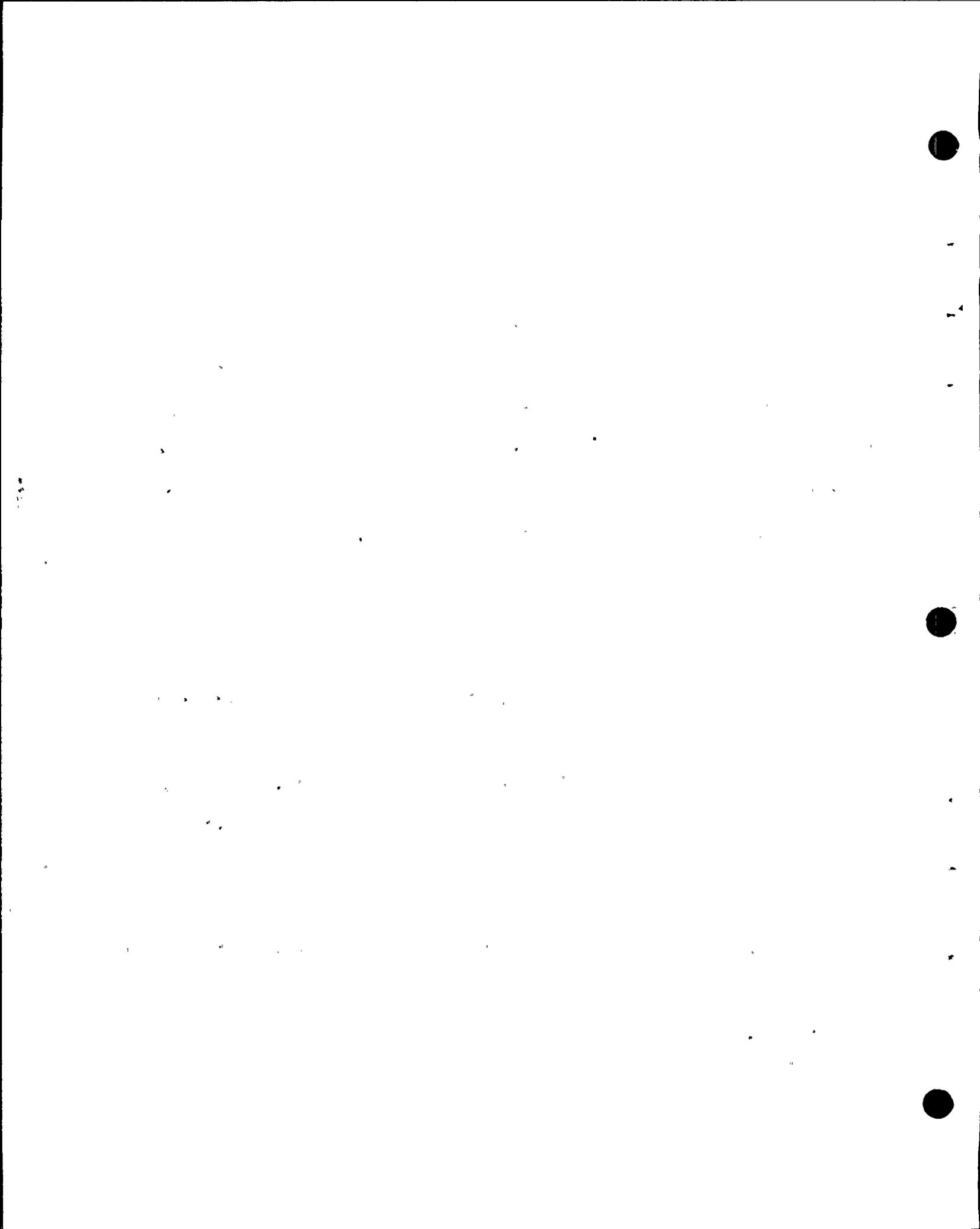
13 (Pause.)

14 MR. NORTON: Mrs. Bowers, while he takes that
15 moment to think, he might want to think about this too:

16 I haven't changed my position at all. At the
17 very beginning these documents were offered by Intervenor
18 and given to the Board in support of their motion.

19 I stipulated that those documents could go into
20 evidence. The Staff stipulated that they could go into
21 evidence. And at that time I was under the impression that
22 Mr. Fleischaker so stipulated. He later pointed out that
23 indeed he had not stipulated, that he had remained silent and
24 not objected, and had done nothing.

25 And I said, well, if that's the case, there's no



1 legal basis for those documents to be in evidence, without a
 2 full stipulation of all the parties there's no way they could
 3 be in evidence, without a proper foundation.

4 Now Mr. Fleischaker has offered two of these
 5 documents up, a foundation has been laid, and I'm moving them
 6 into evidence.

7 That position is 100 percent consistent on all
 8 three occasions. I suggest that it's Mr. Fleischaker's
 9 position which is fluctuating.

10 MR. FLEISCHAKER: I have no comment on that. I
 11 think the record speaks for itself and the issue is before
 12 the Appeal Board.

13 May I have a moment, please?

14 (Pause.)

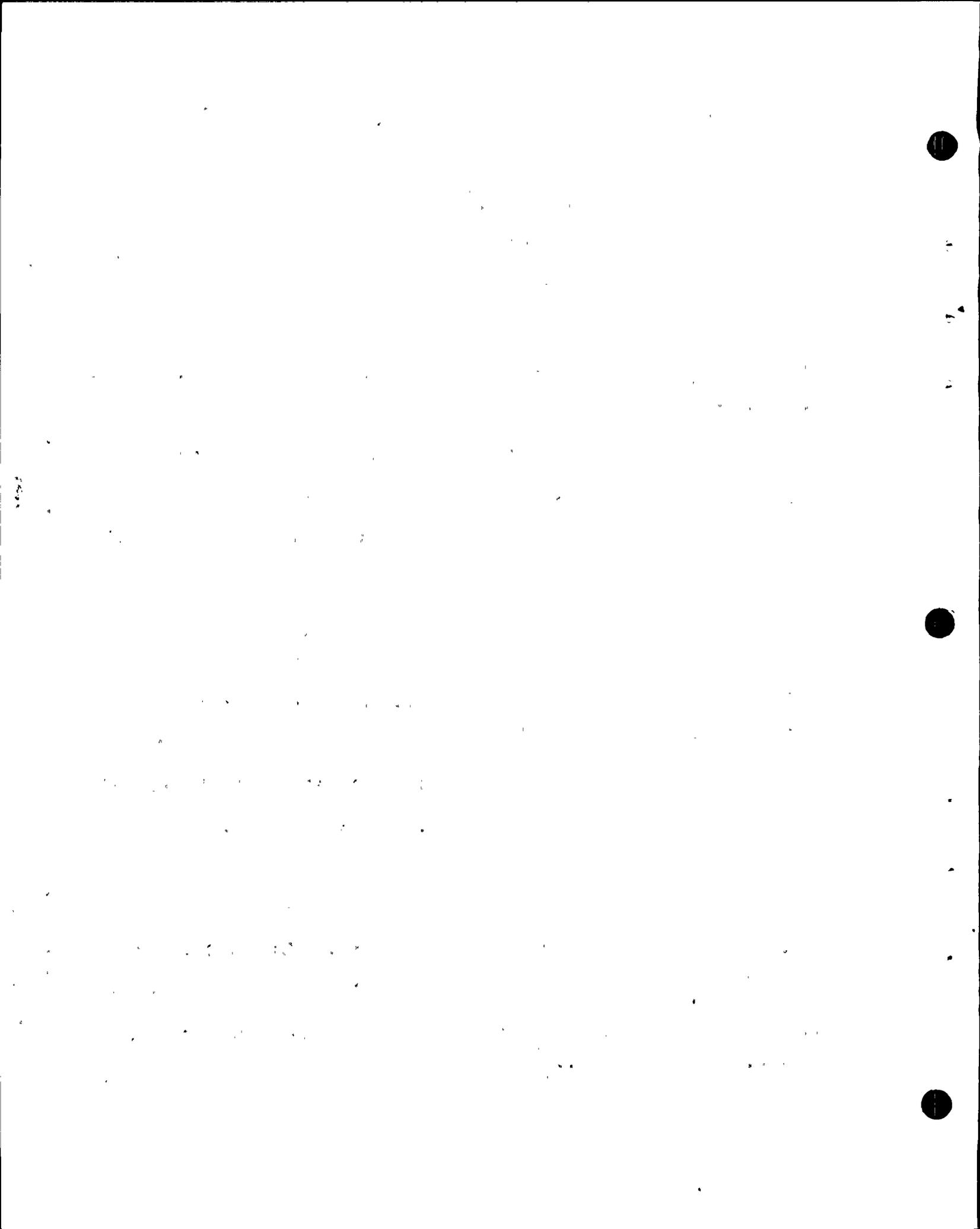
15 MR. FLEISCHAKER: Mrs. Bowers, we have a position.

16 We have no objection.

17 MRS. BOWERS: The documents that have been now
 18 identified as Joint Intervenors' G and H, which are actually
 19 the same documents that were originally Board's Exhibit Number
 20 2, G and H, are admitted into evidence.

21 (The documents referred to were
 22 received in evidence as Joint
 23 Intervenors' Exhibits G and H.)

24 But I think to help move this thing along it
 25 should be made clear as to what the witness' prior contact was



wel 7

1 with these documents, and if he is in fact -- although he
2 couldn't recite from memory from a 1976 document -- simply
3 refreshing his recollection.

4 MR. FLEISCHAKER: I'm sorry, did the Board rule?
5 Oh, yes, you did rule. Okay.

6 BY MR. FLEISCHAKER:

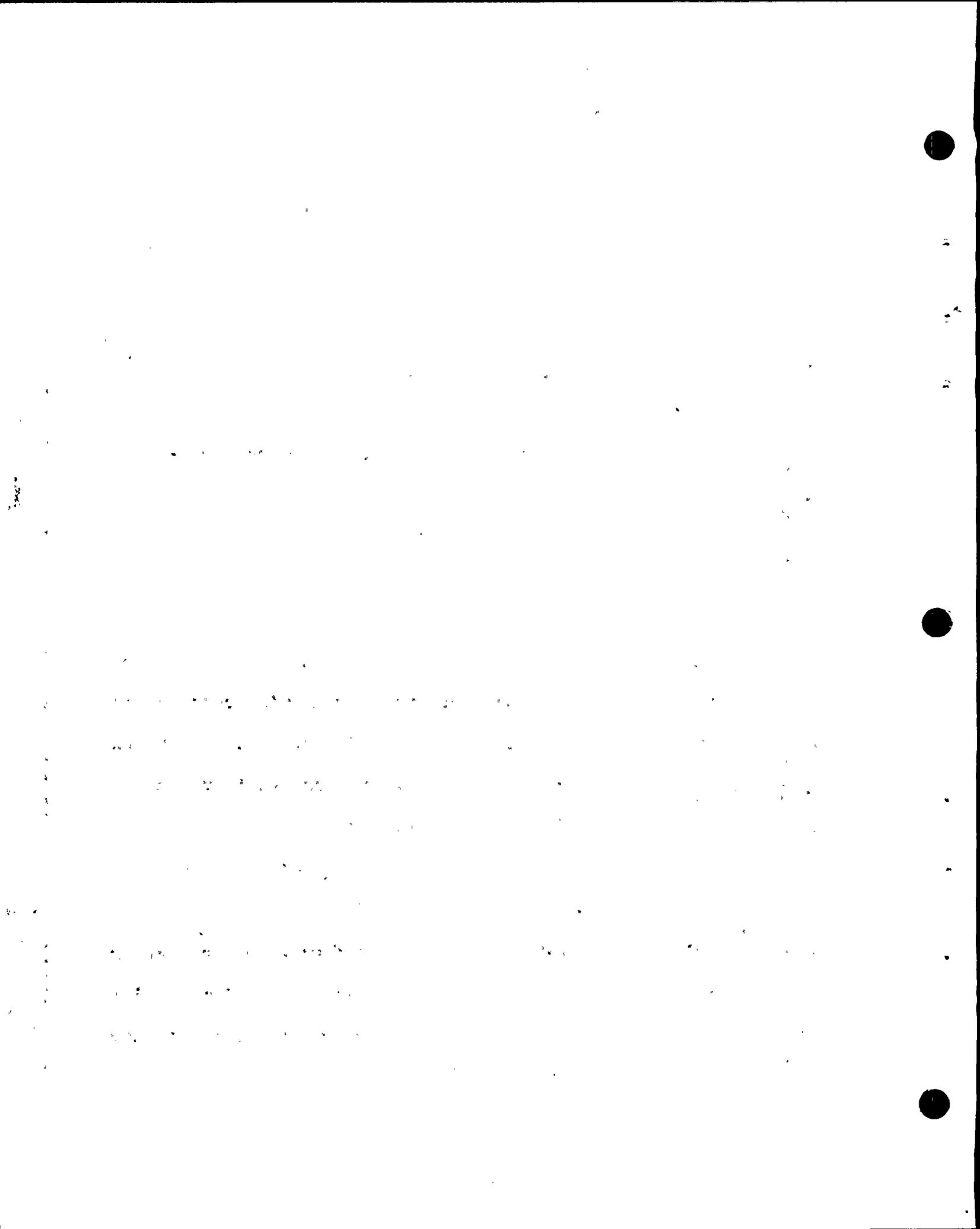
7 Q Mr. Allison, let me go back and see if I can pick
8 up the ball.

9 These documents that have been marked as Joint
10 Intervenors Exhibits G and H, were these among the documents
11 that were forwarded and attached with this letter of December
12 20, 1976?

13 A Yes, they were.

14 Q Have you had an opportunity to review, on Joint
15 Intervenors Exhibit Number G, recommendations by Dr. Trifunac
16 that are set out on pages 1 and 2 attached to the main
17 document there, entitled "Recommendations by Dr. Trifunac?"

18 MR. NORTON: Excuse me. I believe that's a
19 separate document. I realize they're stapled together in
20 what Mr. Fleischaker gave us, but if one looks at Joint
21 Intervenors' Exhibit 70 they see comments by Dr. Trifunac
22 dated 11-11-76 and 12-7-76, and the last two pages that he
23 is now referring to, pages 1 and 2, are under the date of
24 12-7-76, and I believe that's a separate submittal from the
25 first four pages.



1 MRS. BOWERS: Well, it couldn't be attached,
2 because the basic pre-dates it.

3 MR. NORTON: That's my point. And what we've been
4 supplied with is as if it were one document, and I'm relatively
5 certain that it's not.

6 MR. FLEISCHAKER: Well, . . . okay. This is the
7 way I received it from the ACRS.

8 BY MR. FLEISCHAKER:

9 Q Was this among the package of documents --

10 A Yes, it was.

11 Q -- received from the ACRS?

12 A Yes, it was.

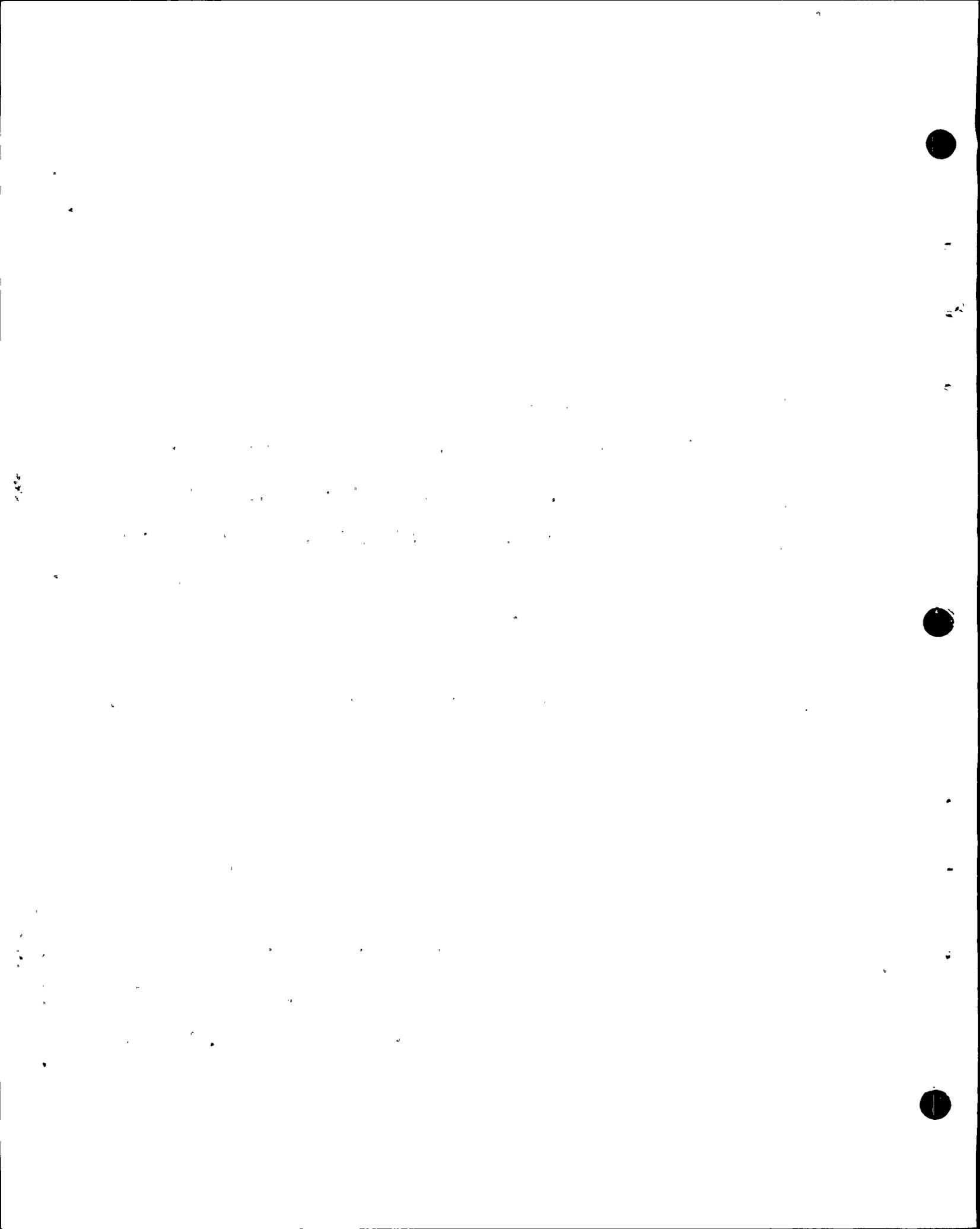
13 Q Okay. Have you had an opportunity --

14 A I guess I'd have to look at the original to check
15 on Mr. Norton's question about whether they're separate or
16 whether they were mailed together. My recollection is that
17 they were mailed together My Dr. Trifunac that way, and I
18 think that's why they appear that way.

19 But I would have to look at the memo, the
20 December 20 memo, to be sure.

21 Q But in any case, whether they were separate or
22 together, were these recommendations that are listed under
23 Approach Number 1 among the package that you received with
24 the December 20 letter?

25 A Well, I believe so. I'd have to look at the



wel 9..

1 December 20 memo to be sure about the 12-7 documents, but
2 I think it was.

3 Q Okay. Now, did the NRC Staff conduct an analysis,
4 as Dr. Trifunac has recommended here under Approach I on this
5 document dated 12-7-76?

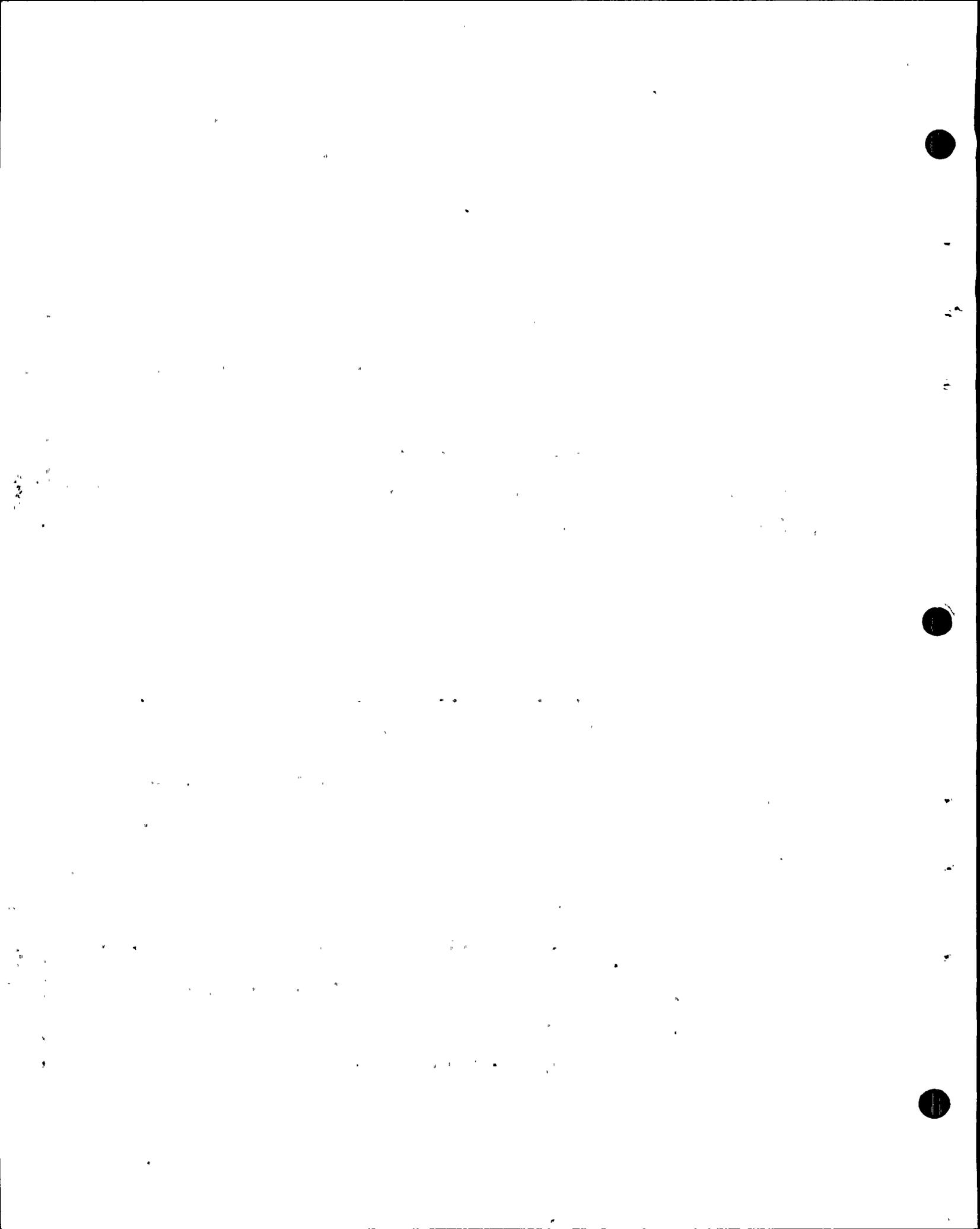
6 A Just a second.

7 (Pause.)

8 The Staff has not conducted an analysis as
9 described in Approach I. It has done something that touches
10 on one of those things. Dr. Newmark has conducted a
11 sensitivity study on damping which, in a general theoretical
12 sense, predicts the change in responses in loads and structures
13 and equipment for changes in damping, so that you can plug
14 in a given change in damping and say that will change the
15 structure's load by about so much, or equipment's loads by
16 about so much.

17 That goes partly to the last sentence on sub-item
18 1 on Approach I, where Dr. Trifunac recommends finding the
19 places that are critical in that they needed the 7 percent
20 damping in the past.

21 You can use that result and compare with margins
22 to see where 7 percent might be critical and where it isn't.
23 But it's only in that sense that the Staff has done analyses
24 going to Approach I. So for the most part, the Staff has not
25 done the analyses in Approach I.



wel 10.

1 Q All right. I understand that.

2 A Pardon me, Mr. Fleischaker, I guess my answer
3 wasn't complete.

4 Approach I, I guess, includes the second page as
5 well. At the top of the second page Dr. Trifunac is recom-
6 mending probability studies, basically.

7 Now, since then, Dr. Trifunac has done a probabilit-
8 ity study similar to the one that he recommended, and we've
9 had the opportunity to review it. We've -- Dr. Newmark and
10 Ang have done one. And, of course, as you know, the Applicant
11 has done one as well.

12 So that probability studies have been done, some
13 of them by Staff consultants.

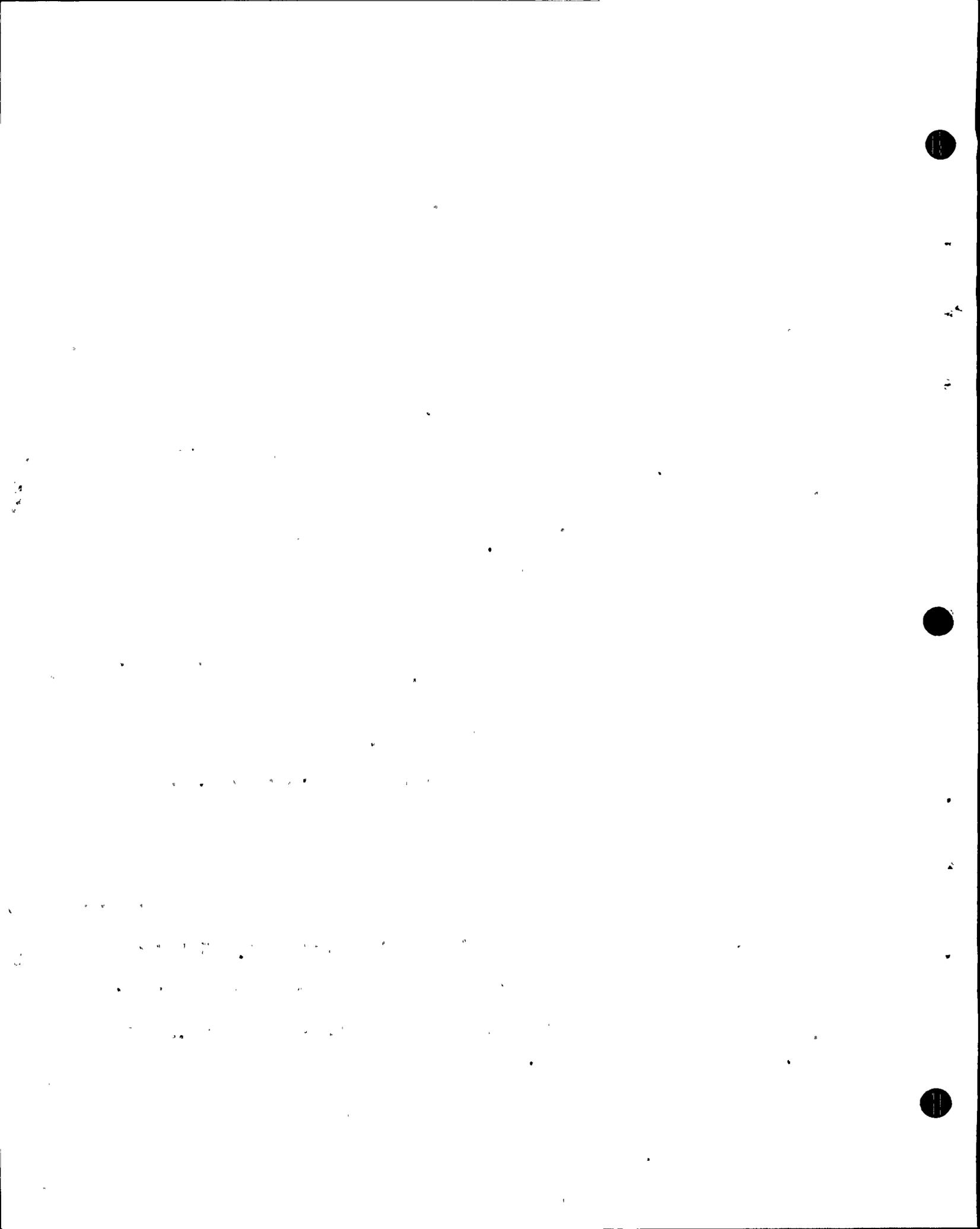
14 Q Is the name of the Trifunac probability study,
15 "The Uniform Risk Absolute Acceleration Spectra for the
16 Diablo Canyon Site, California, by J. G. Anderson and M. D.
17 Trifunac, A Report to the Advisory Committee on Reactor
18 Safeguards, U. S. Nuclear Regulatory Commission," dated
19 December 30, 1976?

20 A Yes, it is.

21 Q Where is Dr. Newmark's analysis on the impact on
22 the response spectra -- on what impact on the response spectra
23 a variation in damping would have?

24 Is that a docketed report?

25 A Yes, it is.



3WEL

wel 11

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MR. TOURTELLOTTE: Excuse me, Mrs. Bowers. We

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have a couple of questions there. I'm not sure which one the

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witness is supposed to answer.

4

You asked two questions, and I think we ought to

5

ask them one at a time.

6

MRS. BOWERS: Could you re-state it, Mr.

7

Fleischaker?

8

BY MR. FLEISCHAKER:

9

Q Did Dr. Newmark supply you with a report?

10

A Yes, he did.

11

Q Can you give me the name of that report?

12

A I think so.

13

Q Okay.

14

A I'll have to look in the chronology of the SER.

15

(Pause.)

16

MR. NORTON: Excuse me. We've found the title

17

in one of our things, if it would help the proceeding move

18

along a little faster.

19

THE WITNESS: It sure would.

20

MR. NORTON: It's dated February 2, 1977, report

21

from NRC Staff consultant Dr. Newmark entitled, "Notes on

22

Approximate Relations for Sensitivity of Design Spectra to

23

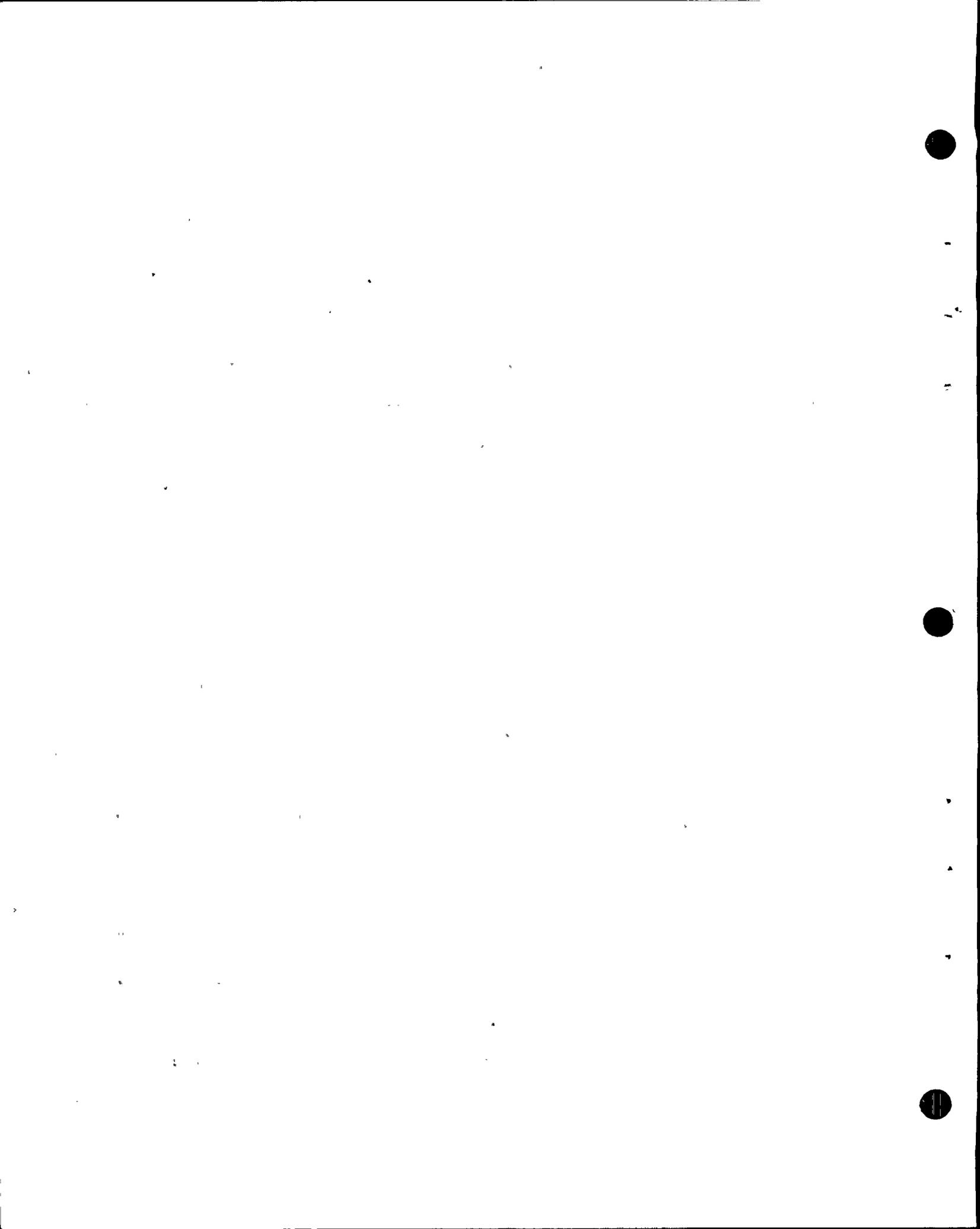
Variations in Damping Factor and Ground Acceleration." It's

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shown in Supplement 7, page A-1.

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THE WITNESS: Thank you very much.



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BY MR. FLEISCHAKER:

Q Is that analysis contained as an appendix to any of the supplements, as Dr. Newmark's main report was?

A No, it's not.

Q Do you know whether this was a docketed report?

A Well, Dr. Newmark sent us the report with a letter saying, here's my report. And we received that and sent copies to the service list and the Public Document Room, and put it in the docket file.

Q You did send copies of that to the service list? Is that your recollection?

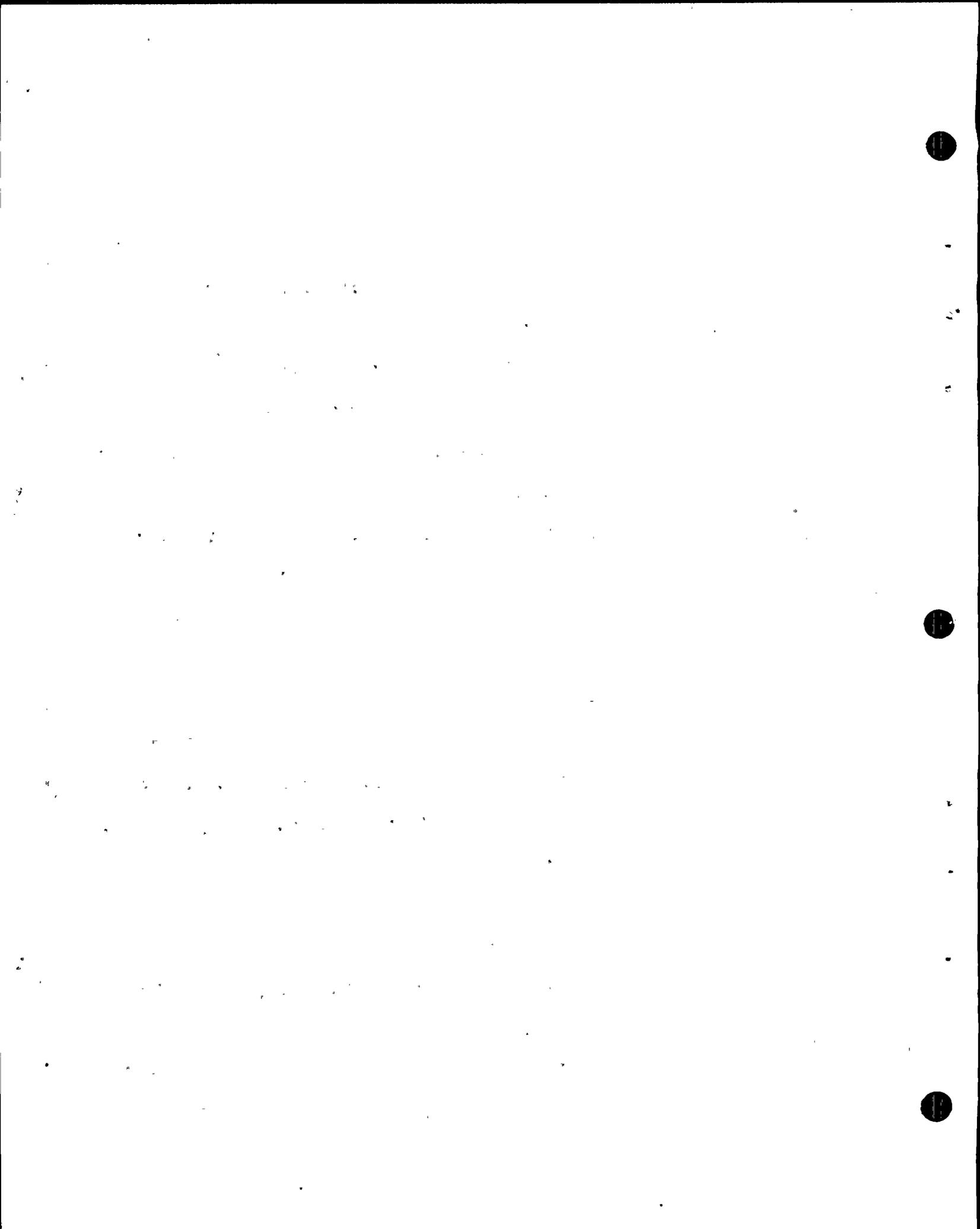
A Yes.

Q Let me direct your attention now to the recommendations by -- or the comments by Dr. Luco, dated November 13, 1976, and then the recommendations by Dr. Luco dated 12-8-76, and ask you whether this was included among the documents that were attached.

Do you recall whether this was among the documents that were attached to the December 20 letter from the ACRS?

A Yes, it was. Similar to Dr. Trifunac's, I suppose I would have to look at the original memo to make sure that the second document was attached with the first. But I think it was. That's the way I recall it.

Q Now, did the Staff conduct an analysis, a sensitivity analysis, as outlined there in the recommendations



wel 13

1 by Dr. Luco?

2 A The recommendations by Dr. Luco dated 1.2-8-76?

3 Q That's correct.

4 (Pause.)

5 A No, the Staff has not conducted an analysis
6 similar to what he recommended there.

7 Q Now, did the Applicant conduct an analysis as
8 outlined by Dr. Luco here and submit it to the Staff?

9 A The Applicant did conduct . . . well, first let
10 me correct my last answer.

11 Dr. Luco, once again, mentions several cases
12 regarding structural damping, and your previous question was
13 has the Staff done anything. And of course the answer is
14 the same as from Dr. Trifunac. Mr. Newmark did the damping
15 sensitivity study.

16 Now, to get to the Applicant, which was --

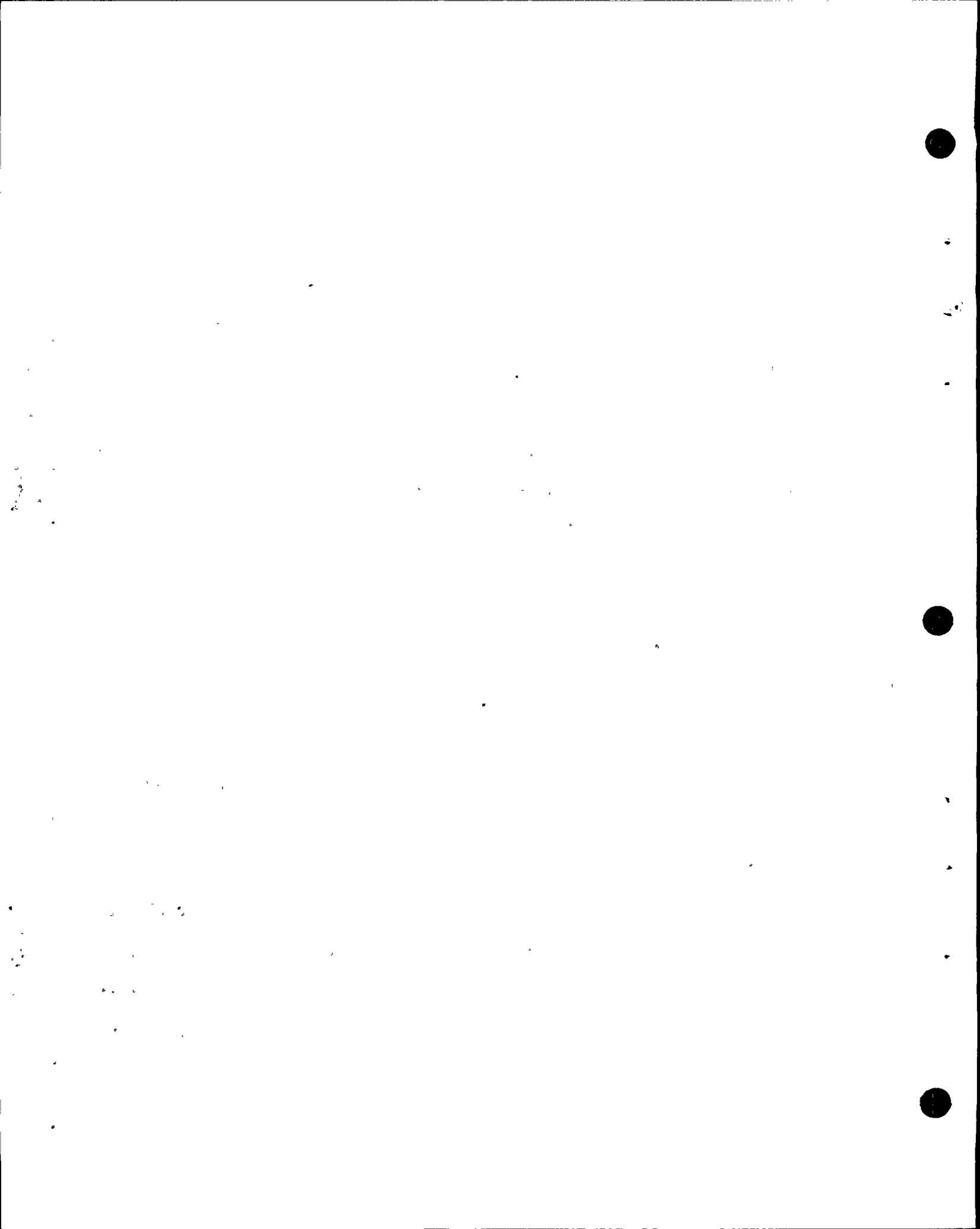
17 Q Let me ask you a question about that, though.

18 Would that be -- damping, it would appear from
19 his recommendations, was one of the factors in an analysis
20 in which he outlines the form --

21 A That's right.

22 Q Was the Newmark sensitivity analysis as Dr.
23 Luco recommended it here?

24 A No. No. It only went to the point of how change
25 in damping would change the load. Yes, as you said, Dr. Luco



wel 14.

1 recommended specifically vertical waves with 3 percent damping,
2 so that the damping value is only one part of that particular
3 case that Dr. Luco wanted to see run.

4 Dr. Newmark's thing only goes to the damping.

5 Q Dr. Luco, in other words, had an integrated case
6 in which there were several functions, one of them being a
7 variation in damping?

8 A That's correct.

9 Q Okay. And Dr. Newmark's analysis was an analysis
10 limited to variation in damping?

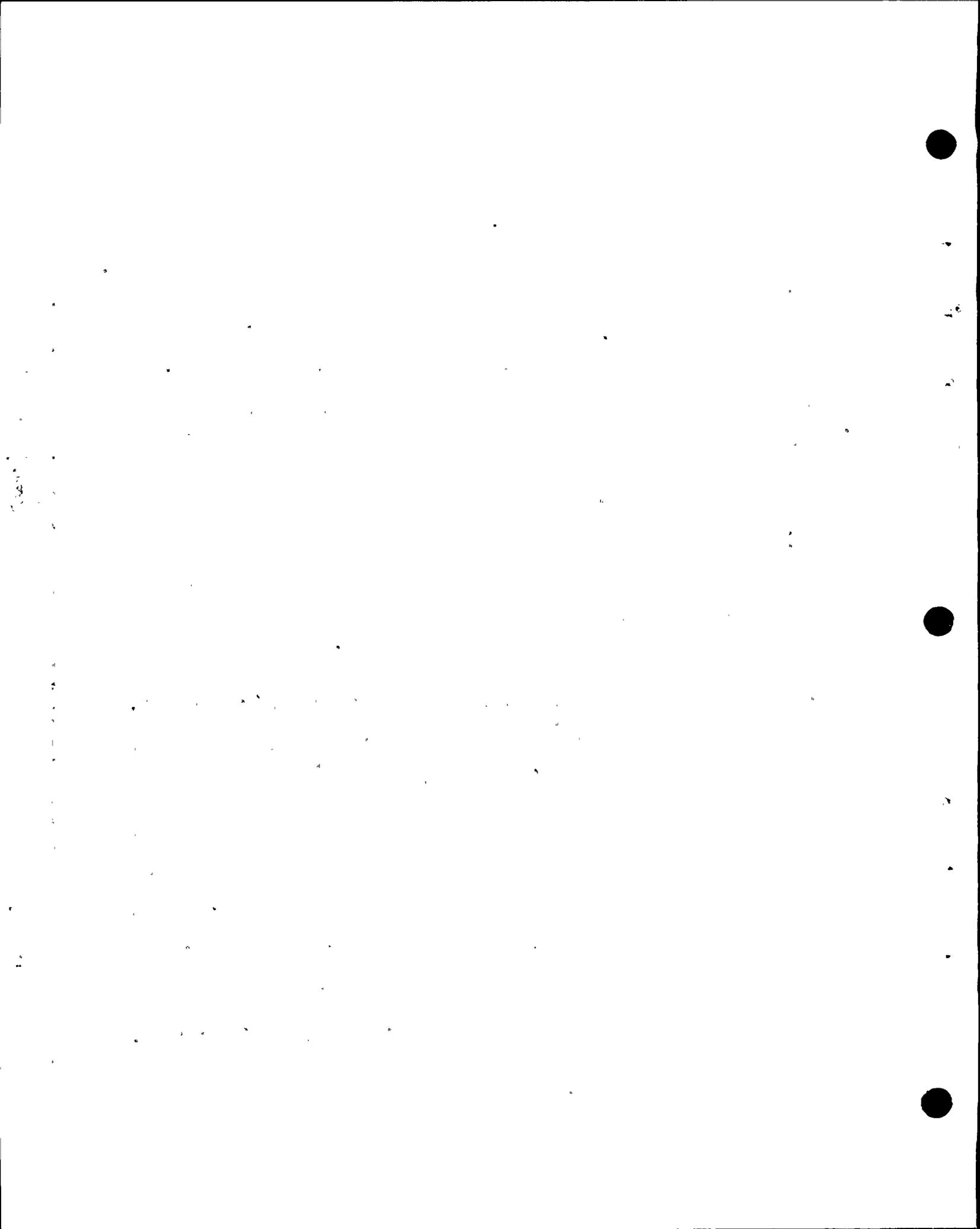
11 A That's right.

12 MR. NORTON: Excuse me. I think there's some
13 miscommunication going on between the attorney and the
14 witness here.

15 MR. FLEISCHAKER: I don't see any miscommunication.
16 I think that we're understanding each other perfectly well.

17 MR. NORTON: Well, my problem is that I think
18 you're talking about one study, and he may be talking about
19 another. Because the recommendation of Luco, as I read it,
20 says soil-structure interaction analysis, and I don't think
21 Newmark's was a soil-structure interaction analysis. And that
22 question of damping and vertical waves and so on is under the
23 soil-structure interaction analysis, not under damping analysis.

24 And I think there's a muddy record right at this
25 moment.



1 MR. FLEISCHAKER: May I proceed?

2 MRS. BOWERS: We'd like to have the witness
3 clarify this.

4 MR. FLEISCHAKER: Was that an objection? I
5 don't understand. I thought --

6 MRS. BOWERS: Well, he was attempting to clarify
7 the record, feeling there may not be a full communication.

8 MR. FLEISCHAKER: Well, I didn't feel -- I think
9 the record -- I think he's making a speech.

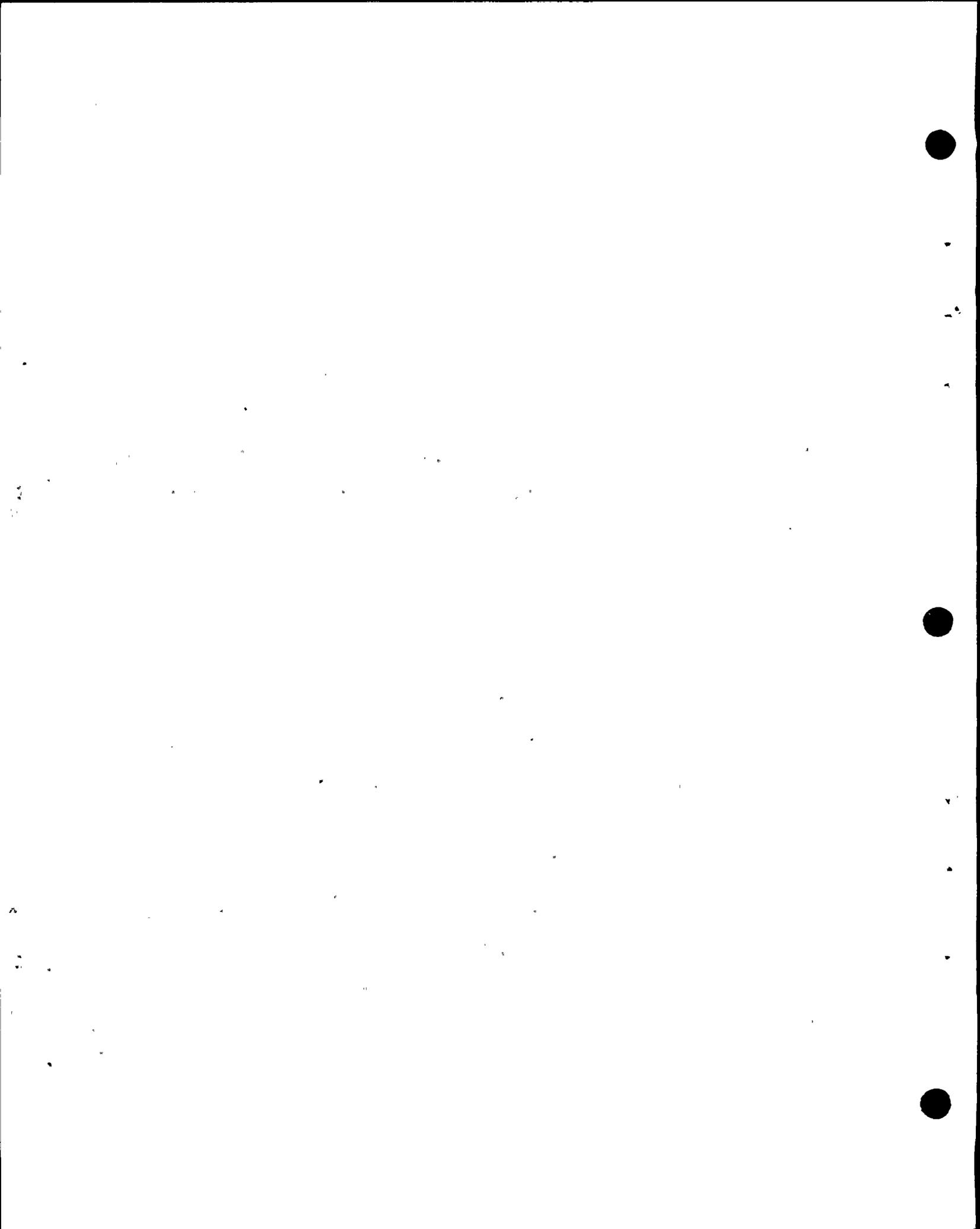
10 MRS. BOWERS: A question has been raised, and
11 we'd like to have it answered.

12 THE WITNESS: Just a second, Mrs. Bowers.

13 (Pause.)

14 MR. FLEISCHAKER: Mrs. Bowers, this happens
15 periodically, and I think the appropriate way to proceed
16 under the circumstances is for Mr. Norton to raise these
17 questions during his cross examination.

18 MR. NORTON: Mrs. Bowers, my objection was that
19 I was getting confused as to which study which person was
20 talking about. They started all of a sudden talking about
21 study, and nobody was defining the study, neither the
22 questioner nor the response to the questions. And I was
23 getting lost as to which studies they were talking about,
24 because as I was looking at the sheet I saw soil-structure
25 interaction analysis, and Mr. Allison was answering questions



1 about damping analysis, and I just got very confused as to
 2 what the questions and answers were about.

3 Now, maybe Mr. Fleischaker understood it all and
 4 maybe Mr. Allison understood it. I'm sorry, I didn't. And
 5 I would like a clarification as to what was being talked
 6 about.

7 MRS. BOWERS: The Board considers it appropriate
 8 if one of the parties feels there's been a confusion that's
 9 crept into the record, that perhaps the witness and counsel
 10 are not fully communicating, and we've had this from time to
 11 time from all parties, we consider it appropriate.

12 MR. FLEISCHAKER: Okay. Very well. We can go
 13 ahead.

14 BY MR. FLEISCHAKER:

15 Q Mr. Allison, can you --

16 A Yes. I've been talking about the recommendations
 17 by Dr. Luco dated 12-3-76, which is the last page stapled
 18 on the back of Dr. Luco's letter.

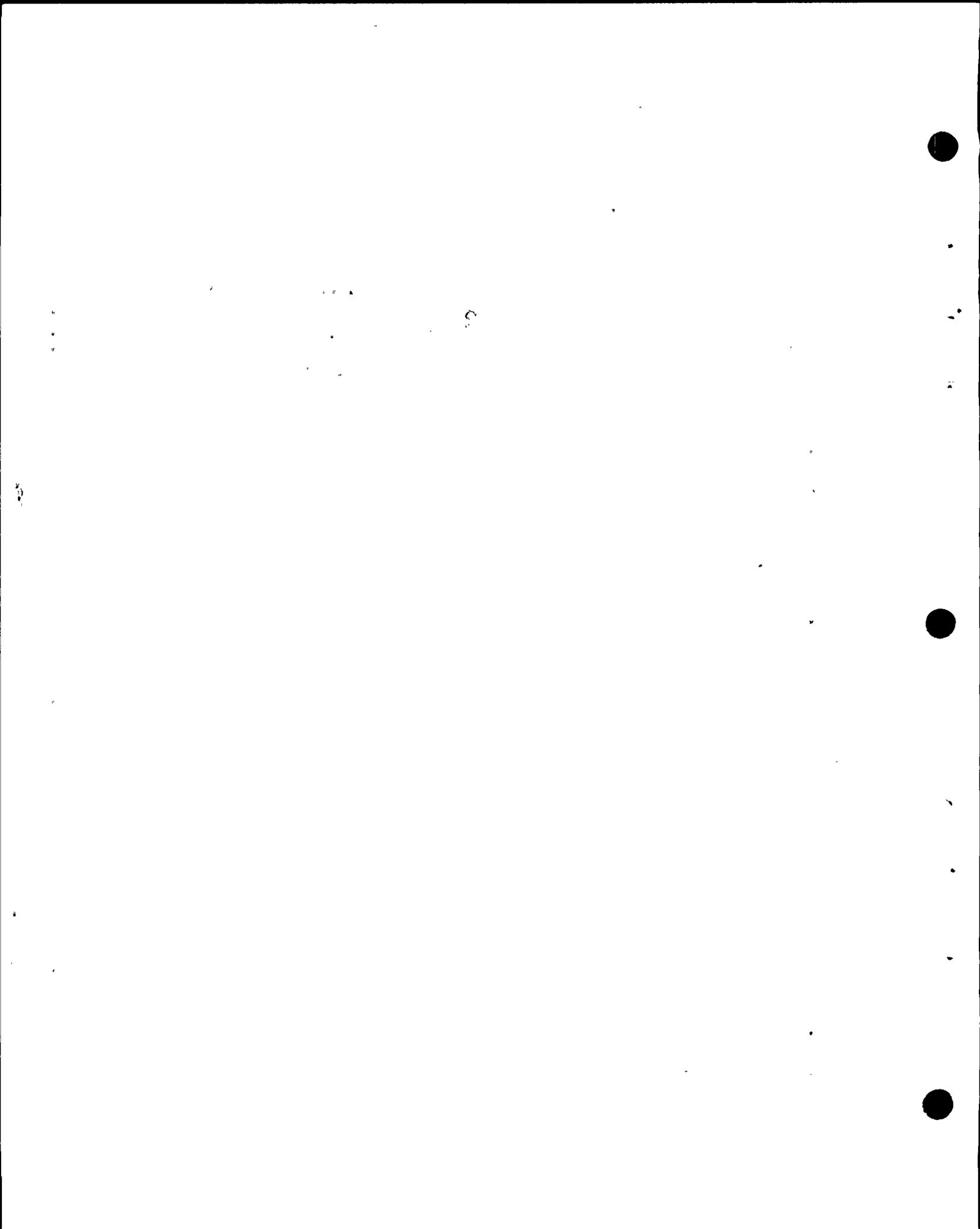
19 Now, that recommendation starts out like this:

20 "I recommend the following sensitivity analyses:

21 (a) Input..."

22 and he talks about some things that should be done there,
 23 including, in part, some changes in damping, but some other
 24 things as well.

25 "(b) Response. Structural response should be



wel 17.

1 obtained by the use of a three-dimensional
2 soil-structure interaction analysis for cases..."
3 and once again he starts talking about damping and other
4 factors as well.

5 And then he goes on to other things.

6 There's a (c), floor response spectra, and he
WRB fls 7 talks about different values of damping there.

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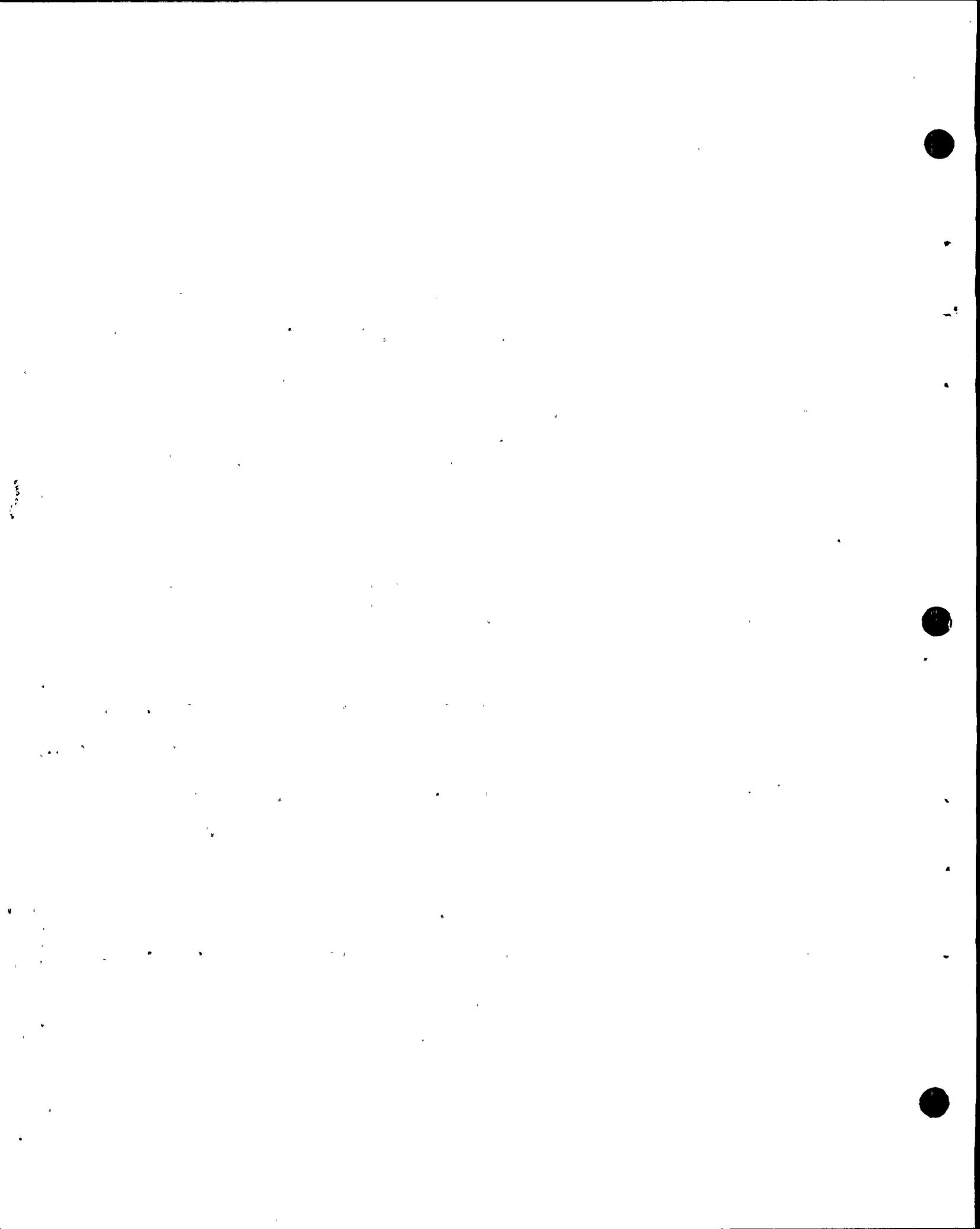
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1C
NRB/agbl

1 Item C appears to be the only simple study where
2 you're just changing damping. Everything else either -- (B),
3 as Mr. Norton pointed out, is completely tied up with soil-
4 structure interaction, which Dr. Newmark did not do, he just
5 went to the damping. (A) has to do with changing the input,
6 namely, larger accelerations, different kind of accelerograms
7 and damping gets mixed up in the cases there, too.

8 Once again, Dr. Newmark's study didn't do any
9 of that. It only looked at a change in damping. So I
10 think...

11 Q Okay. Good.

12 Now, did the Applicant perform an analysis as
13 outlined here by Dr. Luco, and submit the results of that
14 analysis to the Staff?

15 A The Applicant has done -- these are sensitivity
16 studies that Dr. Luco is speaking of. The Applicant has either
17 done sensitivity studies or in some other way addressed the
18 sensitivity of the responses to these various parameters
19 mentioned.

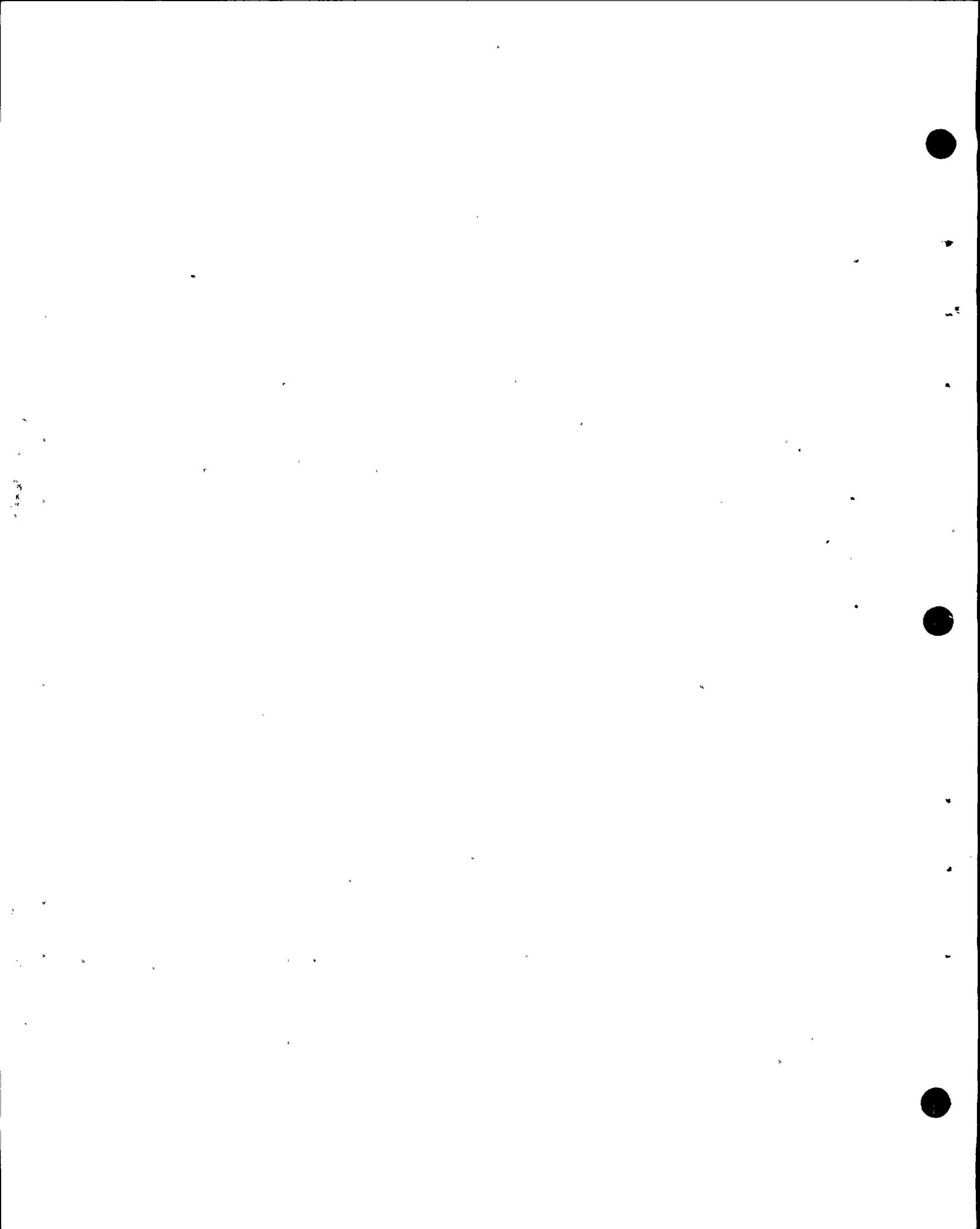
20 I can't say that -- and I don't know whether or
21 not the Applicant has done an analysis, whether you would
22 call it "as outlined by Dr. Luco."

23 Q That's my question.

24 A Okay. I think not as outlined by Dr. Luco.

25 But if I can continue, he has I think addressed

C8



WRB/agb2

1 in the FSAR all of these factors in some manner, either by
2 judgment or by an analysis.

3 Q Well, I'm talking about a specific kind of a
4 methodology and analysis that is outlined here by Dr. Luco
5 which, according to the paper requires a three-dimensional
6 soil-structure interaction analysis, a variation in the
7 damping factors, the incidence of the waves, et cetera, so
8 we're talking about a specific method analysis.

9 And my question is, just so it's clear, has the
10 Applicant followed this method in an analysis and submitted
11 that information to you?

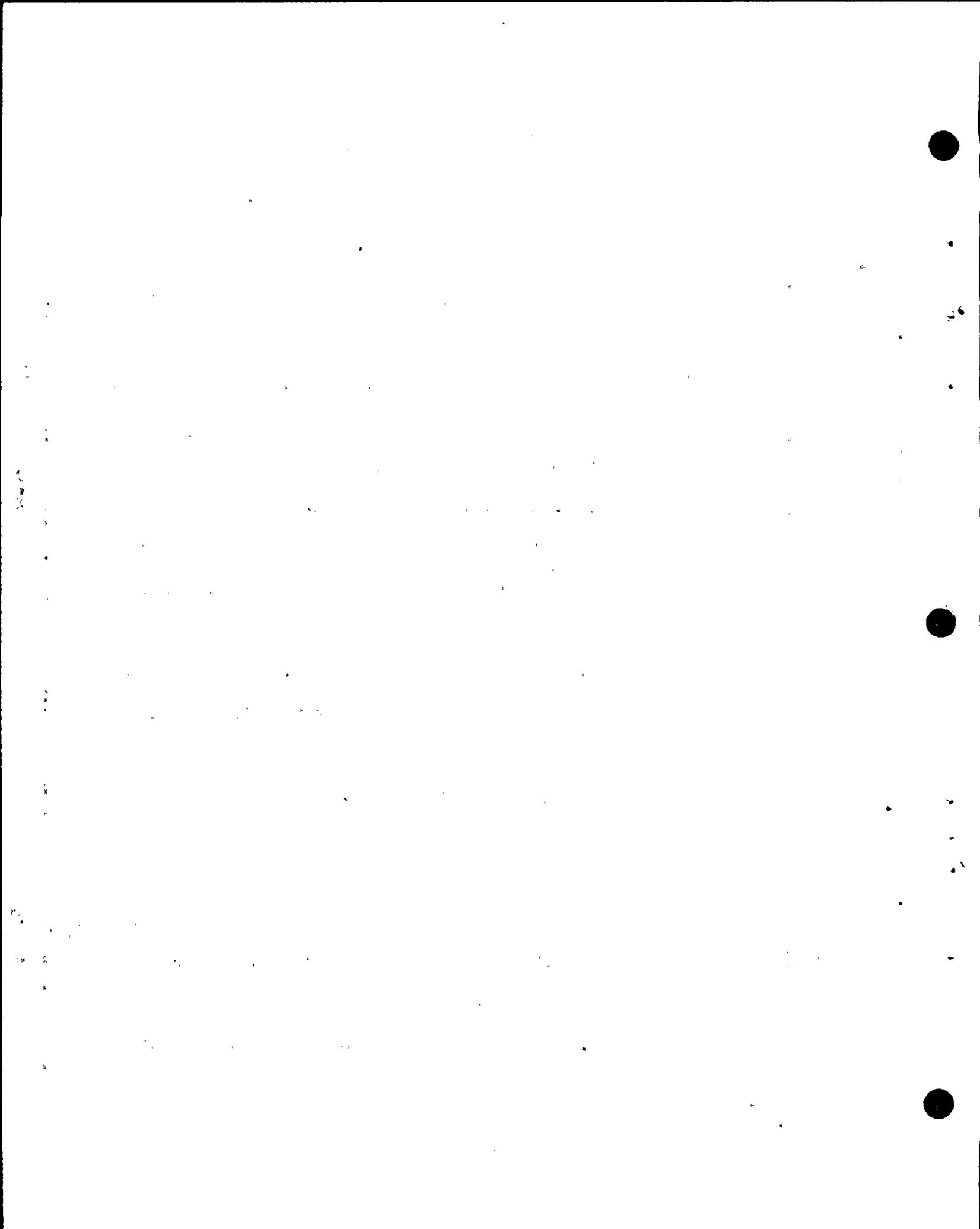
12 MR. NORTON: Excuse me. Again, there are at
13 least three different analyses listed on this page, and
14 Mr. Fleischaker keeps referring to "this analysis" in the
15 singular. And the question should be for each analysis, or
16 each of the three analyses.

17 MRS. BOWERS: I thought the witness was really
18 asked this question earlier and responded that he didn't know
19 that the Applicant followed this exact procedure that was
20 outlined.

21 MR. FLEISCHAKER: Well, I wasn't clear, Mrs. Bowers,
22 and so consistent with the Board's -- I'm trying to clarify
23 in my own mind that the record is clear on this matter.

24 BY MR. FLEISCHAKER:

25 Q Mr. Allison, do you understand?



NRB/agh3

1 A Yes. All I know about the Applicant's response
2 is that he has addressed all the various factors that are
3 raised here or in any of the other items attached to the
4 December 20 memo. Now that's about as far as I can go in
5 saying what the Applicant did, except perhaps a gratuitous
6 comment, I'm sure he didn't follow Dr. Luco's prescription,
7 or I think he didn't follow it exactly but I don't know that.

8 Q Let me ask the same question ---

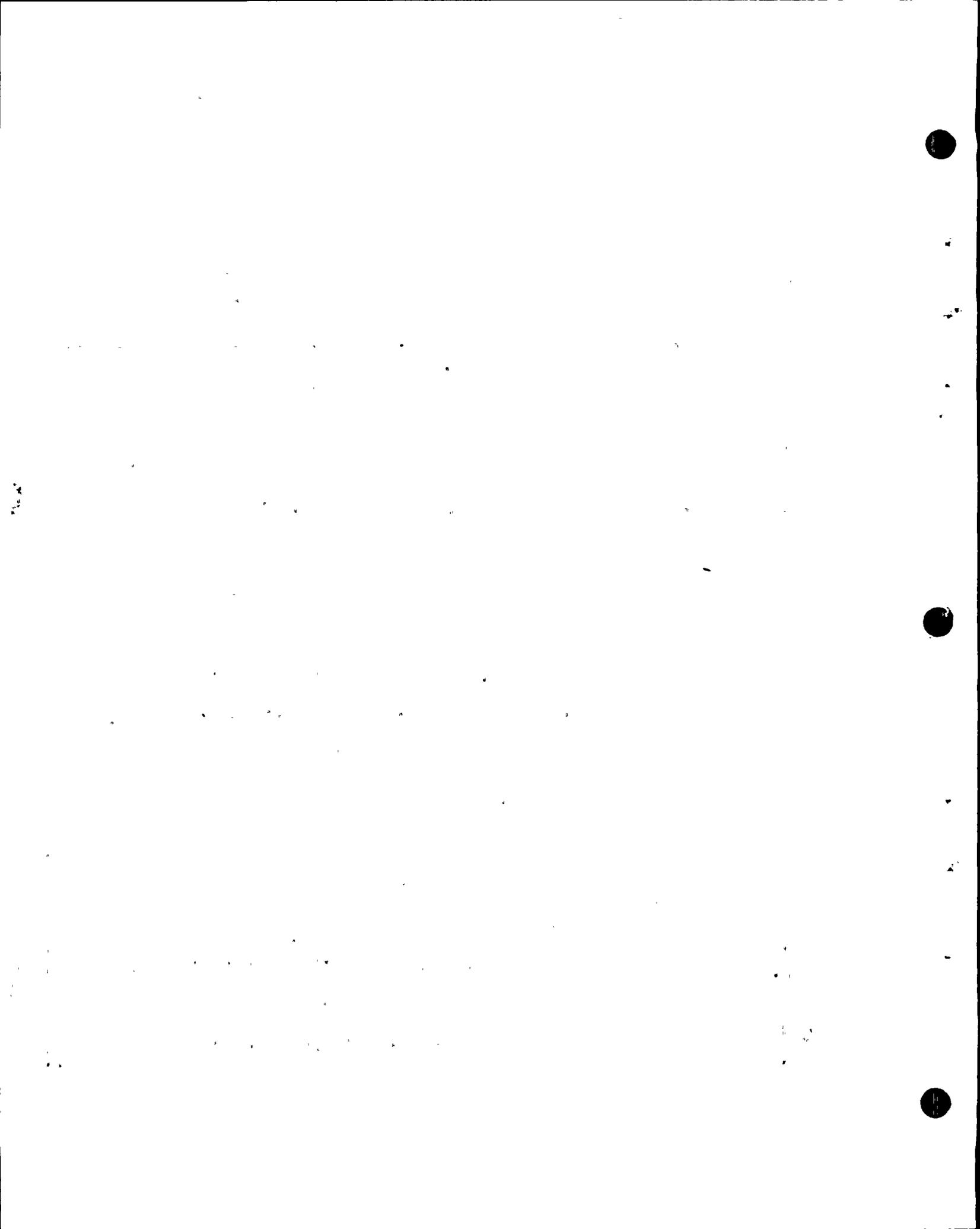
9 A I would have to ask him.

10 Q Let me ask you the same question with respect to
11 Dr. Trifunac: Did the Applicant conduct analyses -- are you
12 aware that the Applicant has conducted analyses as prescribed
13 by Dr. Trifunac and submitted the results to the NRC Staff?

14 A Well the answer is the same, I guess. All I
15 really know about the Applicant's answers is that he has
16 addressed all the points that Dr. Trifunac raised. I don't
17 know that he has done it in the manner that Dr. Trifunac
18 recommended.

19 Q Do you know whether, at the time of the ACRS
20 sign-off, whether Dr. Trifunac and Luco accepted the procedures
21 and the methodologies that had been presented to the ACRS
22 that far by the Applicant and the Staff as adequate?

23 MR. NORTON: Excuse me, could the full question
24 be read back, because I think the last two words maybe the
25 person wasn't listening to, he was thinking of the response



1 when they were tacked on.

2 (Whereupon, the Reporter read from the record,
3 as requested.)

4 THE WITNESS: Well I guess I have to give you my
5 impression of how Dr. -- from listening to what Dr. Trifunac
6 and Luco said at the meeting. I'll give you my impression of
7 how I thought they felt, based on what they said, if that's
8 an adequate kind of an answer.

9 My impression is that they did not accept the
10 methodologies and whatnot as being adequate.

11 BY MR. FLEISCHAKER:

12 Q Okay. Let me move on to another line.

13 I'd like to talk for a minute about the OBE.

14 Are you familiar with Mr. Hoch's testimony, the Project
15 Manager for the Staff -- I'm sorry, the Project Manager for
16 the Applicant?

17 A No, I'm not.

18 Q Okay.

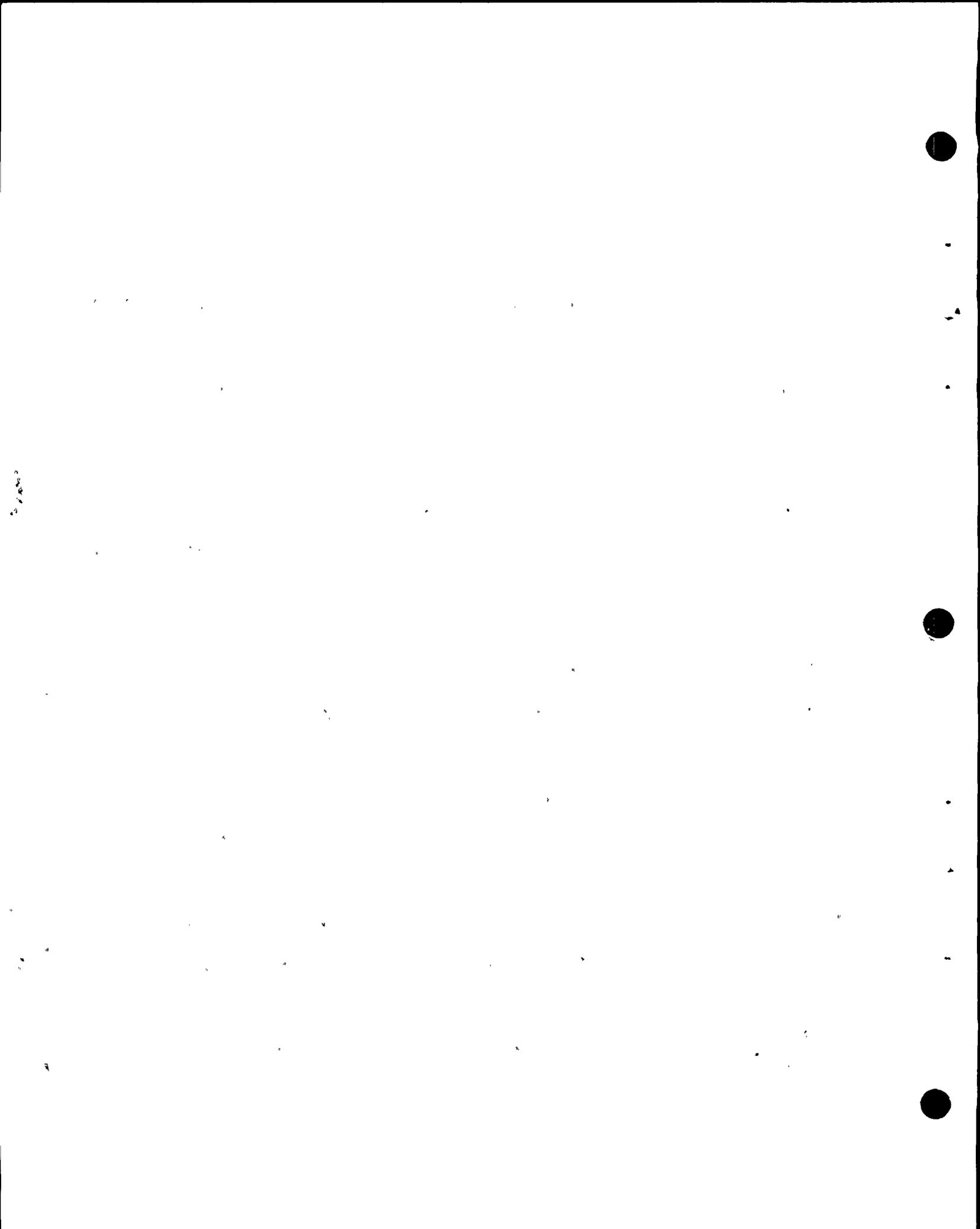
19 Well I believe on Page 10 of his testimony, Mr.
20 Hoch listed some plants for which the OBE was less than
21 one-half of the SSE, and I think you may have a list in
22 Supplement 7 of the SER, is that correct?

23 A No, we didn't list them in Supplement 7.

24 Q Well do you know from you own experience, can you
25 list the plants for which the OBE is less than One-half of

PB/agb4

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WRB/agb5

1 the SSE?

2 A No, I can't.

3 Q Can you list any plants? I didn't ask -- maybe
4 you misunderstood me. I'm not talking about a full listing,
5 but do you have in your mind the name of any plant for which
6 the OBE is less than the SSE?

7 A Yes, I do, and that is Byron and Braidwood.

8 Q What is the OBE value there?

9 A I don't recall, but I know that it's less than
10 one-half because I discussed that case -- that was the first
11 one, I think, and I discussed that with the project manager
12 for that plant.

13 Q Is that one plant or two plants?

14 A You got me. I think it's two plants.

15 Q Do you know where it is, where it or they are
16 located?

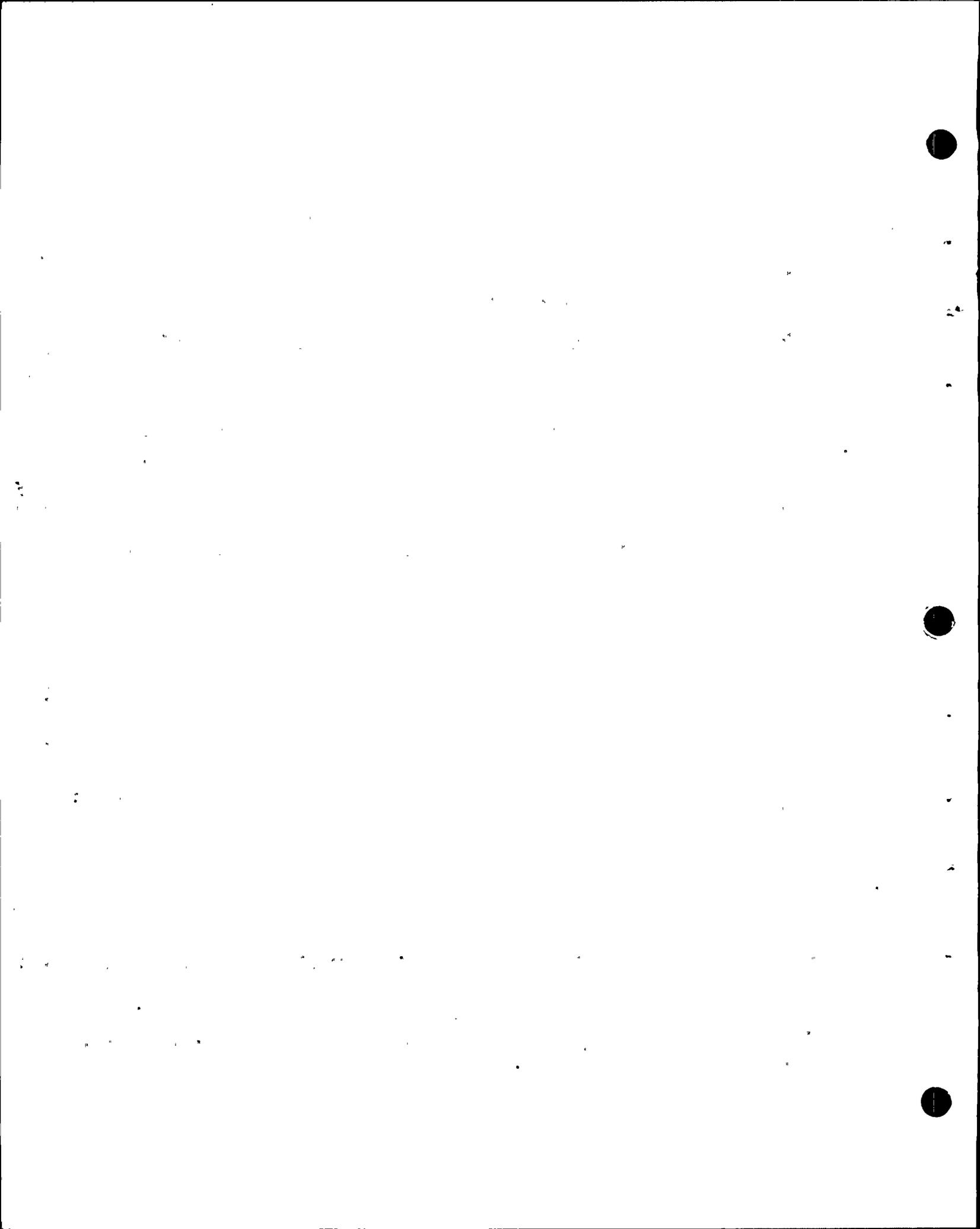
17 A No, I don't know where it is.

18 Q Is there a statement in the SSE anywhere that
19 there are other facilities, do you recall --

20 A In the SER, yes, we said we had accepted an OBE
21 of less than one-half the SSE for several of the plants.

22 Q Who wrote that?

23 A I wrote it, and -- Well, Dr. Stepp and I r
24 wrote it really, I'm not sure, and we agreed on it. I'm not
25 sure whether you should attribute the words to me or to him,



1 but we were agreed on it before it was published.

2 Q Other than Byron and Braidwood, do you recall --
3 well, let me ask you about the list that Mr. Hoch --- Mr. Hoch's
4 list and ask you whether you have any recollection with
5 regard to those specific plants.

6 Clinton, do you have a recollection with respect
7 to that plant?

8 A No, I won't have any recollection with respect to
9 any other plant unless bByron and Braidwood is on the list.

10 Q Okay.

11 MRS. BOWERS: Mr. Fleischaker, I raised a point
12 earlier when I think Mr. Hoch was testifying, and it may have
13 been inappropriate for me to have done so then, so I think
14 I should continue the same inappropriate behavior.

15 (Laughter.)

16 At that time, because I was rather familiar with
17 Marble Hill, Marble Hill except for environmental siting, was
18 a Chinese copy of Byron, and the SER began with particulars
19 for Marble Hill and then incorporated the Byron SER.

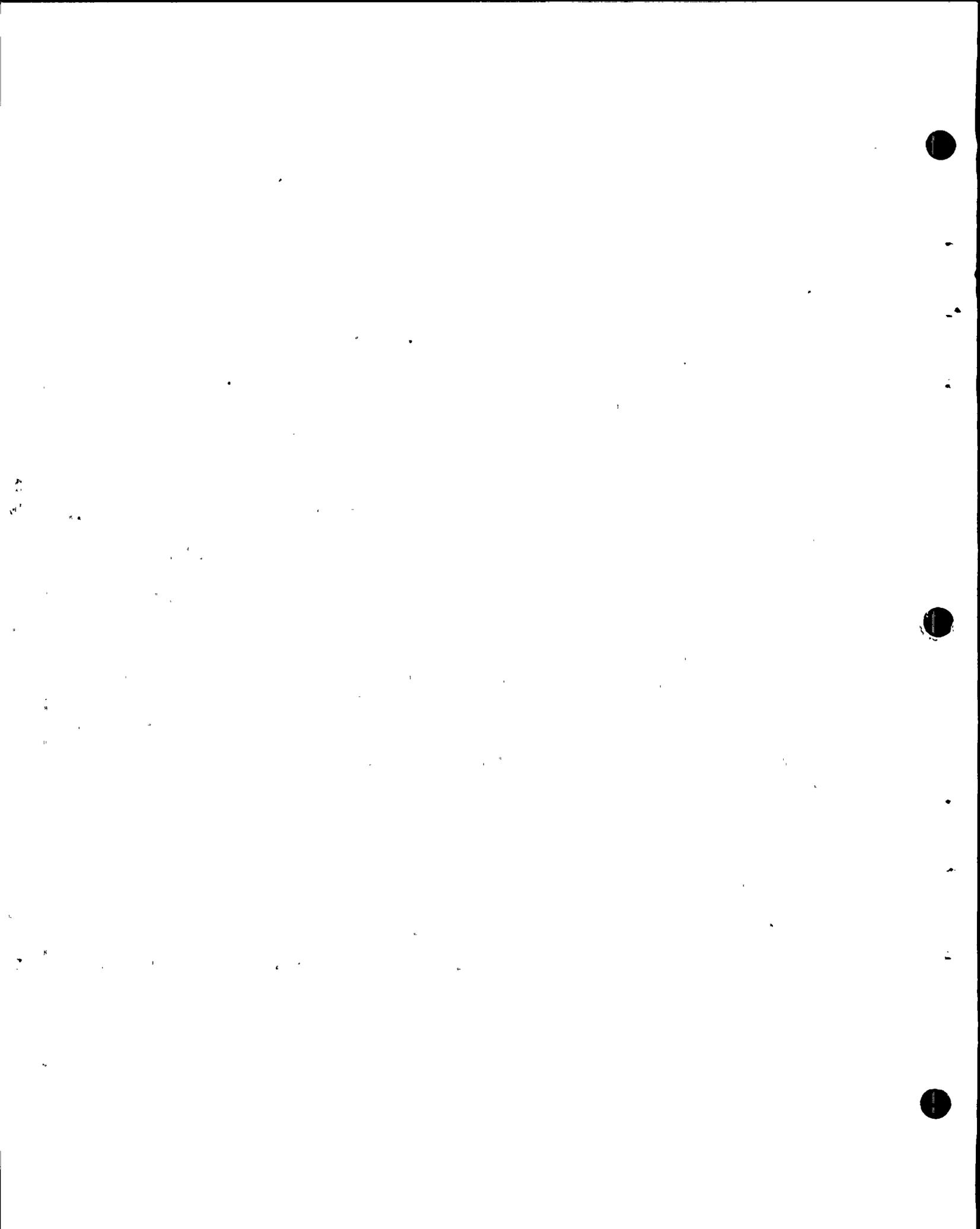
20 Are you familiar with that?

21 THE WITNESS: Yes, I'm familiar with the process
22 and how we write replicate plant SERs.

23 MRS. BOWERS: But you were not aware that Marble
24 Hill was a replica of Byron?

25 THE WITNESS: Yes, I was.

RB/agb6



WRB/agb7

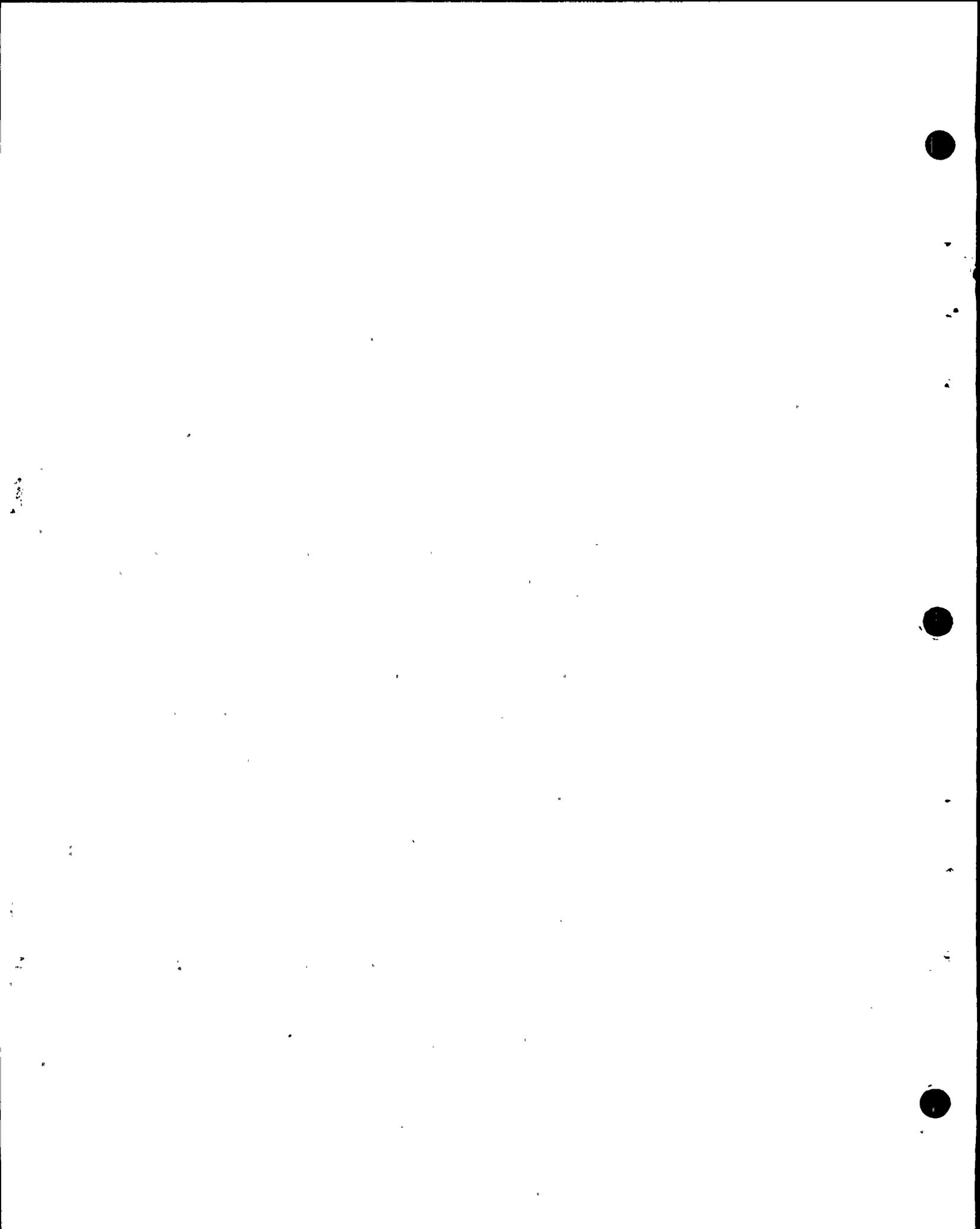
BY MR. FLEISCHAKER:

Q Let me ask you, Mr. Allison, I inquired of this in my interrogatories and I wanted to ask you a few questions about how the Staff obtains dissenting views from among the people who review, how that procedure was utilized, or what is the procedure for obtaining the views of a dissenting member of the Staff.

Are you involved in that, that's the first question?

A Well yes, all Staff members are involved in that. We have been sent numerous -- all members of the Staff -- numerous letters and instructions and procedures and whatnot reminding us that if a person is a dissenter -- if a person has a different view, doesn't agree with the Staff position on something, that that person has a right and I think a duty as well to express that view, bring it up with his boss or with whoever he wants to to get it out.

Now if that situation persists, you know, if the Staff doesn't change it's position or the person doesn't change his opinion, then that should be made known when the SER goes out, for instance, in the SER or -- it depends, it varies on where the plant is and when it becomes known. But that information should be made public and dissenters' views should be made part of the SER, the hearing record, or whatever is appropriate at the time.



WRB/agb8

1 The individual involved, as I said, has not only
2 a right but a duty to bring that information forward. And his
3 supervisors and so on are, of course, admonished not to
4 squelch him and try to scare him away or whatever might be
5 done to suppress the dissenting view.

6 Q Well, in the SMR, I noted that there were no ---
7 there was no statement on dissenting views with regard to the
8 seismic issues, is that correct?

9 A That's right.

10 Q So I take it from that, therefore, that there
11 were no significant dissenting views that came to your attention
12 in any case.

13 A That's right.

14 Q --- within the Staff.

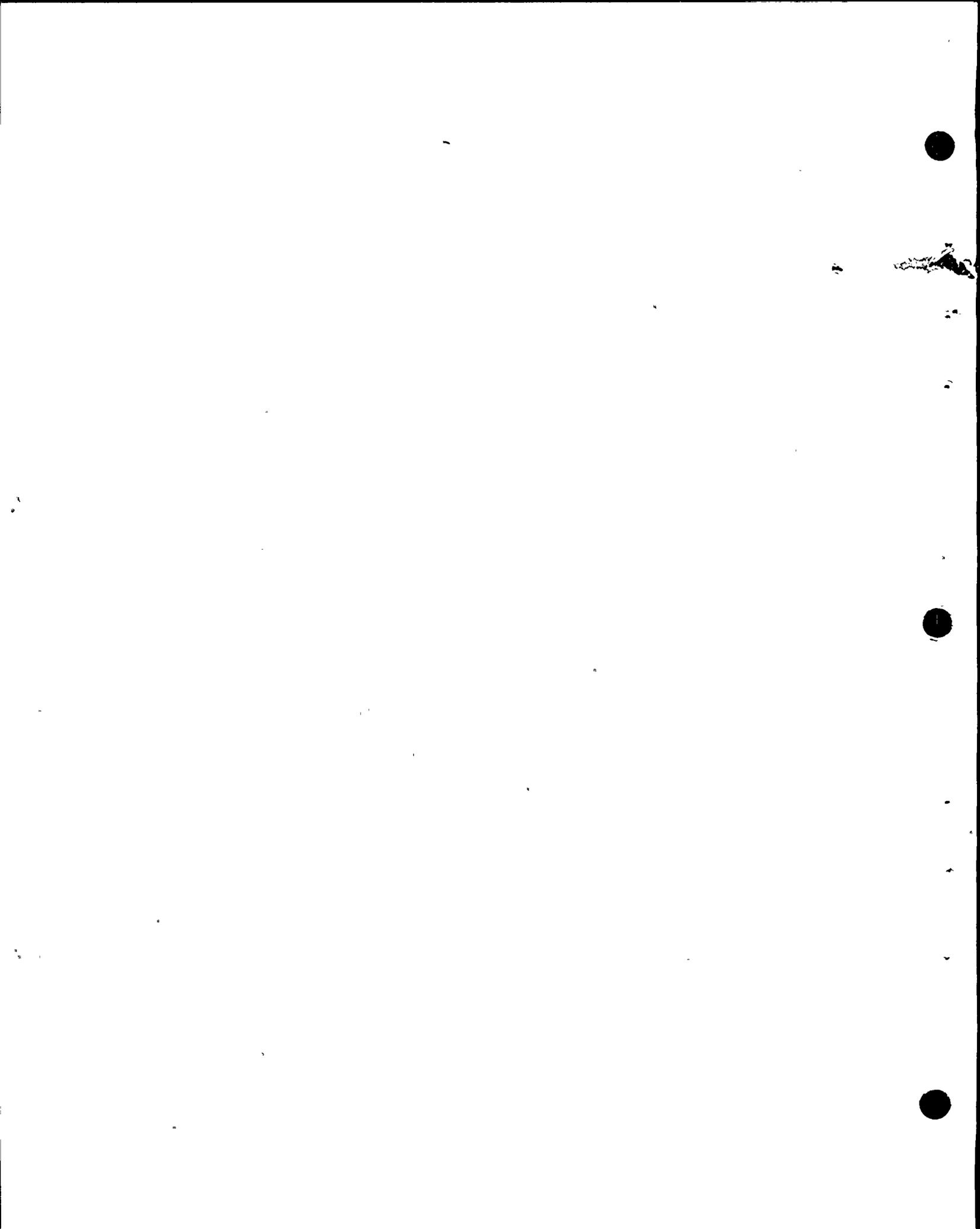
15 Q With the possible exception that Dr. Stepp and
16 Mr. Hoffman don't agree on some of the details of what various
17 seismological data mean.

18 Q Right.

19 A But we've discussed that, and I guess you'll see
20 that in their testimony.

21 Q Right, and I think you mentioned that in the
22 answers to the interrogatories.

23 A On that particular thing, both men support the
24 Staff position so that it is not clear that, even if you call
25 them in disagreement, it's not clear that it's the kind of



WRB/agh

1 thing that has to be published.

2 Q Right. Okay, I understand that.

3 Are you the appropriate person to ask about the
4 designation of the OBE value as 0.2g?

5 A Yes, I think so. Well, Dr. Stepp or I.

6 Q Okay.

7 What was the basis for selection of the 0.2g as
8 the OBE for this facility?

9 A The basis -- do you mean the original selection
10 or why we are accepting it now?

11 Q I mean why you're accepting it now.

12 A We're accepting it now because we reviewed the
13 probability studies and concluded that the probability of a
14 0.2g OBE was low enough to meet our usual acceptance criterion
15 which is a return period of 130 years or greater.

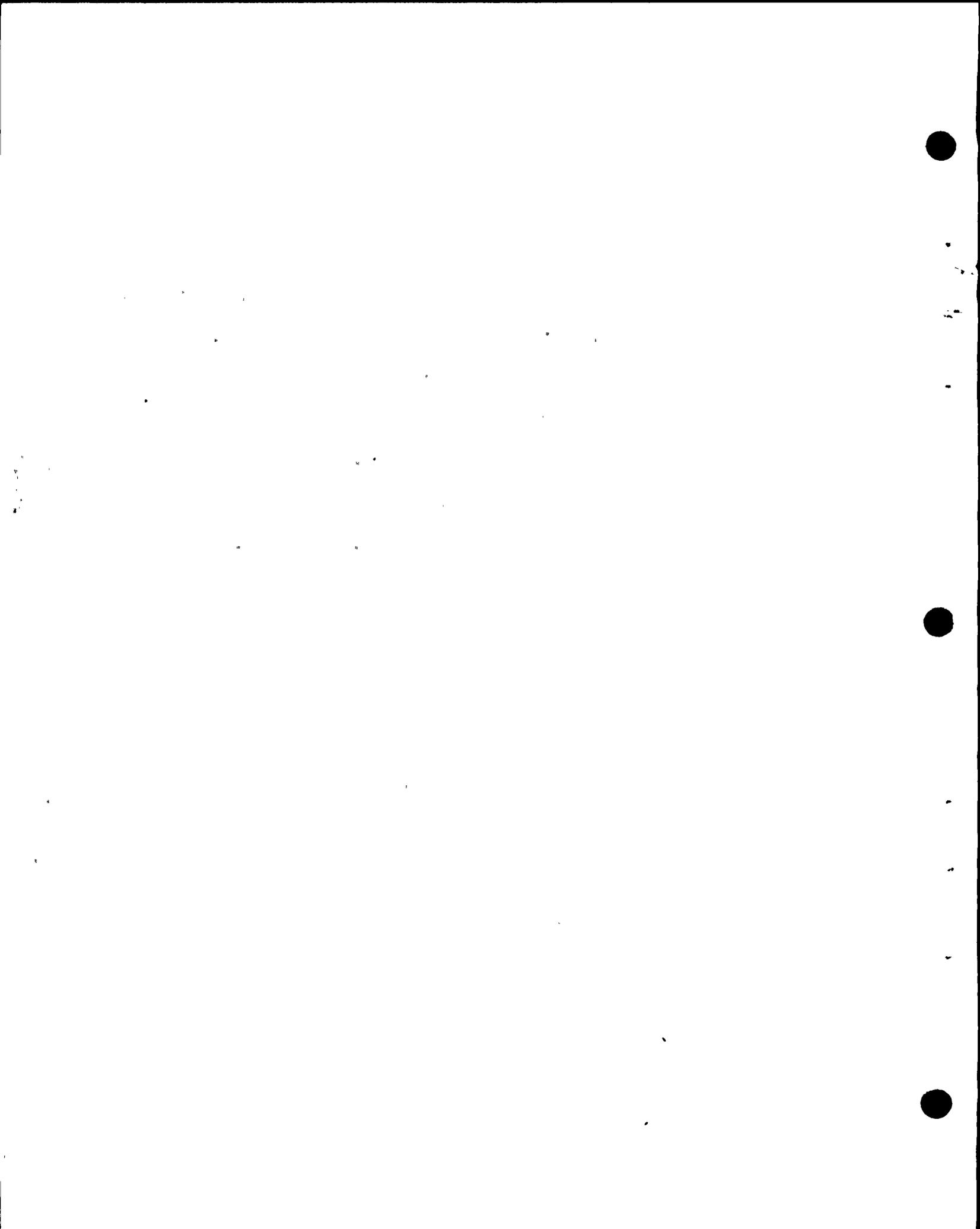
16 Excuse me, I may have that number wrong. I think
17 you probably ought to ask Dr. Stepp about that, about what
18 the return period is.

19 Q Okay.

20 A But it was on the basis of probability, and that's
21 described in Supplement 7.

22 Q Was there any particular probability study on
23 which the Staff placed reliance?

24 Q In Supplement 7, we cited the Applicant's study
25 and we noted that it was consistent with our consultant's

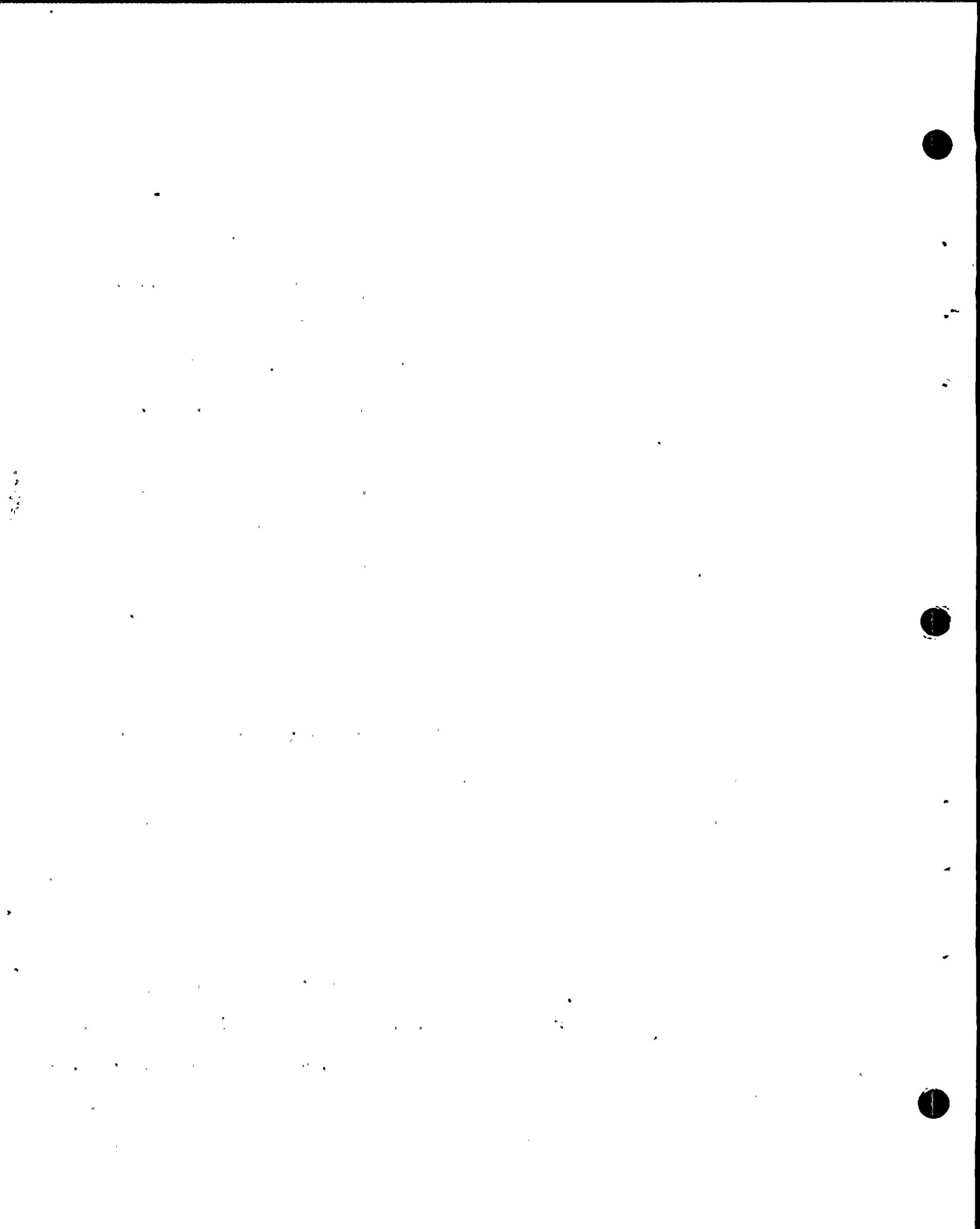


NRB/agbl0

1 study.

2 Q That's Dr. Newmark?

3 A Dr. Newmark and Dr. Eng did a probability study
4 for the Staff.5 Q Did you review the probability study, or did the
6 Staff review the probability study by Dr. Trifunac?7 A We've read it, but we made no comments on it,
8 no review or critique out on it.9 I might point out that Dr. Trifunac took his
10 probability study and answered the ACRS as to what he thought
11 the return period was, and he felt it was within our criteria
12 as well. So he was with a different number, but, you know,
13 he's in agreement with our conclusion.14 endID
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1 Q Do you recall what the number was, what the
2 numbers were that he gave with respect to .2g?

3 A Slightly better than our acceptance criteria.

4 Q Mr. Allison, do you recall whether Dr. Trifunac
5 in fact concluded that for at least three of the seismicity
6 models that he utilized he predicted that the-- Strike that.

7 Let me ask you if you recall any prediction
8 he had with respect to exceedance of the peak acceleration
9 during the forty-year period?

10 A His probability study lists a number of curves
11 from which you can take a probability of exceeding a peak
12 acceleration. That's one source. The other source is what
13 he said in response to the ACRS question when they asked him
14 What's the probability of exceeding .5g? I don't think you
15 get the same answer.

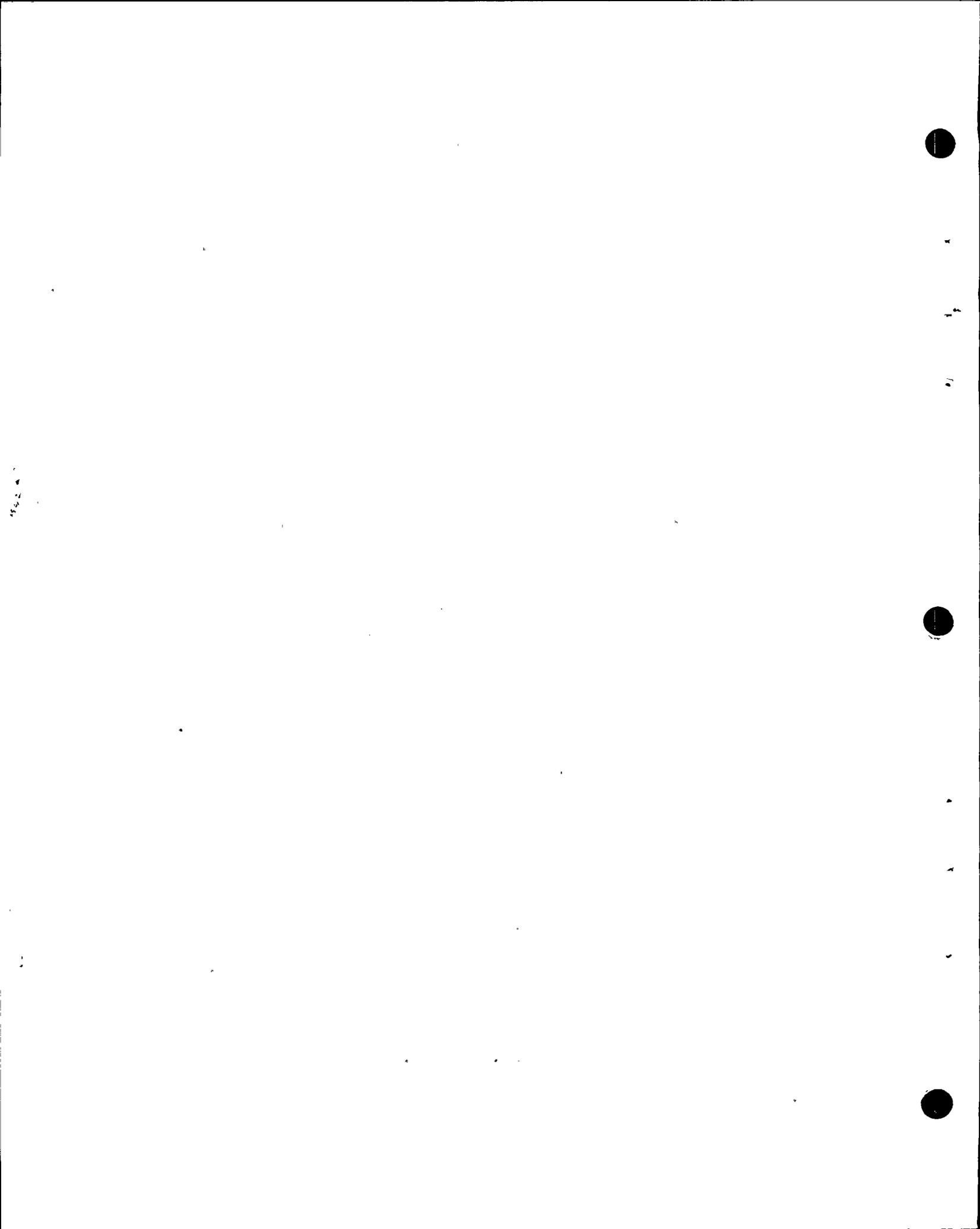
16 Q Okay. Let's address that one, because we're on
17 OBE.

18 Do you recall what his answer was with respect
19 to that particular question?

20 A Not specifically.

21 Q Okay.

22 A I believe-- Well, I understood him to say,
23 though, that the probability of exceedance of .2g was within
24 our acceptance criteria for OBEs. That's my understanding of
25 what he said.



1 Q Would Mr. Stepp be the appropriate person to
2 question on this?

3 A I think so. I don't know that he will know what
4 Dr. Trifunac said without reading the transcript.

5 Q ...Okay. Well, we'll try with Dr. Stepp.

6 In your re-analysis of the seismic design of
7 the facility did you consider the impact of the unresolved
8 generic safety items in that re-analysis?

9 A Well, I'm a little hard-pressed to answer that.
10 I guess I can't say that we considered them all. I'm just....
11 Well, let's try No for an answer.

12 Q MR. FLEISCHNER: I have no further questions.

13 MRS. BOWERS: Mr. Norton.

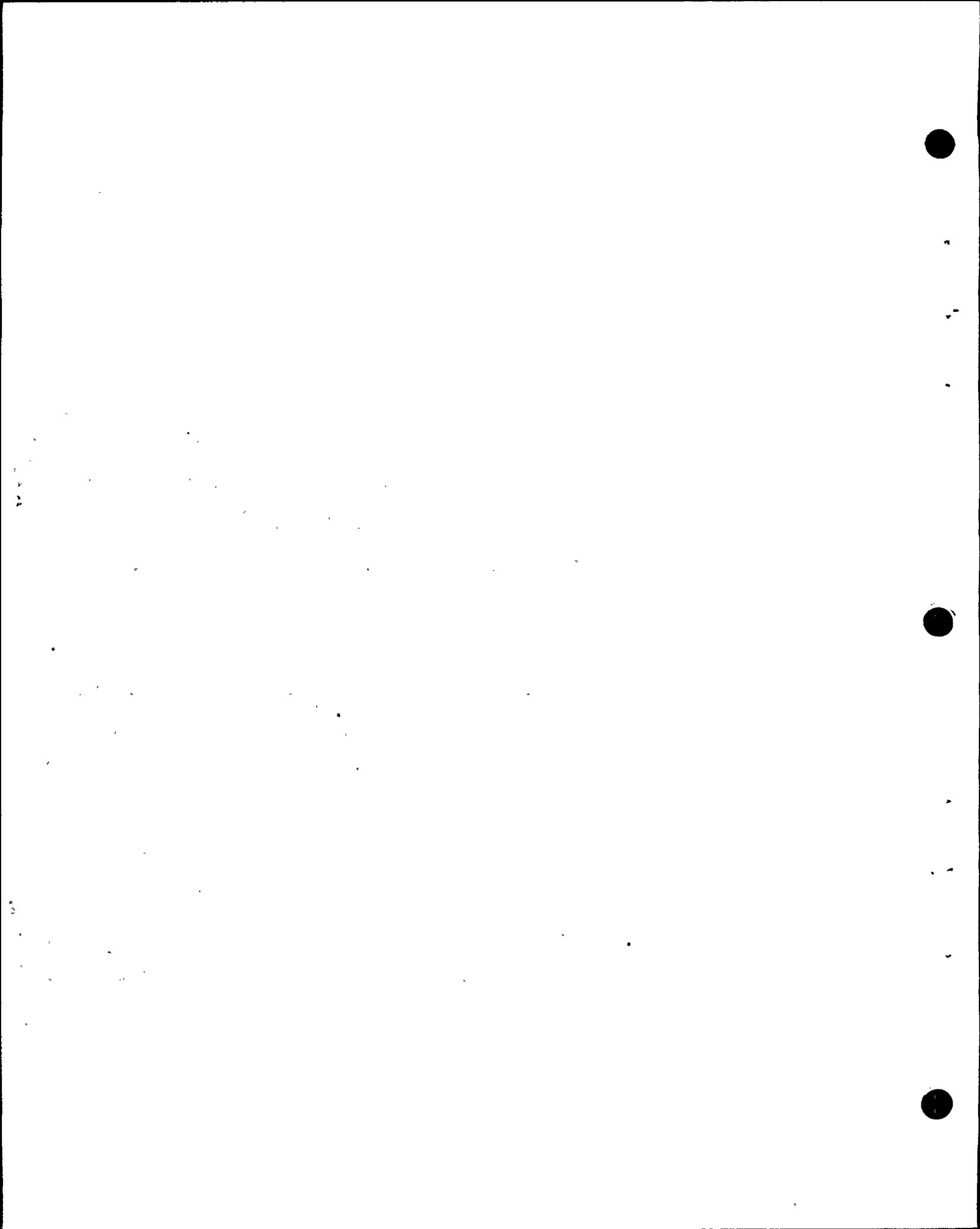
14 MR. NORTON: That was the longest forty minutes
15 I've ever seen.

16 I promise to take less than forty minutes.

17 BY MR. NORTON:

18 Q Referring to Joint Intervenors' Exhibit 70,
19 which I guess was not offered into evidence but was just
20 marked, you were never asked to read it. But I believe-- Well
21 you were perhaps asked to read, but I think it was just
22 paraphrased as to the studies, the sensitivity studies sug-
23 gested.

24 That letter does not require, or does not even
25 ask that all of those sensitivity studies be performed, does it?



1 A No, I don't believe it does.

2 Q In fact it says, "The Subcommittee also believes
3 it would be useful to the Committee for the NRC Staff and/or
4 applicant to perform some of the sensitivity studies sug-
5 gested." and lists, for example, some of those studies; isn't
6 that correct?

7 A Yes, that's correct.

8 Q All right.

9 And so it didn't require the Staff to do all
10 the studies, or the applicant to do all the studies, but the
11 applicant and/or staff to do some of the studies?

12 A Well, no, it didn't require it; it requested it.

13 Q It requested it. It suggested it. All right.

14 And, in fact, that's exactly what was done,
15 wasn't it? The staff did some studies, the applicant did some
16 studies, and in fact all of the issues were addressed in one
17 fashion or another; isn't that correct?

18 A Yes, that's true.

19 I'd like to expand just a little on that answer,
20 though.

21 Q All right.

22 A We're speaking of the third paragraph which
23 deals with sensitivity studies.

24 Q Yes.

25 A The last sentence of that indicates that the

Figure 1

1 Committee doesn't even request that somebody do all of the
2 studies. It says, "The Subcommittee recommends that the
3 consultant reports be taken as indicative of the type of
4 studies desired, and that an appropriate range of conditions
5 be selected to provide a meaningful basis for evaluation."

6 Q And in your opinion was that done?

7 A Yes. Yes, it was.

8 Q All right.

9 As a matter of fact, I'll hand you what is
10 Table 10.1 of the Hosgri Report which is already in evidence.

11 (Handing document to the witness)

12 Mr. Allison, do you recall reviewing this, or
13 having seen this before?

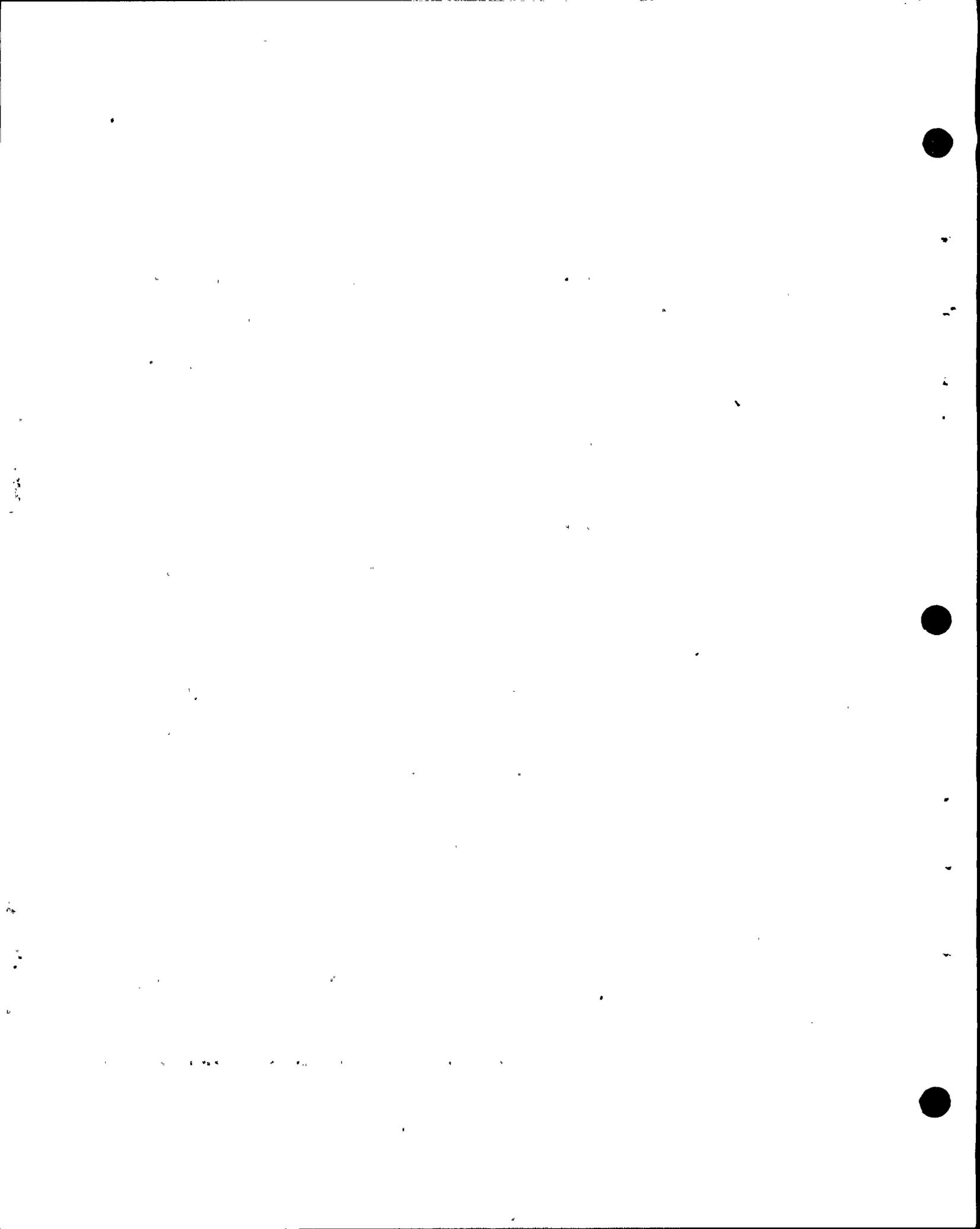
14 A Yes, I've read it before.

15 Q All right.

16 And it is, in fact, is it not, a list of the
17 sensitivities, the subject discussed, the sensitivities and
18 the reviewers who addressed those sensitivities, and then the
19 reports submitted by the applicant in the final column on the
20 right which do indeed address those sensitivities; is that
21 correct?

22 A Yes. I believe it's more than sensitivities,
23 I think, sensitivity studies that were recommended; I think.
24 It goes to all the comments that were made by the consultants.

25 Q All right.



1 And these reports, the DLL reports, were in fact
2 reviewed by the Staff, were they not? --the ones that were
3 listed here that were submitted?

4 A We didn't review all of those reports in the
5 sense of, Well let's take a three-dimensional soil-structure
6 interaction analysis that you did, or something. As an
7 example, we took the attitude that that wasn't necessary.

8 Q That's because the three-dimensional soil-
9 structure interaction analysis wasn't necessary in your
10 opinion?

11 A That's right.

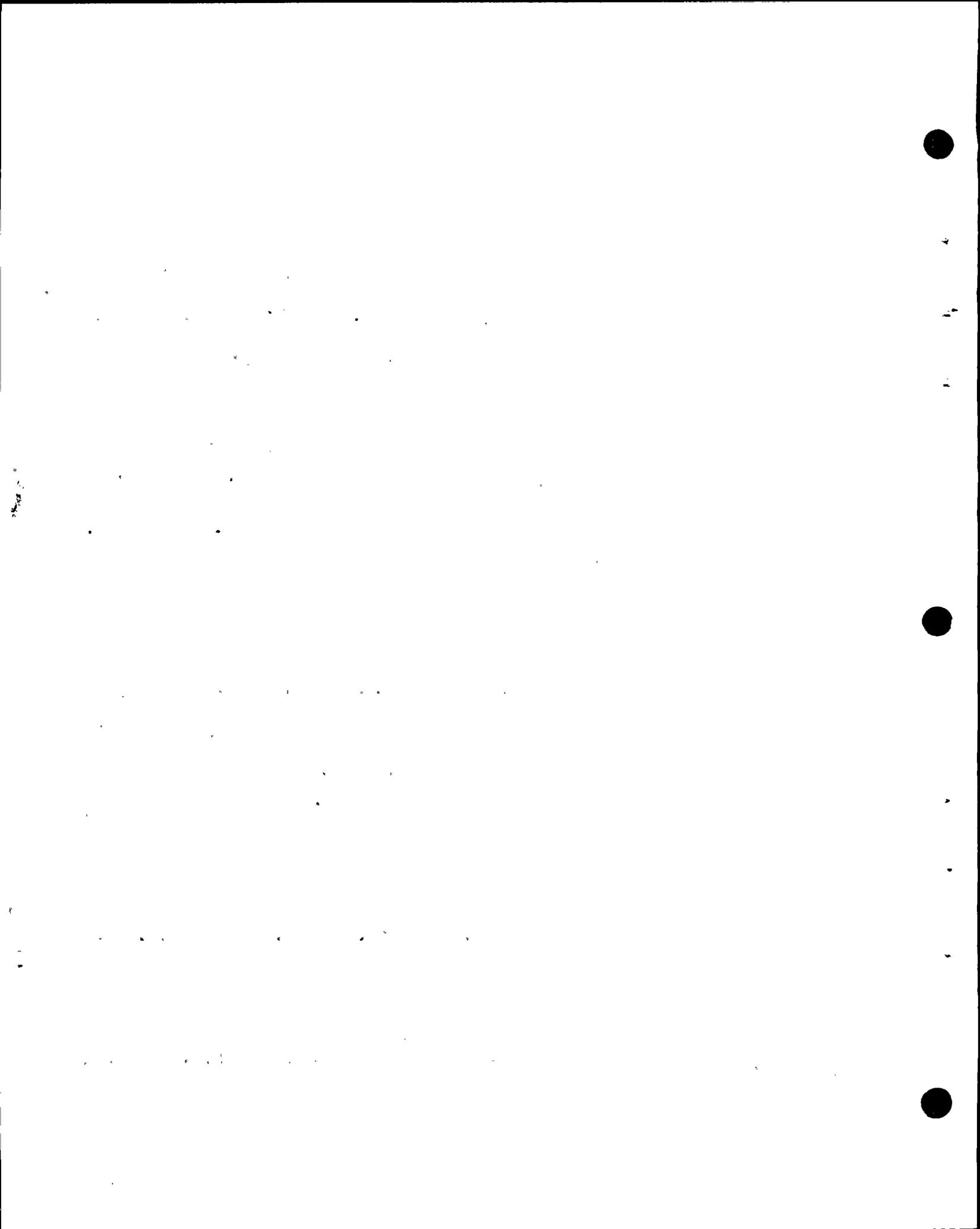
12 Now if I can characterize the Staff's attitude,
13 which is something several of us worked out together, I guess,
14 you know, we didn't consider that kind of an analysis to be
15 necessary. We didn't want that comment from the ACRS con-
16 sultants. They sent it. The applicant had done a study.
17 We did not review that study, critique it, similar to
18 Dr. Trifunac's probability study; send you questions,
19 make you change the sensitivity study until you had done it
20 the way we would like to see it done, the way we do with
21 other kinds of things.

22 Q That is not to say, though, that you didn't look
23 at it?

24 A Right. I'm sure that the reviewer looked at it.
25 But there just wasn't anything to do with it.

RB/wb5

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1 He may not have agreed with it, even, with the
2 way the applicant did the study. But it made no difference
3 to us.

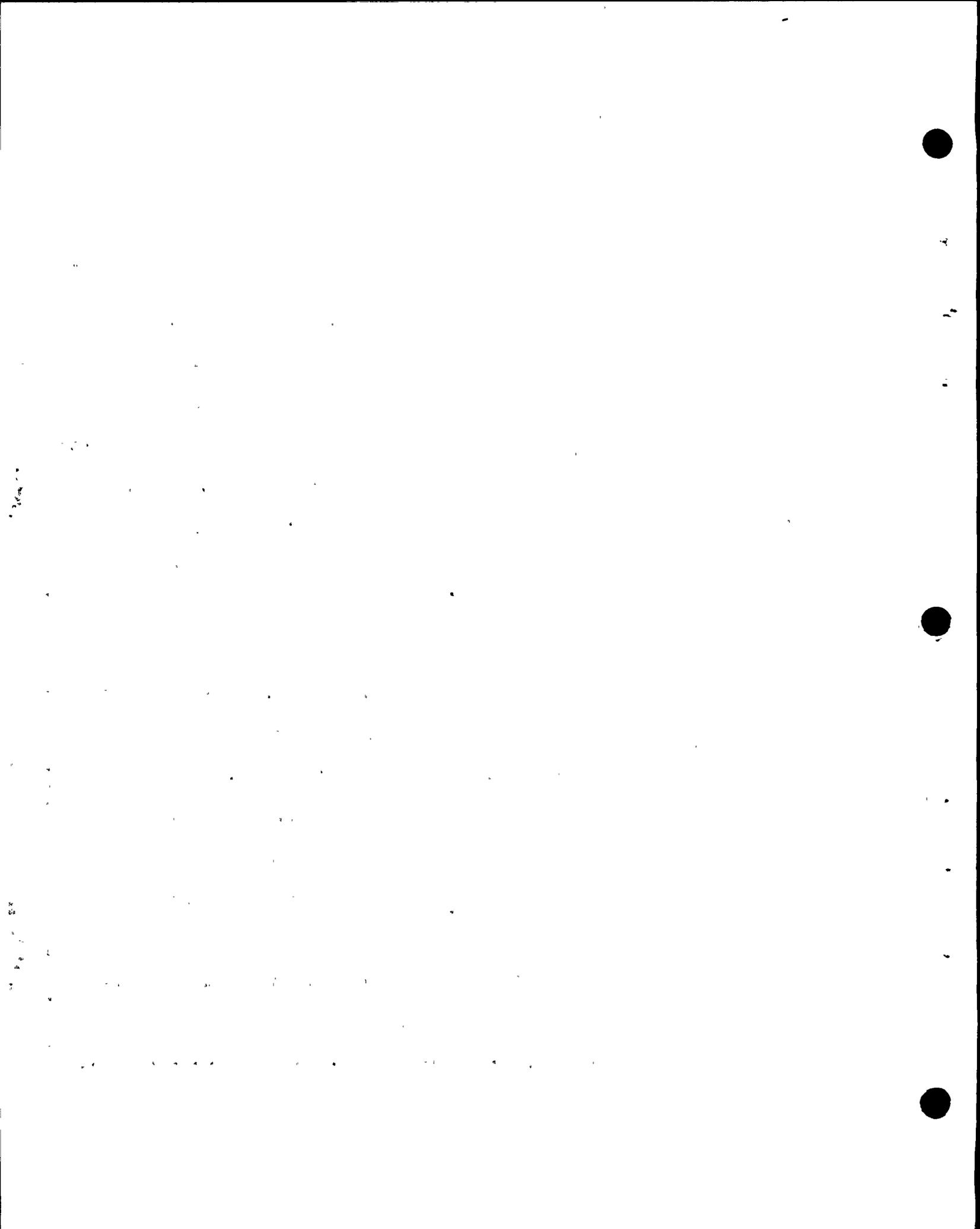
4 Q Now I note in Joint Intervenors' Exhibit C in
5 evidence, on page 3 that-- and, in fact, if you start with
6 the last three words on page 2, "All this has resulted in the
7 effective reduction of the design spectrum amplitude by a
8 factor ranging from about 2 to 3. I am not suggesting here
9 that the design spectra should be increased by these factors.
10 I merely want to point out that starting with perhaps overly
11 conservative earthquake" -- I guess there is the word "a"
12 missing there someplace. " * * * starting with perhaps overly
13 conservative earthquake on the Hosgri Fault and reducing the
14 free field ground motion amplitudes excessively not only sets
15 a precedent which may adversely influence the methodology
16 developed for other plants but simply cannot be justified on
17 some rational engineering or scientific basis."

18 Now that was Dr. Trifunac's writing, of course,
19 that I just read from the exhibit.

20 Did Dr. Trifunac ever indicate to you that he
21 felt that the plant was safe but that he disagreed with the
22 methodology by which that was shown?

23 MR. FLEISCHAKER: Objection.

24 I'm going to object to-- That is rank hearsay,
25 and at this point I think it's totally inappropriate to cross-



1 examine this witness on Dr. Trifunac's conclusions or comments.
2 It can lead to nothing but total confusion in the record.
3 And if the applicant is so interested in Dr. Trifunac --

4 MR. NORTON: We stipulated he could come here.

5 MR. FLEISCHAKER: No, you didn't stipulate he
6 could come here. The rules are that there should be a finding
7 of exceptional circumstances, and the Board so ruled.

8 But, in any case, the basis of the objection is
9 that it's totally inappropriate to cross-examine this witness
10 on what Dr. Trifunac may or might not think, what the meaning
11 of his sentences are and what his conclusions are.

12 The document is in the record. It speaks for
13 itself.

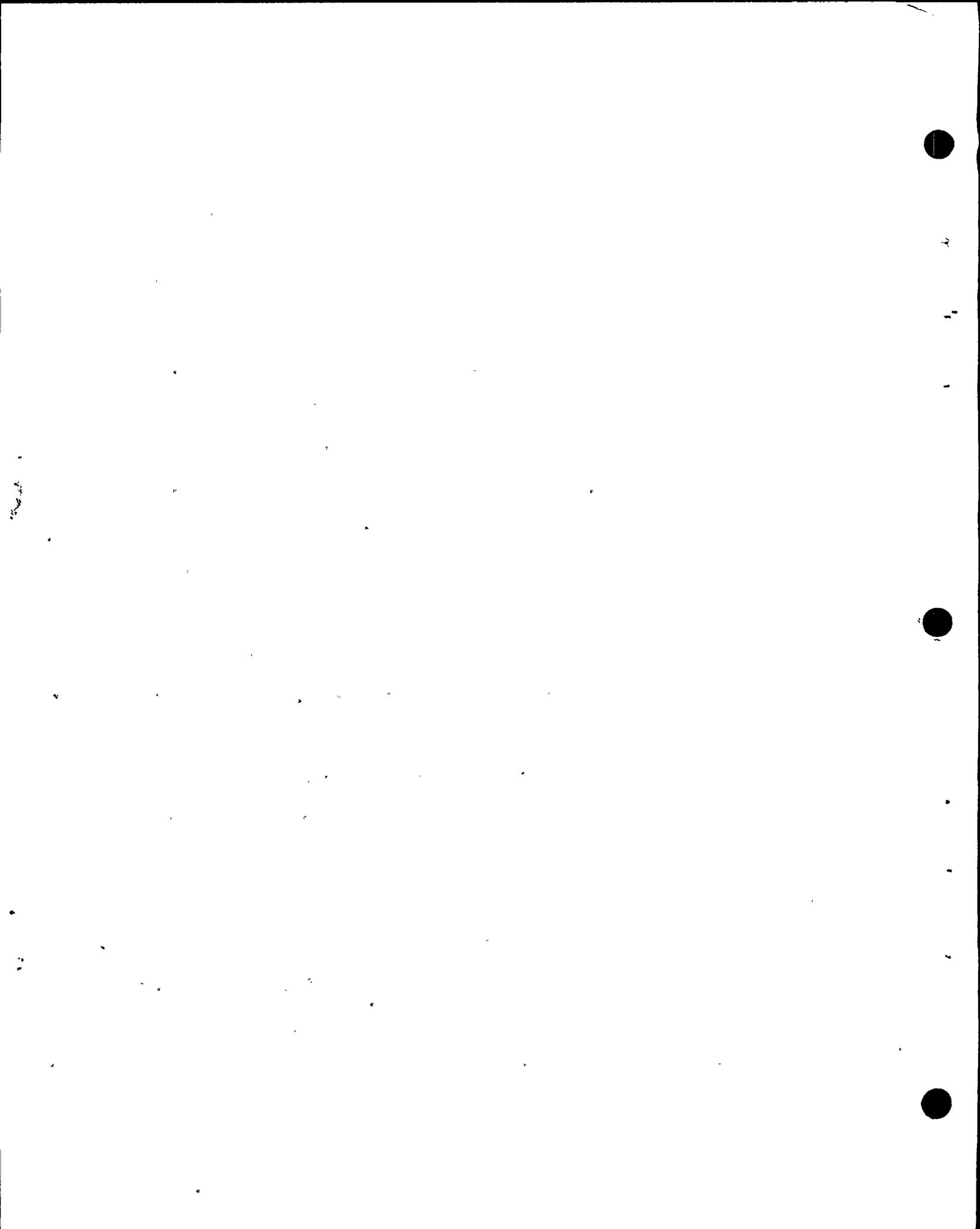
14 MR. NORTON: Well this witness was asked by
15 Mr. Fleischaker a number of times what Dr. Trifunac thought
16 about this probabilistic thing. --which isn't even in the
17 record. And he also said that, well, his memory was that
18 Dr. Trifunac said this. Now I'm asking him what Dr. Trifunac
19 said. And there's no basis for the objection whatsoever.

20 MR. FLEISCHAKER: The document is in the record.
21 It speaks for itself.

22 MR. NORTON: I'm not arguing that it doesn't.

23 MRS. BOWERS: Mr. Tourtellotte?

24 MR. TOURTELLOTTE: Well I think if this witness
25 had any conversations with Dr. Trifunac, and Dr. Trifunac



1 indicated to him, or indicated in his presence where there was
2 a form of round table discussion such as they have at the ACRS
3 meetings and subcommittee meetings, then I think he is
4 entitled to say what it was -- what was his understanding of
5 Dr. Trifunac's remarks.

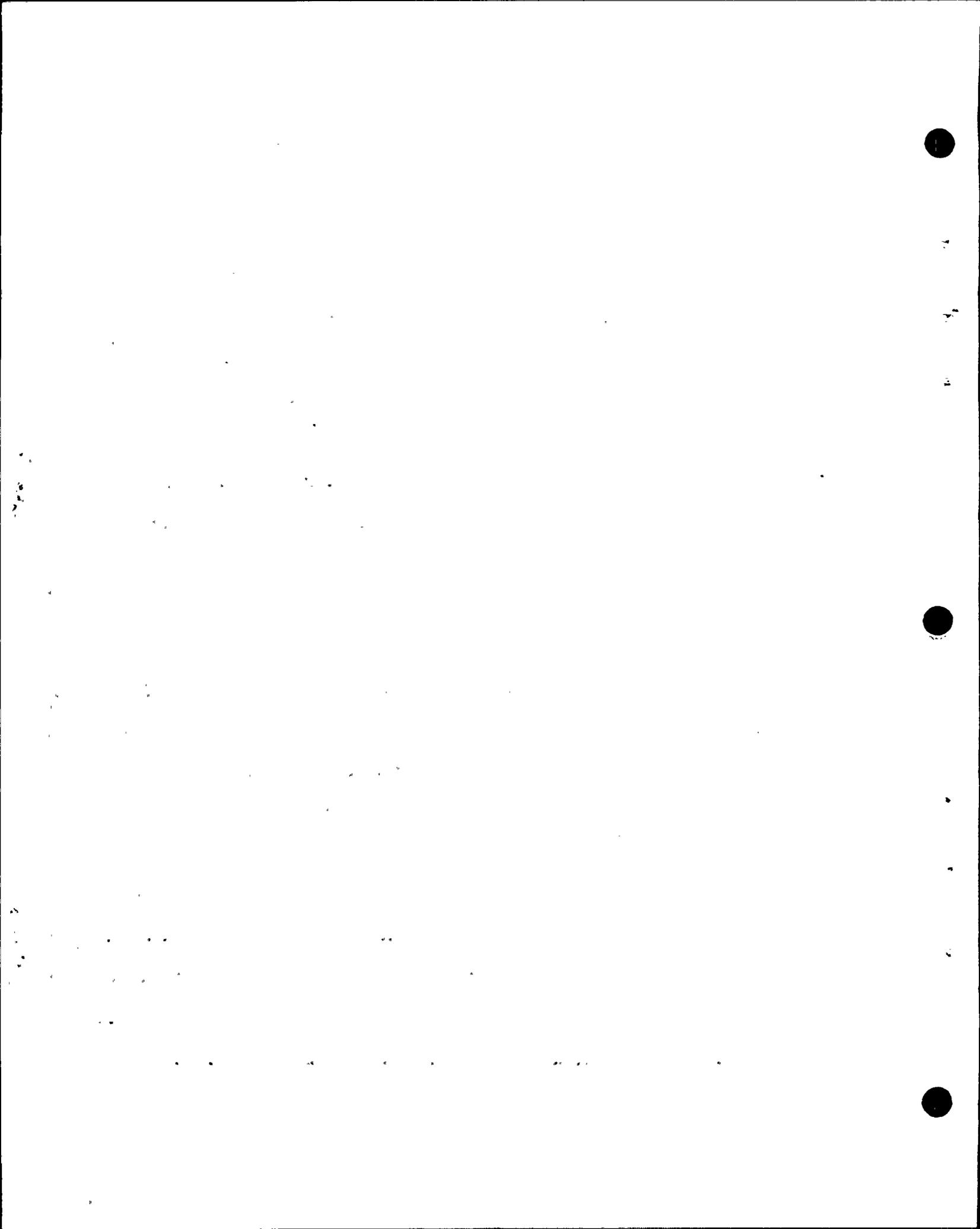
6 MRS. BOWERS: Do you think this is any different
7 from the line of questioning that Mr. Fleischaker asked about
8 what Dr. Trifunac or Dr. Luco had to say at the various meet-
9 ings where Mr. Allison was present?

10 MR. TOURTELLOTTE: Not at all. As a matter of
11 fact, what I'm saying is it's the same thing.

12 MR. FLEISCHAKER: Wait a second. I don't know
13 to what the Board is referring. I had a document here and I
14 asked him whether these recommendations were followed. And I
15 started asking him about some recommendations about probability
16 studies, and then we didn't pursue that.

17 MR. NORTON: Excuse me, Mrs. Bowers. I don't
18 think Mr. Fleischaker did ask him what Dr. Trifunac and Dr.
19 Luco said at any meetings. But whether he did or not, it
20 doesn't make any difference. The fact is that we've got a
21 document here that Dr. Trifunac wrote, we have one Dr. Luco
22 wrote, and he was asked questions about it. Now I'm asking
23 him what Dr. Trifunac said. What's the difference between what
24 he wrote and what he said?

25 MR. FLEISCHAKER: The difference is that-- I don't



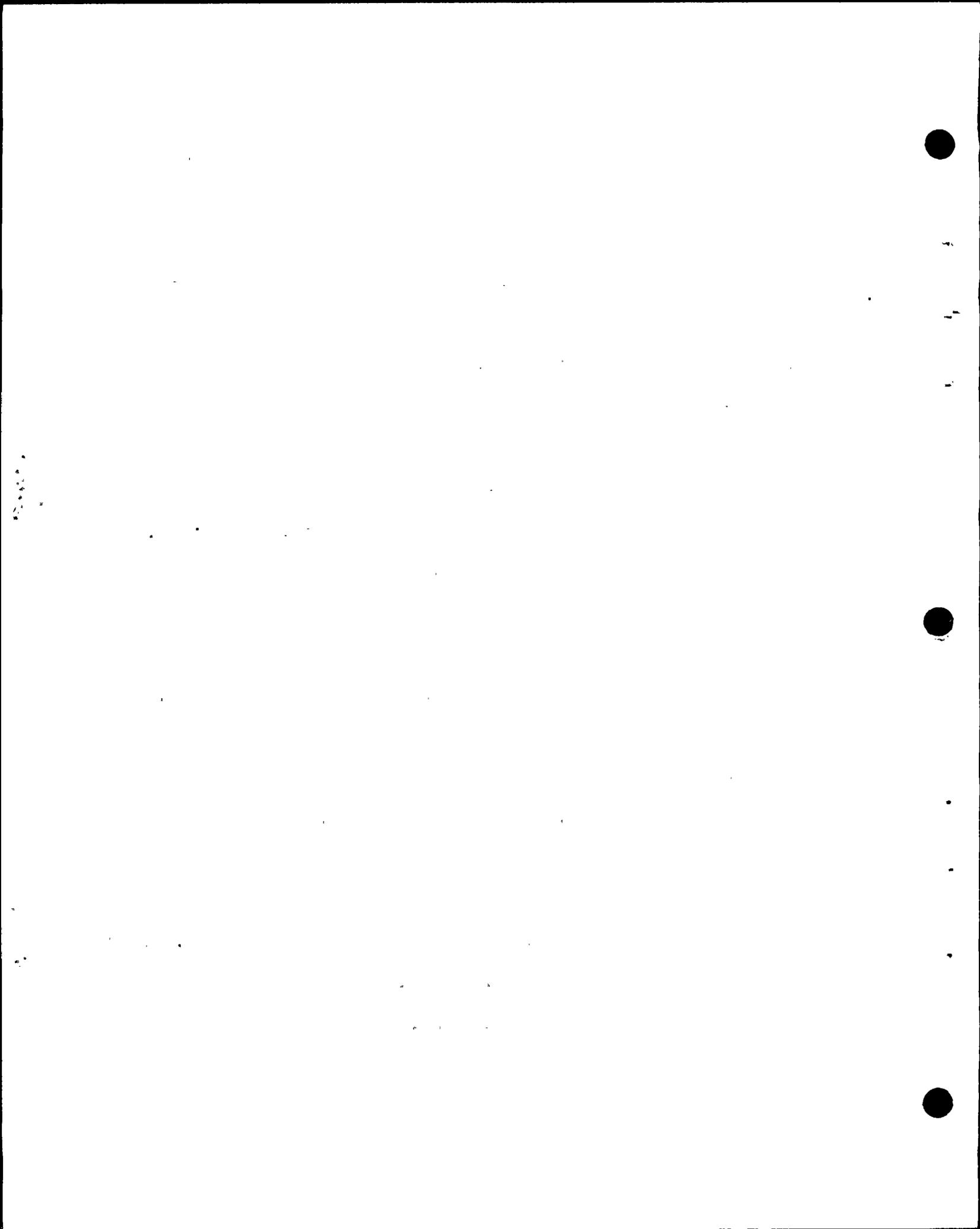
1 know what he said. But this is what hearsay is all about.
2 The document is in the record. It speaks for itself. The
3 document doesn't say it's safe or it's unsafe. Dr. Trifunac
4 in this document has drawn no conclusions about the safety
5 or the lack of safety of the facility. And I think that since
6 the document is in the record it ought to speak for itself
7 and we should not have filtered through this witness's
8 impressions or interpretations what Dr. Trifunac may think
9 or may not think.

10 I have a pretty good feeling of what Dr. Trifunac
11 thinks, but that doesn't matter; the point is, this is
12 hearsay of the worst kind.

13 MR. TOURTELLOTTE: Mrs. Bowers.

14 MRS. BOWERS: Mr. Tourtellotte.

15 MR. TOURTELLOTTE: What he just got through saying
16 is an indictment against virtually his entire questioning of
17 this witness all morning, which is this witness' impression
18 of what other staff members had told him, this witness'
19 impression about what was in this document entitled Joint
20 Intervenors' Exhibit No. 70, and everything -- all the ques-
21 tions he asked about that document. If documents can speak
22 for themselves he need not have asked this witness anything.
23 But documents don't speak for themselves in the first place.
24 In the second place, what is relevant here is, we're talking
25 about statements that were made in the presence of this



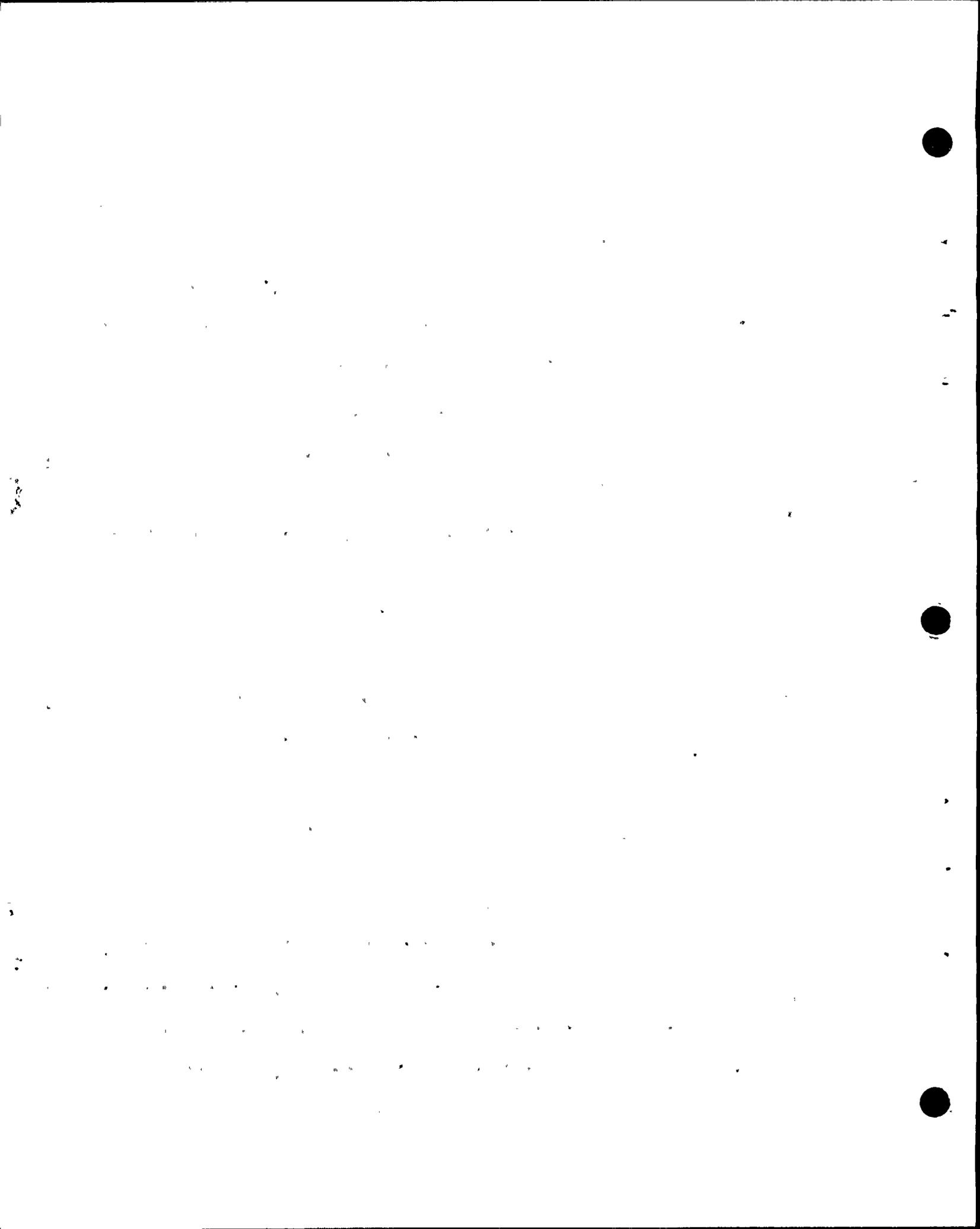
1 witness, either to this witness directly, or indirectly by
2 reason of the kind of round table discussion that they have
3 at ACRS meetings and Subcommittee meetings.

4 MR. NORTON: Mrs. Bowers, I can't believe that
5 I cannot ask a question of a witness if he heard the author
6 of a report in evidence say something that's the subject
7 matter of this report or in any way relevant to the subject
8 matter of this report. I think it's an absurd objection.
9 It's not even hearsay.

10 MRS. BOWERS: Well my comment may have been too
11 narrow. Because, you know, we listened this morning to ques-
12 tion after question about meetings where Mr. Allison was in
13 attendance as to what Dr. Trifunac or Dr. Luco said, I think
14 a minute or so ago I indicated what they said to Mr. Allison
15 or in response to questions. And I was actually recalling
16 that he was present when they made various statements that
17 he recalled.

18 The Board overrules this objection. We think
19 this is a proper line of questioning or we would not have
20 permitted it all morning.

21 MR. NORTON: I believe I'll have to restate the
22 question, it's been so long, rather than have the Court
23 Reporter try to find it on the tape.



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BY MR. NORTON:

Q Isn't it a fact that Dr. Trifunac has stated in your presence, either to you or to someone else, but in your presence, that it is not the resulting safety of the plant that he is concerned about, but the methodology that was used in the analysis that he was concerned about, that in fact he felt there were other factors, for example, the earthquake was too large, and so on and so forth --

MR. FLEISCHAKER: Objection.

BY MR. NORTON:

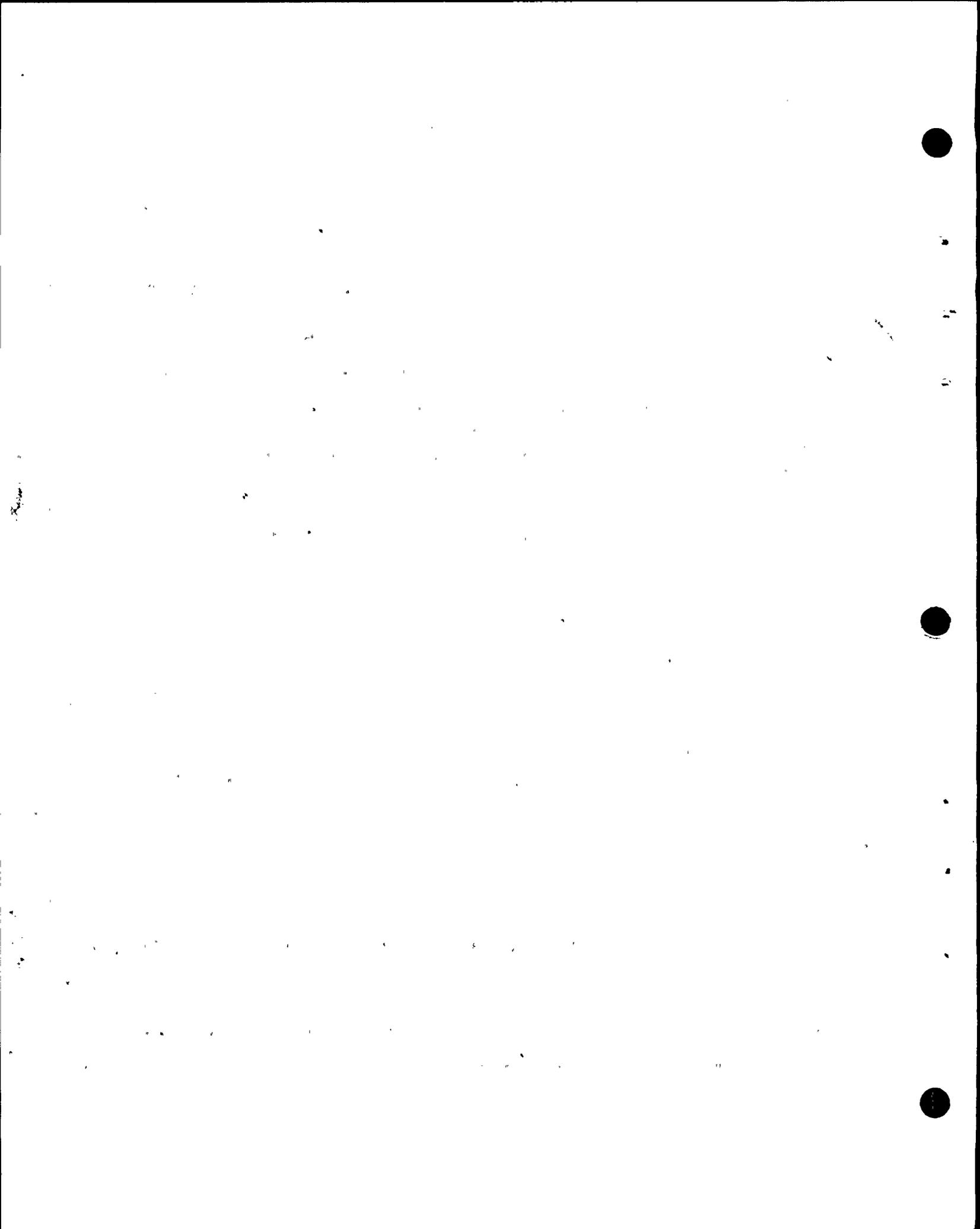
Q -- that he was not concerned about the safety but rather the methodology.

MR. FLEISCHAKER: Objection.

As long as Mr. Norton is going to ask it, why doesn't he just ask the question of Mr. Allison:

What has Dr. Trifunac said to you about the safety of this facility, his opinion on the safety.

MR. NORTON: Dr. Trifunac has made his comments at ACRS Subcommittee meetings. I've heard them. I could testify as to some of the things he's said. But I don't know whether he's had conversations in addition to that with Mr. Allison or not, and so I'm covering the broad spectrum of in any setting, whether it was personally to him or in an ACRS subcommittee meeting or a full Committee meeting, or in the hallway, standing around talking about it outside the



mpb2 1 ACRS subcommittee meeting.

2 You know, I'm covering the broad spectrum with
3 that question.

4 MRS. BOWERS: Mr. Tourtellotte?

5 MR. TOURTELLOTTE: I think we've already said
6 enough.

7 MRS. BOWERS: The objection is overruled. We'd
8 like for the witness to answer the question.

9 THE WITNESS: The answer is yes.

10 MR. NORTON: I have nothing further.

11 MR. FLEISCHAKER: Yes, to what?

12 Can I have the question back?

13 (Whereupon, the Reporter read from the record
14 as requested.)

15 MR. NORTON: He was not concerned about the safety,
16 but rather the methodology.

17 THE WITNESS: I would like to just amplify or
18 correct one of my answers to one of your questions.

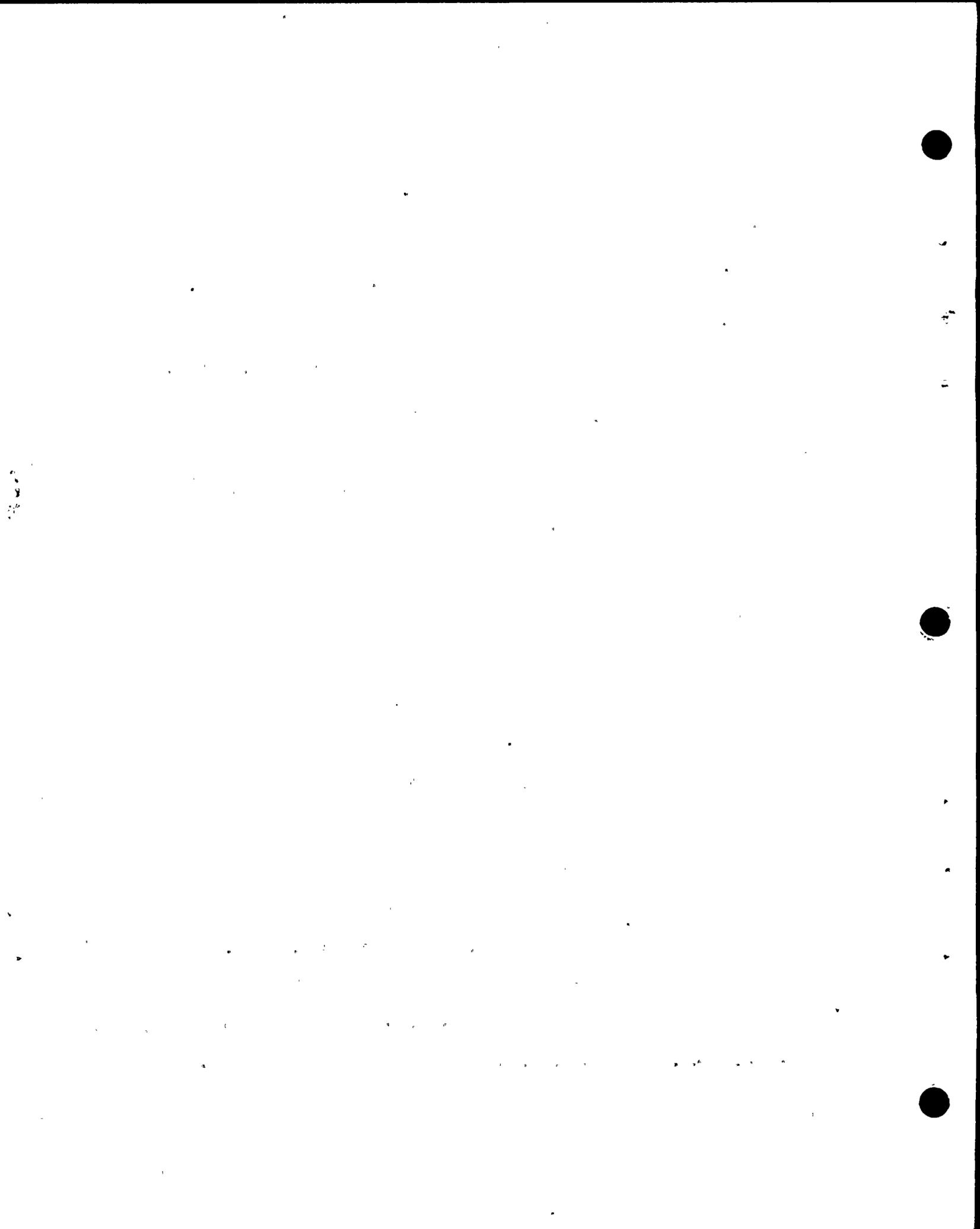
19 BY MR. NORTON:

20 Q Sure.

21 A You recall when we were talking about Table 10-1?

22 Q Yes.

23 A I was explaining why we had not reviewed some
24 of the sensitivity studies or responses to ACRS consultants'
25 comments in the full blown review sense, anyway. It may have



mpb3 1 sounded like we didn't review any of it, and that's not true.
2 Some of them -- for instance, damping, we did go over it with
3 great zeal because we wanted to use that information or be-
4 cause we were interested in it, or whatever.

5 So I was explaining -- I just want to make it
6 clear I was explaining why some of the reports we may not
7 have reviewed in great detail and sent questions and so on.
8 But I didn't mean at all to imply that we hadn't reviewed
9 any of them.

10 Some of these are, in fact, part of the main case.
11 And they have been reviewed.

12 Q Are you aware why they're called "DLL" reports?
13 I'm sure everybody in the world here reads this, DLL reports.
14 Everyone that hears the "LL", they wonder why they're LL
15 reports.

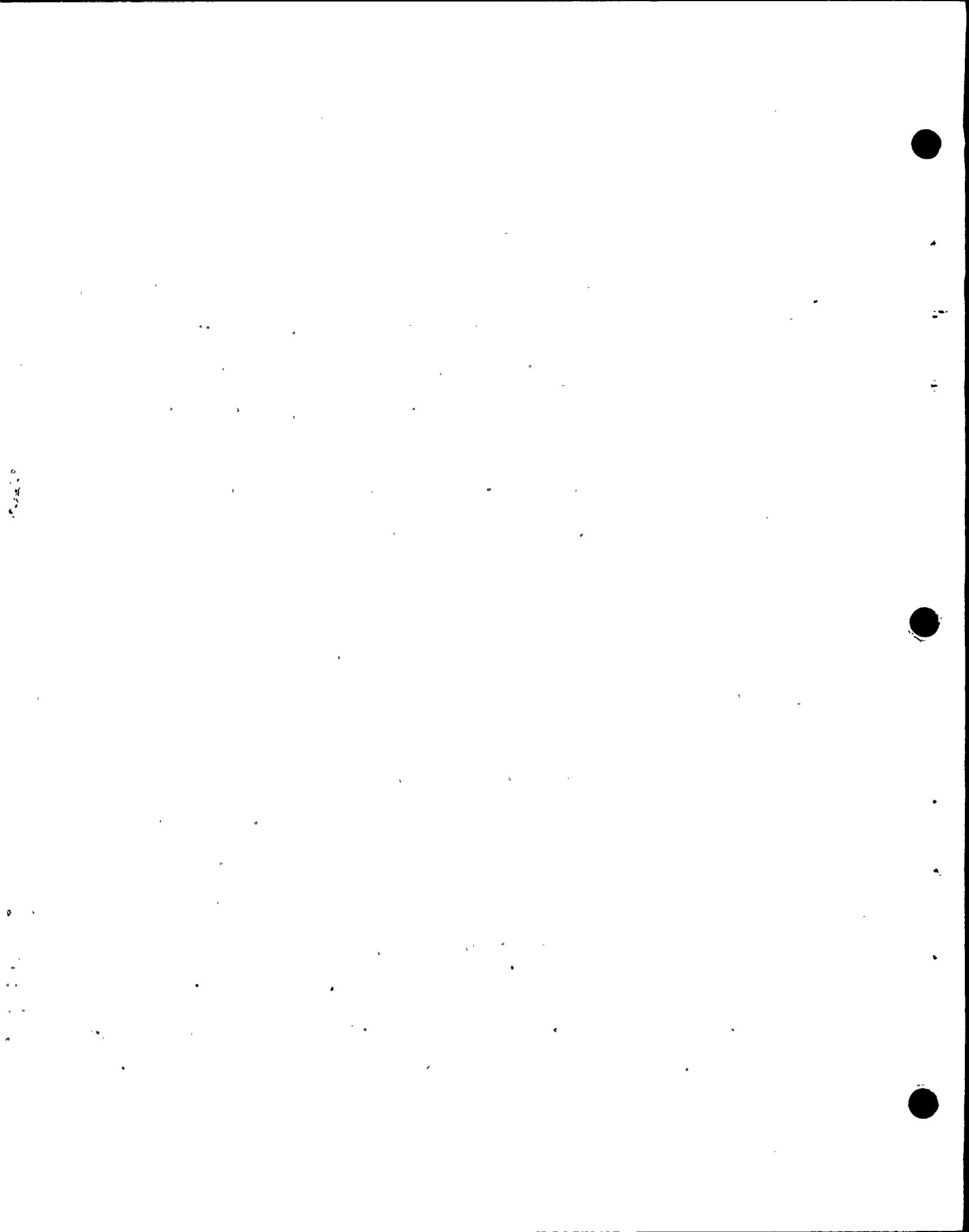
16 A Yes, I'm aware of it.

17 Q Well, why don't you explain it to the Board?

18 A Yes.

19 Dr. Blume as a consultant to the Applicant, made
20 up one time about three years ago a laundry list of all the
21 research, studies, what have you, that the Applicant should do
22 or that Dr. Blume considered that might be done or so on. And
23 that's where these things come from. They're "Dr. Blume's
24 Laundry List, Item number ten, or eleven, or so on."

25 (Laughter.)



mpb4

1 Q So that's the term LL, Laundry List. Okay.

2 MR. NORTON: Nothing farther.

3 MRS. BOWERS: Well, Mr. Tourtellotte, the Board
4 has no questions.

5 MR. FLEISCHAKER: Before Mr. Tourtellotte begins,
6 can I do some cross-examination? I have questions that were
7 raised by Mr. Norton's last line of questioning. And I
8 figure I might as well do that before Mr. Tourtellotte so
9 that he can just clean up.

10 MRS. BOWERS: Well, we have permitted this on
11 occasion, while we feel that it's not the best way to proceed.

12 Mr. Norton or Mr. Tourtellotte, do you have any
13 objection to Mr. Fleischaker asking a few questions?

14 MR. NORTON: I don't have any. That's Mr.
15 Tourtellotte's prerogative.

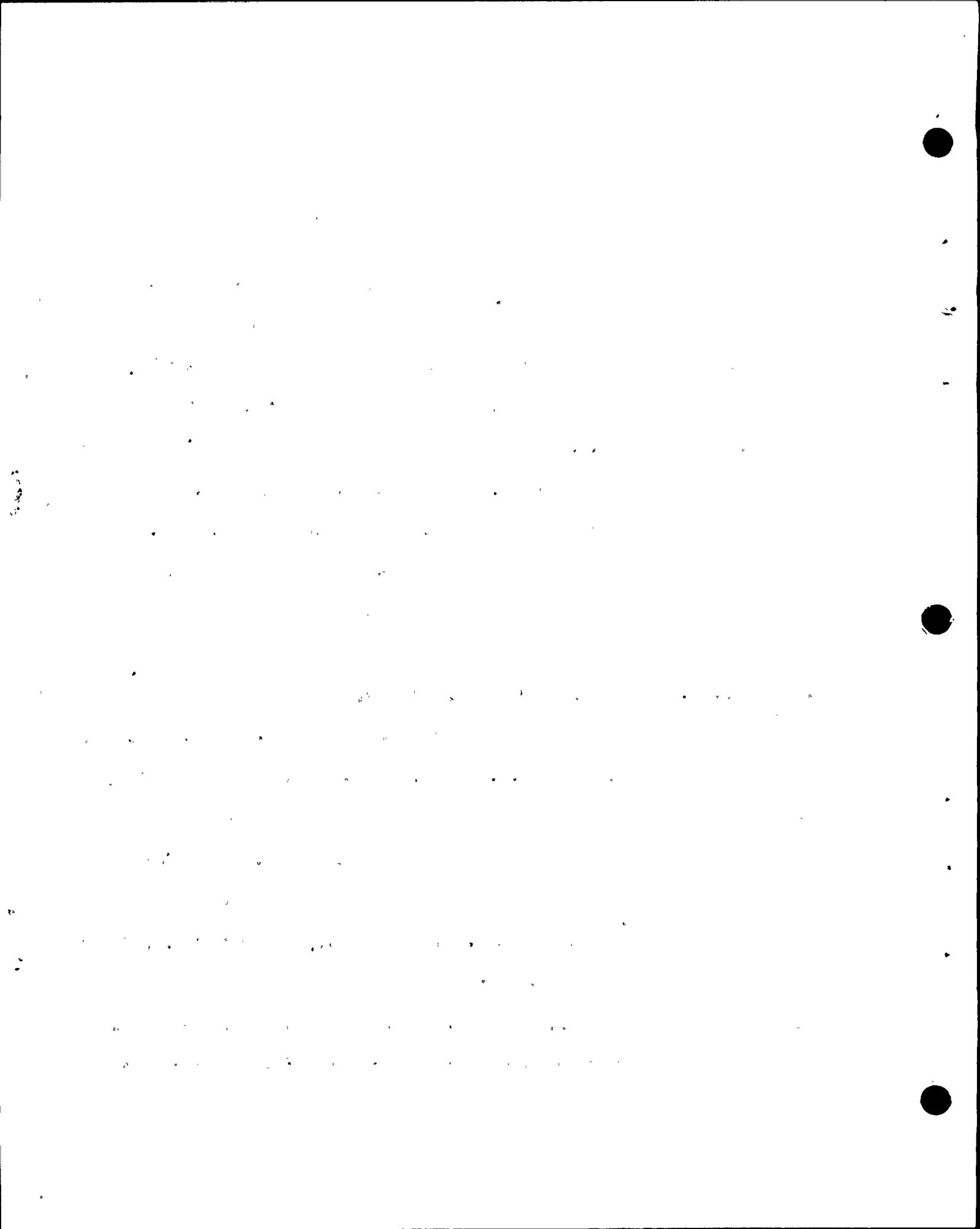
16 MR. TOURTELLOTTE: Not a few.

17 BY MR. FLEISCHAKER:

18 Q Mr. Allison, these conversations or these dis-
19 cussions that you've overheard with Dr. Trifunac, what did
20 Dr. Trifunac say about the safety of the facility?

21 A I recall three conversations.

22 One is a conversation between Dr. Trifunac and
23 myself on the phone alone. I asked him what was wrong with
24 our approach, and so on, and he told me, and they are the
25 kinds of things we've seen before. And I don't recall exactly



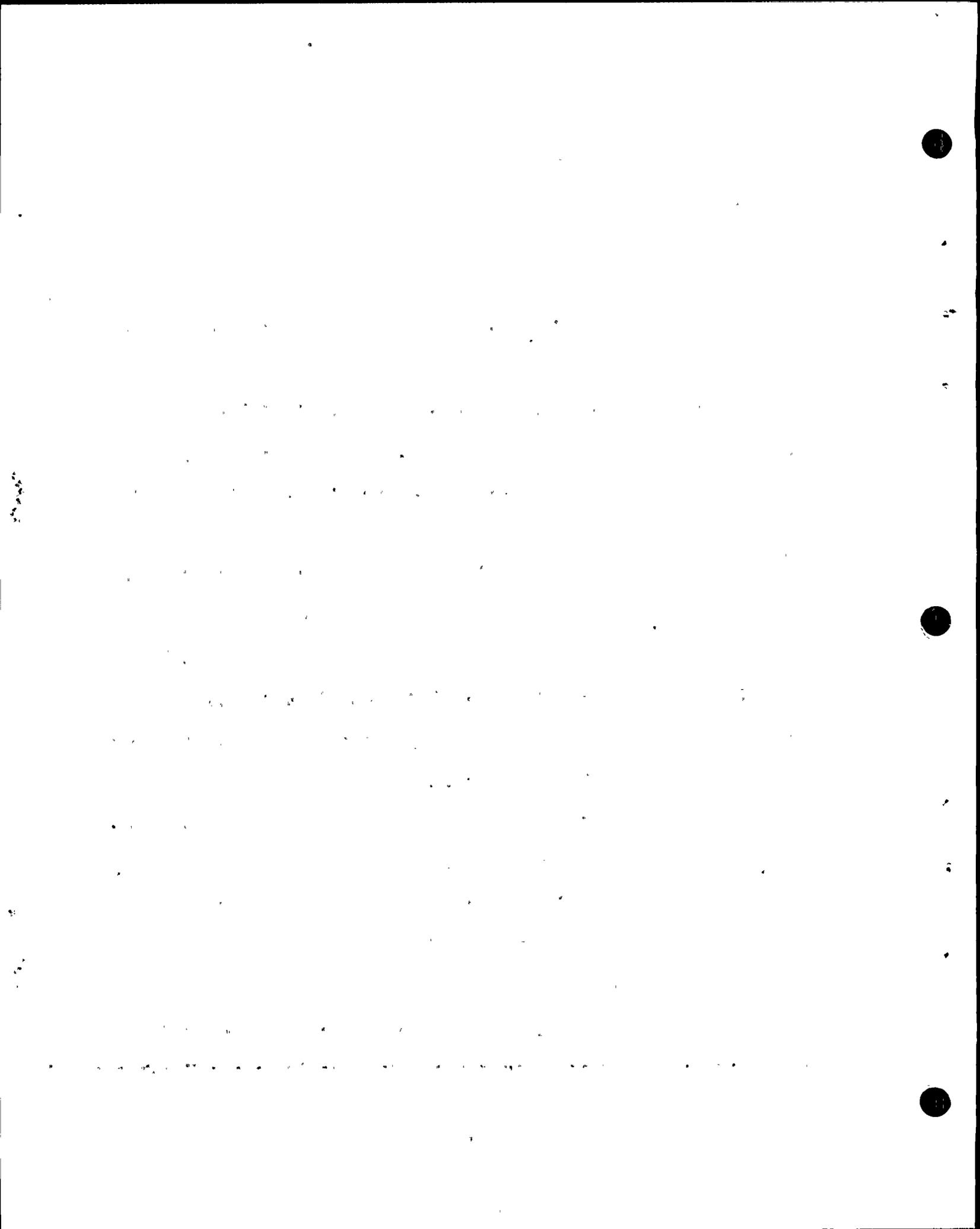
mpb5 1 what he said. I do recall though, that in the end he said
2 he thought that the design basis, the .75g acceleration and
3 the response spectra were a good selection. But he didn't
4 like the methodology.

5 Finally, I asked him, Well, what would you do if
6 you were the Staff? And he said he would do a uniform risk
7 kind of an assessment. And basically instead of trying to
8 do a deterministic kind of analysis, he would look at it
9 from the standpoint of risk and decide what risk is accept-
10 able and design the facility, then, for that risk.

11 The second conversation was -- in that first
12 conversation I'd like to qualify my recollection is he
13 said it's "probably" all right, it's "probably" a good
14 selection, "probably" perfectly okay. But the word "probably"
15 sticks in. That's my recollection.

16 And the second one that I remember was a conver-
17 sation at an ACRS meeting, one of the hall conversations,
18 where Mr. Knight and I and several other members of the Staff
19 were present and we were talking to Dr. Trifunac and my
20 recollection of what he said at that time was that it was
21 an adequate design basis, but, once again, the methodology
22 he thought was not acceptable.

23 The third thing that I can recall is Dr. Trifunac's
24 statements to the ACRS in the last series of subcommittee and
25 full Committee meetings, which are basically answers to



mpb6

1 questions. Those are available to us in written form. We
2 can all review them. But the substance, which I will try
3 to summarize is Do you have a problem? Is there any thing
4 wrong with the design basis, or do you have any problem with
5 the design basis plant?

6 Dr. Trifunac's answer was, as I recall, along
7 this line:

8 No, I don't. And that's an intuitive answer
9 in the sense that I haven't done my own analysis my own way
10 to show that this is exactly the right design basis, but it
11 seems all right.

12 Q Now in the first conversation, do you recall
13 whether Dr. Trifunac was talking about selection of the
14 response spectra including the incorporation of tau in the
15 high damping, or was he talking about just the...

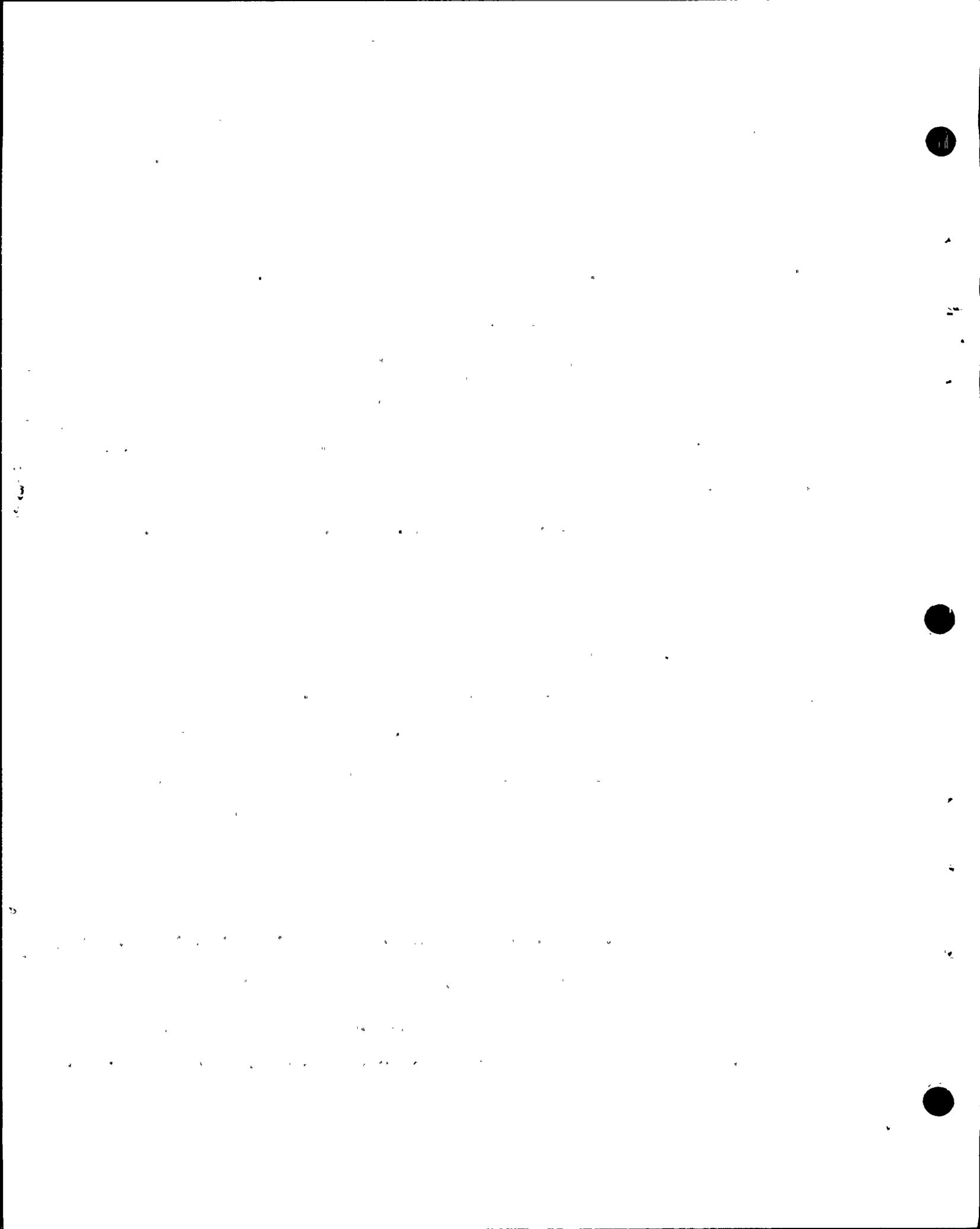
16 A It's my recollection that at that time he was
17 talking about .75g, just the number.

18 Q So he wasn't talking about the ultimate spectra
19 that was used in the analysis?

20 A No. I believe the conversation took place
21 before that spectrum was available.

22 Q Okay.

23 Now the second conversation, when he said he
24 thought there was an adequate design basis, again I ask you
25 the question:



mpb7

1 Was Dr. Trifunac discussing the ultimate response
2 spectra that results when you incorporate the damping and
3 the tau effect in the .75g effective acceleration?

4 A I don't know, for the second one.

5 Q How about the third time? Do you know whether
6 Dr. Trifunac has ever accepted the spectrum given the damping,
7 the high damping, the tau effect reduction in the high fre-
8 quency range, and the effective acceleration of .75g?

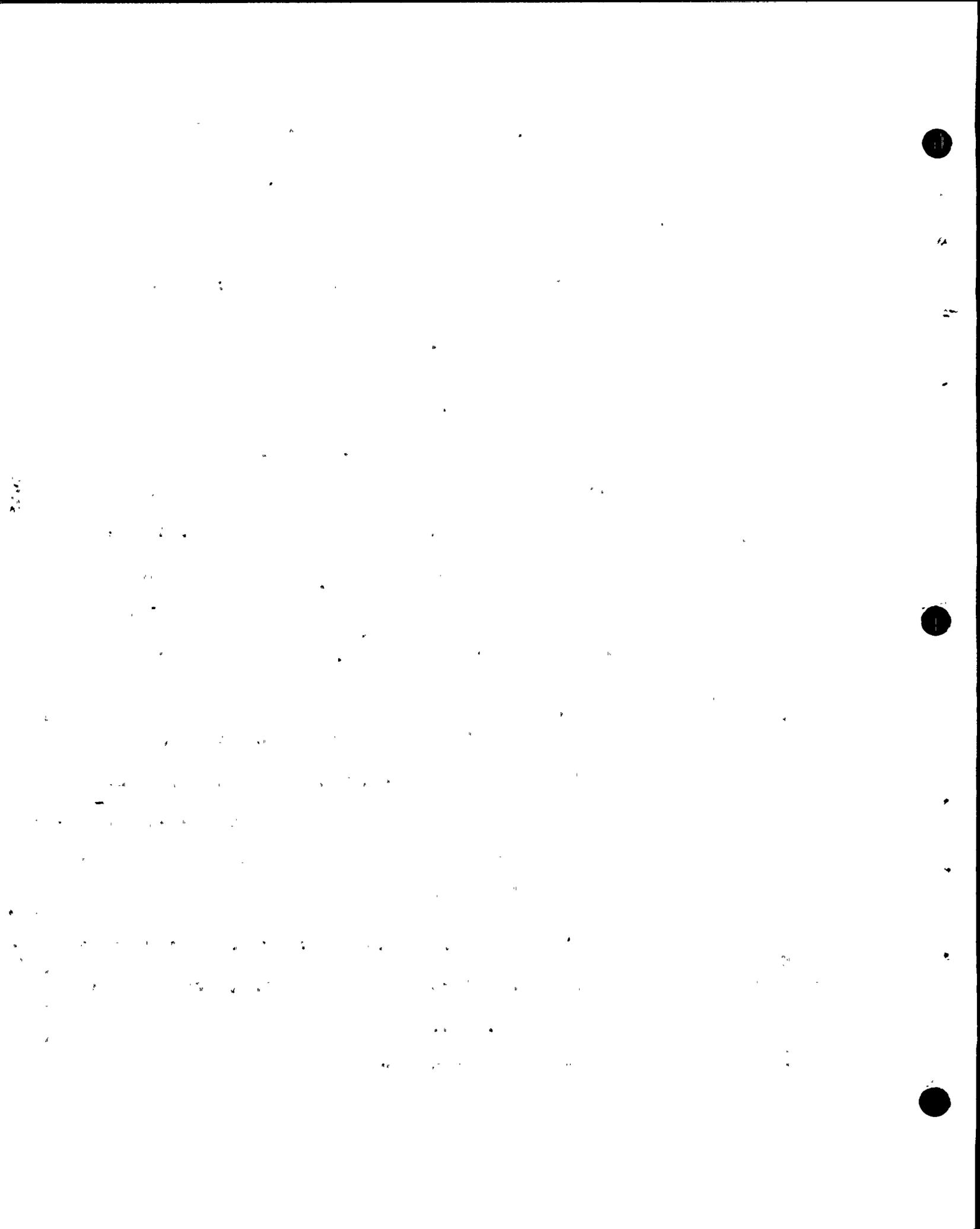
9 A I believe he was talking about the whole thing
10 the third time.

11 Q Was he talking about with respect to structure,
12 structural safety?

13 A As I understand it, that's his area of expertise,
14 seismology and structural engineering. So that would be what
15 he was talking about, we would assume, anyway.

16 Q Do you know whether Dr. Trifunac's comments were
17 to the effect that he believed they went to the adequacy of
18 the structure or whether they included both the adequacy of
19 the structure and the equipment and components. -- let me
20 restate that.

21 Do you know whether Dr. Trifunac's comments were
22 to the effect that the use of the Newmark response spectra
23 was adequate for structural analysis, or was he saying that it
24 was adequate for structural analysis as well as the derivation
25 of floor response spectra for ultimate analysis of equipment?



mpb8

1

MR. TOURTELLOTT: I object to the question, Mrs.

2

Bowers.

3

The way it's phrased Mr. Fleischaker is asking this witness to actually read Trifunac's mind. And while I think the world of Dennis's abilities, I don't think that mind reading is one of them.

7

(Laughter.)

8

Nor do I believe that it's appropriate to elicit that kind of information in cross-examination.

10

The statement was made by this witness very clearly that Dr. Trifunac made the statement that he didn't have any difficulty with the design basis for the plant. Now what was going on in his mind, whether it was one part of the design or some other part of the design was apparently not manifested in what he had to say.

11

12

13

14

15

16

MR. NORTON: Same objection, Mrs. Bowers.

17

Mr. Fleischaker, I have a right to object too.

18

To ask a witness what he thinks someone else thought is totally improper. To ask him what he said, which is what I asked him, is proper.

19

20

21

MR. FLEISCHAKER: Well, I didn't ask him what he thought, I asked him how he took his comment. And I think that as long as we're in this --

22

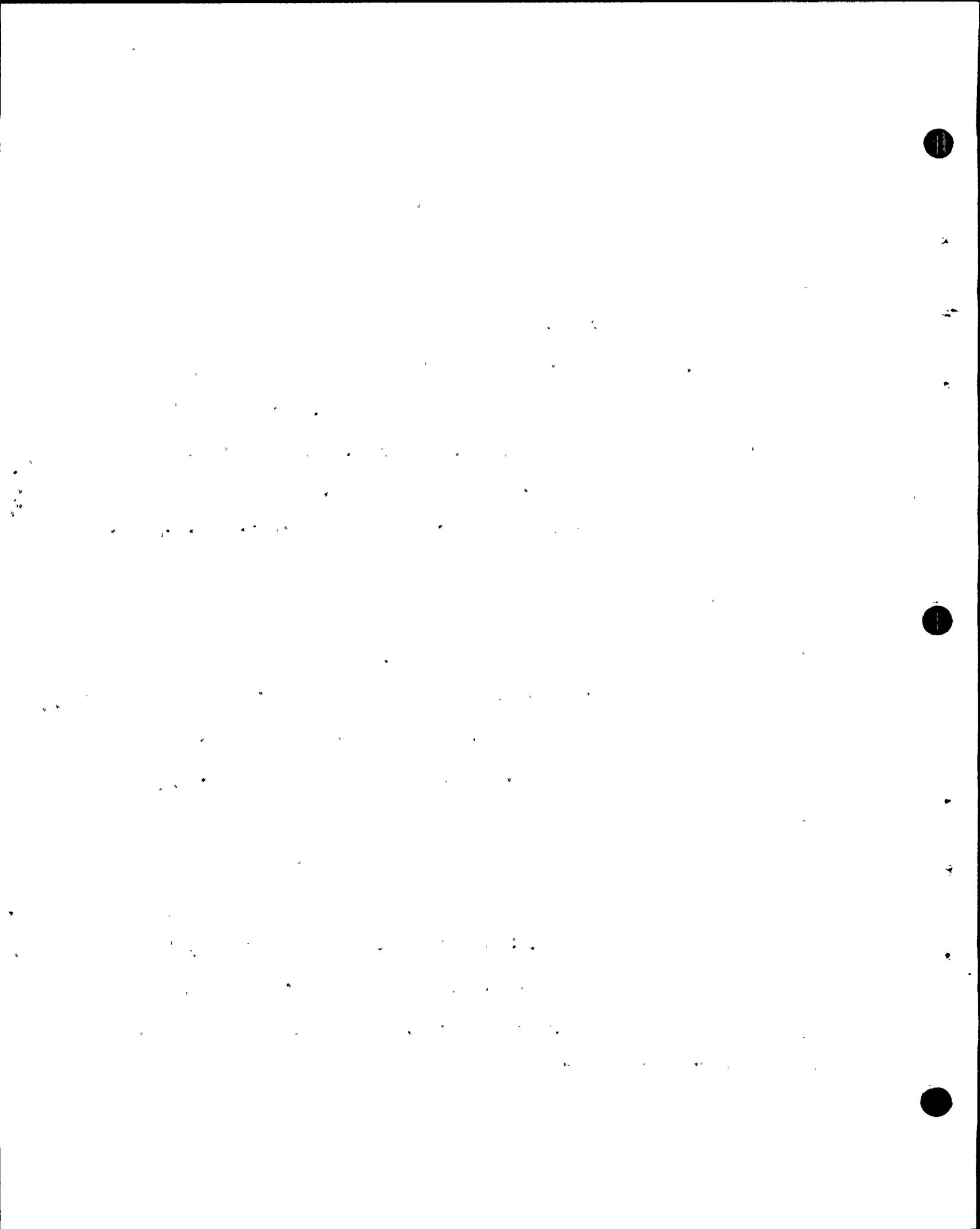
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24

MR. NORTON: Objection.

25

That calls for speculation.



mpb9

1 MR. FLEISCHAKER: -- that's right, and we're
2 here because we're into hearsay. And we've got some vague
3 statements about what Trifunac meant when he made these
4 statements.

5 It happens to be that I've had a number of
6 comments with Dr. Trifunac. I could get up there and
7 testify as to what he thinks too. But I'm a lawyer.

8 And I think as long as we're off into this field
9 -- and I might add, I'm asking Mr. Allison because I think
10 he has as good answers as anybody. So I think as long as
11 we're off into this field, I should have the right to probe
12 the hearsay statements that are currently in the record.

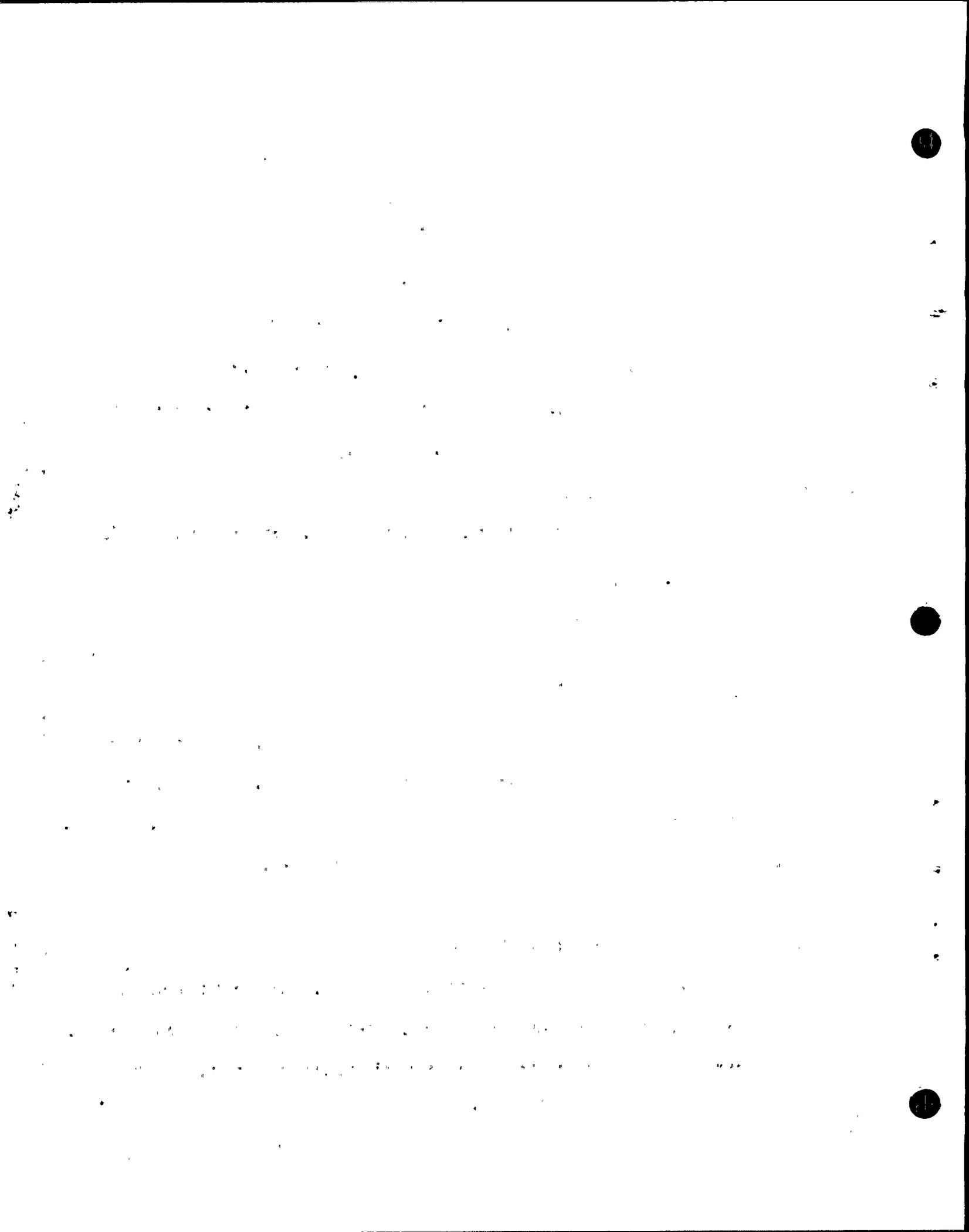
13 MR. NORTON: Excuse me, Mrs. Bowers.

14 I don't believe these are hearsay statements.
15 This witness is testifying what he heard. He's not testifying
16 the accuracy of that or the fact that somebody told him that
17 somebody told him that somebody told him, or anything like
18 that.

19 He's saying I was there and this is what was said.
20 And it's relevant to these documents that are in evidence.

21 MR. FLEISCHAKER: Hearsay is an out-of-court
22 statement that, you know, that is given to demonstrate the
23 truth of the matter contained in the statement. This is a
24 hearsay statement.

25 MR. NORTON: Well, is it Mr. Fleischaker's position



mpbl0 1 that hearsay statements are not admissible in administrative
2 proceedings?

3 MR. FLEISCHAKER: No.

4 I'm saying as long as it's there I should have
5 the opportunity to try to explore.

6 MR. TOURTELLOTTE: Well, Mrs. Bowers, I don't
7 have any difficulty with this trying to explore it. But he
8 can't ask the question in such a way as to try to get this
9 witness's impression of what somebody else was thinking.

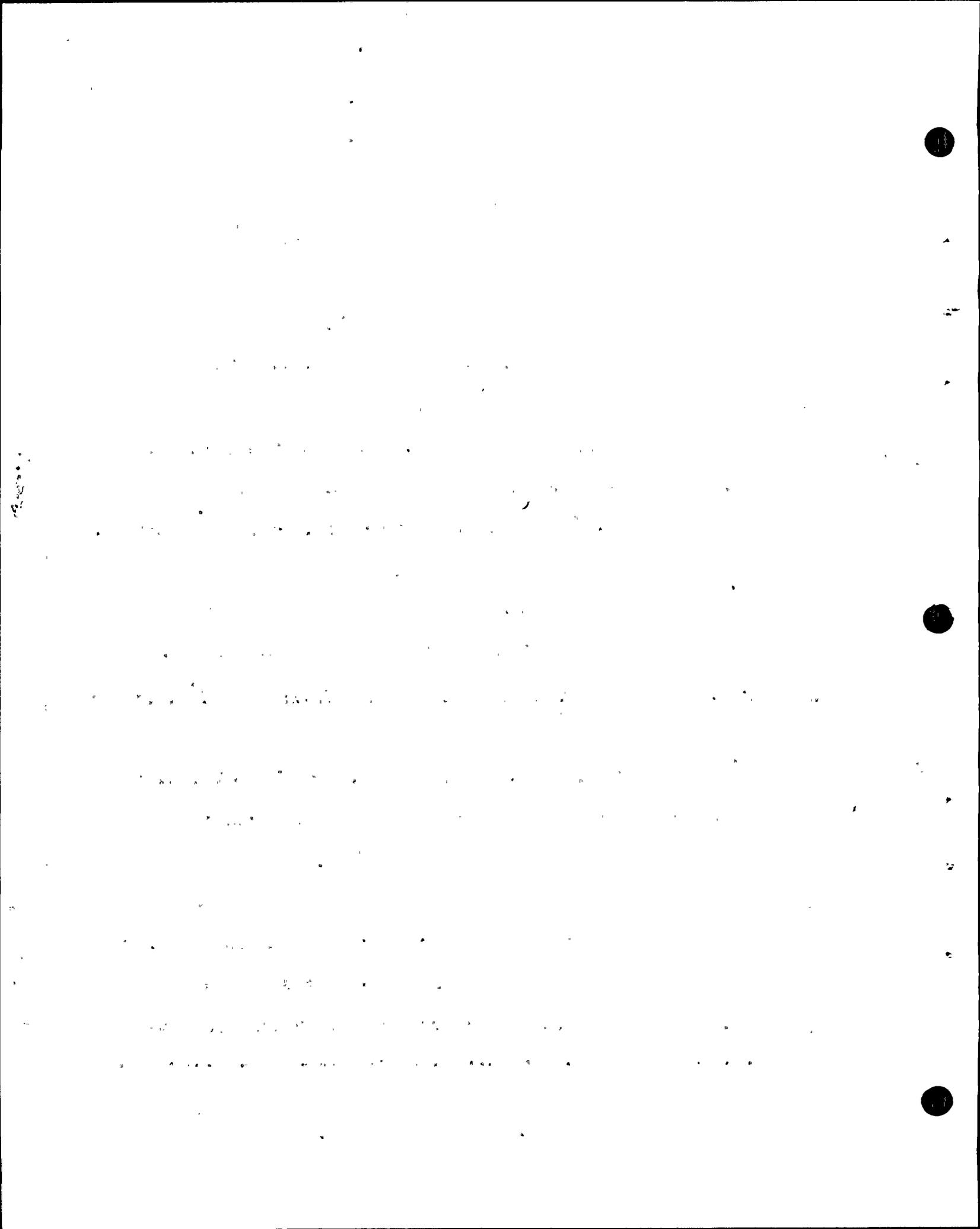
10 That has no value at all.

11 The only way he can probe it is to find out if
12 the witness said anything else. Did he say anything else that
13 would indicate anything else. And if he didn't, why, he
14 didn't. And if he did say something else, fine. Let's hear
15 it.

16 MRS. BOWERS: Well, the objection is sustained.
17 We do think it's improper to ask this witness what he might
18 have thought that Dr. Trifunac might have been thinking. And
19 matters, of course, that were expressed by Dr. Trifunac are
20 very appropriate.

21 BY MR. FLEISCHAKER:

22 Q In his statement, did Dr. Trifunac make clear
23 that he thought that the Newmark response spectra was adequate?
24 Did he make clear that the Newmark response spectra was ade-
25 quate for reanalysis of the structures, systems, and



mpb11 1 components of the Diablo Canyon Nuclear Power Plant?

2 MR. NORTON: Object.

3 Asked and Answered.

4 MR. FLEISCHAKER: It hasn't been asked and answer-
5 ed.

6 MRS. BOWERS: Mr. Tourtellotte?

7 MR. TOURTELLOTTE: I have nothing to offer.

8 (The Board conferring.)

9 MRS. BOWERS: The Board is unsure that this
10 particular question has been asked and answered.

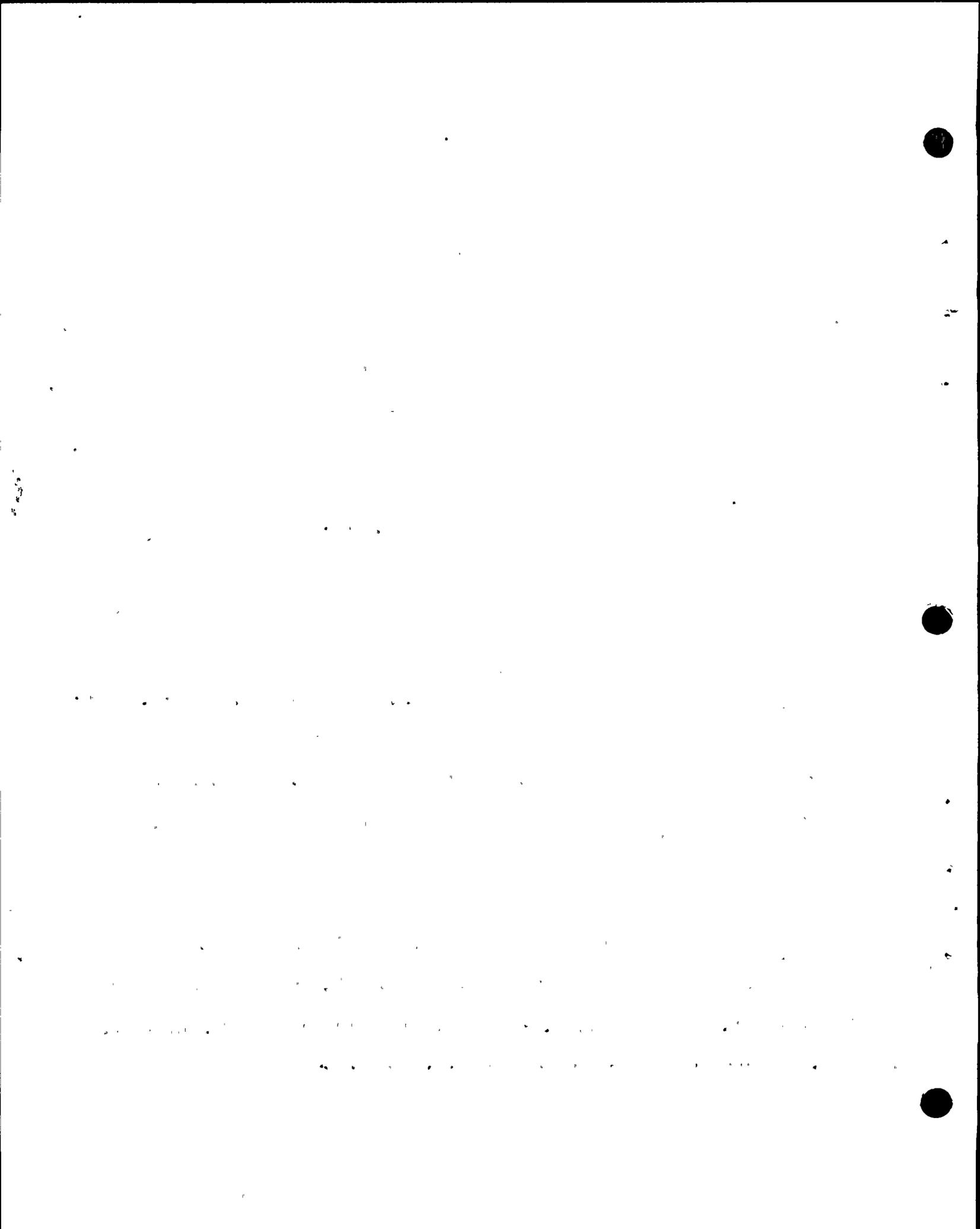
11 So we'd like for the witness -- the objection is
12 overruled. We'd like for the witness to answer.

13 THE WITNESS: With regard to the third set of
14 statements that I recall at the ACRS, Dr. Trifunac did not
15 specifically say what he was talking about. So that the ans-
16 wer to your question is no.

17 Of course, the context was such that I think one
18 would assume he was talking about the whole thing.

19 The second conversation, I don't know.

20 In the first conversation, which was long ago,
21 and I said I thought he was only talking about the .75g
22 number and not the whole thing. He said something else
23 that's pertinent to it, to the question you're asking, and
24 that is he told me at that time that he was not concerned
25 about the structures. He felt that basically based on



mpb12 1 experience in earthquakes where conventional structures have
2 stood up to some pretty severe shocks, extrapolate that to a
3 nuclear power plant structure that was designed for a pretty
4 high value to start with, built with quality assurance, the
5 basic impression I got there was that the earthquake has not
6 ever been invented that would damage one of those structures.

7 However, he was concerned that, you know, as I
8 said before in that first conversation, he didn't like our
9 methodology. And his opinion was that you couldn't hurt the
10 structures, so the only thing to be concerned about, then,
11 was whether we were using a high enough input to design the
12 equipment and components.

13 So that was his concern at that time, clearly.

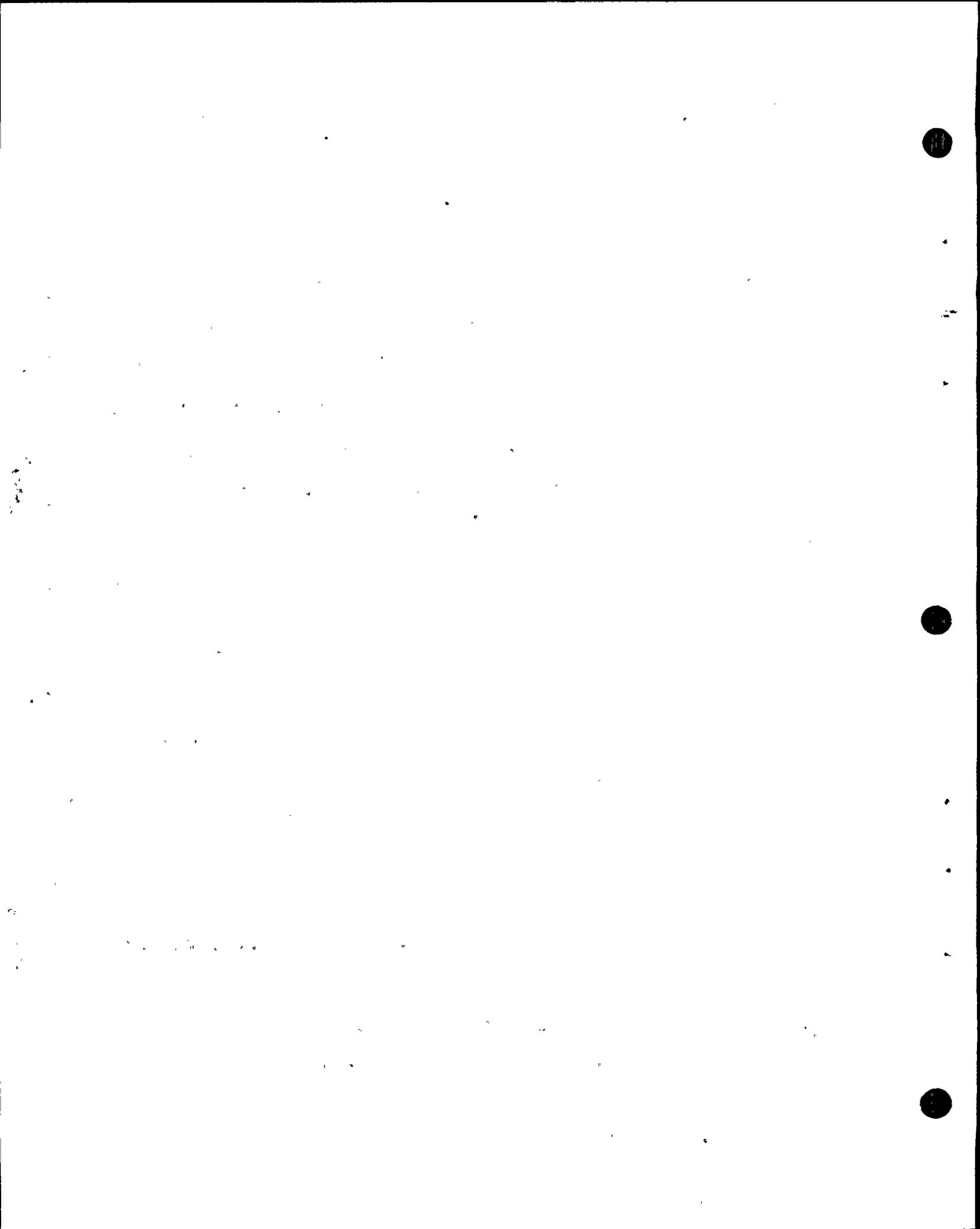
14 In the second one, as I said, I don't remember.

15 The third one, I don't recall that he -- I don't
16 recall any specific definition of the scope of what he was
17 talking about, so I don't think he made it clear from the
18 context that one should assume that he's talking about the
19 whole thing.

20 BY MR. FLEISCHAKER:

21 Q Well, then, your impression is that by the end
22 he was satisfied by use of that particular response spectra
23 for analyzing the adequacy of the structures, systems, and
24 components, is that your understanding?

25 A That's -- well, that's my impression.



mpbl3 1 Q And you take that from the context of the conver-
2 sation?

3 A Well, not only from the context of the conversa-
4 tion, but from the fact that the whole reanalysis has been
5 done. There was an evolution of knowledge.

6 In the first conversation we were talking about
7 a simple number. We didn't even have the spectra. But I
8 guess that's -- no, let's just say from the context. I think
9 it's reasonable to assume that's what he meant.

10 Q Now is this a statement that is in the ACRS
11 record?

12 A Yes, it is.

13 Q Okay.

14 A A couple or three times in that last series of
15 meetings.

16 MR. FLEISCHAKER: I have no further questions.

17 MRS. BOWERS: Mr. Tourtellotte?

18 MR. TOURTELLOTTE: Well, since it's so close to
19 the noon hour, why don't we save my redirect until after lunch.

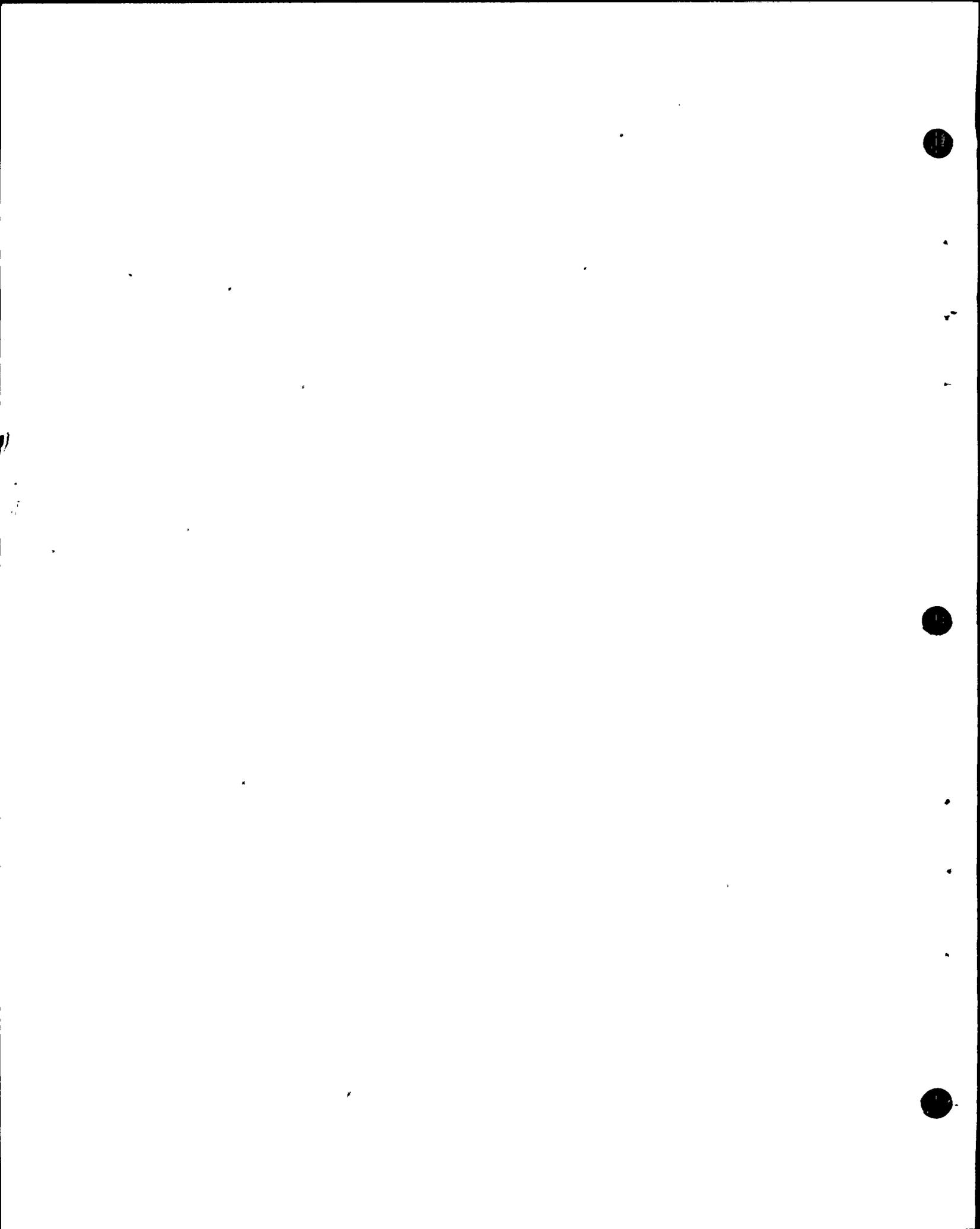
20 MRS. BOWERS: Well, fine.

21 But we'd like to have a bench conference for a
22 few minutes.

23 MR. TOURTELLOTTE: Okay.

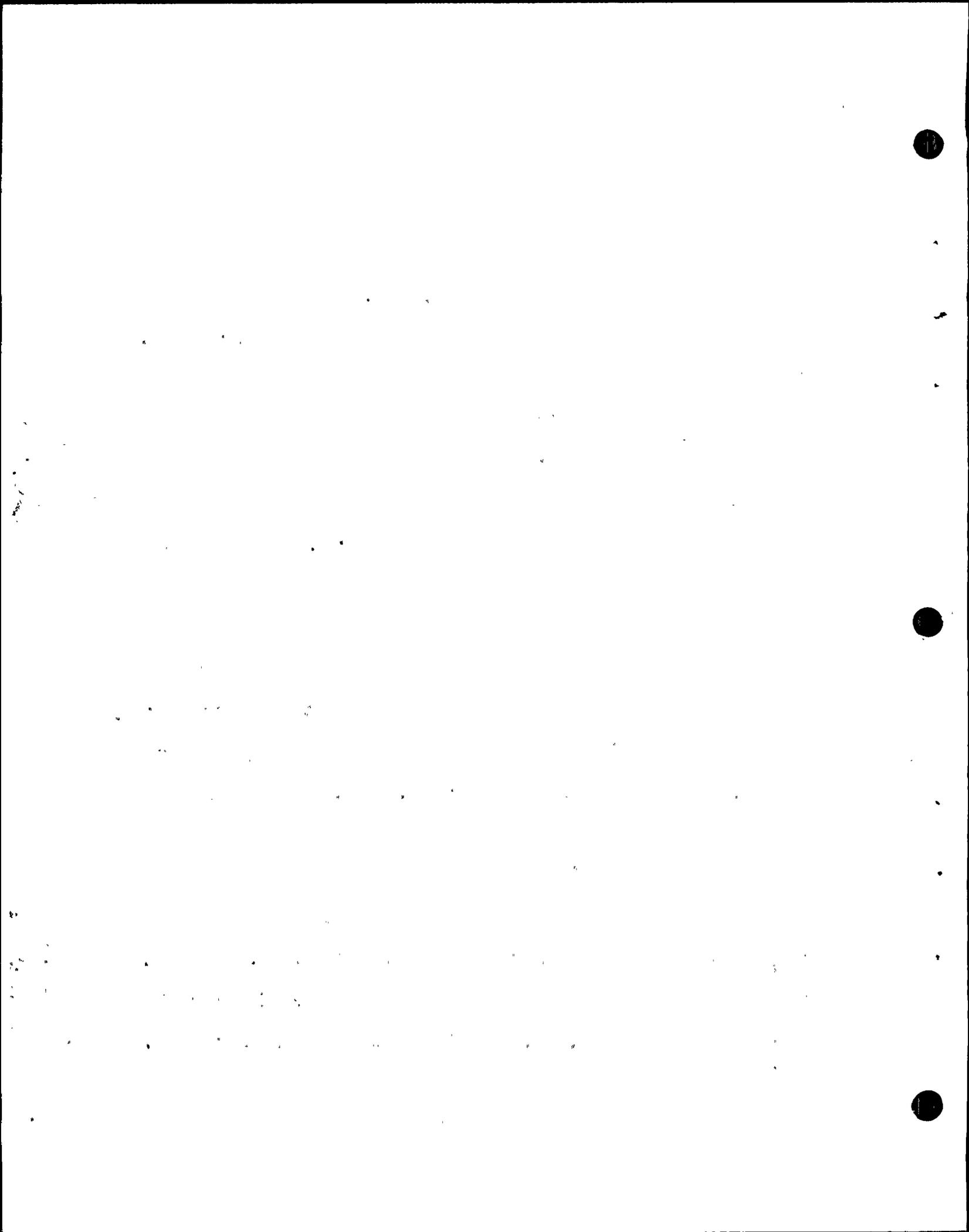
24 (Whereupon, a bench conference was had.)

25 MRS. BOWERS: We'll recess for lunch and reconvene



mpb14 1 at one o'clock.

2 (Whereupon, at 12:00 noon, the hearing in the
3 above-entitled matter was recessed, to reconvene at
4 1:00 p.m., this same day.)
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1F 1
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AFTERNOON SESSION

(1:00 p.m.)

3 MRS. BOWERS: We'd like to begin.

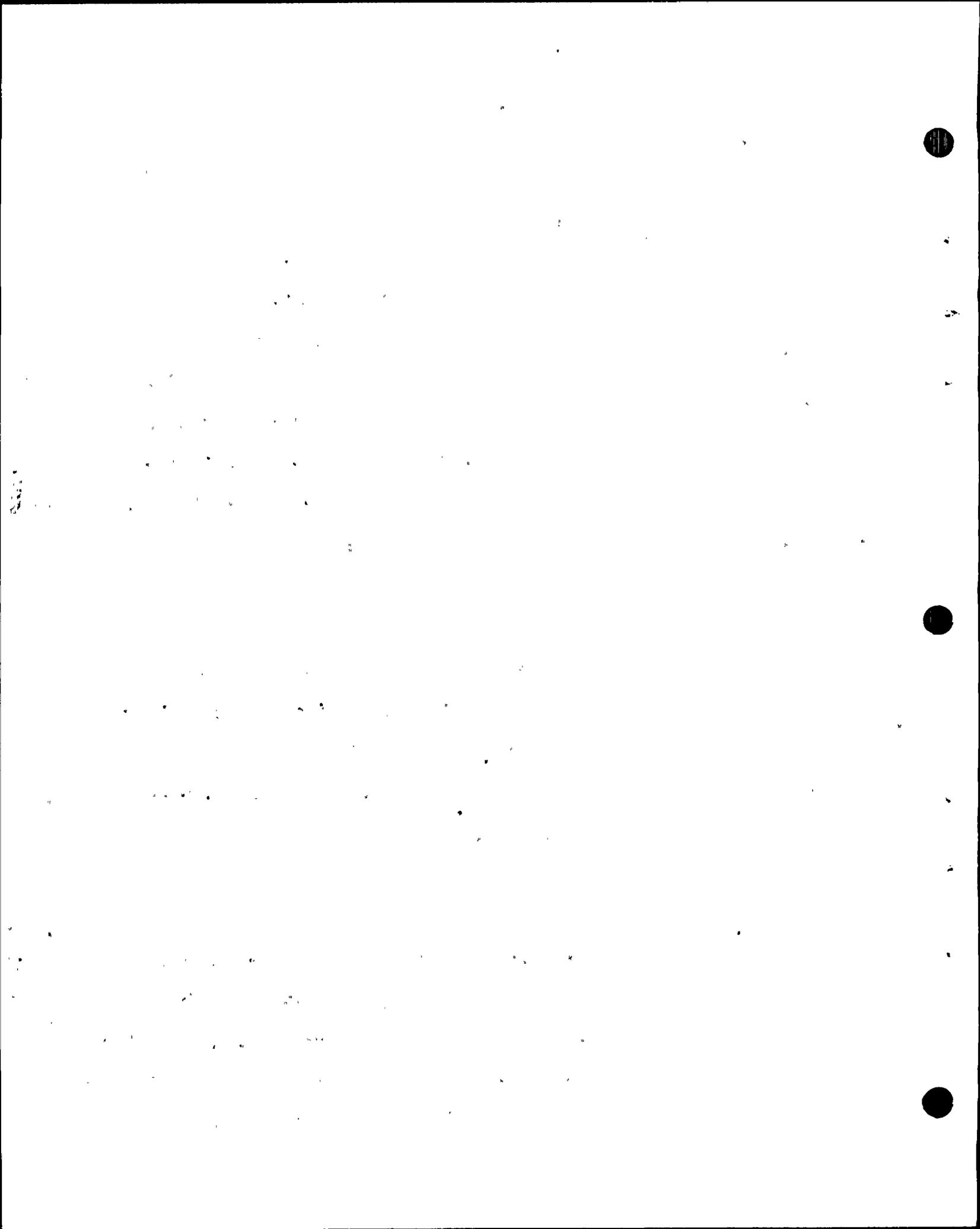
4 Whereupon,

5 DENNIS P. ALLISON

6 resumed the stand as a witness on behalf of the Regulatory
7 Staff, and, having been previously duly sworn, was examined
8 and testified further as follows;

9 MR. FLEISCHAKER: Mrs. Bowers, before lunch I
10 ended my cross, but I have a few more questions for Mr. Allison
11 regarding the transcript that I would like to ask him about
12 -- I haven't got the ACRS transcript here. I do have some
13 of the transcripts here and I'm not sure what date he was
14 referring to, and I would like to determine what date he
15 was referring to and I would like to have the opportunity
16 to go back and read that transcript and then, if necessary,
17 ask Mr. Allison some more questions on that particular
18 point.

19 MR. TOURTELLOTT: Mrs. Bowers, if this witness
20 remembers what meeting the ACRS it was, remembers the specific
21 date that's one thing. But as far as whether we do it or
22 he comes back to it or not, again it's highly irregular,
23 I think one could reasonably assume if you're going to cross-
24 examine this witness, you're going to cross-examine him about
25 the ACRS, then you should have all the documents of the ACRS



1 with you and available to aid you in that cross-examination.

2 And the business of cross-examining this witness
3 today and coming back tomorrow and then coming back next
4 week, and maybe next February it would be interesting to talk
5 to him again, is simply not an efficient way to proceed.

6 MRS. BOWERS: Do you want to respond?

7 MR. FLEISCHAKER: Yes, I could get the document
8 back here within an hour if Mr. Allison can identify it.
9 But I just wanted to say I didn't anticipate that we were
10 going to proceed into this kind of cross-examination. I did
11 anticipate other kinds of cross-examination and brought the
12 documents and Xerox copies.

13 But the fact is that we have ACRS transcripts
14 back at the house, we didn't bring them. We have, I think
15 some testimony from Mr. Allison regarding his understanding
16 of some remarks by Drs. Trifunac and Luco, and I think we
17 ought to have the opportunity to explore with him what it
18 was and the context of the statements that led him to believe
19 that Drs. Trifunac -- what led him to his interpretation of
20 Dr. Trifunac's statement, whatever it was.

21 So what I'm requesting is that we can identify
22 the date, we can get the transcript and we can either cross-
23 examine Mr. Allison this afternoon later on or first thing
24 tomorrow morning, it doesn't matter to me. But the fact is,
25 I haven't got the transcript here, I haven't had an opportunity

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WRB/agb3

1 to review it.

2 MR. NORTON: WELL Mrs. Bowers, it's very interesting
3 because he finished his cross-examination before lunch, and
4 now he's obviously thought up a new line of questioning.
5 If he wanted that information before lunch he should have
6 asked the question, and then he had all the lunch hour to
7 get the transcript.

8 But he didn't do that. And he had obviously
9 thought up some new questions over the lunch hour and he
10 wants to reopen cross-examination.

11 MR. FLEISCHAKER: WELL actually I was having
12 lunch with Mr. Norton, and it was --

13 MRS. BOWERS: Who paid for that lunch, by the way?

14 (Laughter.)

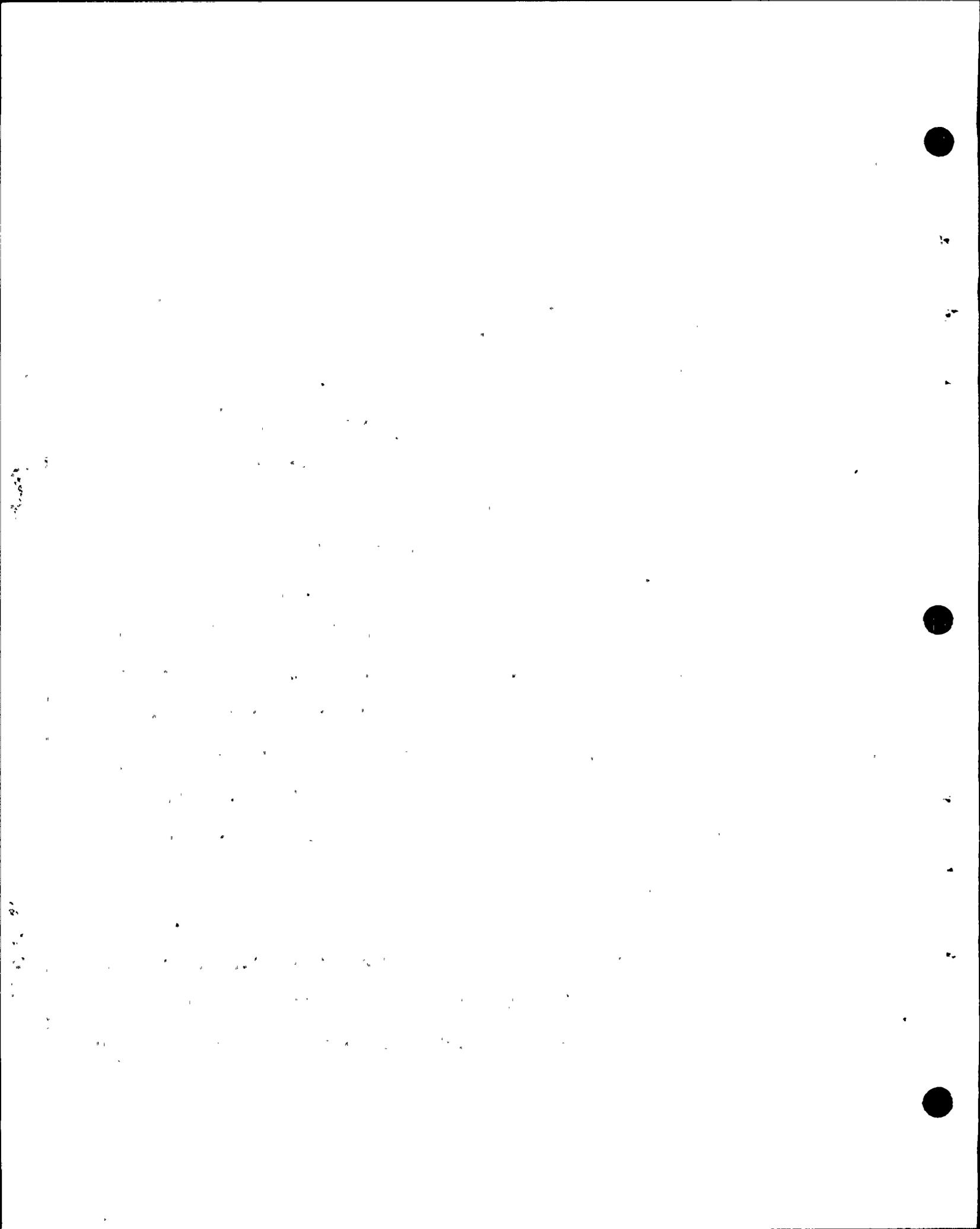
15 MR. NORTON: I paid for my own.

16 MR. FLEISCHAKER: I paid for mine, too.

17 It was actually just sitting there with Mr. Norton
18 that I got these vibrations for a good line of cross-examina-
19 tion.

20 It is true that I didn't go back over lunch, but
21 you know, I still believe that we ought to have the opportunity
22 to examine that ACRS transcript, we have it, and ask Mr.
23 Allison some questions about it if necessary.

24 So what I would like to do is to ask Mr. Allison
25 if he can identify the date and then have Mr. Kristovich go



1 back and pick up the transcript.

2 MR. NORTON: Excuse me, I have one other problem
3 with that.

4 Mr. Fleischaker made a motion to strike, and the
5 Board struck from our testimony, a final paragraph of an
6 ACRS letter. Now why are we going to now read ACRS transcripts
7 into the record? I would like Mr. Fleischaker to point out
8 how one is subject to a motion to strike the writing of the
9 ACRS and yet the transcript is somehow admissible in evidence,
10 I don't quite understand.

11 MR. FLEISCHAKER: I think there was a paragraph in
12 the sign-off letter that was struck from the testimony, and
13 that speaks for itself. It's not subject to cross-examination
14 for the reasons stated in Aeschlimann and the Commission's
15 decisions. We made the motion to strike on that basis, that
16 the ACRS letter was not to be used in support -- excuse me,
17 did not constitute substantive evidence, but is in the record
18 to demonstrate that the ACRS complied with the statutory re-
19 quirements. So that was the basis for that.

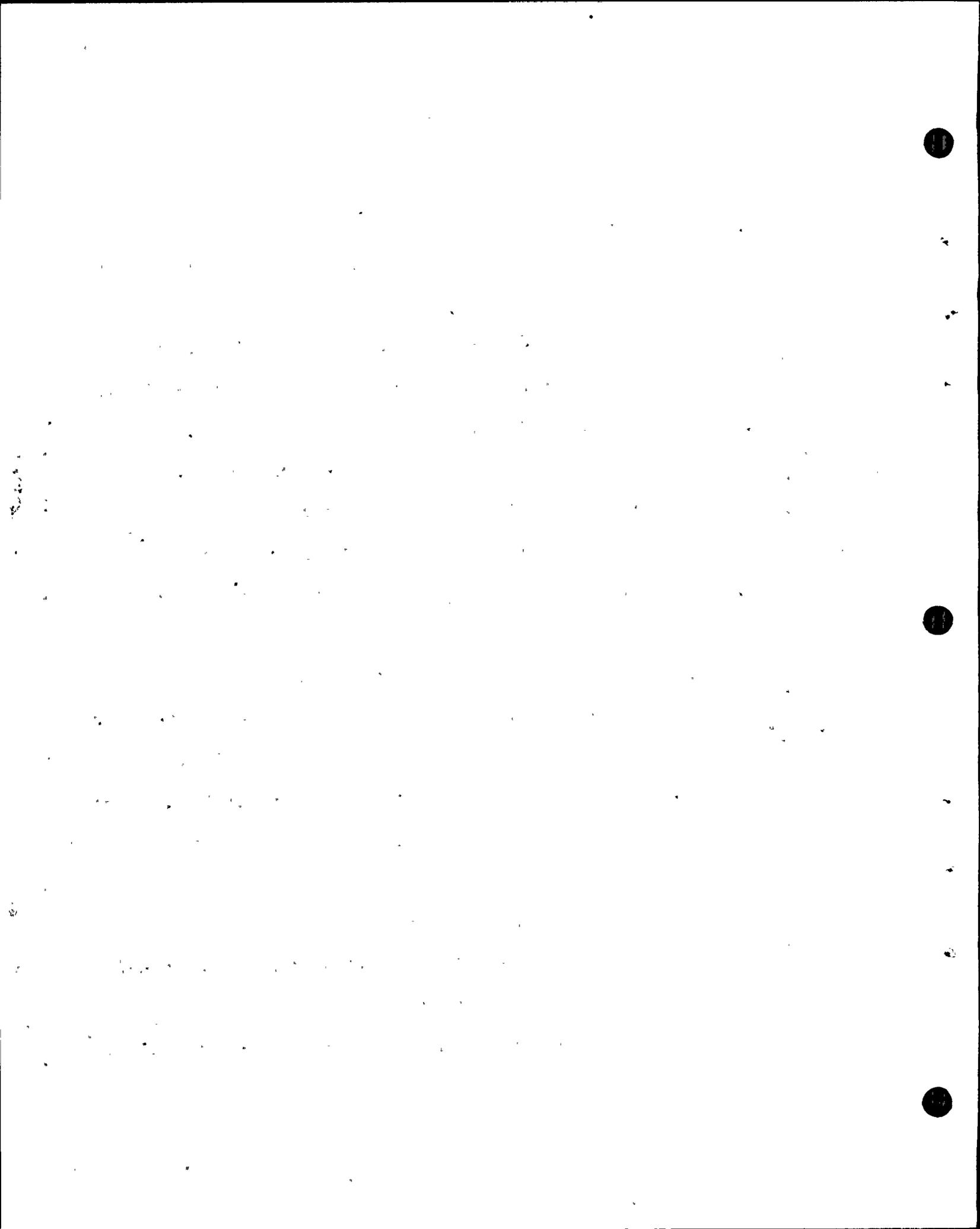
20 Now the basis for this is to explore further this
21 witness' statement in the record concerning Dr. Trifunac's
22 opinions expressed on the record in the ACRS transcript.

23 MRS. BOWERS: Well let me first ask the question
24 of the witness:

25 Although you testified that you learned Dr. Trifunac's

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1 opinion on certain matters at a couple of -- you identified
2 a couple ACRS meetings, you were also earlier asked what you
3 may have heard from him either formally, when he was testifying
4 at the ACRS meetings, or meetings in the hall or other in-
5 formal discussions.

6 Now, it won't serve any purpose if the informa-
7 tion you were referring to was not a part of that official
8 transcript record. Do you know if it is?

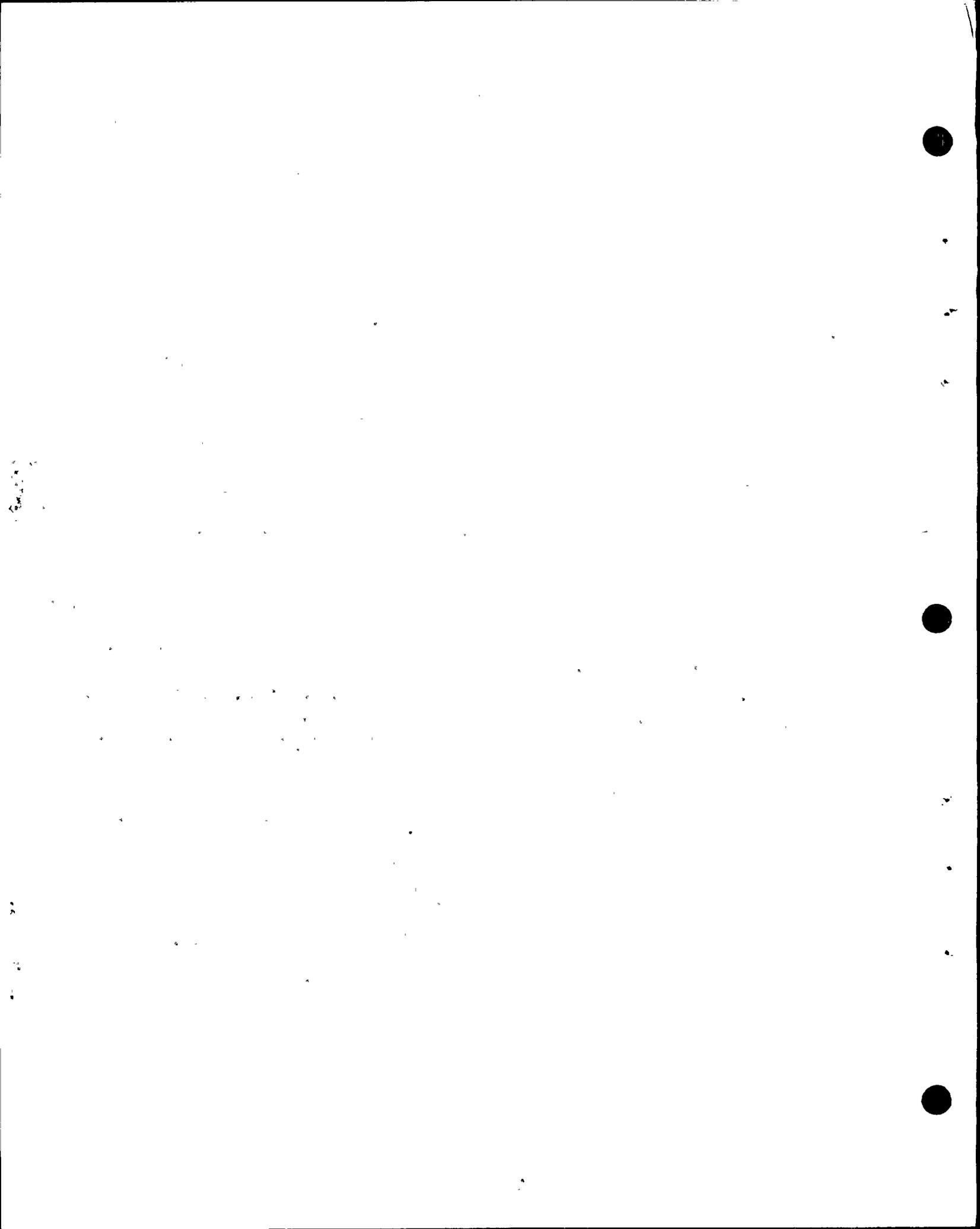
9 THE WITNESS: I'm not sure I understand --

10 MR. FLEISCHAKER: Mrs. Bowers, my recollection
11 is that Mr. Allison said there were three statements, three
12 times he talked to Dr. Trifunac, once on the phone, a second
13 time in the hall and the third time there was a comment on
14 the record. And the record will speak for itself.

15 But it was the third time, I believe, that he said
16 that he believed that there was some kind of definitive
17 statement in the record by Dr. Trifunac, and it is that third
18 statement that I wish to explore, and I understand that that
19 is in the ACRS transcript.

20 MRS. BOWERS: Is that correct?

21 THE WITNESS: That's right. The third occasion
22 that I was talking about actually is a series of discussions
23 that took place and are recorded in the ACRS transcripts
24 on June 14, June 15, at Subcommittee meetings, and July 7
25 at the Full Committee meeting, 1978.



1
2 And I lumped those together. I'm not sure where
3 all the things that Dr. Trifunac said are, whether he said
4 it on June 14 or June 15, for example. But it was both at
5 the Subcommittee and the Full Committee meeting. But I
6 lumped that all together as the third occasion, the first
7 two are not recorded anywhere, although there are other wit-
8 nesses who can speak to the second one as well.

9
10 MR. TOURTELLOTT: I guess I might also have
11 an objection on the grounds of materiality, since what has
12 gone on so far is the witness has told what he knows and
13 that's all that is really required to do.

14 Now, going out and getting copies of the transcript
15 and then questioning this witness about the transcript is of
16 no particular significance relative to what he knows or what
17 he knows right now and if of no particular value and would
18 only be cumulative and repetitive.

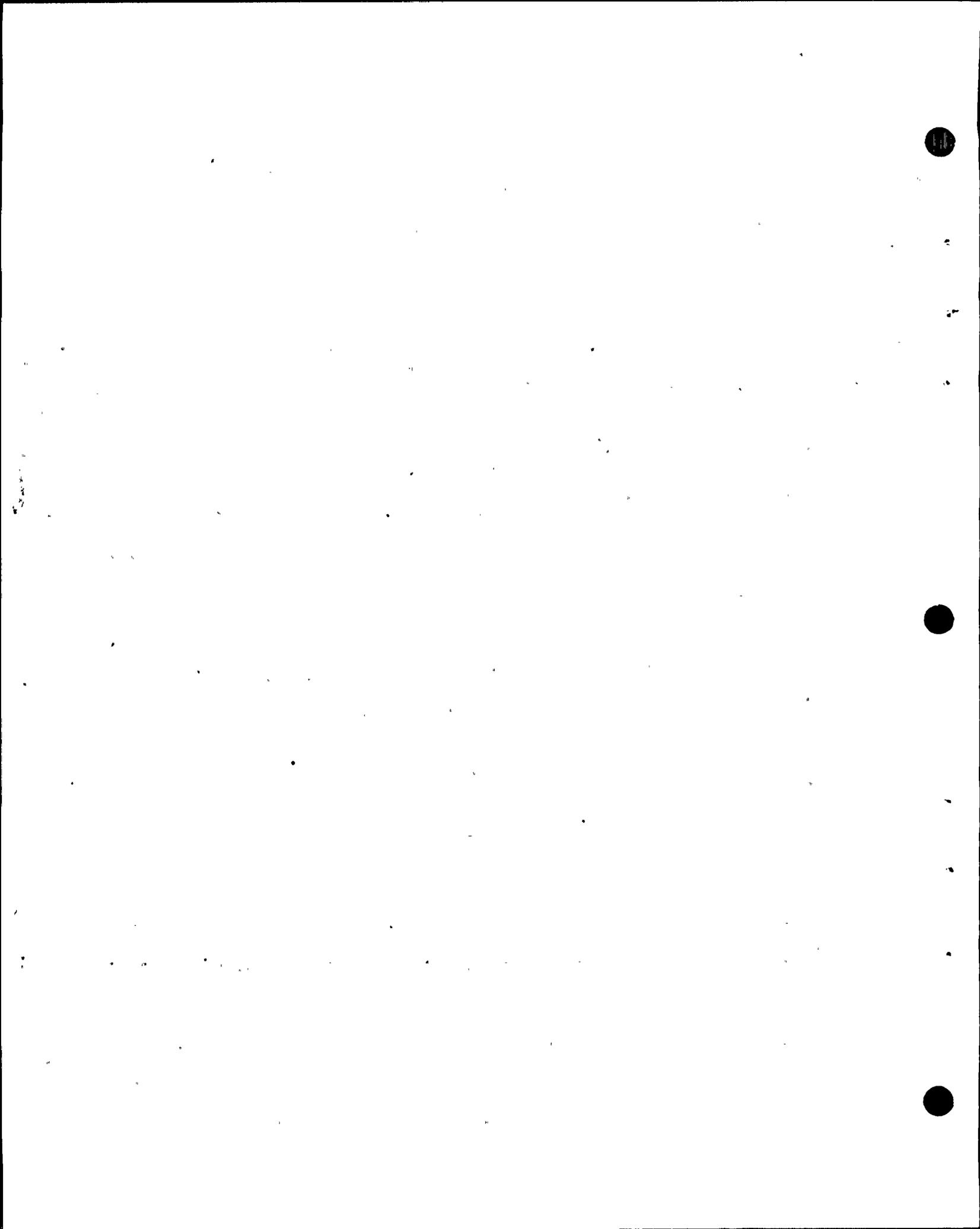
19
20 If there is something in that transcript and
21 for some reason or other the Intervenors want to introduce
22 that as evidence to controvert what it is Mr. Allison has
23 recollected, then I think that's a different situation. But
24 I don't know why we have to sit here and listen to a lot of
25 transcript that is just going to repeat whatever it is that
26 he said.

27
28 MR. FLEISCHAKER: One of the problems is I don't
29 even know what it is that Mr. Allison is referring to. We

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1 have no identification of the statements in the record, the
2 date or the page.

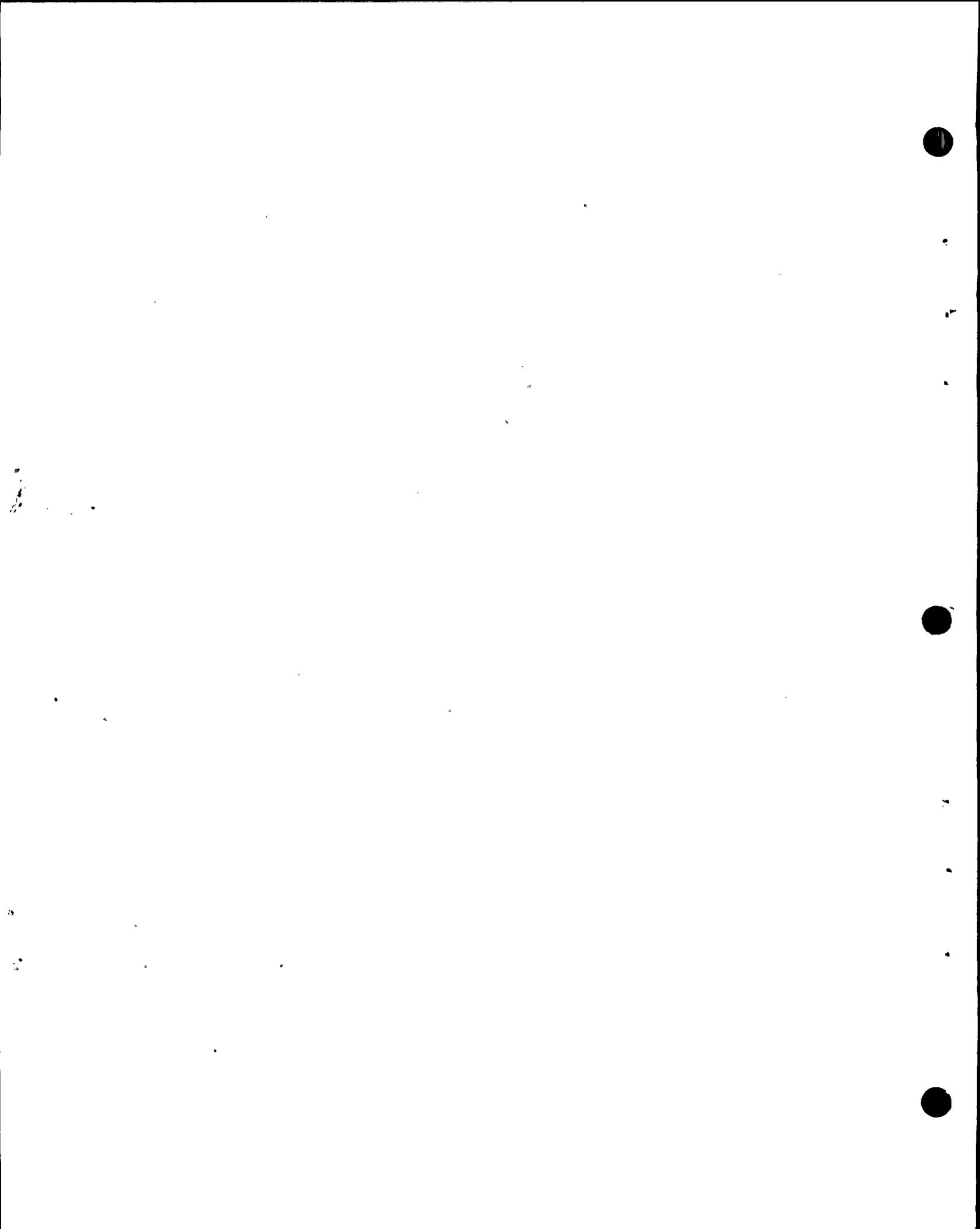
3 MR. NORTON: Well Mrs. Bowers, that's exactly
4 what happens when you ask questions that you don't know what
5 the answers are going to be to on cross-examination, that's
6 where you often find yourself and that's no excuse to, after
7 you have closed cross-examination, to go away and think about
8 it for a while and come back and open it up again....

9 MRS. BOWERS: Mr. Tourtellotte, are we correct in
10 our understanding that there will be later witnesses, Dr. Stepp
11 and perhaps Dr. Newmark, others who also were in attendance
12 at those meetings and are intimately familiar with the subject
13 of Dr. Trifunac's comments?

14 MR. TOURTELLOTTE: I'm not certain. I know that
15 I was at the meeting, but I'm not really certain whether --
16 Dr. Stepp was not there and I don't believe Dr. Newmark was
17 either.

18 MR. FLEISCHAKER: Mrs. Bowers, I have no desire
19 to pursue this any further with any other witness. I think
20 it's ridiculous to try to determine what Dr. Trifunac meant
21 when he made whatever statements he made on June 14, 15 and 16,
22 or July 7.

23 I happen to be in the position because Mr. Allison
24 has given his interpretation and it is sitting in the record.
25 I think it is not worth much weight, and I base that on the



WRB/agb8

1 written comments that have been submitted and discussions I've
2 had. But nevertheless, it's sitting there in the record.

3 MRS. BOWERS: Well let me ask one more question
4 of both Applicant and the Staff.

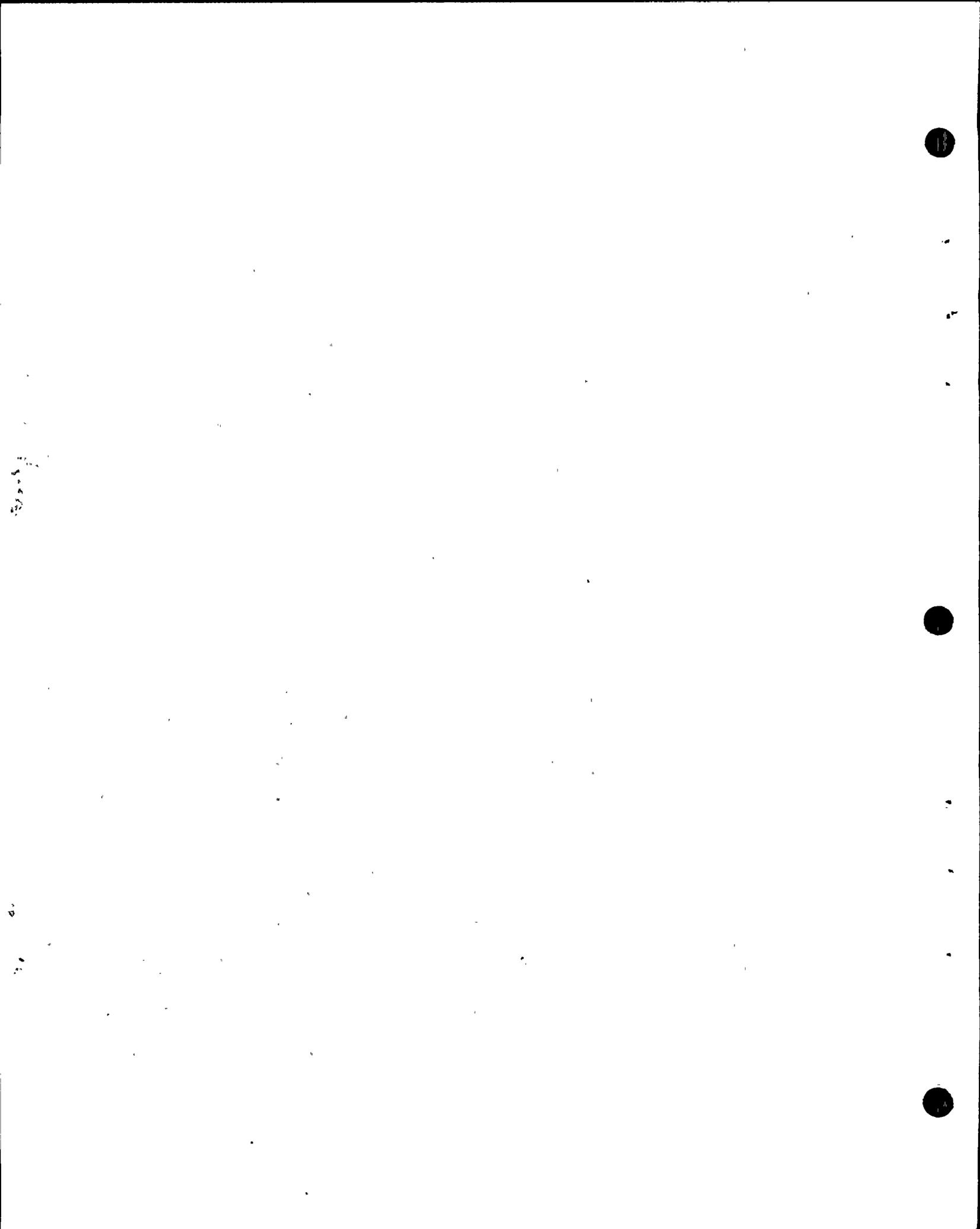
5 Do you have copies of those transcripts here in
6 the room?

7 MR. NORTON: I'm not sure we have copies of all
8 of those transcripts here in the room. I know we have some
9 of them. I'd have to check.

10 The problem is that those are voluminous transcripts.
11 It's going to take quite a bit of looking, you know, it may
12 only take Mr. Fleischaker an hour to get the transcripts,
13 but it's going to take us all a lot longer to look through,
14 because this isn't just one comment, necessarily, that
15 we're looking for. If my memory is anything like Mr. Allison's,
16 these kind of conversations were conducted on at least -- on
17 more than one occasion during these meetings.

18 So if we are going to allow him to reopen cross-
19 examination based on those transcripts, then we're all going
20 to have to sit down and read the entire transcript to find
21 those places. And that's not going to take an hour, it's
22 going to take a lot longer than that.

23 MR. FLEISCHAKER: Well, I don't have any desire
24 to examine the whole transcript. I simply want to know from
25 Mr. Allison what the statements are that he's relying on to



1 draw his conclusions about what Dr. Trifunac thinks about
2 the adequacy of the -- thinks about the design response
3 spectra; the Newmark spectra.

4
5 MRS. BOWERS: So you want Mr. Allison to examine
6 the transcripts?

7 MR. FLEISCHAKER: That's right.

8 MRS. BOWERS: And identify the references?

9 MR. FLEISCHAKER: That's correct. I'd like him
10 to examine the transcripts and say These are the statements
11 that we are relying on.

12 I can't guess. I have no idea --

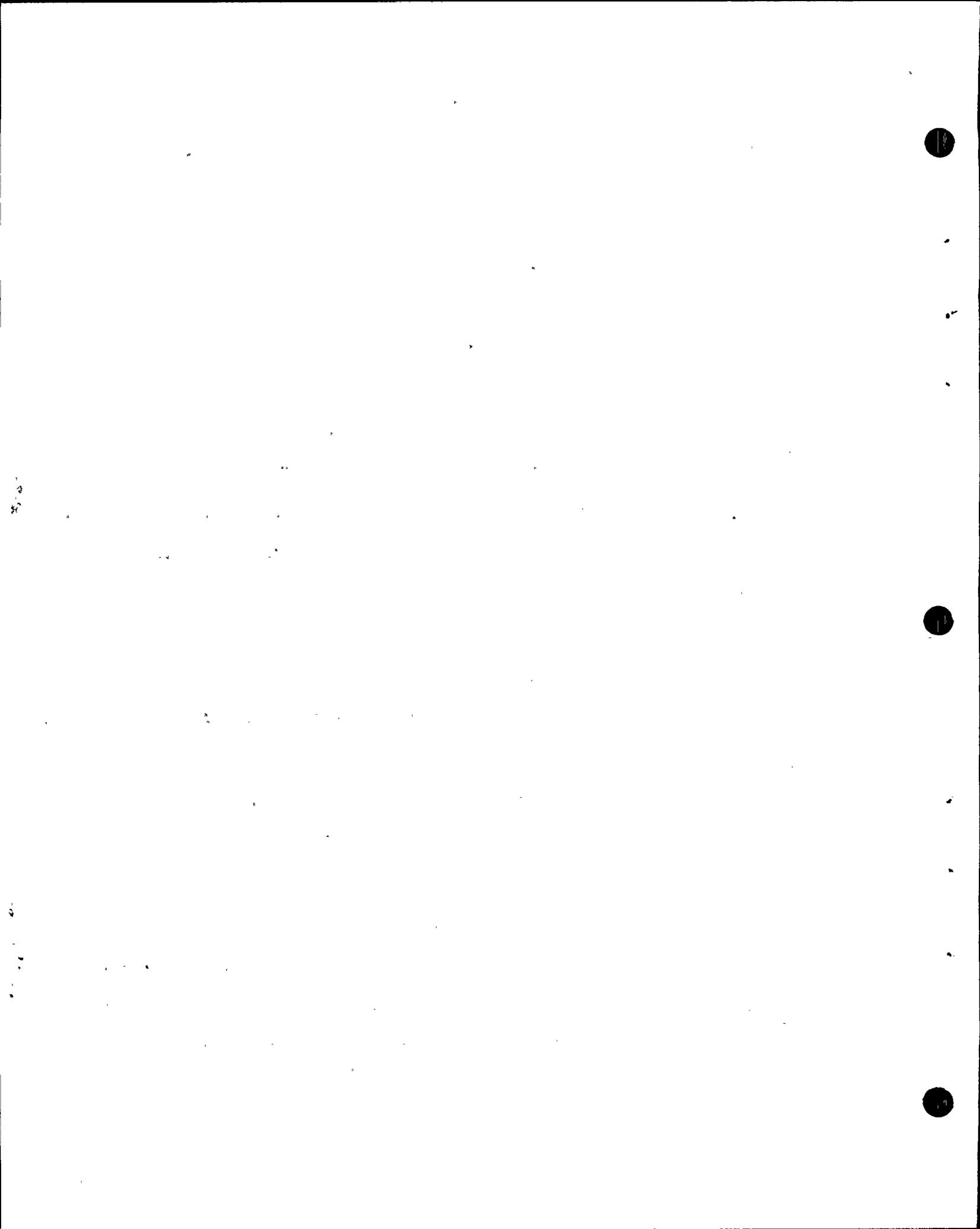
13 MR. TOURELLOTTI: Wait a minute.

14 I object to that. That isn't what this witness
15 was up here testifying to. He's not saying that he read
16 the transcript and that he was relying on part of the
17 transcript for that opinion or for that statement. He said
18 that he was in attendance at these meetings and this is what
19 he understood Dr. Trifunac to say.

20 I don't know whether this witness has even seen
21 the transcripts. But he's not relying on that, he's relying
22 on something that occurred in his presence. And I don't know
23 how you're going to recreate that, with or without transcripts.

24 MRS. BOWERS: The Board would like to consider
25 this.

(The Board conferring.)



WRB/agb10

1
2 MRS. BOWERS: I think there are several objections
3 to the proposed manner of proceeding by Mr. Fleischaker by
4 both Applicant and Staff.

5 The Board sees no reason to temporarily excuse
6 the witness and expect that witness to review transcripts
7 in order to substantiate what he testified to as to his best
8 memory of what transpired.

9 Now Mr. Fleischaker, if you find after reviewing
10 the transcripts that this would be an appropriate argument
11 for you in taking exception to the testimony, you'll have the
12 transcripts to refer to when you are preparing argument or
13 exceptions.

14 MR. FLEISCHAKER: Okay. I understand that. I
15 appreciate the Board's ruling.

16 So I had a specific request to reopen that has
17 been denied?

18 MRS. BOWERS: That's been denied.

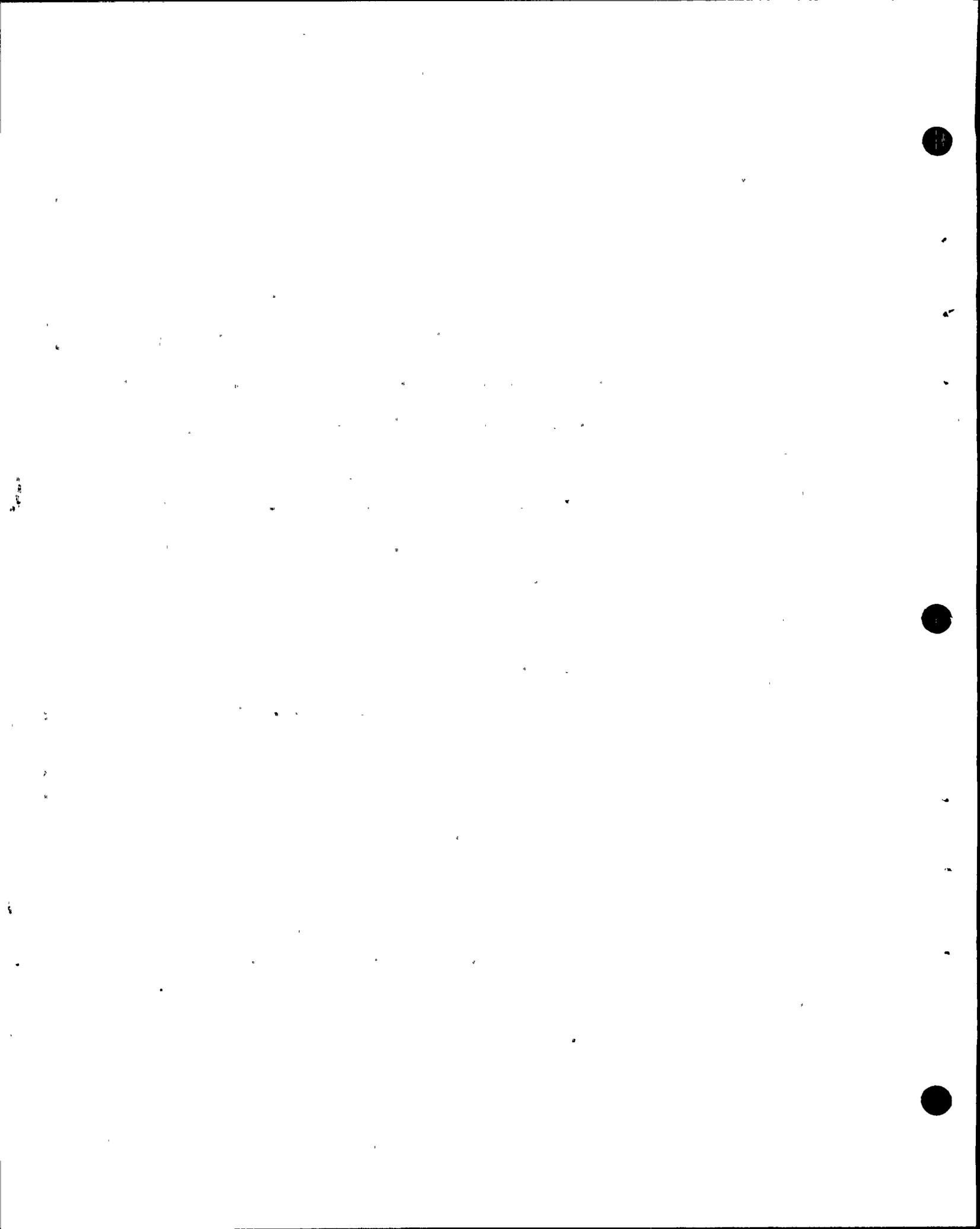
19 MR. FLEISCHAKER: Okay. Thank you.

20 REDIRECT EXAMINATION

21 BY MR. TOURTELLOTTTE:

22 Q Mr. Allison, there was a great deal of discussion
23 this morning having to do with the ACRS. And we in the govern-
24 ment and those of us who deal with the government often use
25 initials. What does ACRS stand for?

A That stands for the Advisory Committee on Reactor



WRB/agbl1

1 Safeguards.

2 Q And that Committee is simply an advisory committee
3 is it not?

4 A Yes. That's correct.

5 Q And that's why, when Mr. Norton indicated in
6 referring to Joint Intervenors' Exhibit number 70, when he
7 used the word, "required by ACRS," you corrected him and
8 said they only requested it. Isn't that correct?

9 A Yes, that's correct.

10 Q Because in fact they don't have the right to
11 require you, as a project manager, to do anything, do they?

12 A Yes, that's correct.

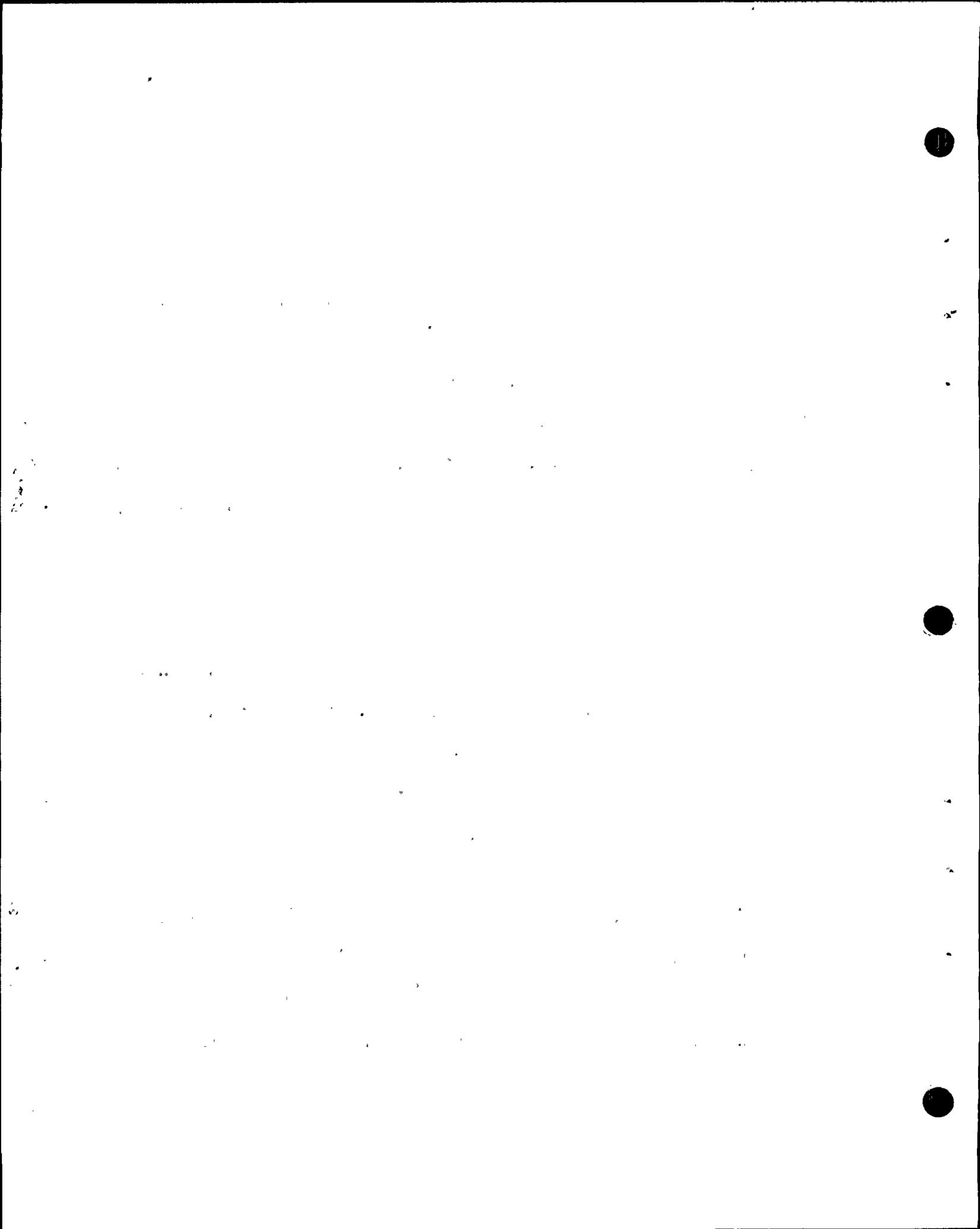
13 Q As a matter of fact, they could write a letter
14 that would totally recommend not licensing the plant and you,
15 as a project manager for this plant, could, if you chose to,
16 go ahead and take the necessary steps that you felt were
17 necessary to see that this plant was licensed?

18 A Yes, that's correct.

19 Of course, I suppose I should add that the
20 Committee's recommendation would carry some weight. And had
21 it recommended not licensing the plant, it would give us
22 pause for some thought. I wouldn't say we would necessarily
23 go ahead.

24 Q Correct. But the fact is --

25 A It does not require that we not go ahead.



RB/abb12

1 Q ACRS recommendations are not a requirement of
2 the Staff?

3 A Absolutely.

4 Q Now were questions asked you this morning as to
5 whether the Staff had performed or done any studies such as
6 the one proposed by Dr. Trifunac. Did the Staff believe it was
7 necessary to perform such a study?

8 A No. We had performed all the studies or we
9 performed or had had performed all the studies that we felt
10 were necessary to complete our review and reach our conclusions.

11 Q In fact, there is more than one methodology for
12 solving a problem in licensing nuclear plants, isn't there?

13 A Yes.

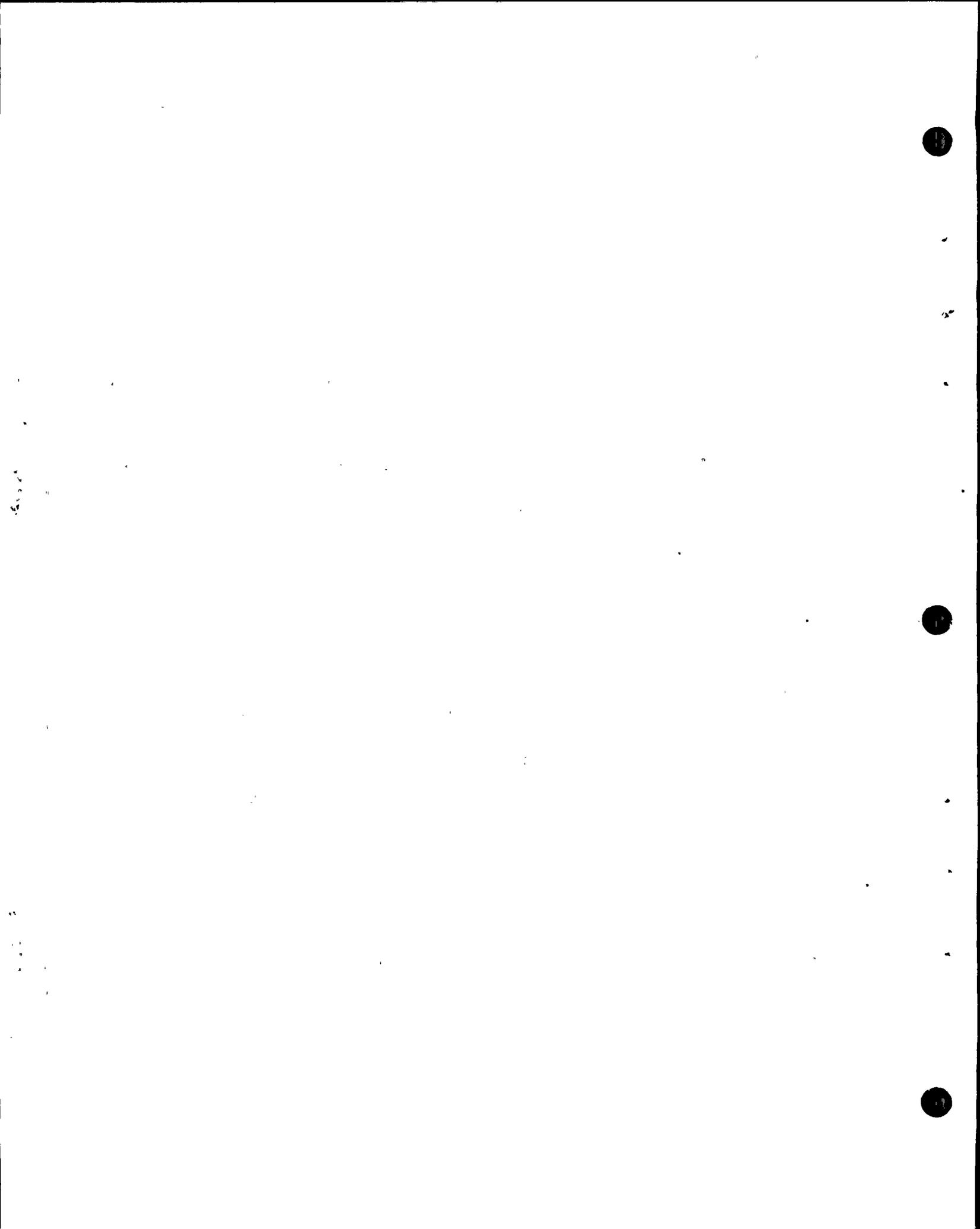
14 Q And the same holds true with Dr. Luco's recommenda-
15 tions. Did the Staff believe it was necessary to follow
16 Dr. Luco's recommendations?

17 A No, we did not.

18 In fact, the readings that I've gotten from our
19 structural engineers is that it's impossible to do what Dr.
20 Luco has recommended, or that it is not within the state of
21 the art.

22 Q So that the Staff did consider both Dr. Trifunac
23 and Dr. Luco's input but they decided, for one reason or
24 another, that it was inadvisable to use those methodologies?

25 A Yes.



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Q And is it also true that nevertheless the Staff did consider the general subject areas that were mentioned by Drs. Luco and Trifunac?

A Yes, those have all been considered by the Staff.

Q And by the Applicant as well?

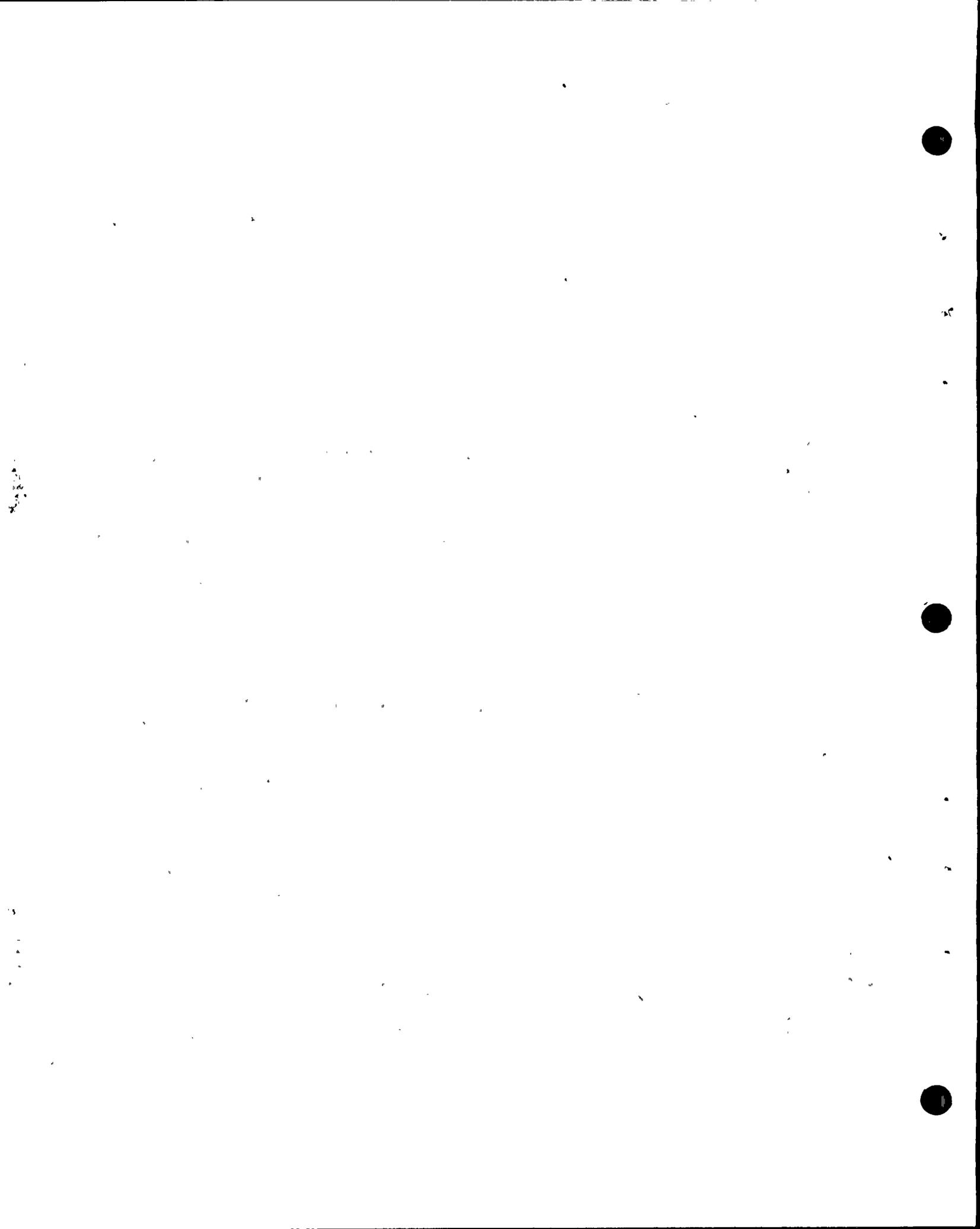
A Yes.

Q A question was asked today about whether it was your impression that Drs. Luco and Trifunac were in agreement with the final ACRS sign-off, and I think you indicated they were not in agreement with the final ACRS sign-off.

Is it also true that the reverse applies, that the ACRS did not agree with Drs. Trifunac and Luco?

MR. FLEISCHAKER: I object. That's a misstatement of the record. The question that was asked was whether Dr. Trifunac and Luco at the final meetings accepted as adequate the Staff and Applicant methods and procedures. No question has been asked about Drs. Trifunac and Luco's view of the ACRS sign-off.

MR. TOURNELLOTTE: Okay, we'll put it in those terms.



1G-2

WRB/wbl

1 BY MR. TOURTELLOTT:

2 Q You indicated that Drs. Trifunac and Luco were
3 did not accept the methodologies offered to the ACRS by the
4 Staff and the Applicant.

5 A That is correct.

6 Q Isn't it also true that the reverse applies; that
7 their methodologies were not accepted?

8 A By the ACRS. Yes, that's true.

9 I'd like to amplify that just a little bit.

10 Q All right.

11 A I can read in the ACRS letter some recognition

12 of Drs. Trifunac's and Luco's comments, as well as others.

13 MR. FLEISCHAKER: Wait a minute. Before we
14 go any further I'm going to object to that question and that
15 answer and have them stricken; for this reason:

16 The Commission has requested that we not get
17 into the substance of ACRS letters. They are written, they
18 are in the record, they're clear on their face. And I don't
19 think that it's appropriate for this witness to interpret
20 the meaning of the ACRS letter. He's not in a position to
21 interpret anything in the ACRS letter. The writing is there
22 on the pages, it stands for itself.

23 So I'm going to request that the question and
24 the answer be stricken as inappropriate.

25 Mr. Allison, as competent a project manager as he

10/10/10

1 is, and he's very competent. I do 't think he is competent
2 to say that the ACRS accepted and rejected in terms of
3 methods and procedures.

4 MR. NORTON: We are, in part, in agreement with
5 Mr. Fleischaker, although I don't think that was exactly the
6 question. The question is whether or not the ACRS considered
7 the views of Luco and Trifunac. And that question is not--
8 Well, it can be read. But I believe the letter states indeed
9 what they did. That's not going to the substance of the ACRS
10 decision, simply that they did consider the viewpoints of
11 Trifunac and Luco.

12 MR. FLEISCHAKER: Even if that was the question
13 I object to it and think it should be stricken. The ACRS
14 letter is clear on its face. I don't think anyone in this
15 proceeding should start getting into whether the ACRS con-
16 sidered this or that: that's not the subject of this proceed-
17 ing, and it's an inappropriate area for us to be exploring.
18 And I think the Commission's decisions and the decisions of
19 the Court of Appeals are clear on that.

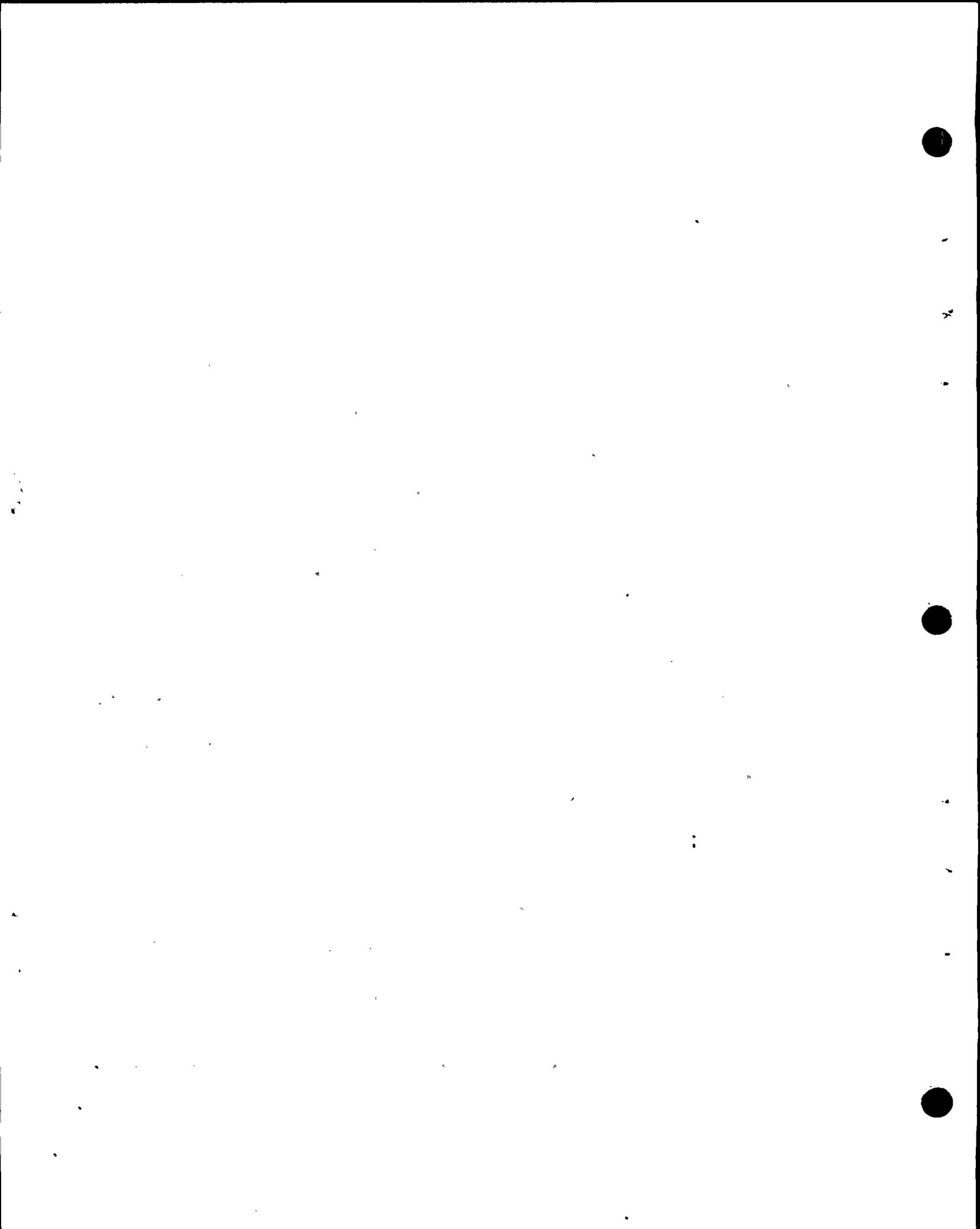
20 So I'm going to object to the question and the
21 answer and request that they both be stricken.

22 MRS. BOWERS: Mr. Tourtellotte?

23 MR. TOURTELLOTTE: To some extent I think
24 Mr. Fleischaker is mixing the question and the answer with the
25 follow-up explanation offered by the witness, which is to go

MRB/vb2

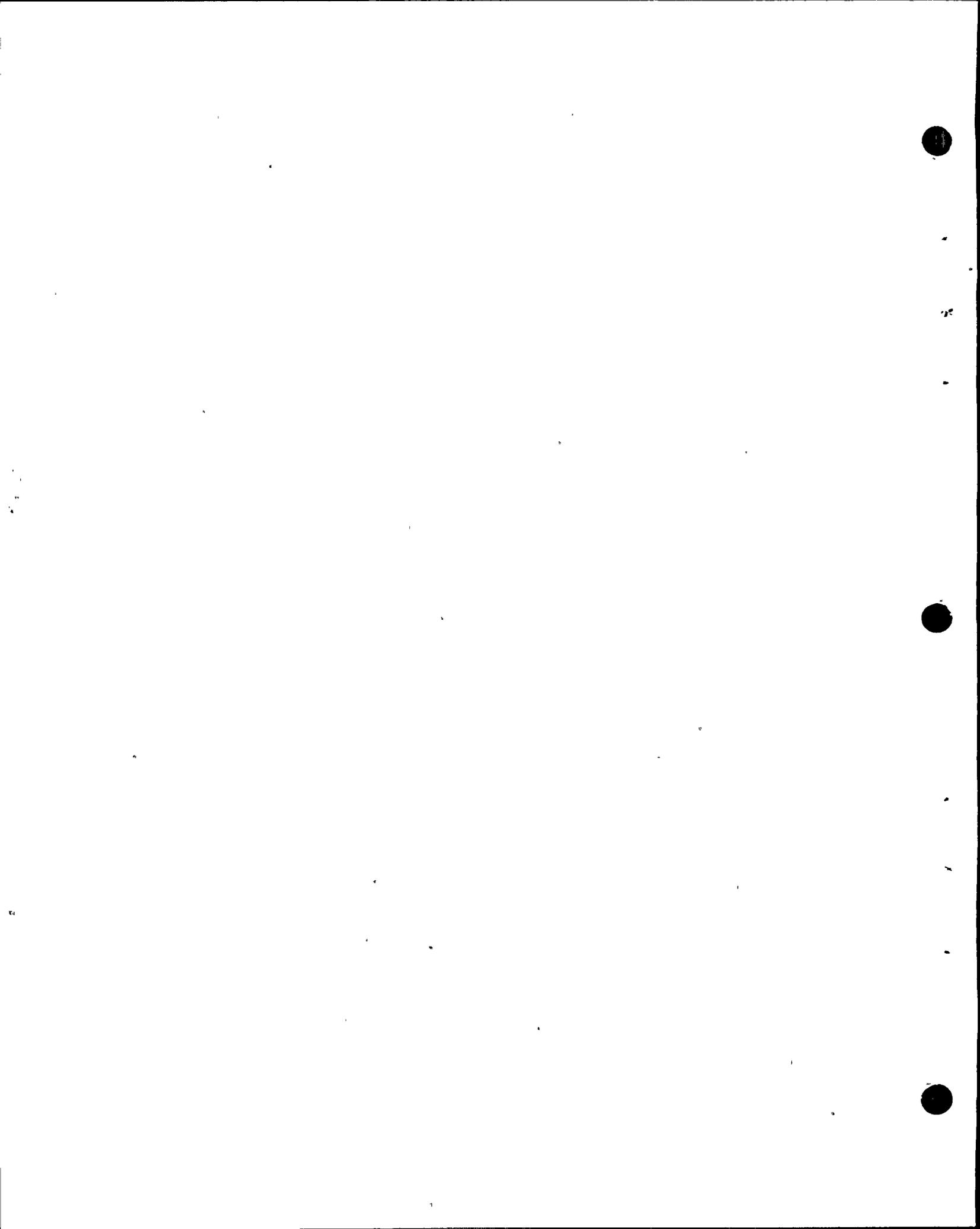
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1 to the letter and refresh his recollection. But it seems very
2 strange to me, indeed, that the Intervenor can ask a question
3 about whether or not some members of the ACRS, some consultants
4 to the ACRS who are dissenting from the general view of the
5 ACRS were in agreement with the final methodologies that were
6 used so that the ACRS could sign off, but it is impermissible
7 to say the reverse is true, which probably logically follows
8 anyway, that the ACRS disagreed with them. Obviously you
9 cannot have unilateral disagreement.

10 But it seems to me that the question as put is
11 simply as to whether or not they are in a majority or in a
12 minority. And while you can say that the letter speaks for
13 itself, the door was opened by the Intervenor. I didn't happen
14 to want to inquire into this at all. But it seems like if the
15 door is opened and one thing is in the record then the record
16 ought to also indicate what the full story is on that parti-
17 cular subject matter.

18 Now as far as referring to the letter to refresh
19 recollection, that's one thing. As far as referring to the
20 letter and reading the letter as substantiation of this
21 witness' opinion, I would have to say that that can't be done.
22 And if my witness were to try to do that I would have to
23 agree that he can't do that. But I do believe he can refresh
24 his recollection by referring to that letter or anything else
25 he wants to use.



1 MR. FLEISCHAKER: Well the objection stands, and
2 I'm requesting that the question and the answer be stricken.
3 It was an inquiry into what the ACRS accepted or rejected.
4 I don't think that this witness is in any position to comment
5 on that. And the letter speaks for itself.

6 MRS. BOWERS: You made a reference, Mr. Fleischaker,
7 to the fact that it's in the record. It's in the record for
8 only one purpose, and that's to show that the ACRS opinion
9 was issued; isn't that correct?

10 MR. FLEISCHAKER: That's correct.

11 (The Board conferring)

12 MR. FLEISCHAKER: Excuse me, Mrs. Bowers. Before
13 the Board rules could I request to have the question and
14 answer read back?

15 MRS. BOWERS: Yes.

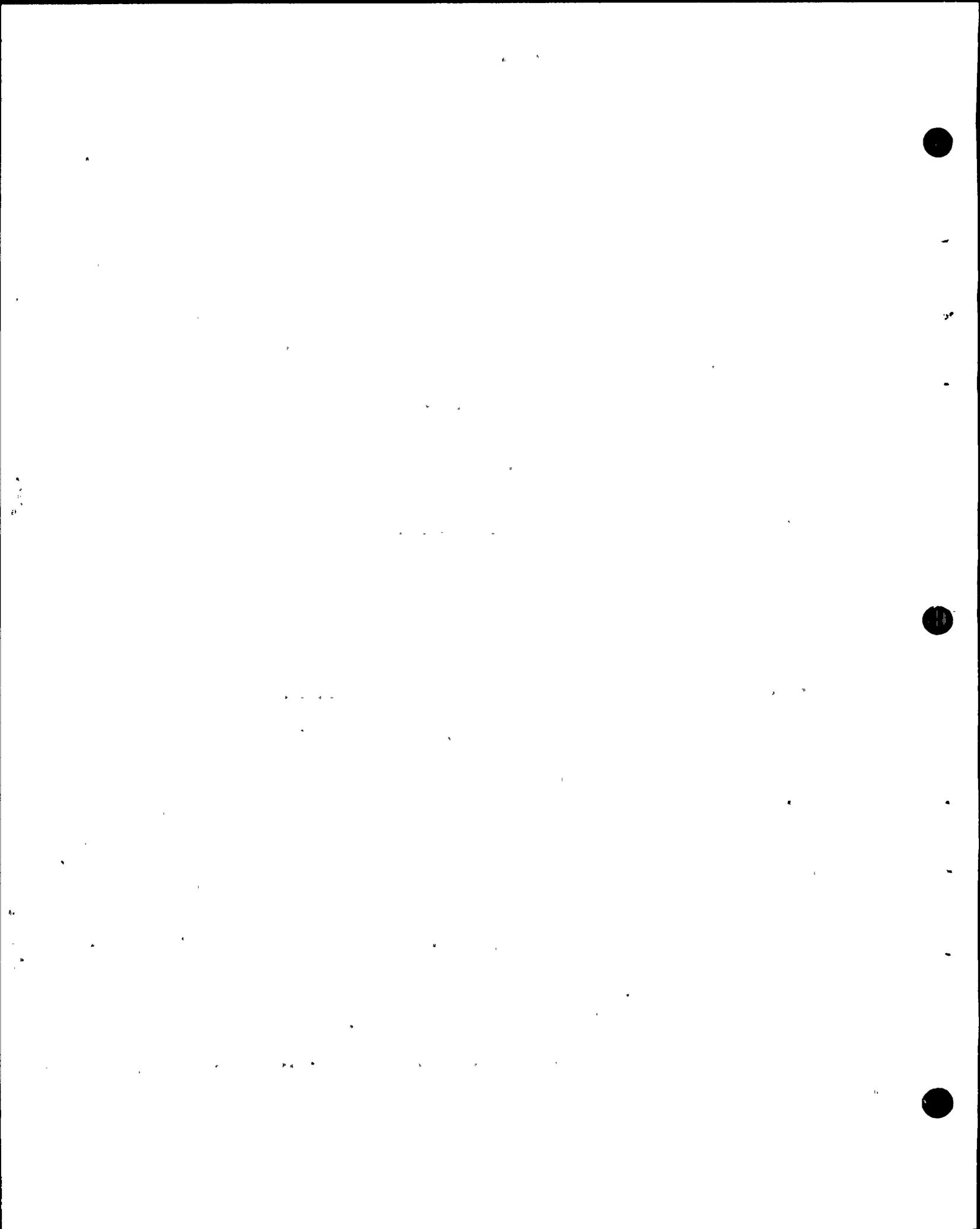
16 (Whereupon the Reporter read from the record
17 as follows:

18 "QUESTION: You indicated that Drs. Trifunac
19 and Luco were -- did not accept the methodologies
20 offered to the ACRS by the Staff and the Applicant.

21 "ANSWER: That is correct.

22 "QUESTION: Isn't it also true that the
23 reverse applies; that their methodologies were not
24 accepted?

25 "ANSWER: By the ACRS. Yes, that's true.



1 "I'd like to amplify that just a little
2 bit.

3 "QUESTION: All right.")

4 MR. NORTON: As I understand it, there's a
5 motion to strike that question and the answer?

6 MR. FLEISCHAKER: No. I'd like to clarify that.
7 That's why I had it read back.

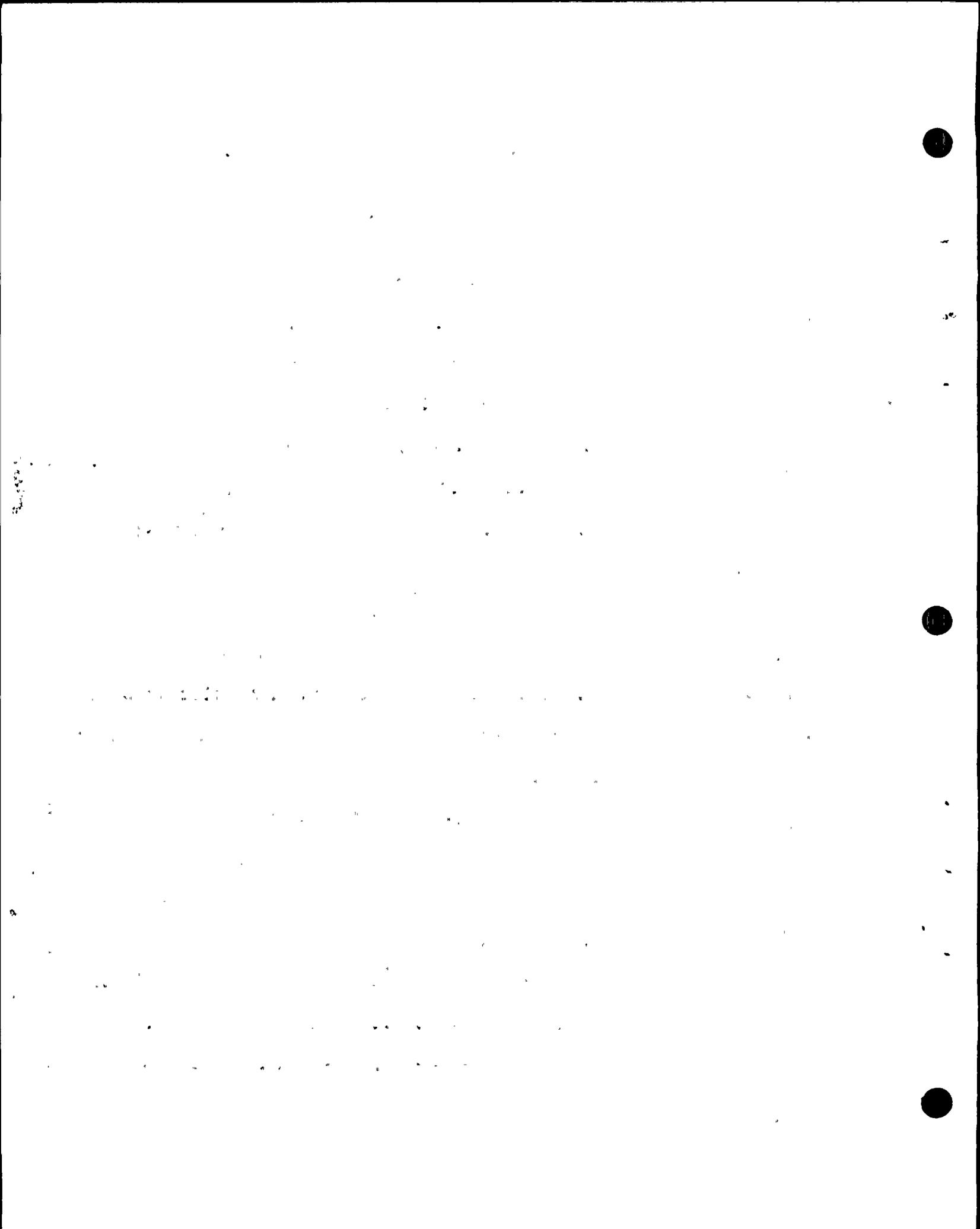
8 I would like to make the motion to strike the
9 questions and answer from that in which Mr. Tourtellotte
10 asked the question: And isn't it true that Drs. Trifunac and
11 Luco's methods weren't accepted? Then I believe there was
12 an answer by Mr. Allison "By the ACRS." From that question
13 until my objection I would like to strike all the questions
14 and answers on the basis that I have given.

15 MRS. BOWERS: Well, Mr. Tourtellotte, do you
16 want to respond to that?

17 MR. TOURTELLOTTE: I don't see any reason to
18 belabor the point. I've already said everything I have to.

19 MR. NORTON: Mrs. Bowers, may I respond for a
20 moment?

21 I think maybe it should be stricken, too. Because
22 this Board, you know, under Aeschlimann and other decisions,
23 is not supposed to consider the specific findings of the ACRS
24 nor of its consultants, of course, which puts us in kind of
25 an interesting quandary if we're arguing that Messrs. Luco and



1 Trifunac should be here to testify, then I guess you are
2 considering the opinions of the ACRS and its consultants.
3 But that's Mr. Fleischaker's problem, not mine.

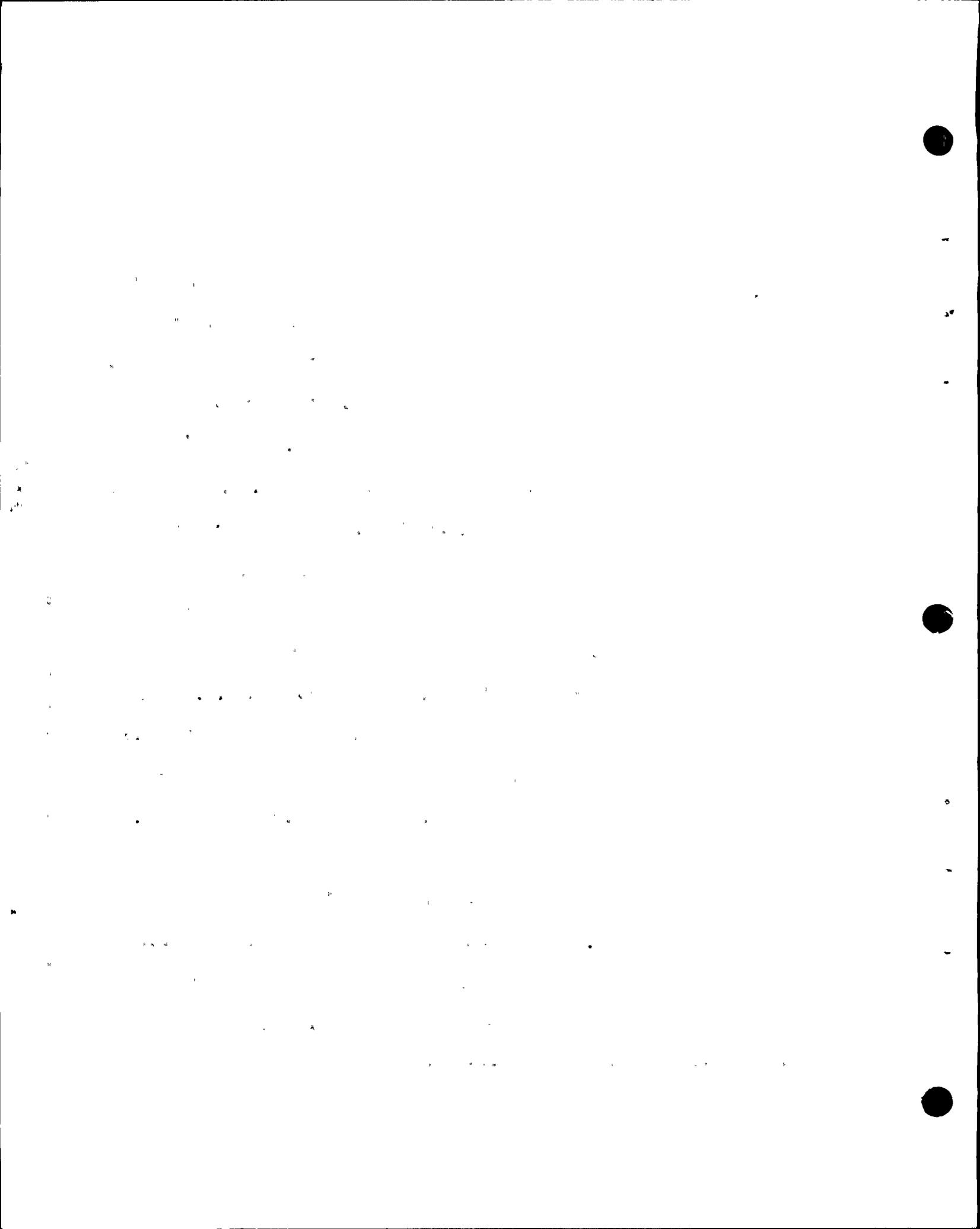
4 But I think here that I guess you could argue
5 that this is somehow the deliberations of the ACRS. I'm
6 not sure that it is. But I think one can make that argument.
7 And I, for one, don't want to see reversible error in the
8 record in anyplace but particularly where it isn't very
9 meaningful, as in this particular situation.

10 MR. TOURTELLOTTE: Well I have to disagree in
11 principle. I don't think that either Mr. Fleischaker or
12 Mr. Norton have it straight.

13 It's not a matter that the Commission has said
14 the Boards will not consider what the ACRS has done. What
15 they have done is, they have said they won't inquire into the
16 truth of the matter asserted in the ACRS letter. And that is
17 quite a different item.

18 We're not talking about not considering what the
19 ACRS has done; we certainly do consider it, the Staff considers
20 it, and testimony has been from this witness that the Staff does
21 take it into consideration.

22 What is confusing about it is that the Staff is
23 not required, nor is the Commission required, nor is the
24 Commission bound in any way, nor is the Staff bound in any
25 way, to follow what the ACRS letter might recommend. And the

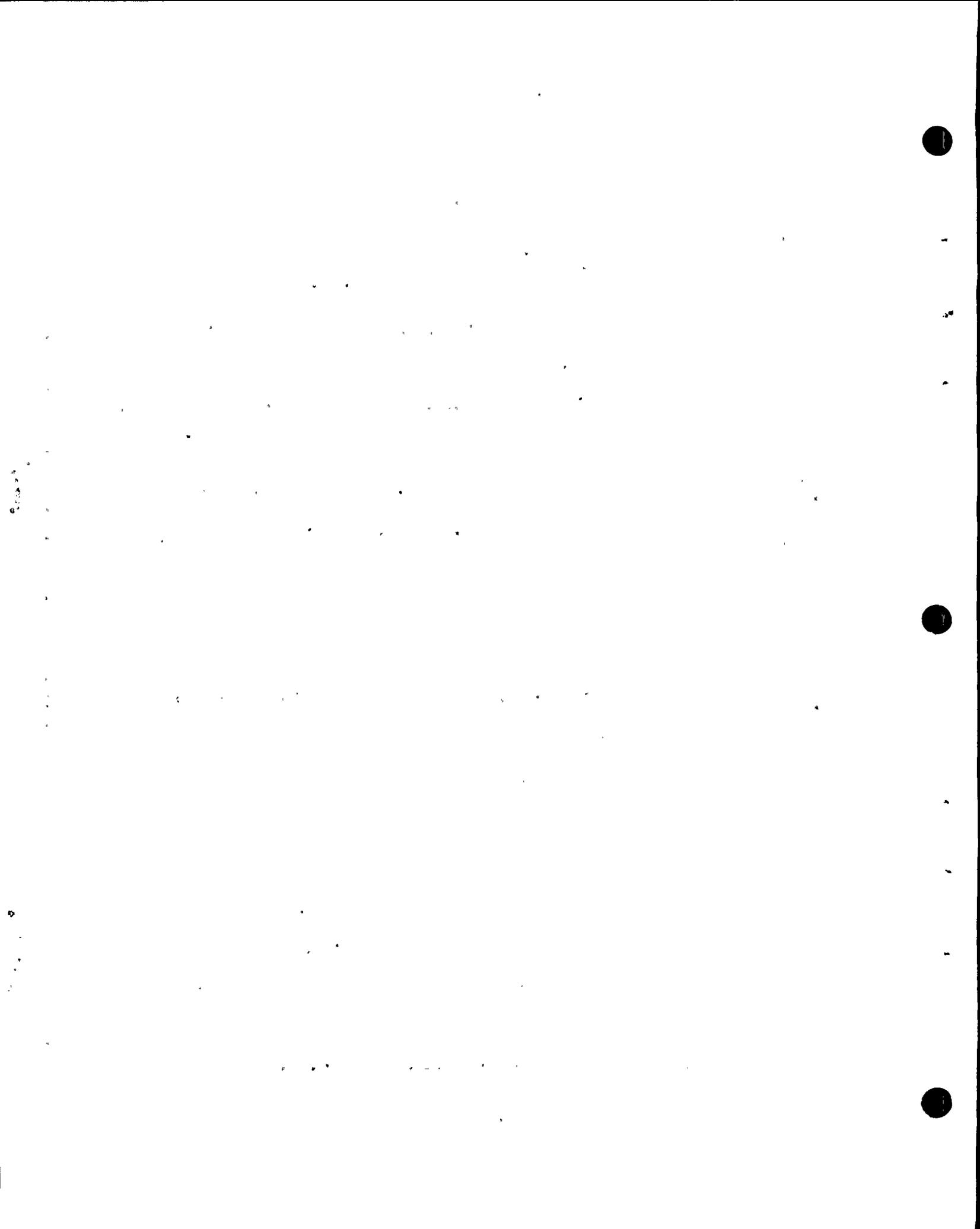


1 reason for that is that the ACRS is an independent separate
2 body. The separateness of the body is to insure the integrity
3 of the review, though. The separateness of the body is not
4 so that their opinions won't be considered by -- the opinions
5 of the ACRS would not be considered by the Commission or
6 vice-versa. That's why they are advisory. And it's just
7 that, again, the whole scheme turns on the word "advisory."
8 That's all they are, they're an advisory committee.

9 And while we may not be bound by what they say,
10 and it may not be evidence in terms of showing anything for
11 the truth of the matter asserted, we can consider it. And I
12 would invite the Board's attention to the fact that I didn't
13 open the door to the ACRS, the intervenor opened the door
14 to the ACRS. And what he's asking this Board to do is to
15 accept his cross-examination about two consultants to the
16 ACRS and how much they were complaining to the General ACRS
17 and to the Staff about the methodologies used, and not allow
18 the Staff in any way to establish the fact that obviously
19 the rest of the ACRS discarded what they had to say or they
20 would have made it more prominent in their recommendation.
21 It seems to me that's kind of an unfair way to proceed.

22 If we are going to strike this then we need to
23 strike all of the cross-examination this morning that
24 Mr. Fleischaker had on the ACRS.

25 (The Board conferring.)



1 MRS. BOWERS: Well, we are going to grant the
2 motion to strike. We do think it is an inquiry into the
3 collegial thinking of the ACRS.

4 We also believe that there has been a great deal
5 of time spent trying to explore the fact that there was
6 advice given to ACRS by Dr. Trifunac and Dr. Luco, that the
7 record evidently supports was not accepted.

8 We'd like for you to proceed, Mr. Tourtelotte

9 BY MR. TOURTELLOTTE:

10 Q You indicated that when you talked with
11 Dr. Trifunac and asked him what he thought the Staff should
12 do that he suggested a probabilistic analysis; is that
13 correct?

14 A Yes.

15 Q And how did the Staff generally view that
16 recommendation?

17 I will ask you: How did you view that recommen-
18 dation?

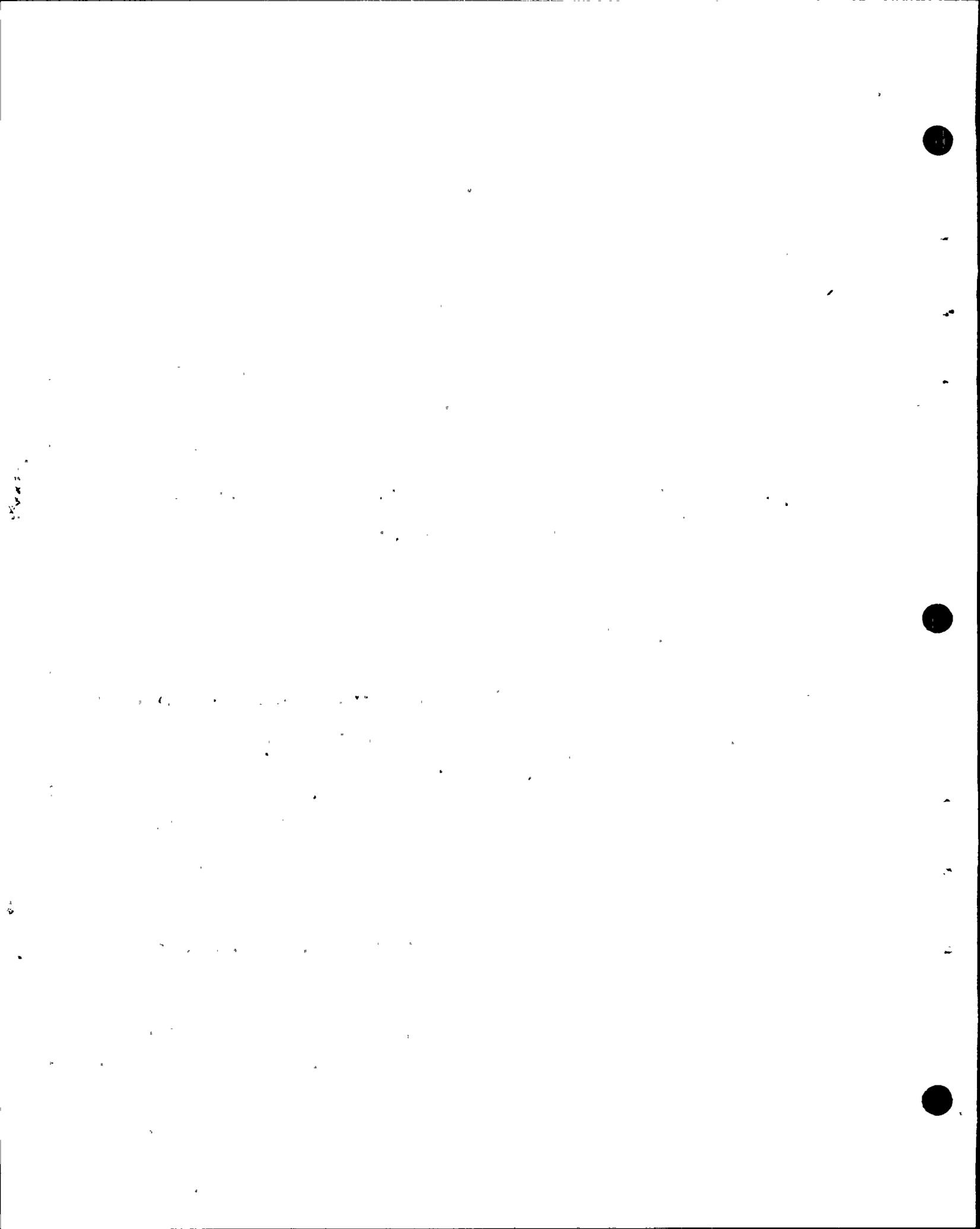
19 A I viewed it as an impractical way to proceed,
20 because I view the regulations as basically requiring a
21 deterministic analysis as opposed to a probabilistic one.

22 Q What is the standard that you use for the purpose
23 of reviewing plants?

24 A The standard that we use is to provide assurance
25 the legal language is "reasonable assurance," but assurance

WRB/wb8

C5



1 that the plant can be operated safely without any undue risk
2 to the public health and safety.

3 Q And there have been various comments about
4 whether the review accomplished in the case of Diablo was the
5 normal review or not. Was it a normal review?

6 A No, it wasn't normal at all.

7 Q Would you say that the type of review that was
8 performed was above or below normal?

9 A The review was above normal in the sense of
10 being more detailed and paying far more attention to seismic
11 design matters than we normally do.

12 Q And compared with a "normal" review, how much
13 confidence would you have in the kind of review that was
14 performed vis-a-vis the normal review?

15 A Well the kind of review that has been performed
16 provides me with far more assurance that the seismic design
17 is adequate than a normal review would . .

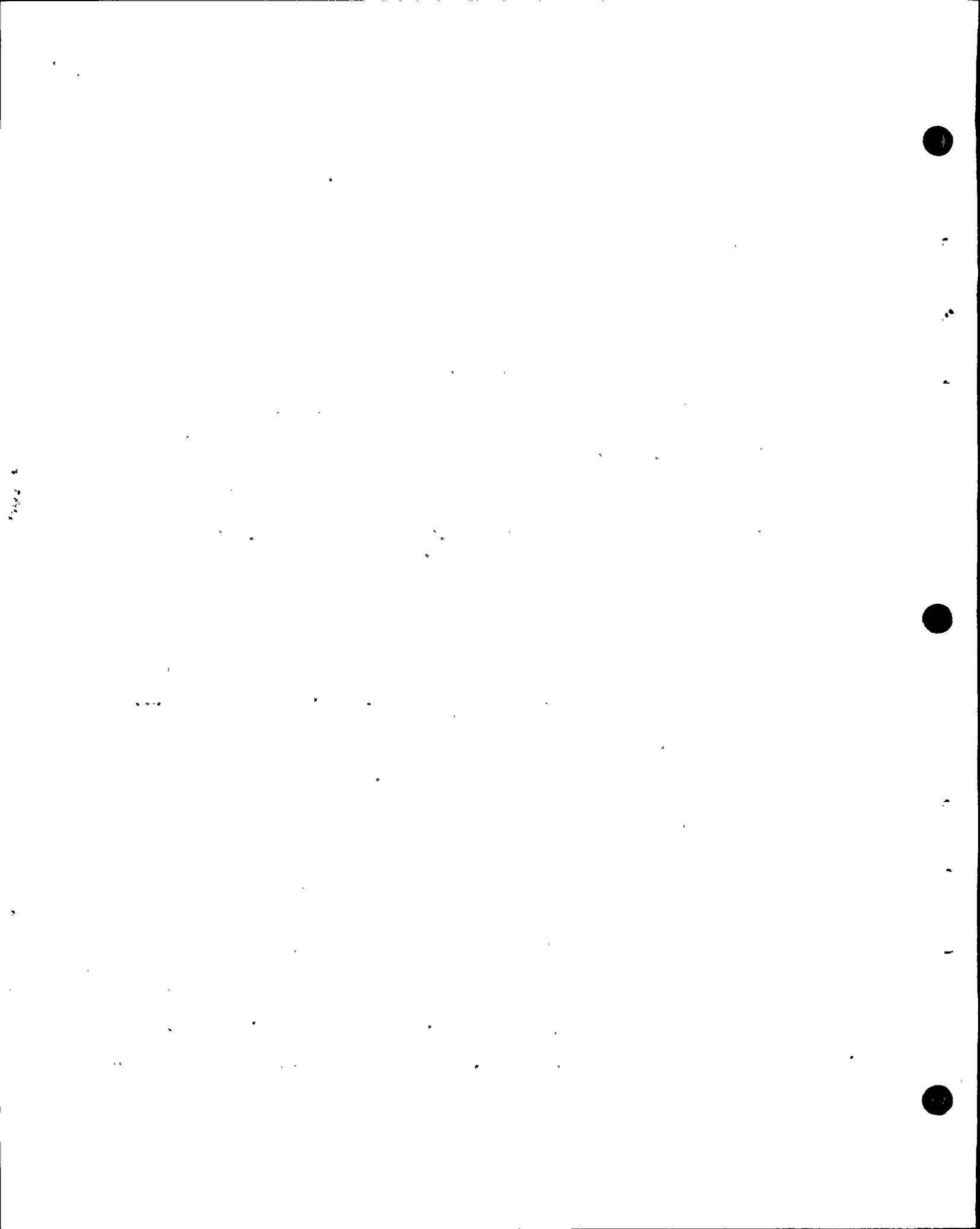
18 Q Were there any exceptions made -- any exemptions
19 given from the regulations by the Staff relative to the
20 seismic review?

21 A No, none of them given relative to the seismic
22 review.

23 MR. TOURTELLOTT: I have no other questions.

24 MRS. BOWERS: I assume that closes cross-examination.

25 MR. TOURTELLOTT: Yes. And we would like to ask



1 that this witness be excused.

2 MRS. BOWERS: Wait a minute. The Board has a
3 question or so.

4 EXAMINATION BY THE BOARD

5 BY MR. BRIGHT:

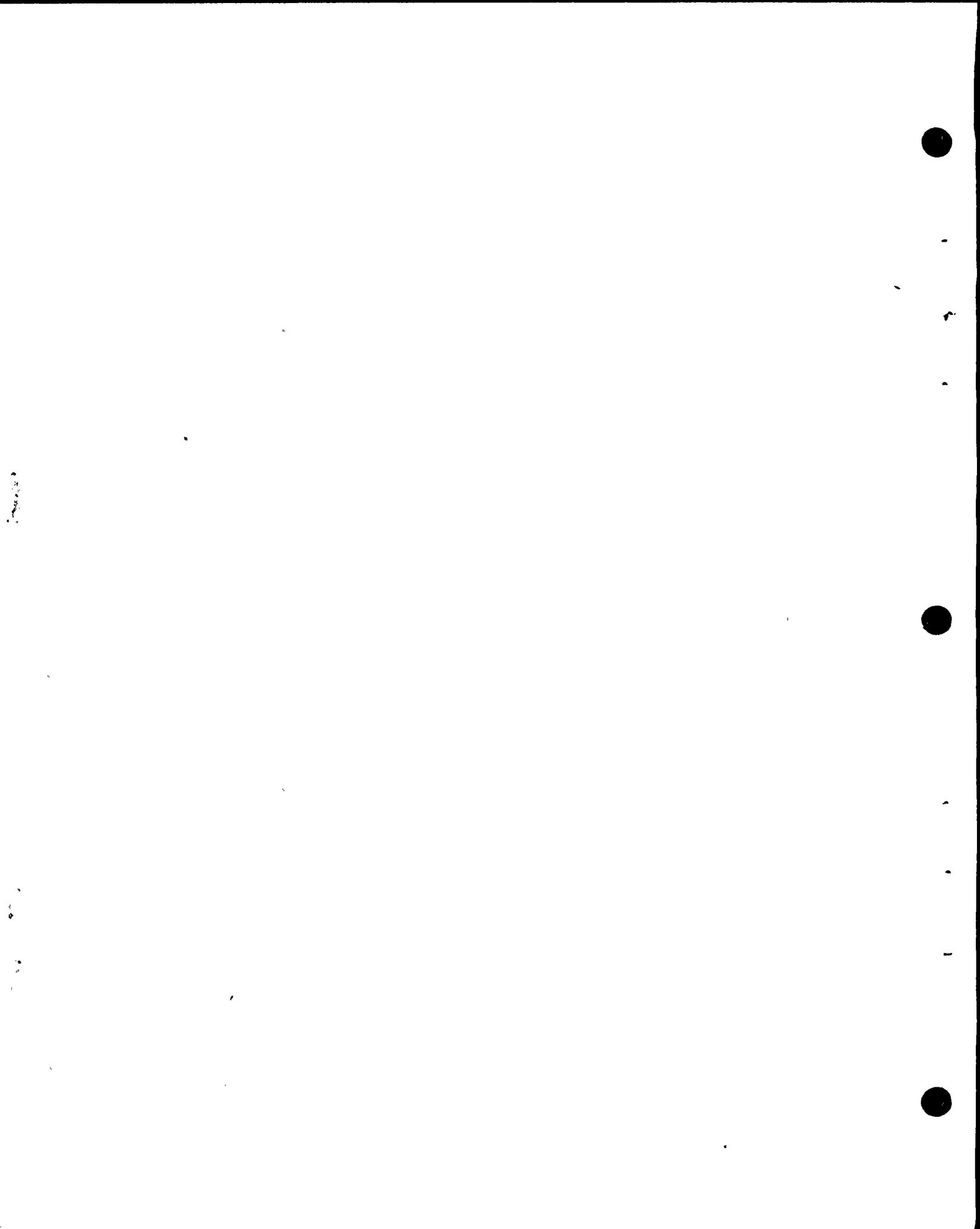
6 Q Just one. And this is strictly tied in with
7 Mr. Tourtellotte's question of exemptions being granted.

8 I understand from your testimony this morning
9 that the OBE of .2, which is less than half the SSE figure,
10 it was granted because of a probabilistic estimate of return,
11 or occurrence I presume you could put it, over some specified
12 number of years. Where is that set forth in the regulations?

13 A Excuse me just a second.

14 (Pause)

15 The .2g OBE -- I'm going to explain in this
16 answer it's not an exemption or a waiver of the regulations.
17 It does violate one sentence in Appendix A to Part 100.
18 There's a sentence in there that says that the operating basis
19 earthquake shall be at least one-half the safe shutdown
20 earthquake. However, in the beginning of Appendix A there is
21 another passage which says that if an applicant believes an
22 alternate approach should be used to anything in this regula-
23 tion he should submit a justification and we'll see about it.
24 That is what has been done here, so it meets Appendix A. Even
25 though it violates that one sentence in Appendix A, it meets

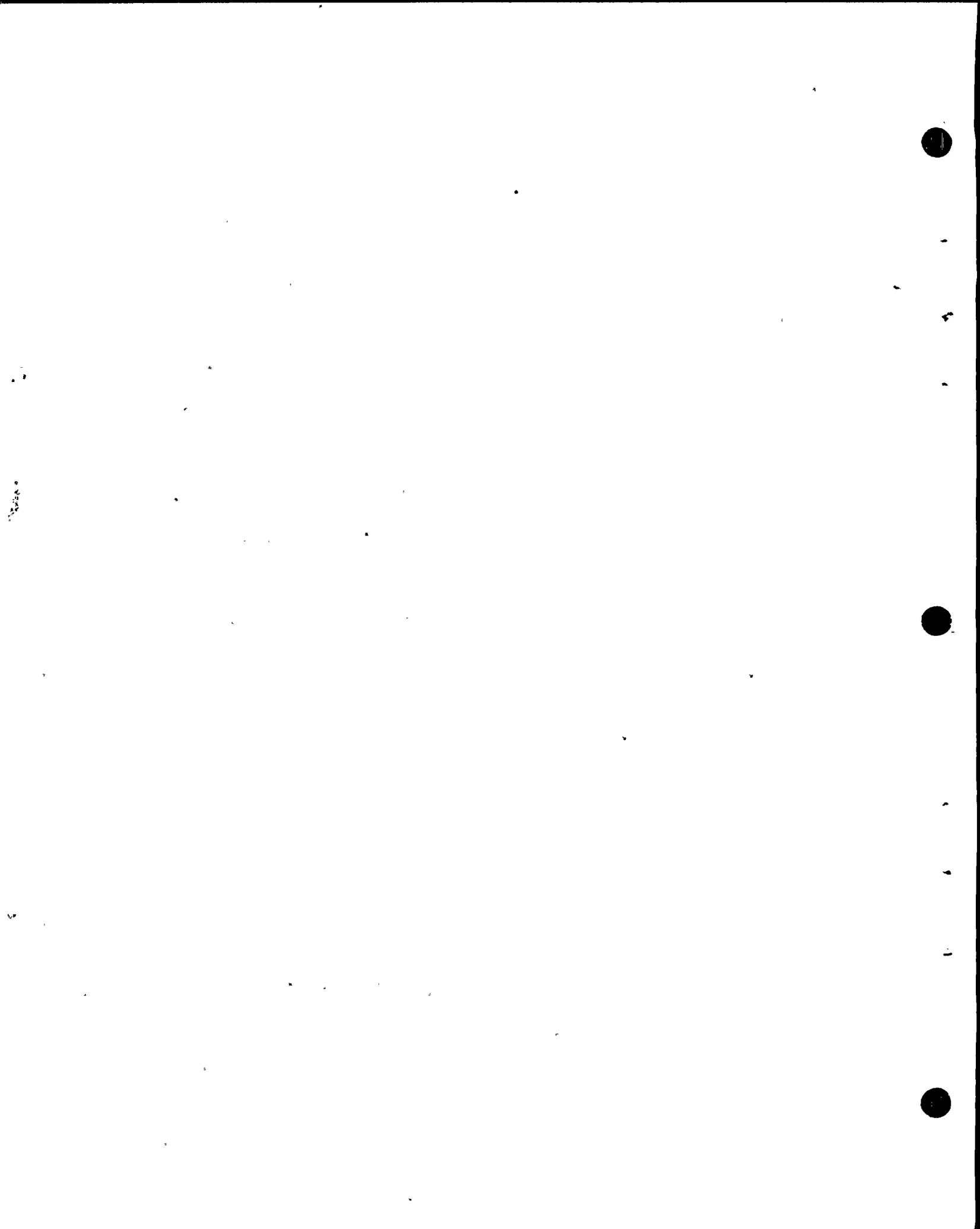


1 Appendix A itself, so it meets the regulations.

2 Q So that particular deviation from that particular
3 sentence was because of an overriding consideration, which
4 is that one may, if it can be justified, submit some other way of
5 doing these things?

WRB/wb11

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1 A Yes, that's correct. And the passages are quoted
2 on page 2-4 and 2-5 of Supplement 7 in the SER.

3 MR. BRIGHT: Fine.

4 BY MRS. BOWERS:

5 Q Are you familiar with the Bodega Bay situation?

6 A Yes, a little bit. I've done some reading of that
7 file incidental to answering questions about Diablo Canyon.

8 Q Do you know if that's the only time that the Staff
9 did not accept the ACRS advice?

10 A No, I'm not sure about that. In that particular
11 case, the Staff went flatly against the specific recommendation
12 of the ACRS. Of course, it was a known situation. The Staff
13 had gone to the ACRS and said this is what we think, and the
14 ACRS came out -- this was not done in public in those days --

15 (Laughter)

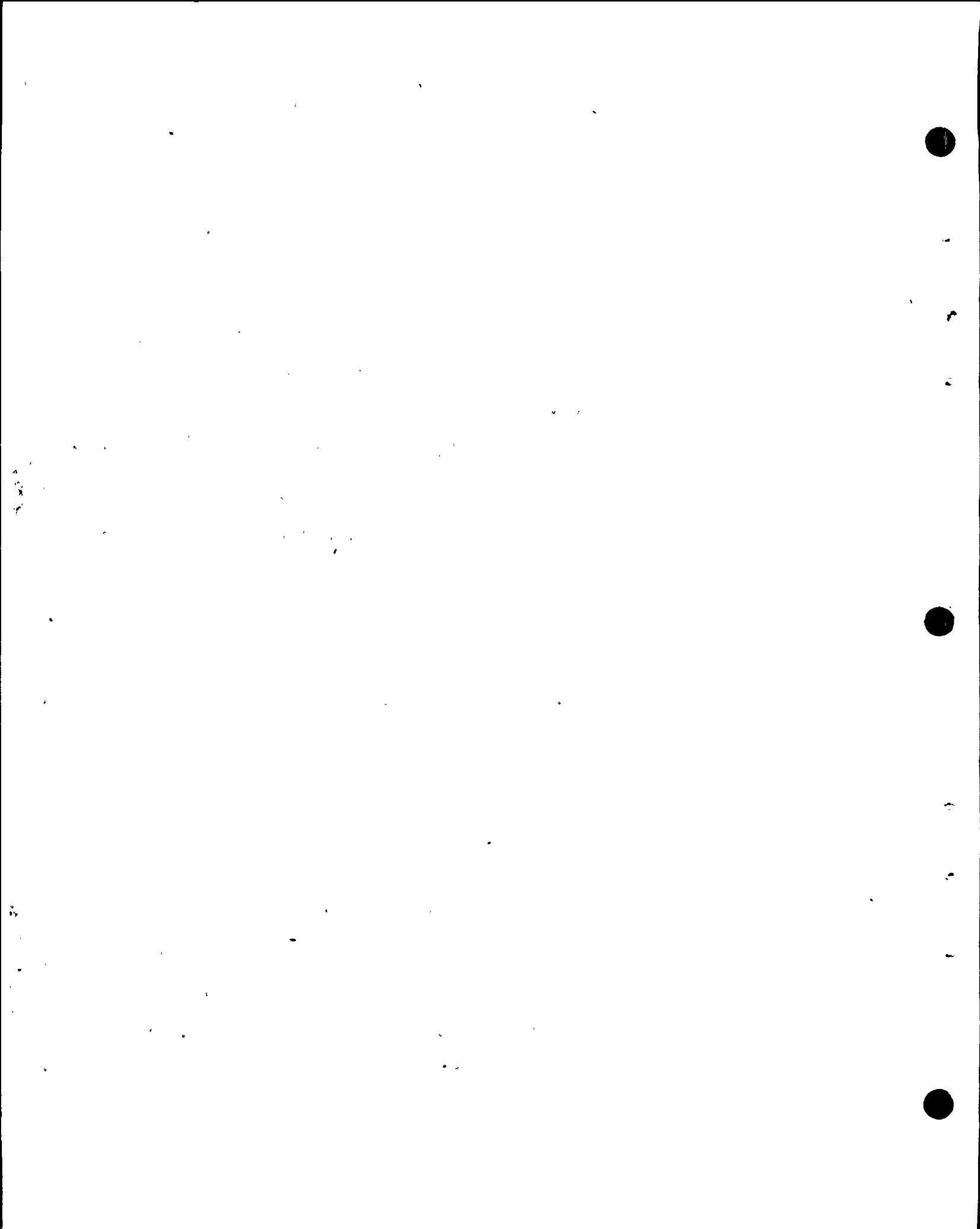
16 -- the ACRS came out and said the exact, you know -- no. And
17 the Staff then got the last shot to make its position public.

18 But it decided no, we have to oppose the ACRS in
19 this issue.

20 I think there may be another example, but I'm not
21 familiar with it.

22 MR. FLEISCHAKER: Can I just add a note? Wasn't
23 Enrico Fermi -- was it that kind of a --

24 THE WITNESS: I believe that was the other case,
25 but I'm not familiar with that case.



wel 2

1 MRS. BOWERS: Let me check with the parties on the
2 Board's questions.

3 Mr. Tourtellotte?

4 MR. NORTON: I think Mr. Tourtellotte should go
5 last. It's his witness.

6 MRS. BOWERS: All right, Mr. Norton.

7 CROSS-EXAMINATION ON BOARD QUESTIONS

8 BY MR. NORTON:

9 Q By Mrs. Bowers' last question it left the impression
10 in my mind that somebody might think that the ACRS advice
11 wasn't followed in this case. That's not your testimony, is
12 it?

13 A No, it's not.

14 MR. NORTON: Okay.

15 MRS. BOWERS: Mr. Fleischaker?

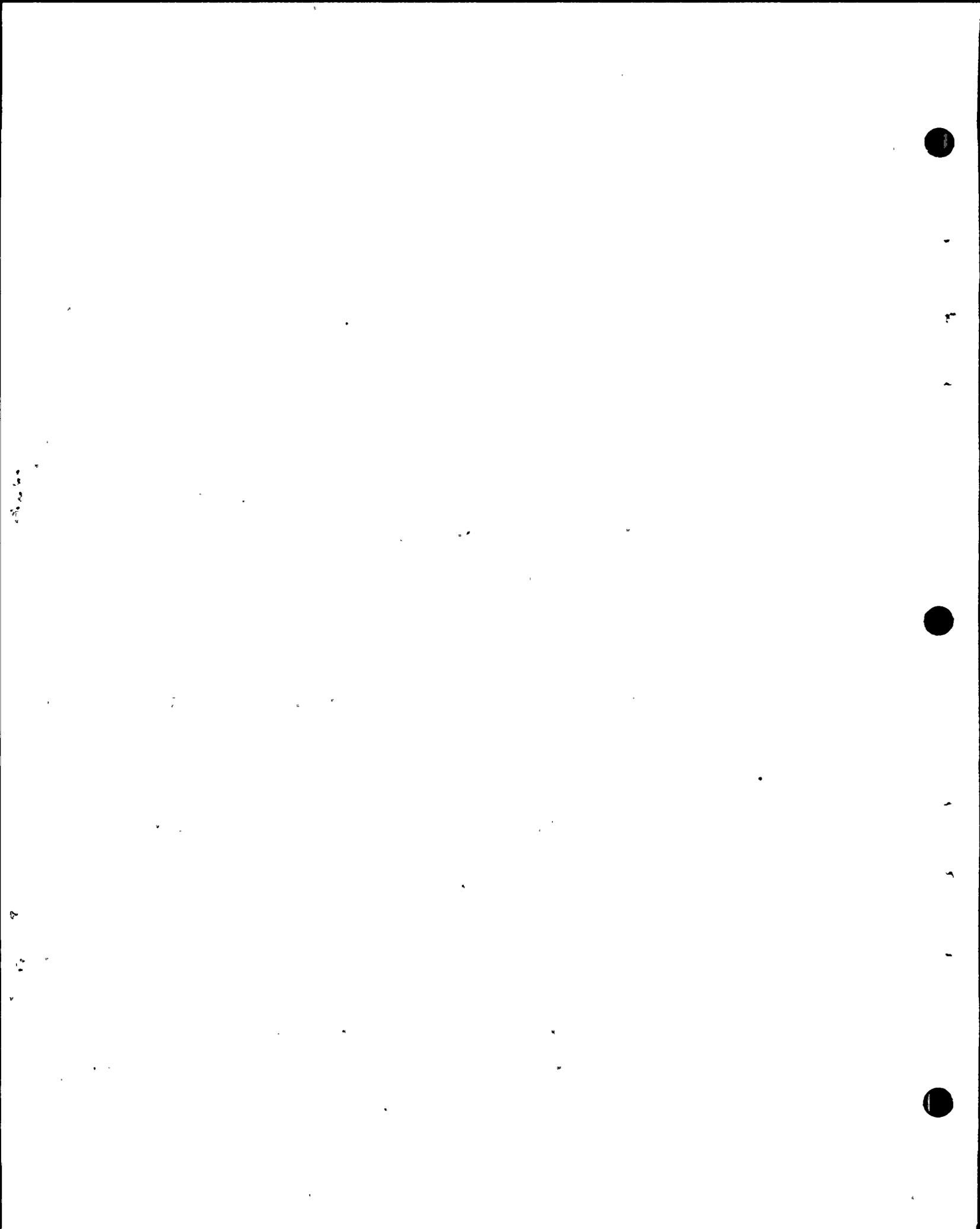
16 MR. FLEISCHAKER: No.

17 MRS. BOWERS: Mr. Tourtellotte?

18 BY MR. TOURTELLOTTE:

19 Q I guess being an old prosecutor I cringe a little
20 bit when somebody uses the word "violate," but I'd like for
21 the witness to clarify the use of that term, as to whether he
22 meant that actually the regulations were not followed, or
23 whether the methodology used was an alternative method which
24 was permitted by the regulations.

25 A The methods used were an alternative that are



1 permitted by the regulations, so there was no violation of
2 the regulations, nor exemption, nor exception.

3 MR. TOURTELLOTTE: I have nothing further.

4 MRS. BOWERS: The Board has no further questions
5 of this witness.

6 MR. TOURTELLOTTE: Could you give us about ten
7 minutes to arrange our papers, and we will call next Dr.
8 Stepp, Renner Hofmann and Richard McMullen.

9 MR. NORTON: May Mr. Allison be excused?

10 MRS. BOWERS: Any objection, Mr. Fleischaker?

11 MR. FLEISCHAKER: No.

12 MRS. BOWERS: Mr. Allison is excused.

13 (Witness excused.)

14 (Recess.)

15 MRS. BOWERS: Are you ready to proceed, Mr.
16 Tourtellotte?

17 MR. TOURTELLOTTE: Yes.

18 MRS. BOWERS: First, let's swear the witnesses in.

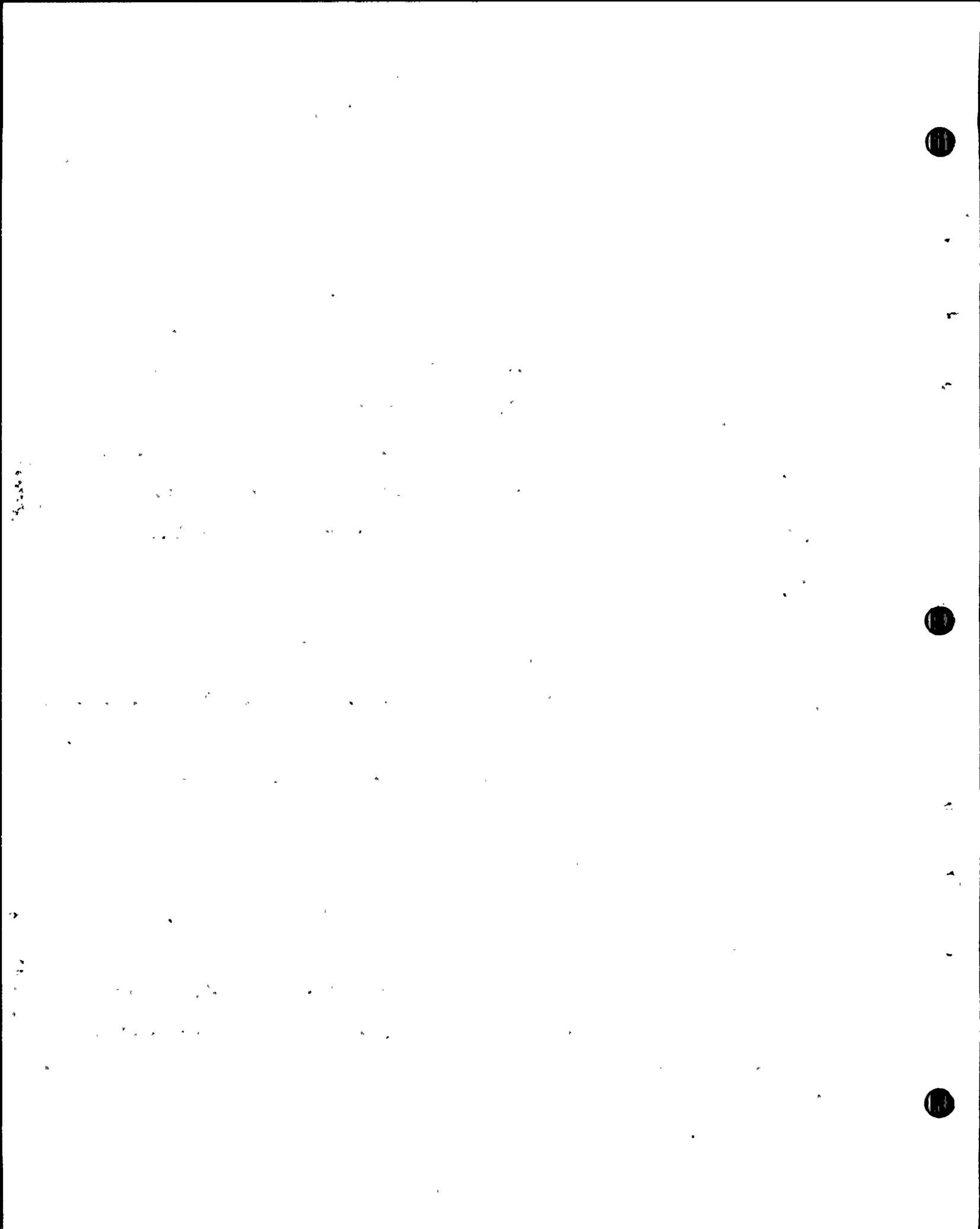
19 Whereupon,

20 J. CARL STEPP

21 and

22 RICHARD B. MC MULLEN

23 were called as witnesses on behalf of the NRC Regulatory Staff
24 and, having been first duly sworn, were examined and testified
25 as follows:



wel 4

1 MR. TOURTELLOTTE: Mrs. Bowers, so there won't be
2 any confusion, as the parties and the Board know, in the seis-
3 mic matter we have two different pieces of testimony prepared.
4 One was prepared primarily by and under the supervision of
5 Dr. Stepp, and another set of testimony was prepared by
6 Renner Hofmann.

7 And since they have separate pieces of testimony,
8 rather than put them all on at the same time and being
9 confused about what testimony each of the parties are answering
10 questions about, we're going to proceed with Dr. Stepp's
11 testimony first, and then we'll proceed with Mr. Hofmann's.

12 MRS. BOWERS: Fine. Did I get what was simply
13 an additional copy of Dr. Stepp's testimony, Mr. Ketchen?

14 MR. KETCHEN: Yes.

15 MR. TOURTELLOTTE: We have sent out all the copies
16 of testimony and P.Q.'s, but we happened to bring copies today
17 with us so that in the event that anybody needed them we
18 would have them.

19 MRS. BOWERS: Mr. Ketchen said he's not going to
20 take any of that back with him, so I think that's why he's
21 being very generous.

22 MR. TOURTELLOTTE: That's true. Any copies that
23 we have left we are going to distribute on the street corners
24 of San Luis Obispo.

25 (Laughter.)



Handwritten mark or scribble on the left margin.

1 MR. FLEISCHAKER: I didn't understand why we were
2 putting on two different panels.

3 MR. TOURTELLOTTÉ: We have two different pieces of
4 testimony. One is entitled, "Testimony of Dr. J. Carl Stepp,"
5 and the other are two pieces of testimony which were
6 prepared and have the name of Renner Hofmann on them. So
7 at this time we're going to submit these parties for cross-
8 examination on the testimony of Dr. Stepp. When they are
9 through, Renner Hofmann will take the stand in regard to his
10 pieces of testimony.

11 MRS. BOWERS: But in questions by the parties, do
12 they still treat the two of them as a panel if they have a
13 question to be answered by one or the other? If you're
14 treating them completely separately, why have them both here
15 at the same time?

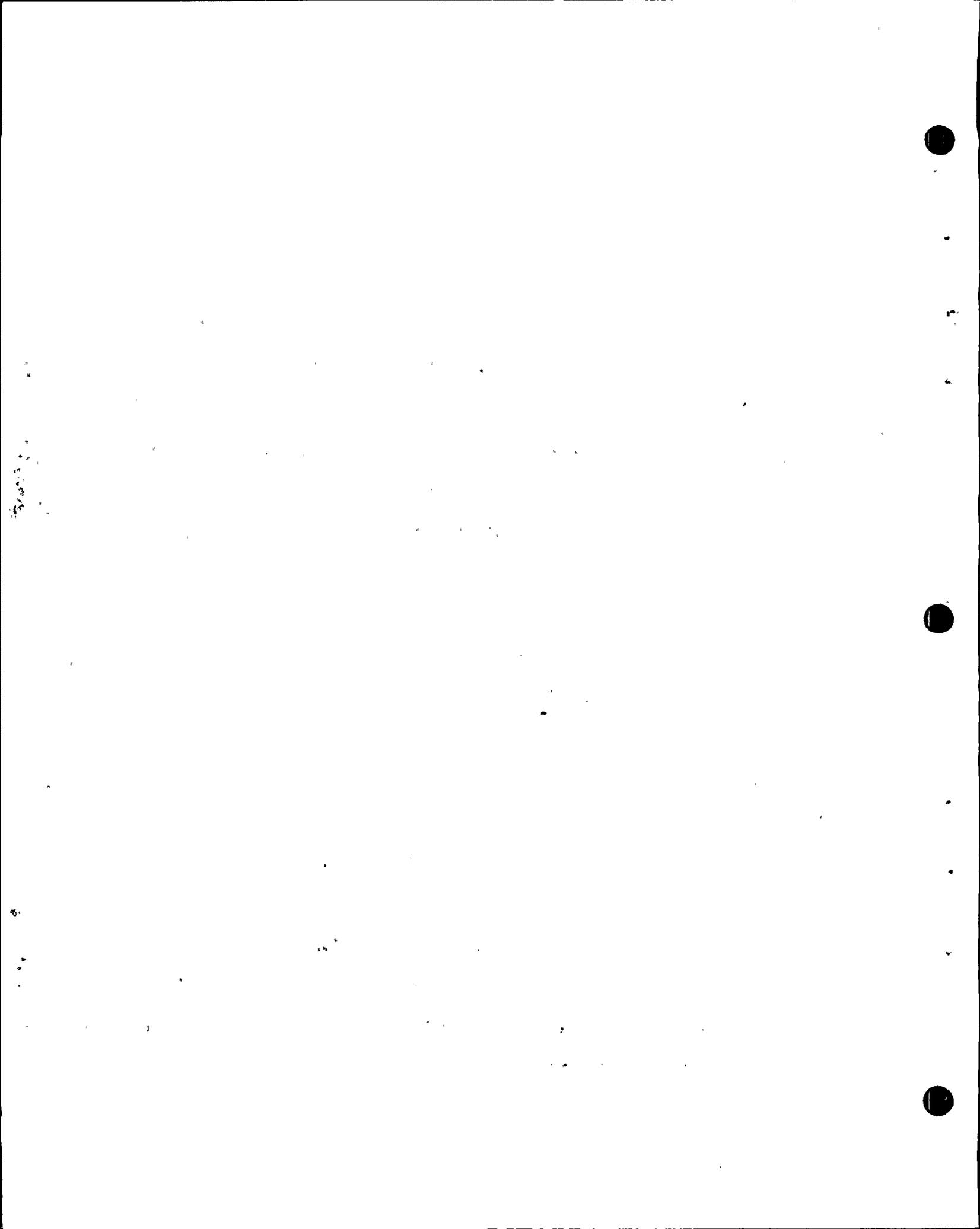
16 MR. TOURTELLOTTÉ: No, who you have right now are
17 Dr. Stepp and Richard McMullen seated at the panel table there.

18 MR. FLEISCHAKER: Here's my confusion:

19 I know Mr. McMullen is a geologist. Dr. Stepp is
20 a seismologist. He may also be testifying on geological
21 matters, I don't know.

22 But I also understood that Mr. Hofmann is a
23 seismologist, and so you're going to have two panels on
24 seismology. Is that it?

25 MR. TOURTELLOTTÉ: We have two different pieces of



wel 6

1 testimony on seismology and geology -- actually on seismology,
2 I guess. And that is in keeping with the Commission's view
3 on dissenting viewpoints, because while Dr. Stepp and Renner
4 Hofmann agree in the bottom line, there is a difference of
5 opinion about methodology.

6 So the principal Staff view is represented by
7 Dr. Stepp and the dissenting view is represented by Renner
8 Hofmann.

9 MRS. BOWERS: I misunderstood. I didn't realize
10 that Mr. McMullen is who he is.

11 MR. FLEISCHAKER: Jim, I don't think I'll have any
12 problem with it, but so I can cross-examine this panel -- I
13 have their testimony, but this is geology and seismology,
14 and Mr. Hofmann is just seismology, correct?

15 MR. TOURTELLOTTE: Yes.

16 MR. FLEISCHAKER: And the principal reason for
17 dividing it up is because Hofmann represents the dissenting
18 view?

19 MR. TOURTELLOTTE: Yes.

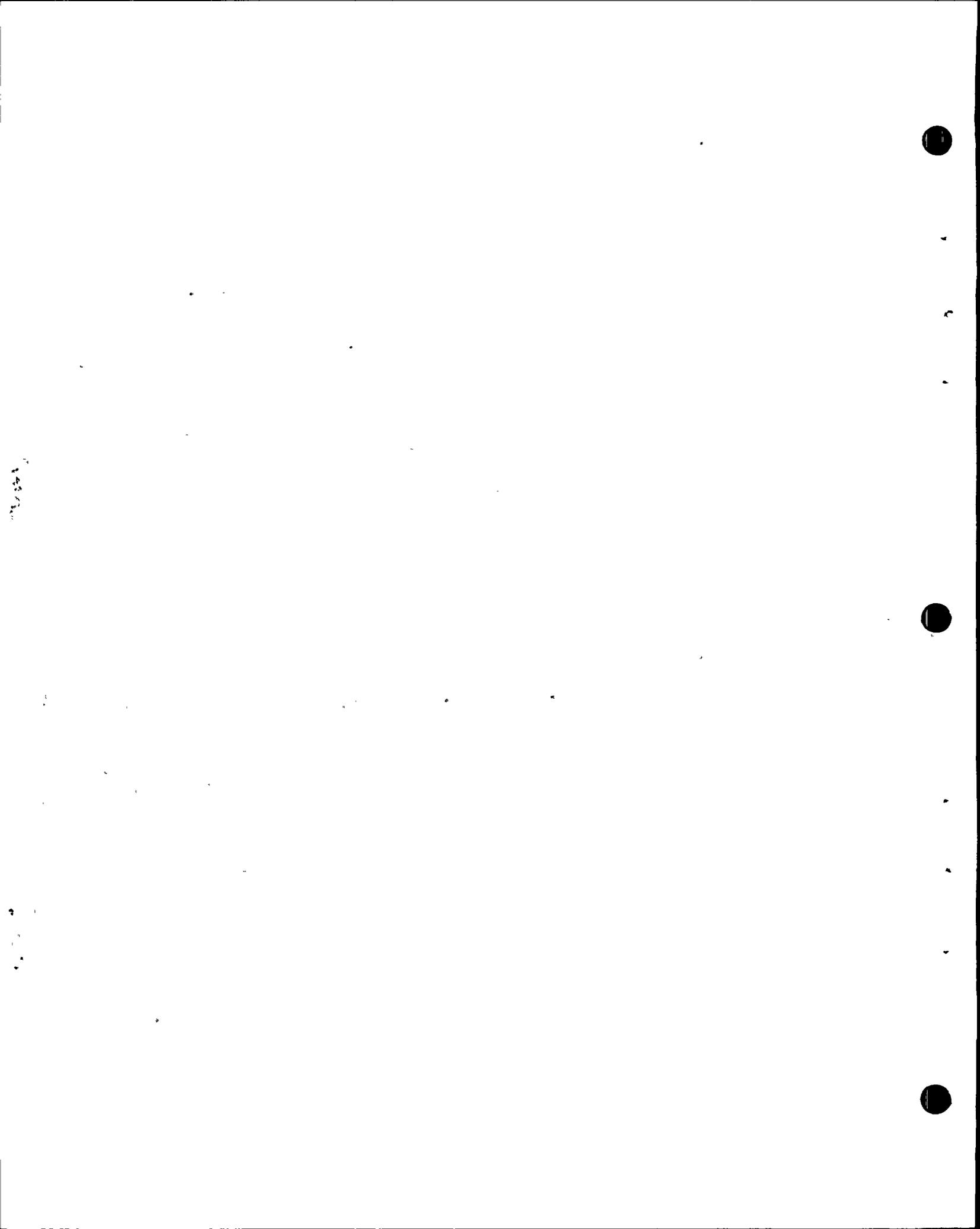
20 MR. FLEISCHAKER: Okay. Thank you.

21 DIRECT EXAMINATION

22 BY MR. TOURTELLOTTE:

23 Q Dr. Stepp, would you state your name, address and
24 occupation, please?

25 A (Witness Stepp) I'm J. Carl Stepp. I live at



1 1424 Highland Drive, Silver Spring, Maryland, and I am
 2 currently Chief of the Geosciences Branch, Nuclear Regulatory
 3 Commission.

4 Q Did you prepare a statement of professional
 5 qualifications for presentation during these hearings?

6 A Yes, I did.

7 Q And is that statement of professional qualifications
 8 entitled, "J. Carl Stepp, Geosciences Branch, Division of
 9 Site Safety and Environmental Analysis, U. S. Nuclear
 10 Regulatory Commission?"

11 A That's correct.

12 Q Do you have any additions or corrections or
 13 deletions you wish to make?

14 A No.

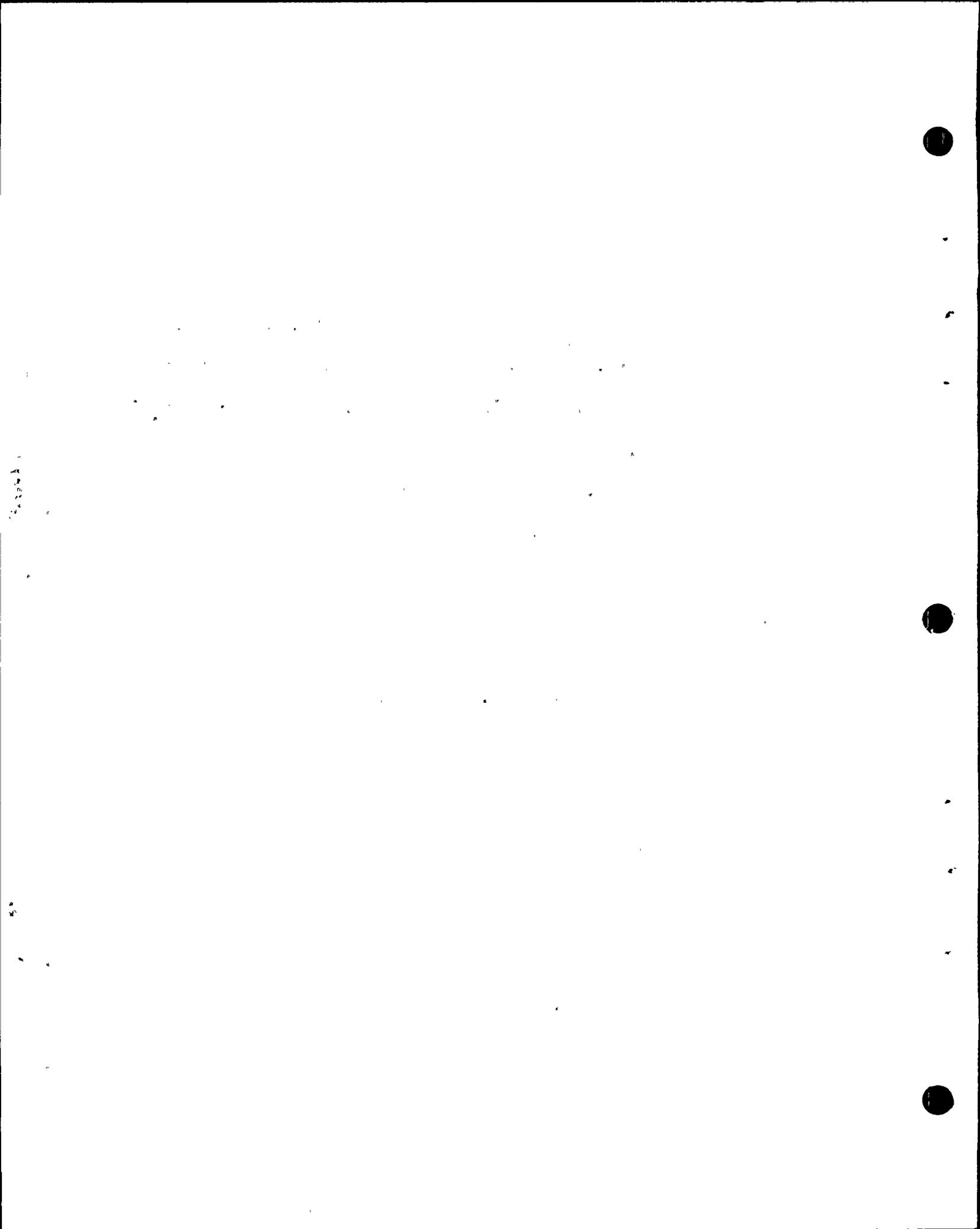
15 Q Mr. McMullen, would you state your name, address
 16 and occupation, please?

17 A (Witness McMullen) Richard B. McMullen. I live
 18 at 11221 Waycross Way, Kensington, Maryland, and I'm a
 19 geologist on the NRC Staff, Bethesda, Maryland.

20 Q Did you prepare a statement of professional
 21 qualifications for this hearing today?

22 A Yes, I did.

23 Q And is that titled, "Richard B. McMullen,
 24 Professional Qualifications, Geosciences Branch, Division of
 25 Site Safety and Environmental Analysis, Nuclear Regulatory



wel 8.

1 Commission?

2 A Yes.

3 Q Do you have any additions, corrections or deletions
4 you wish to make?

5 A No.

6 MR. TOURTELLOTT: At this time I would request
7 that the professional qualifications of J. Carl Stepp and
8 Richard B. McMullen be incorporated into the record as if
9 read..

10 MR. NORTON: No objection..

11 MRS. BOWERS: Mr. Fleischaker?

12 MR. FLEISCHAKER: No objection.

13 MRS. BOWERS: The statements of professional
14 qualifications that you've identified will be physically
15 inserted into the transcript as if read.

INSERT (2) 16

(The documents follow:)

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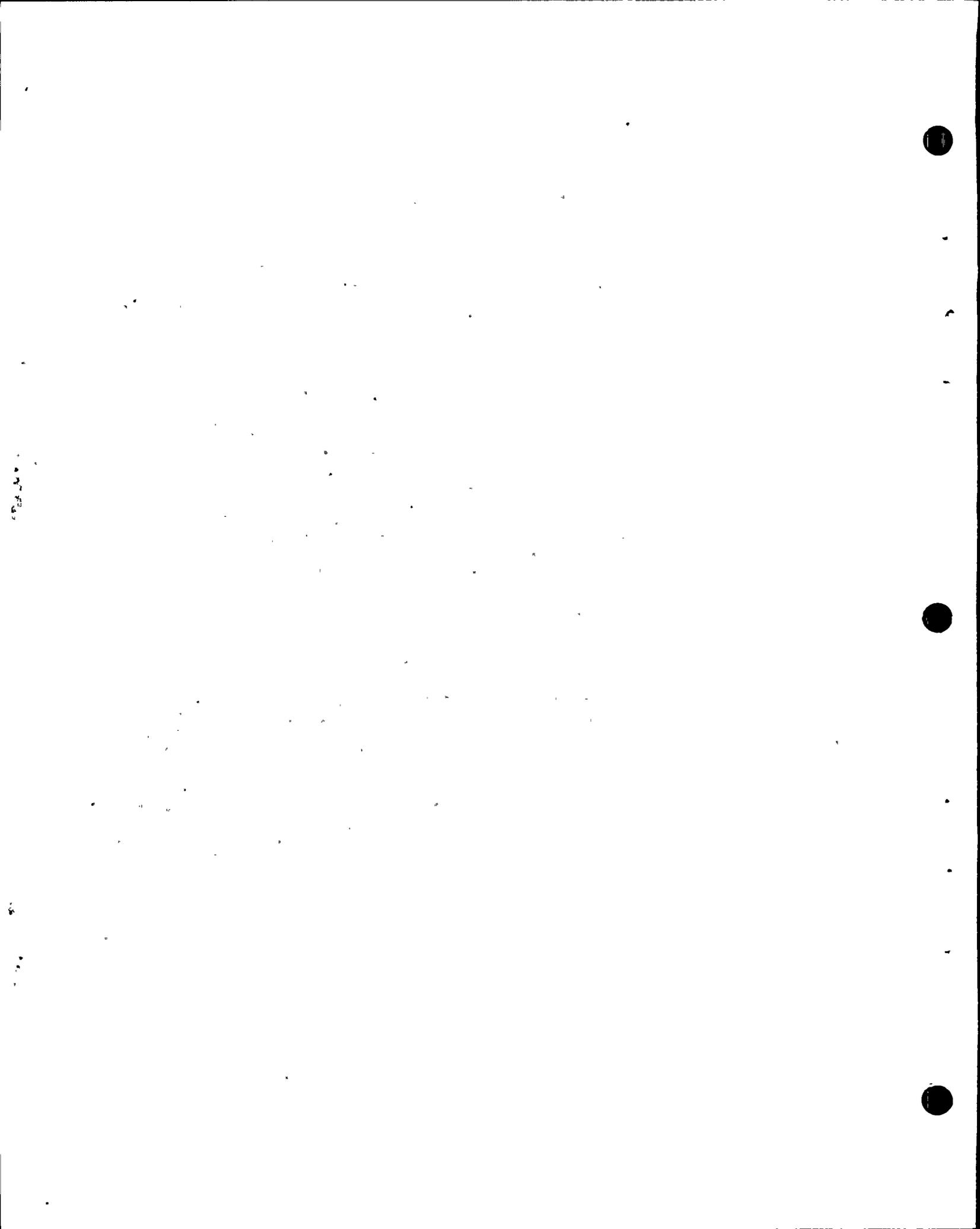
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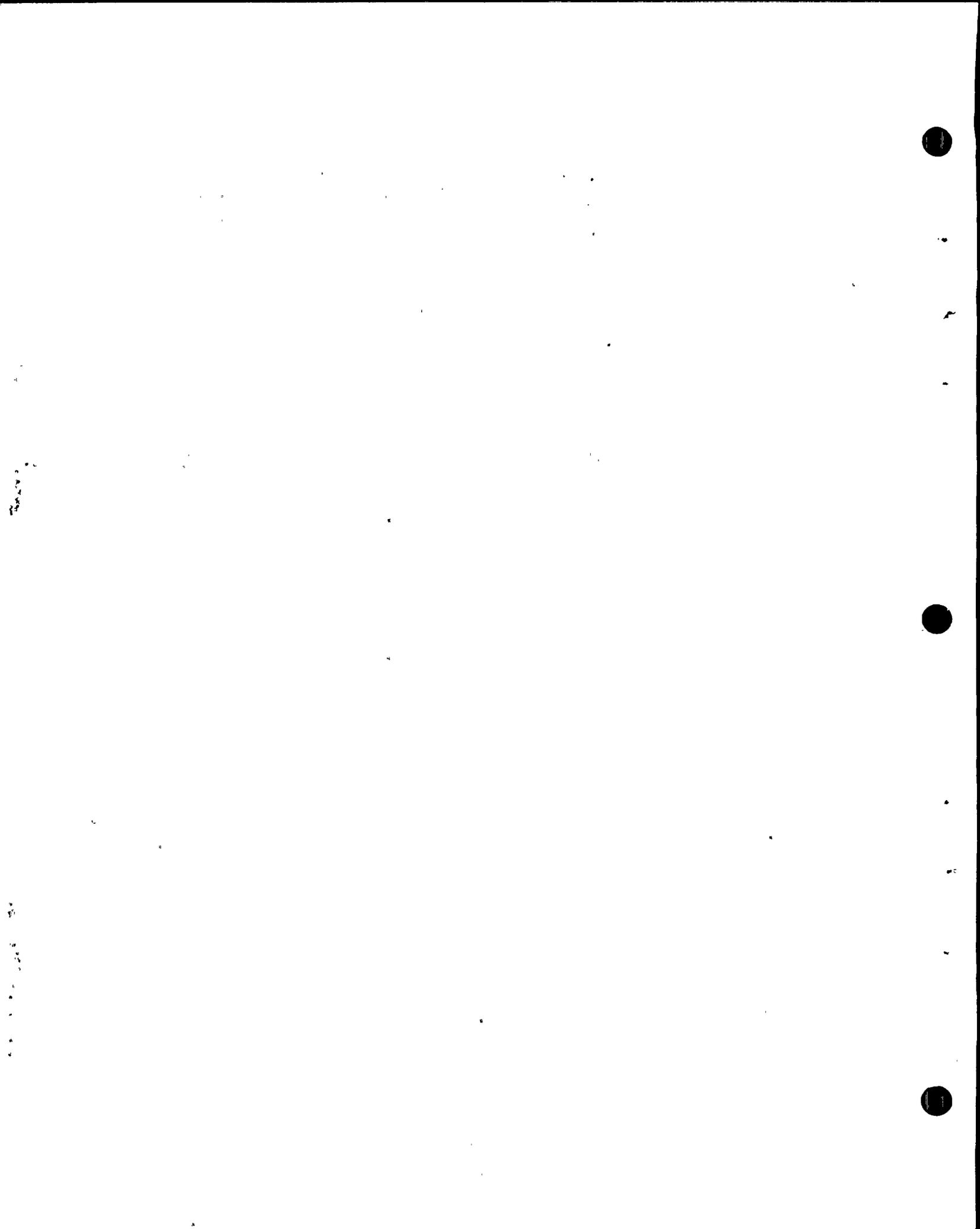


J. CARL STEPP
GEOSCIENCES BRANCH
DIVISION OF SITE SAFETY AND ENVIRONMENTAL ANALYSIS
U. S. NUCLEAR REGULATORY COMMISSION

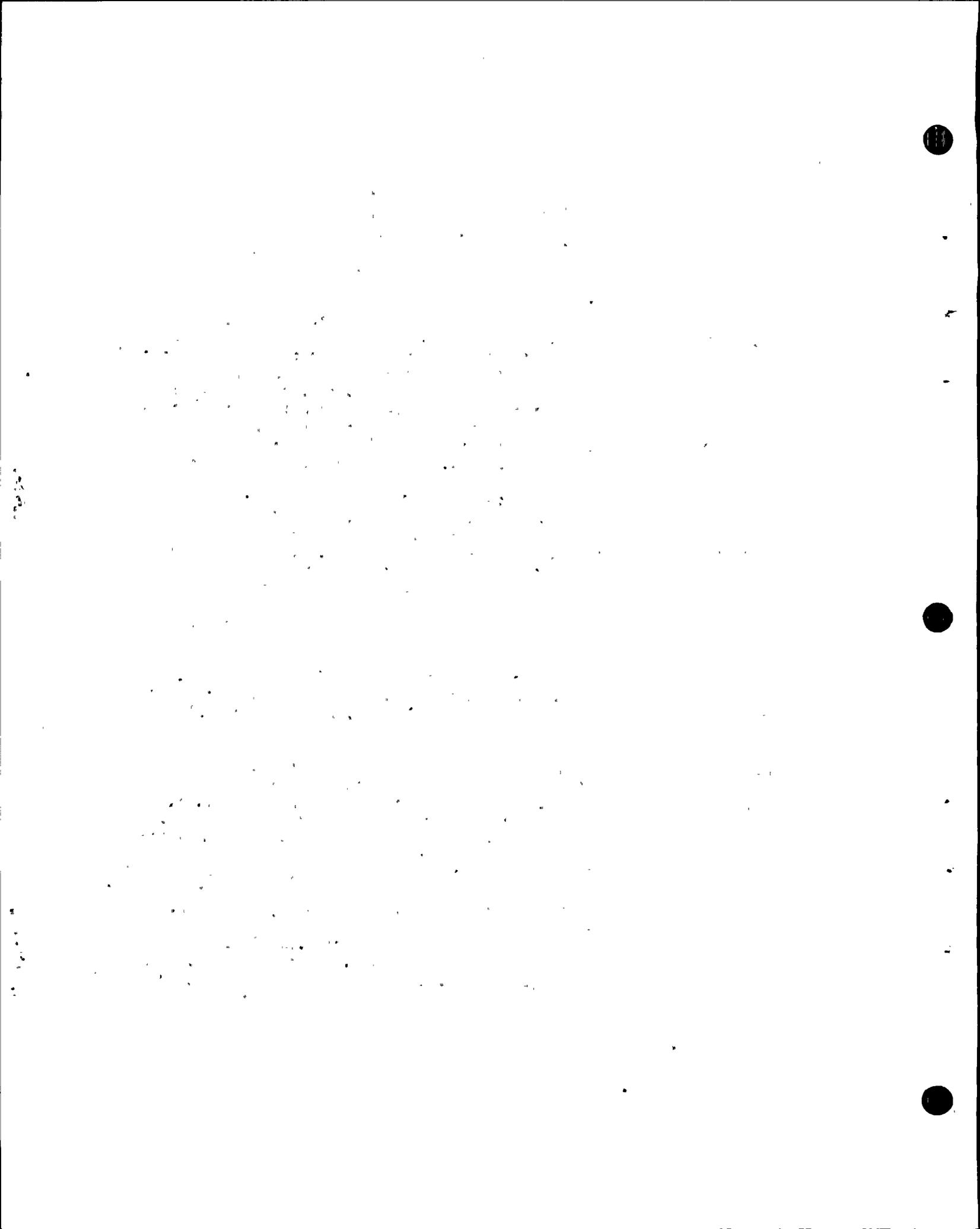
My name is J. Carl Stepp. I presently reside at 1424 Highland Drive, Silver Spring, Md. 20910 and am employed as Chief of the Geosciences Branch, Division of Site Safety and Environmental Analysis, Office of Nuclear Reactor Regulation, Washington, D. C. 20555.

PROFESSIONAL QUALIFICATION

I received a Bachelor of Science degree in Geology from Oklahoma State University in 1959, a Master of Science degree in Geophysics from the University of Utah in 1961, and a Ph.D. in Geophysics (Seismology) from Pennsylvania State University in 1971. With the exception of one year of full time graduate study at Pennsylvania State University in 1964, I was employed by the National Oceanic and Atmospheric Administration (and its predecessor organizations, the Environmental Science Services Administration and the United States Coast and Geodetic Survey) from 1961 through the spring of 1973 as a research geophysicist specializing in earthquake hazard evaluation. My research there was directed toward determining relationships between geologic structure and earthquake occurrence in the United States, the statistical estimation of earthquake recurrence rates, and developing generally applicable methods of mapping earthquake hazards for guidance in earthquake resistant design of structures. As part of my assignment, I participated in a comprehensive study of the seismicity of the United States and a study of the earthquake recurrence statistics in California which formed the basis for the Department of Housing and Urban Development Report to Congress on the advisability of a national program for earthquake insurance. Since accepting my present position in March 1973, I have been responsible for evaluating the seismologic aspects of proposed sites for nuclear generating stations. My current position is Chief, Geosciences Branch. In that capacity I am responsible for managing the staff review of the geological, seismological and geotechnical engineering aspects of nuclear facilities for which applications for licenses have been made. I am a member of the Seismological Society of America, the American Geophysical Union, the Society of Exploration Geophysicists,



and the Earthquake Engineering Research Institute. I have served on the editorial board of Earthquake Notes, the Journal of the Eastern Section of the Seismological Society of America. I am the author or co-author of eight professional publications on earthquake hazard and earthquake zoning.

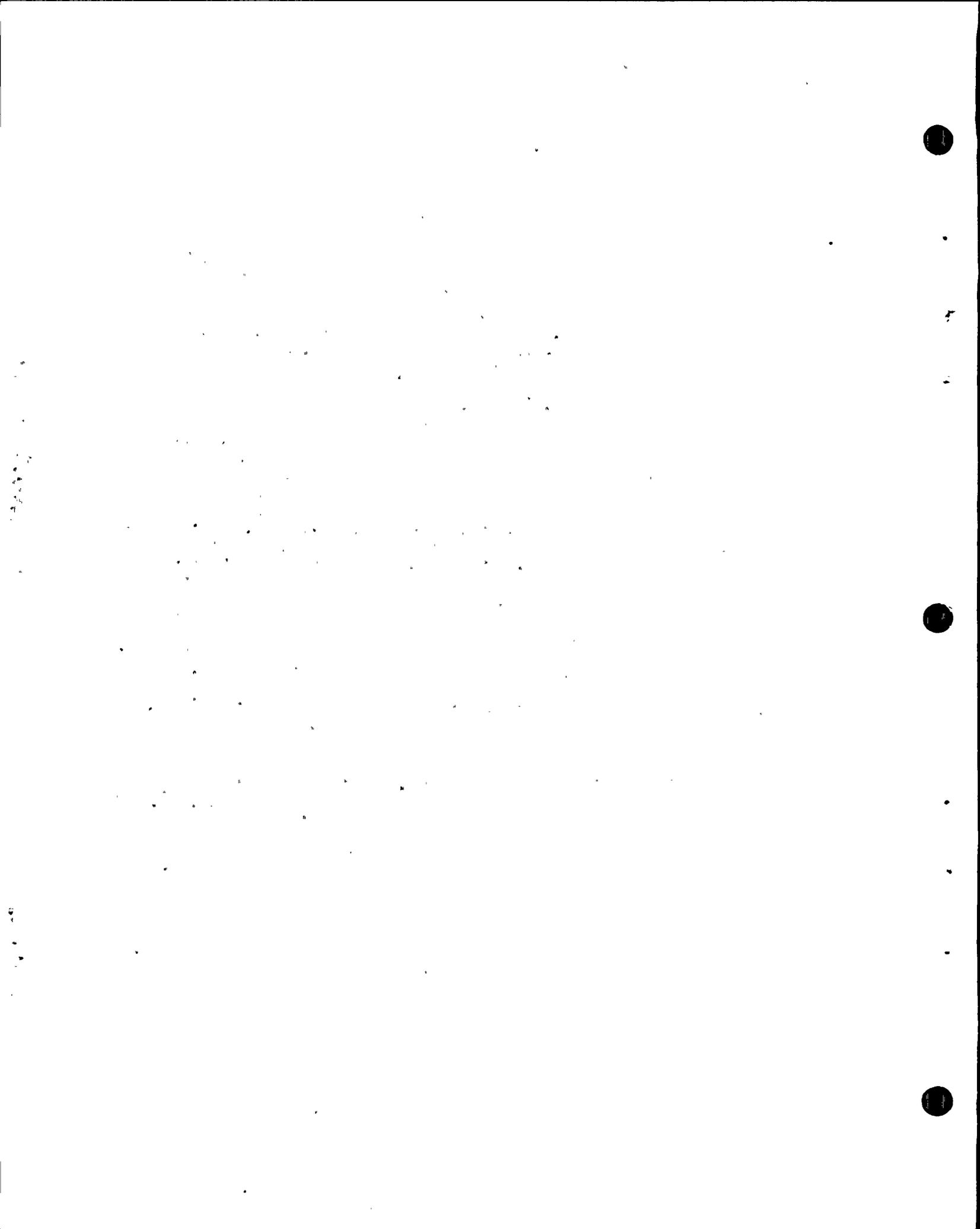


RICHARD B. MCMULLEN
PROFESSIONAL QUALIFICATIONS
GEOSCIENCES BRANCH
DIVISION OF SITE SAFETY AND ENVIRONMENTAL ANALYSIS
NUCLEAR REGULATORY COMMISSION

I am a Senior Geologist in the Geosciences Branch, Division of Site Safety and Environmental Analysis, Nuclear Regulatory Commission. My present duties in this position include: (1) the evaluation of geological aspects of sites for nuclear power generating facilities by analyzing and interpreting the geological data submitted to the NRC in support of applications for construction and operation of nuclear facilities in light of my background and pertinent information in the geological literature; (2) developing criteria; and (3) acting as consultant to the Regulatory staff on engineering and construction matters.

After completion of three years in the Marine Corps I attended the University of Florida and graduated in 1959 with a B.S. degree in Geology. During my professional employment, I have completed correspondence courses in soils engineering and quarrying sponsored by the Army Engineer School at Ft. Belvoir, Va., and short courses in the effects of ground motions on structures, airphoto interpreting, Plate Tectonics, and Engineering Seismology. At the October 1968 international meeting of the Association of Engineering Geologists, I was co-author and speaker of a paper entitled "Investigations for a New Panama Canal." I also presented a paper at the March, 1974 9th Annual Meeting of the Northeastern Section of the Geological Society of America entitled "Geological Aspects of Evaluating Nuclear Power Plant Sites." I am a registered Geologist and Engineering Geologist in the State of California.

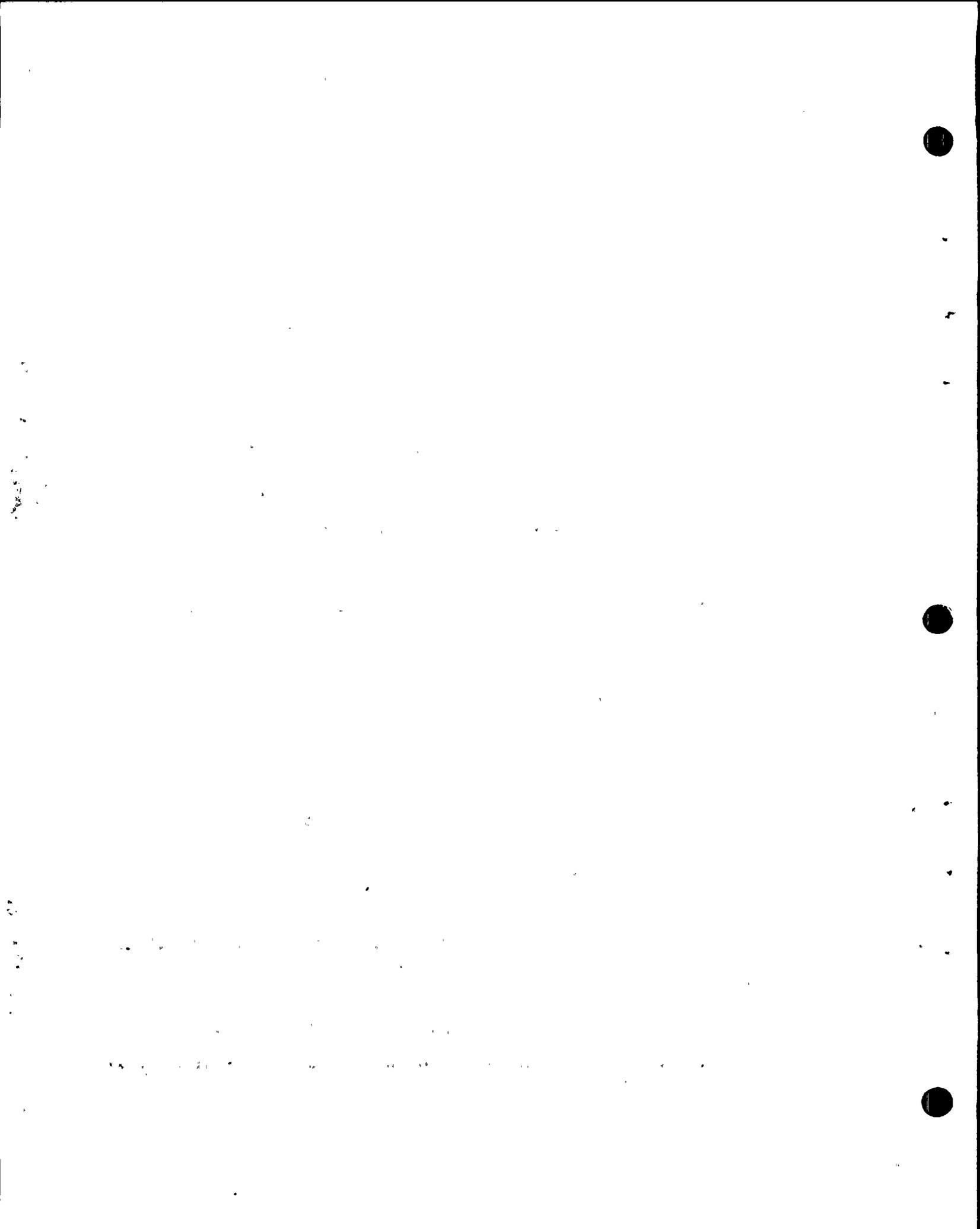
After graduation, I worked as a field geologist with the Corps of Engineers in Florida conducting field geological investigations for flood control structures, levees, canals, military installations, radar sites, and missile launching complexes. I evaluated and wrote reports concerning the stratigraphy, geologic structure, groundwater conditions, and foundation engineering aspects regarding these facilities in Florida and several of the West Indies Islands. In 1963 I was assigned to the Corps of Engineers Canaveral District Office at Cape Kennedy, Florida, first as a staff engineering geologist, and later as District Geologist. My duties were to assist in the planning, direction and the evaluation of the results of geological and foundation studies for missile launch pads and associated facilities for the NASA Manned Lunar Landing Program, the Air Force and the Navy.



I acted as consultant to other government agencies and architectural engineers in developing design features of structural foundations; monitored the performance of foundations during and after construction; and recommended and monitored necessary foundation treatment techniques such as vibroflotation, grouting, surcharging, dewatering and compaction. I wrote reports on the investigations, geology, foundation conditions and foundation construction activities regarding these projects.

In 1967 and 1968 I spent 6 months and 1 month respectively participating in the geological investigations for proposed sea level canal routes in Panama. The region investigated consisted of complex structures of volcanics and folded and faulted sedimentary strata. Among the techniques employed in this study were field geologic mapping, geophysical surveying, bore hole photography, and core borings. In 1968, I was transferred to the Huntsville, Alabama Corps of Engineers Division which was responsible for the siting, design and construction of 15 to 20 (later reduced to 4) Safeguard antiballistic missile installations throughout the United States. My duties were to participate in the site selection and site validation activities and in the planning and carrying out of geological and geotechnical investigations to develop foundation design parameters for construction of the missile complexes. I also served as technical consultant during design and construction to other government agencies, architectural engineers, and contractors.

I have been a member of the Regulatory staff since January 1971 and have participated in licensing activities for at least twenty-five nuclear facilities including Summer, Nine-Mile Point, Washington Nuclear 2, Pebble Springs, and Indian Point. These activities consisted of review of the geological aspects of the sites as presented by applicants and usually an independent evaluation conducted by a review of the most pertinent literature, site visits, and conversations with knowledgeable individuals or agencies. I have previously testified as an expert witness on geological matters at the following proceedings: McGuire Construction Permit (CP), and Operating License (OL) Hearings; Callaway, CP; Indian Point 3 (OL), and Summer CP.



wel 9

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BY MR. TOURTELLOTT:

2

Q Dr. Stepp, did you prepare testimony for this hearing today?

3

4

A (Witness Stepp) Yes, the testimony was prepared under my supervision, yes.

5

6

Q It was prepared by you or under your supervision?

7

A That's correct.

8

Q I have in my hand a 35-page document that bears the cover page title of "Testimony of Dr. Carl J. Stepp."

9

It also has three pages of references attached.

10

Is that the testimony you prepared?

11

A Yes, it is.

12

Q Mr. McMullen, did you assist Dr. Stepp in the

13

preparation of this testimony?

14

A (Witness McMullen) Yes, I did.

15

Q Do you adopt this testimony as your own?

16

A Yes, I do.

17

Q To the extent that you participated in its

18

preparation?

19

A That's correct.

20

Q Are there any additions, corrections or deletions to this testimony?

21

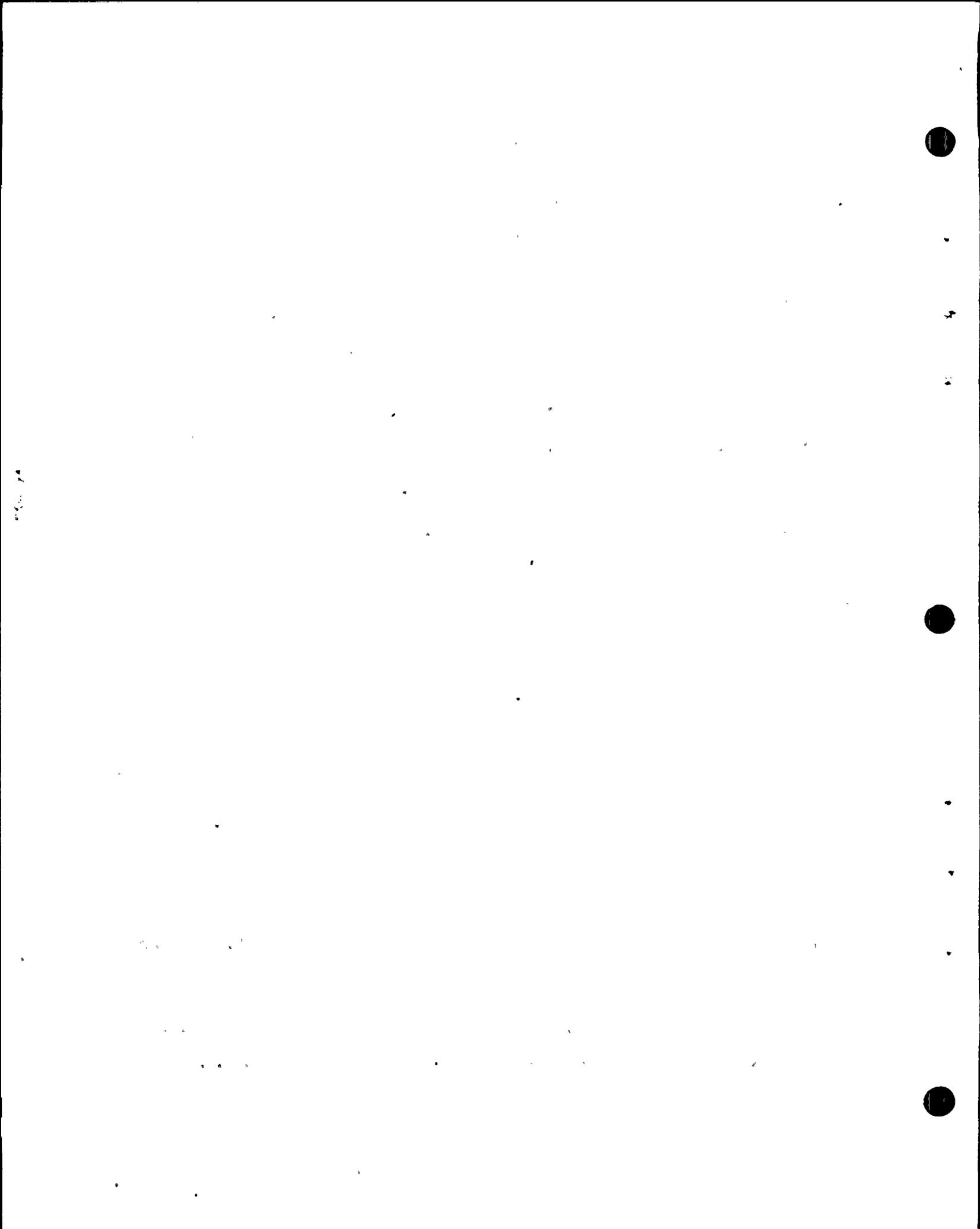
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A (Witness Stepp) There are a number of corrections that I would make that I think could cause confusion in the testimony.

23

24

25



wel 10

1 On page 10, at the beginning of the second
2 paragraph, which reads:

3 "The Intervenor transmitted to the Diablo Canyon
4 ASLB by letter dated April 24, 1978 the following
5 contentions in the areas of geology and seismology:

6 In the first line, between "Intervenor" and "transmitted"
7 I would insert "contentions."

8 In the second line, between "by" and "letter" I
9 would insert "a NRC Staff".

10 Also in the second line, between "1978" and "the"
11 I would insert a comma and "included".

12 The entire sentence should now read:

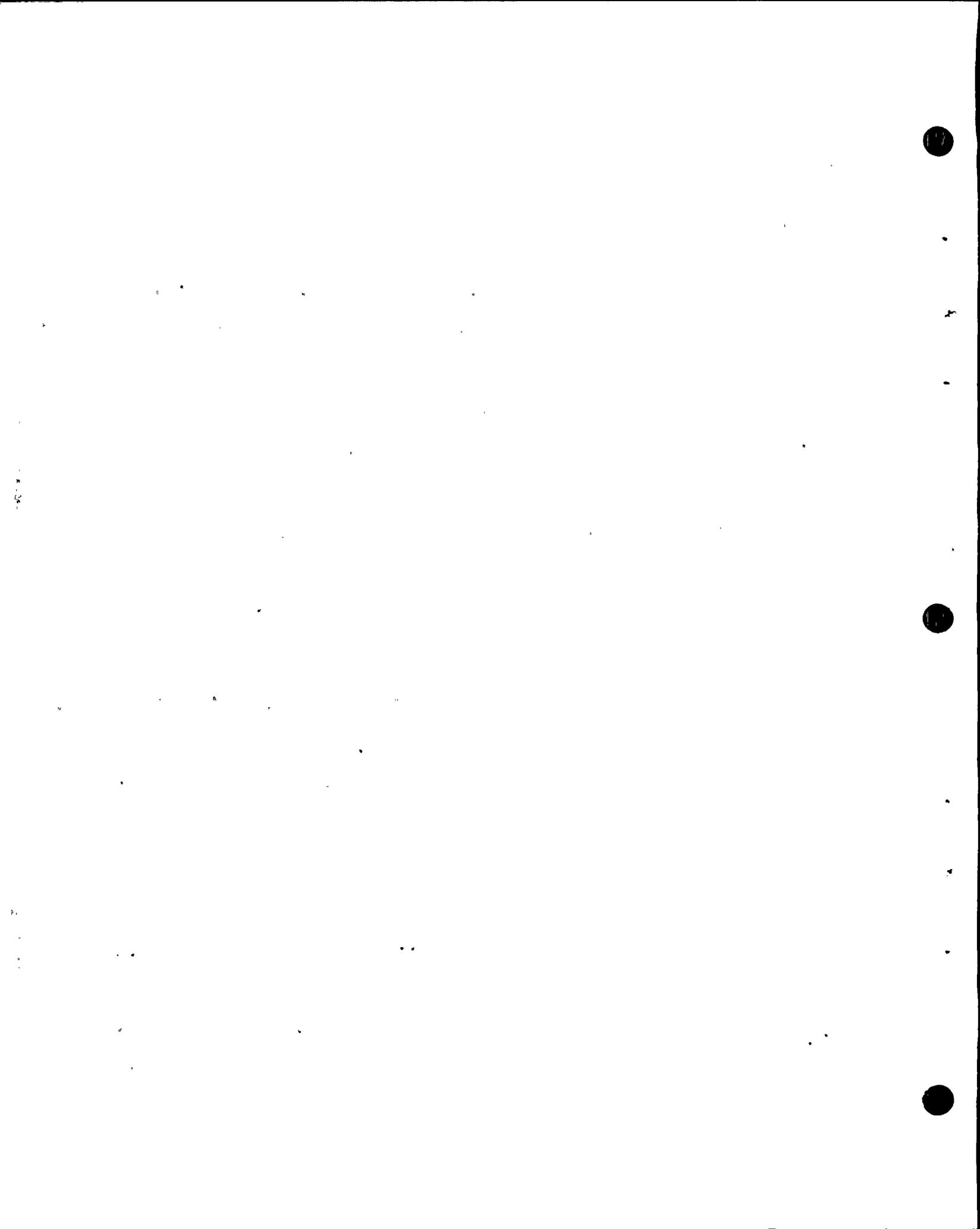
13 "The Intervenor contentions transmitted to the

14 Diablo Canyon ASLB by a NRC Staff letter dated
15 April 24, 1978 included the following contentions
16 in the areas of geology and seismology."

17 On page 13, in the third line from the bottom
18 of the page, there is a reference to "Silver, 1975." That
19 should be "Silver and Von Heune, 1975."

20 On page 17, the second line from the bottom of
21 the second paragraph, again the reference should be Silver
22 and Von Heune.

23 On page 24, the fourth line from the bottom of
24 the page; beginning with "that time," insert between
25 "responses" and "between" the two words "at periods."



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That line should read:

"that time had peak responses at periods between
4 and 6 seconds."

On page 26, third line from the top of the page,
the sentence beginning with, "These stations" should read,
"Later these stations were controlled by the same time source."

In the following sentence, "Thus" should be
struck, so that the sentence now reads:

"There is a suspicion that..." et cetera.

On page 28, third line from the bottom of the page,
the reference USC & CS (1972) should be 1927.

That's all.

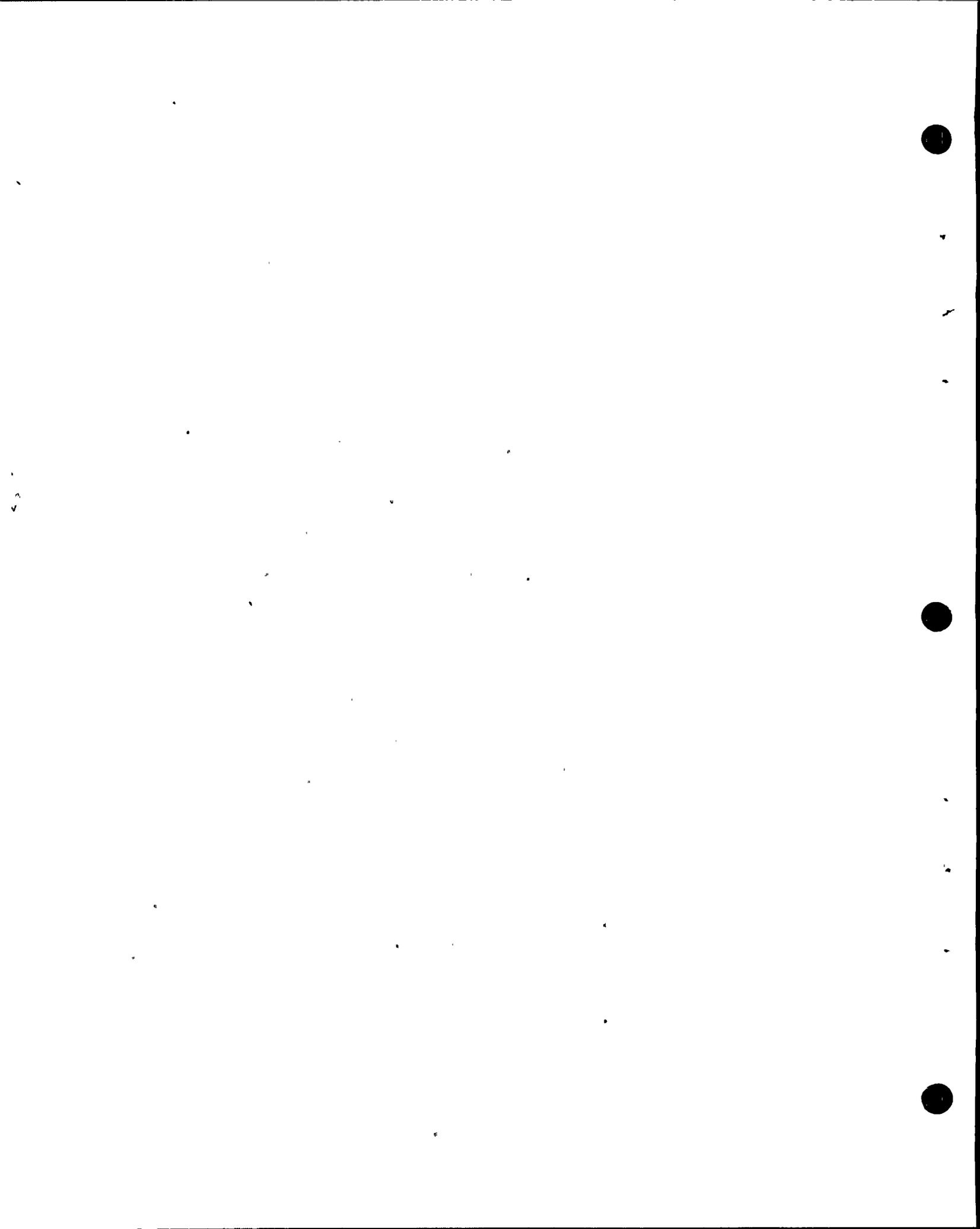
MR. NORTON: Excuse me. I believe there's another
typographical error, and as long as we're correcting it I'd
just as soon get it corrected now as later. But it's an
obvious typographical error.

Page 29, 10 lines up from the bottom, it starts,
"A large earthquake similar to the 1927 event show show..."
I believe that should read, "should show."

WITNESS STEPP: Yes. Thank you. That's correct.
There are other minor typos, but I don't think they would
cause confusion.

MR. TOURTELLOTTE: I ask that the testimony of
Dr. Carl J. Stepp be incorporated into the record as if read.

MRS. BOWERS: Mr. Tourtellotte, is it being



wel 12

1 sponsored and adopted by both witnesses?

2 MR. TOURTELLOTTE: I thought I asked that.

3 MRS. BOWERS: Yes, I stand corrected. It's

4 entitled testimony of Dr. Stepp, and I asked Mr. McMullen if

5 he adopted it as if it were his own, and he said he did.

6 DR. MARTIN: Are Carl J. Stepp and J. Carl Stepp

7 the same person?

8 MR. TOURTELLOTTE: Yes. There's another typo.

9 It should read J. Carl Stepp on the front.

10 WITNESS STEPP: That's correct. Yes, it should.

11 MRS. BOWERS: You're asking that the testimony be

12 physically incorporated in the transcript, is that right?

13 MR. TOURTELLOTTE: As if read, yes.

14 MRS. BOWERS: Mr. Norton?

15 MR. NORTON: No objection.

16 MRS. BOWERS: Mr. Fleischaker?

17 MR. FLEISCHAKER: Well, subject to any later

18 motion to strike.

19 MRS. BOWERS: The testimony you've identified
20 will be physically inserted in the transcript as if read.

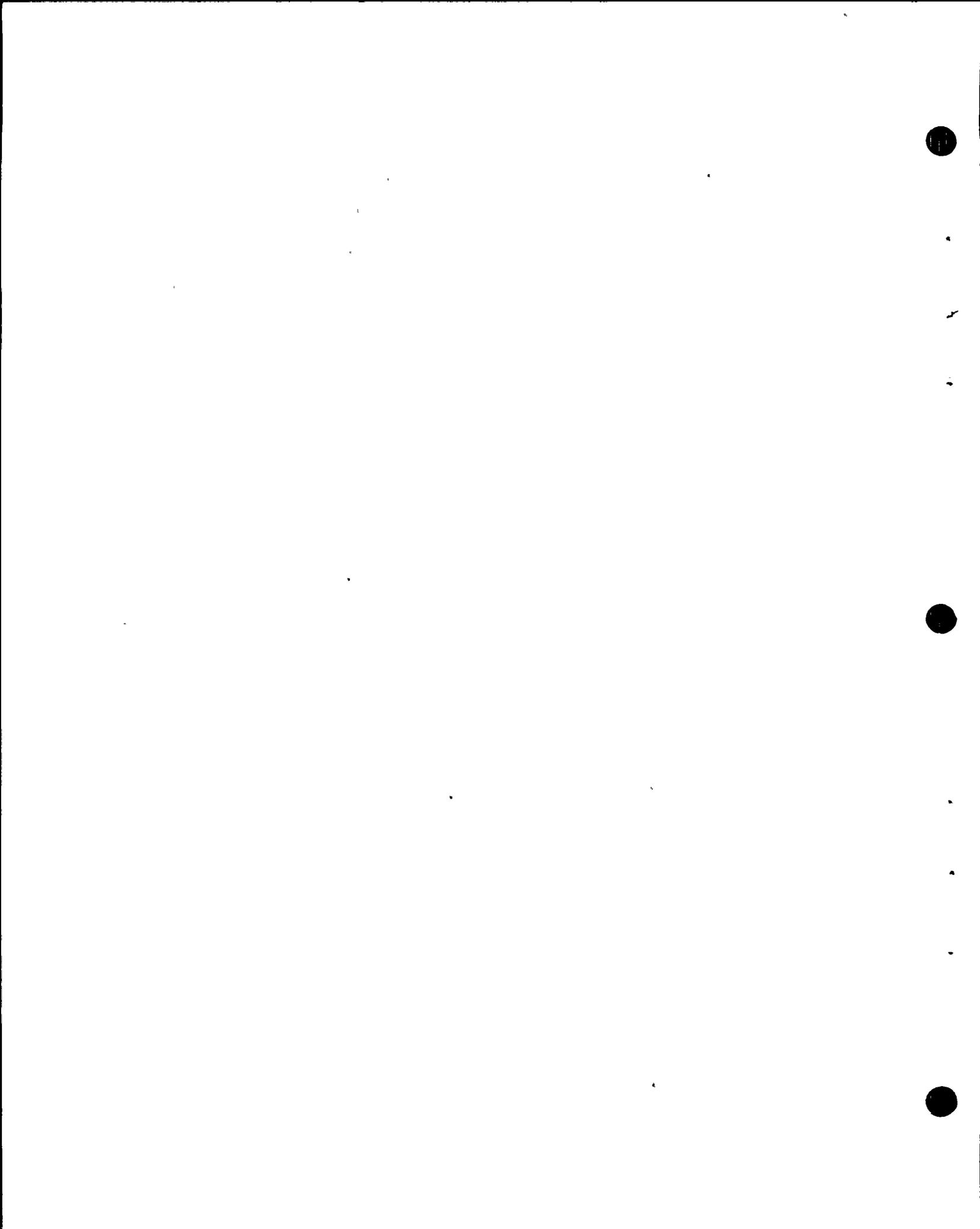
21 (The document follows:)

22 INSERT (1)

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TESTIMONY OF DR. CARL J. STEPP



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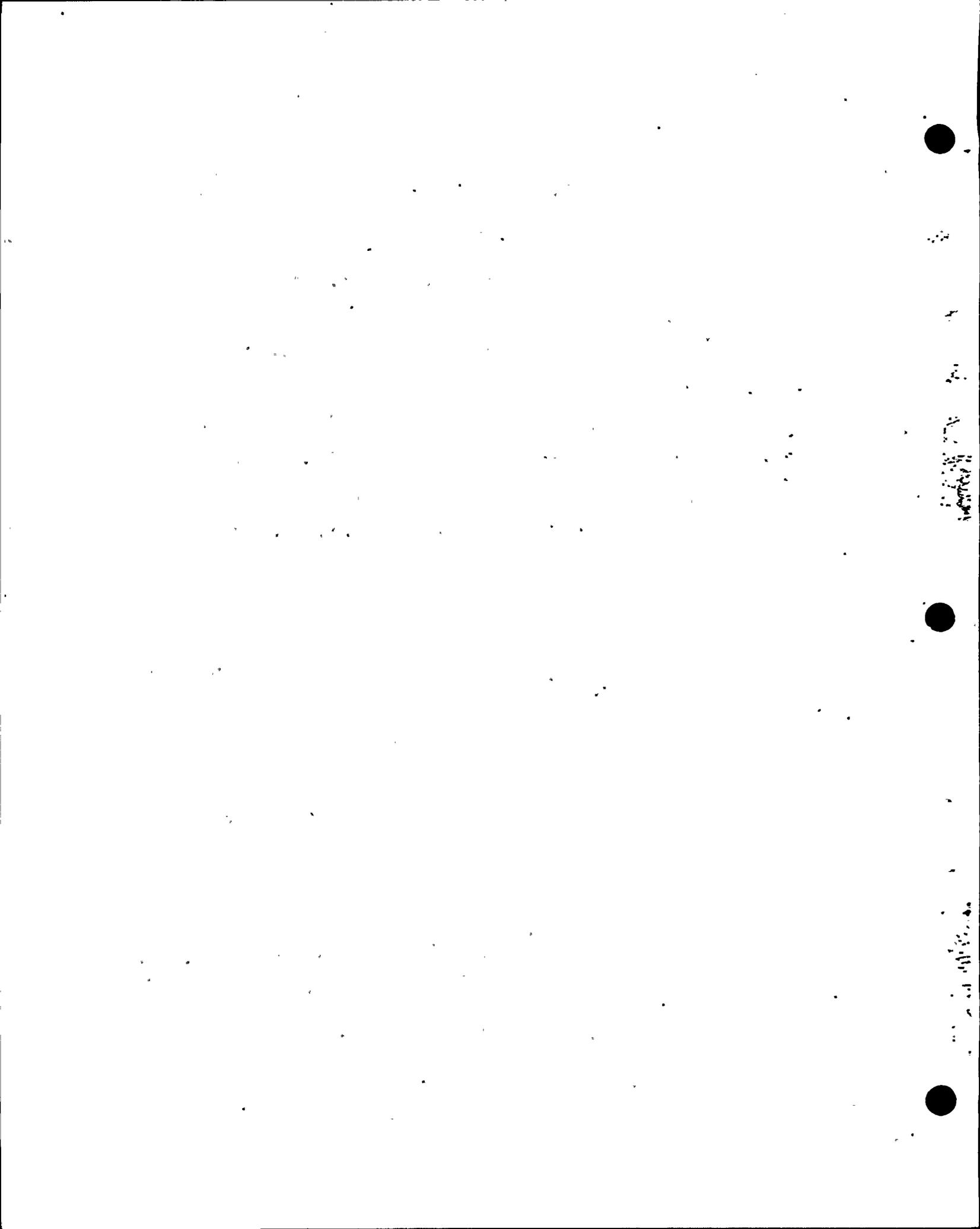
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DIABLO CANYON TESTIMONY
GEOLOGY AND SEISMOLOGY

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DIABLO CANYON
TESTIMONY
GEOLOGY AND SEISMOLOGY

I. Introduction (history of Operating License (OL) review and statement of staff's conclusions)

A. AEC, USGS and NOAA's Conclusions Following Construction Permit (CP) Review

This geology and seismology evaluation reflects our review of investigations conducted since 1969. These investigations are described in the Final Safety Analysis Report (FSAR) for the Diablo Canyon Nuclear Plant site.

The geology and seismology of the Diablo Canyon site as presented in the Preliminary Safety Analysis Report was reviewed by the AEC staff and its geological and seismological advisors, the U. S. Geological Survey (USGS) and the U. S. Coast and Geodetic Survey, during the construction permit review.

The findings of that review were published on November 18, 1969, as part of the Safety Evaluation Report (SER) for Unit 2. With respect to the seismic design input, the staff concluded:

- (1) "There are no identifiable major faults or other geologic structures in the area that could be expected to localize seismicity in the immediate vicinity of the site. The nearest seismically active major fault is the Nacimiento fault, a northwest-trending fault zone that approaches to within about 18-20 miles of the site to the northeast," and

- (2) "...the Coast and Geodetic Survey agrees with the applicant's statement of 0.20g at the site and on rock for the predicted maximum ground accelerations of the design earthquake and twice that value, 0.40g on the rock for the safe shut-down conditions."

B. New Data Following CP Review

Since publication of the SER in 1969 studies of the geologic structure offshore from the site have been published (Hoskins and Griffiths, 1971; Wagner, 1974). These studies revealed significant geologic structure offshore from the Diablo Canyon site. To determine the detailed structural relationships in the offshore region the applicant conducted extensive high resolution geophysical investigations along that reach of the structure. Profiles obtained by the applicant were made available to the USGS and those obtained early in the investigations were included in the independent interpretation of the offshore structure by Wagner (1974). The applicant's interpretation together with a summary of the results presented by Hoskins and Griffiths (1971) and Wagner (1974) are included in the FSAR for the Diablo Canyon site. The Hoskins and Griffiths (1971) paper gives the results of an interpretation of extensive deep penetration seismic reflection surveys along the California Coast. The surveys revealed a

structural basin offshore of the southern Coast Ranges which they called the Santa Maria basin. It is described as being a shallow, synclinalorium about 140 miles long and 25 to 30 miles wide. Structural grain within the basin trends northwest parallel to the trend of the basin. Major faults bound the basin on both the east and west. The eastern border fault as identified by Hoskins and Griffiths passes within about 5 miles of the Diablo Canyon site. It is about 90 miles in total length.

Wagner (1974) utilized both deep penetration seismic reflection methods and high resolution seismic surveys.

The configuration of the sea floor was obtained using precision bathymetric measurements and, locally by side-scan sonar. These techniques provided a considerable refinement of the structure along the eastern boundary of the Santa Maria basin in the region between Cape San Martin and Point Sal. The basin is indicated to have formed in Middle-to Post-Miocene (post 26 m.y.) time. It contains from 2,000 to 5,000 ft of Miocene sediments unconformably overlain by up to 3,500 ft of Pliocene (7 m.y.) section. An erosion surface is indicated to have formed on these Tertiary beds during Pleistocene time. Post-Wisconsinan age sediments, deposited during the past 20,000 years, overlie much of the Tertiary erosion surface.

Wagner (1974) concurred with the interpretation of Hoskins and Griffiths (1971) that a major fault zone forms the eastern boundary of the offshore Santa Maria basin. He called it the Hosgri fault. The Hosgri fault is a zone containing from 2 to 5 subparallel fault splays which locally offset Tertiary and Pre-Tertiary rocks with apparent vertical displacements ranging between 1,500 ft and 6,000 ft. The Hosgri fault is discontinuous and segmented in the late Tertiary and Quaternary section.

The applicant interprets the East Boundary Zone (the Hosgri fault zone of Wagner, 1974) as being the boundary between synclinal downwarping of the offshore Santa Maria basin and regional uplift of the southern Coast Ranges. The style of faulting in the zone is extensional as shown by its localization along the flank of a regional upwarp and by its pattern of basin down normal faults and crested faults along the flank of local structural highs at Point San Luis and Point Piedras Blancas. Reverse drag downfolding characteristic of extensional deformation is also shown in the strata adjacent to the normal faults. Normal faults with east-facing scarps have also been identified and are interpreted as being antithetic faults of the overall extensional system. The applicant states that, due to the lack of evidence for compressional deformation in the Pliocene and Pleistocene sediments

and the presence of the positive evidence for extensional deformation, the Santa Maria basin is in a region that has probably been characterized by extensional strain during much of the time since initial deposition in the basin during the Miocene.

While the movement on the fault zone was predominantly vertical during Tertiary, Wagner (1974) cites evidence of lateral (strike-slip) movement in the upper section. Earthquake focal mechanisms for this zone determined by the applicant support a strike-slip component of movement. Thus vertical movement on the fault may currently be subordinate to the strike-slip.

Evidence of recency of movement on the Hosgri fault zone is found in offsets of the sea floor together with offsets of the Post-Wisconsinan sediments. Wagner (1974) found those offsets on three of his profile crossings of the zone. On other high resolution seismic profiles, offsets of the base of the Post-Wisconsinan sediments are observed but with no offset of the sea floor. Still other profiles show no offset of the Post-Wisconsinan sediments. This pattern of offset is largely supported by the applicant's investigations. We, therefore, conclude that the Hosgri fault zone must be considered capable within the meaning of 10 CFR Part 100 Appendix A, Section III (1).

The applicant places the Hosgri fault in his seismic potential category of Level III which is defined as "Potential for earthquakes resulting chiefly from movement at depth with no surface faulting, but at least with some possibility of surface faulting of as much as a few miles strike length and a few feet of slip." Although current movement on the Hosgri fault appears to be limited to local fault segments, we assume for the purpose of establishing the safe shutdown earthquake (SSE), that the fault is continuous over its 90 mile length.

In its geological input to the Safety Evaluation Report dated 28 January, 1975 (Supplement No. 1, Appendix D) the USGS concluded that the Hosgri fault and the Santa Lucia Bank zone (the fault zone that bounds the western side of the Santa Maria Basin) "should be considered inextricably involved with the strike-slip fault mechanics of plate boundary motions that are currently concentrated along the San Andreas fault." The USGS further concluded that earthquakes along the Hosgri fault should not be expected to be as large as those expected along the San Andreas, but that, based on the limited information on the Santa Lucia Bank fault, "the occurrence of an earthquake as large as events characteristic of subparallel strike slip faults, which bound basins, such as the Santa Maria..." could not be precluded.

In the Seismology Section of that report the USGS concluded that "with the limit of the present information as to the interpretation, of the relationship of the East Boundary fault to the Santa Lucia Bank fault, an earthquake similar to the November 4, 1927, event but occurring along the East Boundary Zone or the Santa Lucia Bank fault zone represents the maximum earthquake that is likely to occur near to the site."*

In its review of Amendments 31, 32, 34, 37 and 40 to the FSAR, which was transmitted by letter dated 29 April, 1976 to the NRC from the Acting Director for the U. S. Geological Survey, the USGS reaffirmed its conclusion transmitted on 28 January, 1975 and that was quoted above. In addition to reaffirming that conclusion, the USGS recommended that a magnitude of 7.5 on the Hosgri fault be used for the design basis earthquake. The NRC accepted the USGS recommendations.

C. Concerns of the USGS and NRC during OL Review

Following our review of the data regarding the Hosgri fault zone, the Staff requested information to address the following:

1. The nature of the intersection between the Hosgri fault zone and the Transverse Ranges faults.

* East Boundary zone is equivalent to Hosgri fault zone.

2. The northern extent of the Hosgri fault zone and relation to the San Simeon Fault Zone.
3. The location and probable mechanism of the 1927 earthquake, and the relationship of this event to geologic structure.
4. The determination of maximum earthquakes that can be expected on faults of various ranks within the San Andreas Fault System, and the relationship of each to historic seismicity.
5. The maximum earthquake on the Hosgri fault zone, and the potential effects on the site if such an event occurred on the segment of the Hosgri fault nearest the site.

D. Investigations performed by the Applicant

In response to NRC concerns regarding the relationship between the southern segment of the Hosgri fault and its intersection with the Transverse Ranges structure, the Applicant obtained new field data and synthesized it with the data which had been previously compiled and analyzed in 1974. The post 1974 data consisted of:

1. Widely spaced seismic reflection lines in the region between the latitudes of Pt. Sal and Pt. Conception.
2. Four lines from the southernmost part of the USGS Kelez survey.
3. Data open filed by the USGS in 1975 from the 1972 R/V

Bartlett cruises (Silver and Von Huene, 1975) and the R/V
Polaris cruises (Wolf, 1975).

4. Proprietary data

Regarding the northern reach of the Hosgri fault zone the applicant utilized interpretations given in earlier reports by Hoskins and Griffiths (1971), Wagner (1974) and Appendix 2.5D to the Diablo Canyon FSAR (ESA, 1974). Data obtained subsequently included sparker records from the USGS Bartlett cruise (Silver and Von Huene, 1975) and the sparker records from a survey of the offshore region north of Point Lopez.

Additional studies were conducted by PG&E to better define the location of the 1927 earthquake and to attempt to determine its relationship to structure. These additional studies include:

1. Re-analysis of the data reported in the International Seismological Summary to locate the 1927 event and to estimate standard errors and joint confidence regions for the epicentral coordinates.
2. A study of the aftershock sequence of the 1927 earthquake.
3. A reevaluation of Byerly's (1930) intensity data.
4. Onshore geologic mapping.
5. Offshore seismic reflection profiling.

The results of these studies indicated that the 1927 earthquake was closer to shore than Byerly (1930) had initially located it; it experienced a large component of dip-slip movement; and a probable structural candidate for the source of this earthquake was determined to be the offshore Lompoc fault which shows evidence of considerable Late Pleistocene or Holocene displacement.

E. Intervenor's Concerns

The Intervenor transmitted to the Diablo Canyon ASLB by letter dated April 24, 1978 the following contentions in the areas of geology and seismology:

The seismic design for the Category I structures, systems and components of the Diablo Canyon Nuclear Power Plant (Unit 1) fails to provide the margin of safety required by 10 CFR Part 50 and 10 CFR Part 100 in that:

1. The Applicant has failed to conduct investigations of the Hosgri fault system to determine adequately (i) the length of the fault; (ii) the relationship of the fault to regional tectonic structures; and (iii) the nature, amount, and geologic history of displacements along the fault, including particularly the estimated amount of the maximum Quaternary displacement related to any one earthquake along the fault.

2. A 7.5 Magnitude earthquake is not an appropriate value for the safe shutdown earthquake.
3. A .75g acceleration assigned to the safe shutdown earthquake is not an appropriate value for the maximum vibratory acceleration that could occur at the site.

E. Summary of the Staff's Conclusions

The staff has reviewed the results of the investigations mentioned above and other data. The following is a summation of our conclusions. The bases for these conclusions is presented in Section II.

1. It is the NRC staff's conclusion that the Applicant has conducted an adequate investigation, which, when synthesized with data by other investigators, provides a basis for making a reasonable and conservative interpretation as to the length of the Hosgri fault zone, its relationship to other regional tectonic structures, and the nature, amounts, and geologic history of displacements on the fault.
2. The Hosgri fault, although possibly belonging to the same fault system, does not appear to be directly linked to the San Simeon fault.
3. The Hosgri fault may have experienced strike slip movement up to a few kilometers. It has not, in our view, experienced strike slip movement on the order of 80 to 115 kms. as suggested by Hall (1977).

4. The 1927 earthquake could have occurred on either the Hosgri fault zone or faults of the Transverse Ranges structure based on error in location. The totality of the data supports an association of this event with the Transverse Ranges structures.
5. It is conservative to assume a 7.5 magnitude on the Hosgri fault.
6. An acceleration value of 0.75g is a conservative value for scaling the response spectra which describe the horizontal ground motion for seismic design at the site.

II. Bases for the Staff's Conclusions

A. Length of the Hosgri Fault Zone

1. Southern Extent and Relationship to Transverse Range Structures

In Appendix 2.5E of the FSAR the Applicant presents seismic profiling data that led to an interpretation that the Hosgri fault bends to the east a few miles south of Point Sal and eventually dies out. However, based on an independent review of the seismic profiles, the U. S. Geological Survey interprets the data to indicate that the Hosgri fault extends at least five miles south of Point Arguello (April 29, 1976 letter to B. C. Rusche, NRC from H. W. Coulter, Acting Director, USGS). Although the precise location of the termination or merging of the Hosgri fault with the Transverse

Range structure is not known, we conclude that the preponderance of the geological data support such an occurrence within the offshore zone of intersection of the Coast Range and the Transverse Range structures.

During the review of the FSAR, the NRC staff and the USGS reviewers were concerned about the southern extent of the Hosgri fault zone and its relation to the Transverse Ranges structure. Because of that concern we requested that the Applicant "provide additional documentation including seismic reflection profiles on the intersection of the Hosgri fault zone with the Transverse Range faults." It was further requested that the Applicant "include geologic maps southward of those provided in the FSAR showing the structural relationships of the Transverse Range faults and structure to the faults and structures having a northwest trend."

Prior the request for additional information in 1974 the geological consultant for the Applicant, Earth Sciences Associates (ESA) had analyzed data from the literature by Von Huene, (1969 and 1971), Haskins and Griffiths (1971), Jennings (1973), and Beyer, et. al (1974). ESA had also evaluated new seismic reflection data by Bolt, Beranek and Newman, Inc. and Aquatronics, Inc. Subsequently additional data became available, including USGS open file data from the 1972 Bartlett (Silver, 1975) and Polaris (Wolf, 1975) cruises. Proprietary data were also examined by ESA. These new data were synthesized with the old data mentioned

above and interpretations made by ESA concerning the southern extent of the Hosgri fault. This analysis is presented in Appendix 2.5E to the Diablo Canyon FSAR.

Hoskins and Griffiths (1971) described the Santa Maria Basin as being 140 miles long, 25 to 30 miles wide and extending southward to the latitude of Point Conception. The recent seismic reflection work appears to support that description. Evidence presented in Appendix 2.5E of the Diablo Canyon FSAR suggests that:

1. South of Point Sal, the eastern portion of the Santa Maria Basin begins to show development of fold and fault structures more characteristic of the Transverse Ranges than are seen further to the north. The Hosgri fault, which appears to be the eastern boundary of the basin, loses its identity as a major dislocation through the Pliocene section and becomes a complex disturbed zone with apparently less vertical separation.
2. The Santa Lucia Bank structural trend appears to swing to the east at a point about 25 miles west of Point Conception and projects toward an east-west fault, which apparently cuts across a projected extension of the Hosgri fault.
3. Between Point Arguello and Point Sal the dominant structural grain is N30°W in the area where the Transverse Ranges structure has veered from east-west to a more northerly trend, merging with structural trends of the Santa Maria Basin.

- a. Structural trends of the Transverse Range province are aligned in an east-west direction, but west of Point Arguello the structural trend is more northward. East-west oriented folds are interpreted to overprint or to be overprinted by north-south folds.
 - b. The east-west synformal structure underlying the Santa Ynez River Valley turns northward just offshore and does not touch the Hosgri.
 - c. The Lions Head fault extends to sea in a north-sweeping arc to a distance of about 2 miles from the Hosgri.
4. A north-to-south plot of similar disturbed zones appearing on seismic profiles, which are interpreted by the applicant to be the southern extension of the Hosgri fault, suggests an eastward bending of the zone south of Point Sal toward the Lions Head and Santa Ynez faults. (Polaris Line 1-7, 4-9, and 2-17A, Figure 10, 12b and 12c respectively, Appendix 2.5E, Diablo Canyon FSAR).
 5. An interpretation that the West Hosgri fault which is located west of the main trace of the Hosgri fault, bends eastward south of Point Sal.
 6. The Purisima fault, which is three miles west of the Hosgri fault, subparallels the southern termination of the Hosgri as defined by the applicant, and extends five miles further, arcs shoreward, and becomes a series of well-defined compressional folds west of Purisima Point.

Dames and Moore (1977) in its analysis of the Central California coastal area for a potential LNG site, using all available offshore and onshore geologic data regarding the southern extent of the Hosgri fault zone, which is summarized by Dibblee (1978), concluded that the bulk of available evidence indicated that the Hosgri veers toward the coastline between Point Sal and Point Arguello and does not extend southward to or beyond the latitude of Point Arguello. Dibblee concurred with this conclusion based on his familiarity with the work of the USGS and Earth Science Associates investigators.

We consider the above data to support the interpretation that the Hosgri fault either terminates or passes into the Transverse Ranges structure. We regard this interpretation to be consistent with mapped Coast Ranges structures in the region where they intersect Transverse Range structures.

2. Northern Extent of the Hosgri Fault Zone and Its Relationship to the San Simeon Fault Zone

The staff's review of the Diablo Canyon FSAR considered the relationship between the Hosgri and San Simeon fault zones. By NRC letter dated 12 February, 1975 the staff requested that PG&E "provide additional documentation, including seismic profiles, on the northern reaches of the Hosgri fault zone." We further requested PG&E to include a fuller development of its views concerning the structural relationship between the Hosgri fault and the San Simeon fault. The Applicant responded to this request in Appendix 2.5 E .

dated August, 1975, which summarized the results of previous studies in that area and the results of additional investigations conducted in direct response to the Staff request.

The area within which the northern reaches of the Hosgri fault zone extends had previously been described by Hoskins and Griffiths (1971), Wagner (1974) and by Earth Sciences Associates (ESA) in Appendix 2.5D to the Diablo Canyon FSAR. Subsequently, data from the USGS Bartlett cruise (Silver, et. al. 1975) became available. In addition, data from a sparker survey conducted by BBN, Inc. in 1974 was provided.

Based on our review of these data, it is the staff's conclusion that the Hosgri and San Simeon fault zones belong to the same coastal zone of deformation. The style of tectonism within the coastal deformation zone is one of anastomosing and en echelon faults, which is typical of other fault systems within the Coast Range that are subsidiary to the San Andreas. Data presented in Appendix 2.5E of the FSAR indicate that these two faults approach as close to each other as 2 1/2 miles north of Estero Bay. However, the weight of the data leads us to conclude that they are not directly linked. The following paragraphs describe the evidence on which we rely in reaching that conclusion.

1. Both Hoskins and Griffiths (1971) and Wagner (1974) indicate that the Hosgri fault, or branches of it, extend north of any postulated intersection with the San Simeon fault. From these data the two faults appear to form an en-echelon or anastomosing pattern rather than that of a single fault.
2. Seismic reflection lines presented in Appendix 2.5E to the FSAR which cross a northern projection of the Hosgri fault zone suggest that it terminates in a series of discontinuous branches and folds north of Point Piedras Blancas. These branches do not appear to veer toward the San Simeon fault but rather to gradually die out along strikes that are subparallel to the San Simeon fault.
3. Seismic reflection lines presented in Appendix 2.5E to the FSAR which cross the Hosgri fault between Point Estero and San Simeon do not show any major branches of the Hosgri fault extending toward the projected southerly extension of the San Simeon fault.
4. These reflection lines suggest that the contact between acoustic Units A2 and A3 approximately parallels the shoreline and there is no indication that it is offset by major vertical or lateral faulting.

5. The straight coast line between Cambria and Point Estero is strongly suggestive of a continuation of the San Simeon fault immediately offshore in that area. This is well southeast of the northern reach of the Hosgri fault zone. At Point San Simeon which is the most southerly onshore exposure of the San Simeon fault, the Monterey cherty shale lies along the southwest side of the San Simeon fault. This unit can be traced 4 miles to the southeast in seismic reflection records, suggesting that there is no major faulting in that reach.
3. Relationship of the Hosgri and the San Gregorio Fault Zones
We consider the data to indicate that the Hosgri and San Gregorio are not linked to form one fault.
 1. The San Simeon and Hosgri faults form the eastern boundary of the Santa Maria Basin. Hoskins and Griffiths (1971) map the northern boundary of the Santa Maria Basin as being the west-northwest trending Point Sur antiform and the Pfeiffer fault. Data presented by the applicant in Appendix 2.5E of the FSAR (Plate 1(N) and Figures 6 (N)) indicate that the northwest trending offshore structures (including the San Simeon fault) turn into a more westerly trending structural grain at the Point Sur antiform. This suggests that the San Simeon fault either veers to the west-northwest or continues as the Point Sur fault. The Point Sur fault is mapped as a thrust fault while the San Simeon displays predominantly normal movement.

2. In its review of the geologic and seismologic data relevant to the Diablo Canyon Nuclear Power Station, Units 1 and 2, transmitted by letter dated 29 April 1976 to Ben Rusche from H. Coulter, the U. S. Geological Survey concluded that offshore faults north of Point Piedro Blancas (an area of possible linkage between the San Simeon and San Gregorio faults) do not form a single continuous fault.
3. The USGS states that the San Simeon fault if projected northwest immediately offshore is truncated by the Sur Nacimiento fault zone, (USGS 1976).
4. Greene et al (1973) interpret the more southeasterly trending Palo Colorado as being the southerly continuation of the San Gregorio fault.
5. Jennings (1977) maps the San Gregorio and Palo Colorado as part of the same fault zone.
6. Data presented in USGS Open-File Report 77-79 (1973) by McCulloch and Chapman show a change in trend of magnetic anomalies from NW to WNW between Lopez Point and Point Sur.

We interpret the data to indicate that the Hosgri fault terminates in folding in this region or trends more westerly.

B. Amount of Strike Slip Movement on the Hosgri Fault Zone

Hall (1975) postulated that more than 80 km of right-lateral movement has occurred on the Hosgri fault since Miocene time. He based his conclusions primarily on stratigraphic sections west of the San Simeon fault and east of the Hosgri fault which he considers to have been once contiguous, but which are now separated by more than 80 km.

The staff considers the available geologic information to indicate that some strike-slip motion has taken place on the Hosgri fault. We consider it likely that the current mode of movement is predominantly strike slip. Although the possibility of large lateral displacement cannot be completely ruled out, we believe the available data support the conclusion that no more than a few kilometers of strike-slip movement has occurred since the Miocene (20 m.y.). This conclusion is based on:

1. An analysis of the southern extremity of the Hosgri fault zone indicates that the fault zone merges with the Transverse Ranges structures.

2. The preponderance of available geologic evidence supports the conclusion that the relationship between the Hosgri, San Simeon, and San Gregorio fault zones is one of an echelon or anastomosing series of faults, which is typical of fault systems in the Coast Ranges, and not a continuous plate margin master break like the San Andreas.

3. Data from a test well (Standard Oil "Oceano No. 1") which encountered the Middle-Miocene Obispo formation, which is of restricted extent, at a point directly opposite its main onshore occurrence indicate a lack of large lateral offset of rocks east and west of the Hosgri fault.

4. Submarine geomorphic features, such as the buried extension of the Sur Canyon, which is filled with probable Plio-Pleistocene sediments, and the Monterey submarine canyon, which cross the projection of the Hosgri and San Gregorio fault zones respectively appear to preclude more than a few kilometers of strike-slip displacement.

The staff considers the available geologic information to indicate that some strike-slip motion has taken place on the Hosgri fault. We consider it likely that the current

mode of movement is predominantly strike slip. However, we believe the available data support the conclusion that no more than a few kilometers of strike-slip movement has occurred since the Miocene (20 m.y.)

C. Location of the 1927, 7.3 Magnitude Earthquake .

An accurate location for the earthquake of November 4, 1927 can not be obtained because of the lack of precise recordings of that event. Several sets of geological and seismological data have been evaluated in considering the location of this earthquake. Although each data set contains uncertainties, the NRC Staff believes that the data taken together support an association of this earthquake with transverse Ranges structure. The uncertainty of the data is such that we cannot conclusively identify the fault on which this earthquake occurred. Specific data and arguments considered are discussed below.

1. Byerly (1930): western margin of the Santa Lucia Bank fault zone.
2. Gawthrop (1975): Near the Hosgri and Lion's Head faults.
3. Hamilton (1975): The Lompoc fault.
4. Engdahl (1975): A few miles south of Purisima Point on the coast, a location that falls on a shoreward extrapolation of offshore-Purisima fault.

5. Smith (1975): The 1927 aftershocks identify an area of permissible sources for the main earthquake. Smith prefers a location between the Lompoc and Santa Lucia Bank faults.
6. Hanks, et al.(1975): Prefer a location 30 km due west of Point Arhuello at 34 1/2 N, 121 W.
7. International Seismological Summary (1931): Gives a location at 34.9N, 121.0 W.
8. USC & GS report (1927): Gives a location at 34.5 N, 120.7 W.

Items which we considered are:

1. Docketed report by Smith (1975): Smith concludes that the 1927 earthquake probably occurred closer to shore than originally thought by Byerly in 1930. His conclusion is based on P- and S- wave arrivals at two nearby stations and the area of maximum damage.
2. The relocation of 1927 earthquake based on seismograms collected by Gawthrop (1975): Most data are clustered in Europe. The instrumentation generally available at that time had peak responses between 4 and 6 seconds. Seismic waves emerging from background noise on recordings from these instruments are difficult to measure on distant records with an accuracy better than several seconds.

The errors in the data are such that a convergent solution for the earthquake epicenter could not be obtained when the entire data set was used. Gawthrop, therefore, used several selected subsets of records from the entire set of recordings available for the earthquake. Each subset resulted in a separate location being obtained. The locations varied within a 50 mile diameter circle which included the Hosgri fault and several others. The selected group of stations preferred by Gawthrop resulted in convergence on the Hosgri fault.

3. Engdahl (1975): This study was similar to that of Gawthrop. It, too, showed that convergence could not be obtained when the entire data set was used. Selected subsets of data each converged on a different epicenter. These epicenters fell within a circle of about 40 km diameter. Error ellipses were calculated for each epicenter. These error ellipses could be enveloped by an elliptical area about 50 x 80 km. This area encloses many known faults, including part of the Santa Lucia Bank fault zone. Many of the error ellipses did not touch each other, suggesting large errors in the data. Two of the nearest stations

in 1927, Berkeley and Mount Hamilton, clearly differ by 6 seconds from the other good stations available in 1927. These stations were controlled by the same time source. Thus, there is a suspicion that a timing error of 6 seconds existed on the day of the 1927 earthquake. These good, proximate stations with sharp high amplitude arrivals would normally be used to test other less precise more distantly recorded data. With the uncertain time correction, however, no greater reliance can be placed on these stations than on others.

Because most stations available were in Europe at essentially the same azimuth from the earthquake, only 4 or 5 recordings actually control the epicenter. Two of these appear to have a serious timing error. We consider Engdahl's analyses to demonstrate that the recordings available from the 1927 earthquake are not adequate to determine a location for this event with enough precision to associate it with a particular fault based on these data alone.

The results obtained by Smith, (1975) , appear to indicate that the earthquake was probably closer to shore than the original location (Byerly, 1930). The center of the circles generated by Gawthrop and Engdahl

are also closer to shore, but the error ellipses on their locations embrace part of the Santa Lucia Bank fault zone. Bylerly's original epicenter, the location of most offshore earthquake activity in this region since instruments were installed in Southern California (about 1934), also is within what is now known as the Santa Lucia fault zone, but is not embraced within the error ellipses.

4. Determination of seismic moment by Thatcher and Hanks (1973); determination of stress relationships by Hanks et al (1975), and a 30 bar estimate for average stress drop on strike-slip faults by Kanamori and Anderson (1975): Hanks et al (1975) computed seismic moments for many southern California earthquakes. Using their calculated seismic moment for the 1927 earthquake and Thatcher and Hanks (1973) relationship between moment, magnitude and stress drop, a stress drop of about 100 bars is obtained for the 1927 event. If the area inclosed by the MMI=VI isoseismal, (assuming the Hosgri fault as the source of the 1927 earthquake) is used to estimate stress drop, about 1000 bar results. This estimate is higher by more than a factor of 30 than Kanamori and Anderson (1975) find to be the average for strike-slip faults of the San Andreas system. We consider this added evidence that the November 4, 1927 earthquake was most likely centered on Transverse Ranges structures.
5. Byerly (1930) and USC & GS (1972): Both of these sources report the occurrence of a tsunami along the California coast near Point Arguello. This would imply that a vertical

component of movement resulted from the earthquakes.

Faults for which geologic evidence of vertical movement has been found are the Santa Lucia Bank fault and Lompoc fault.

6. Wagner (1974) and Hamilton et al (FSAR): Wagner found that offshore seismic profiling indicates only small local vertical displacement of the ocean floor along the Hosgri zone. Hamilton et al (FSAR) state that within the resolution of the offshore seismic profiles no vertical displacement of the ocean bottom can be verified. While we cannot conclude that no displacement of the ocean floor has occurred, we do find that the areas where such displacements may have occurred are small in extent and that the vertical displacement, if any, is also small. A large earthquake similar to the 1927 event show show a substantial area of vertical movement if the fault generating the earthquake had a significant component of vertical movement. Hence, since no significant vertical movement has been found on the Hosgri fault, the movement must have been strike slip, if the 1927 earthquake did occur on the Hosgri fault. Moreover, earthquakes similar to the 1927 event would not be expected to occur as an isolated event in an area which otherwise shows little or no evidence of tectonic activity in the recent past. Gawthrop has argued that a

vertical scarp could have been formed which subsequently was eroded away by offshore currents. However, older scarps, former shorelines which cross the Hosgri fault obliquely, have not been removed by erosion. Thus, the evidence supports the conclusion that the tsunami generated by the 1927 earthquake was not caused by movement on the Hosgri fault and further supports a location for this event on the Transverse Ranges structure.

7. Fault plane solutions obtained by Smith (FSAR): The distribution of stations about the 1927 epicenter and the poor quality of first arrivals at many stations do not permit a reliable fault plane solution to be obtained. A few good records (e.g., Uppsala), however, indicate a substantial amount of vertical movement at the earthquake source. Yeh (1975), using surface wave data, also found that some vertical movement at the source is indicated. Combined with the evidence for a tsunami, this supports the conclusion that the 1927 earthquake source had a substantial vertical component of motion. The data are, however, sufficiently ambiguous that the possibility of strike-slip motion cannot be ruled out.
8. Seismicity of the California offshore area, Hileman et al (1973) between 1932 and 1972 shows some activity which may possibly be associated with the Hosgri structure. The

extremely low level of activity in the area of the Hosgri fault zone, however, suggests that it has a low earthquake potential.

9. Fault ranking is discussed by the applicant in the FSAR. The applicant ranks California faults in order of characteristics and tectonic setting and concludes that a magnitude in the 6 range is the maximum that could be expected from the Hosgri fault. The staff concurs that faults of the San Andreas System subparallel to but not connected with the San Andreas fault have not produced earthquakes of magnitude in excess of 6.5.

Although the available data permit the conclusion that the 1927 earthquake could have occurred on the Hosgri fault, they do not favor a location for this event on the Hosgri fault. The NRC staff considers the weight of the available evidence to support the conclusion that the 1927 earthquake was not centered on the Hosgri fault and most likely occurred on structures in the Transverse Ranges.

However, for the purpose of reevaluating the seismic safety of the Diablo Canyon Units, we have assumed a magnitude 7.5 earthquake on the Hosgri fault, consistent with recommendations of USGS.

D. Maximum Earthquake on the Hosgri Fault Zone

The staff concludes that the assumption of a maximum earthquake of magnitude 7.5 on the Hosgri is very conservative. The

United States Geological Survey (USGS), the staff's advisor on the geology and seismology aspects of the Diablo Canyon review, recommended the assumption of a magnitude 7.5 earthquake on the Hosgri fault for use in evaluating the seismic safety of the DCNGS. The staff has adopted this recommendation. The re-evaluation of the seismic safety of the Diablo Canyon units has been based on an assumed magnitude 7.5 earthquake centered on the sector of the Hosgri fault nearest the plant site (See Section 2.5, SER Supplement 4). The rationale and supporting data for the USGS recommendation are contained in the USGS report, Appendix C to SER Supplement 4. We consider this to be a very conservative assumption. We base this on the following:

- a. The fault has experienced, at most, minor movement during post-Wisconsinan time (10,000 years) and, possibly, during a much longer interval of geologic time.
 - b. Seismicity which may be associated with the fault is very low.
- E. Ground Acceleration for a Magnitude 7.5 Earthquake on the Hosgri Fault
- Dr. N. M. Newmark, the staff's consultant on seismic design, has recommended a design response spectrum scaled to 0.75g for re-evaluating the seismic safety of the Diablo Canyon

units. This ground motion is based on an assumed magnitude 7.5 earthquake on the Hosgri fault (See Sections 2.5 and 3.7, SER Supplements 4 & 5). The rationale and supporting data for Dr. Newmark's recommendation are contained in his report, which is Appendix C to SER Supplement 5. This recommendation has been adopted by the staff, and we consider it to be conservative.

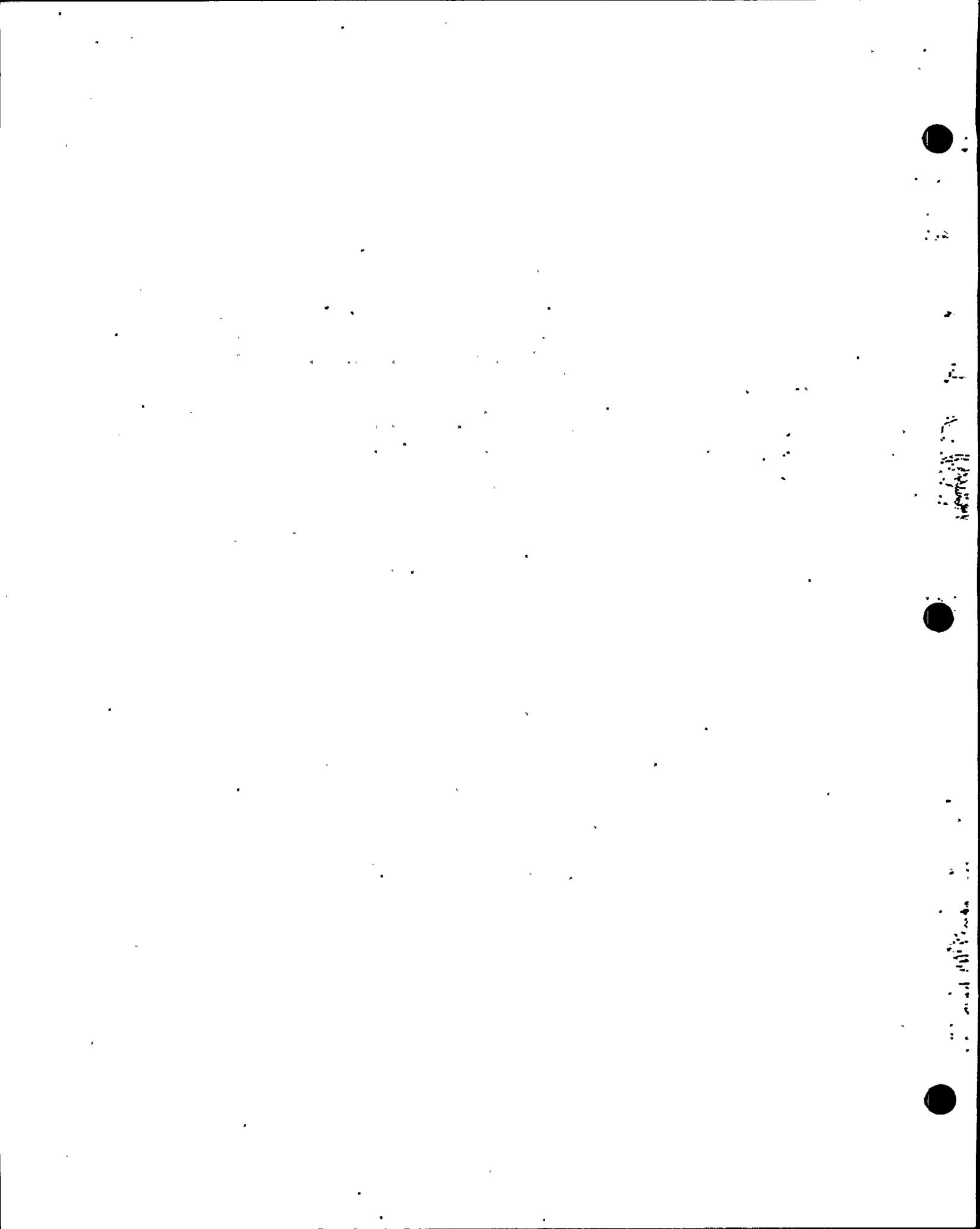
The staff considers several other observations to support the conclusion that the ground motion proposed by Dr. Newmark is adequately conservative.

1. Peak ground acceleration near earthquake sources appears to be only weakly dependent on magnitude for earthquakes larger than magnitude 4 1/2 (Hanks and Johnson, 1976) and may be more directly a function of stress conditions at the source.
2. Available observations support a value of several tens of bars for the average stress drop earthquakes on strike slip faults of the San Andreas fault system (Hanks, 1978; Kanamori and Anderson, 1975).
3. Boore (1972) and Bouchon (1976) have shown that the ground motions recorded at Pacoima Dam from the San Fernando earthquake of 1971 were significantly amplified by topo-

graphic effects. This amplification effect should be considered in using the Pacoima Dam accelerogram to extrapolate to larger events.

4. Observed damage to structures near earthquake sources generally is not commensurate with large accelerations. For example, at a distance of 3 1/2 miles from the 1906 San Francisco earthquake source, the intensities were generally no greater than Rossi Forel IX (at or close to the VIII-IX isoseismal except in areas of saturated soil). The equivalent to Modified Mercalli Intensity is VIII. These observations suggest that large peak accelerations if present near the 1906 earthquake source were not effective in causing damage to structures.
5. Empirical relationships among peak acceleration, distance from source and source magnitude suffer from lack of observational data control at distances closer than about 20 kilometers to the source and for magnitudes larger than about 6.5. Some investigators have extrapolated limited existing near source data to higher magnitudes (Page et al 1972). Others have developed attenuation relationships from distant data which have been extrapolated to distances near the source by incorporating consideration of the finite source dimension (Donovan 1973; Schnabel and Seed, 1973; Seed, et al, 1976; Blume, 1977a, 1977b). The latter relationships support 0.75g as a conservative value of peak horizontal acceleration at the DCNGS for a magnitude 7.5 earthquake on the Hosgri fault.

The staff recognizes that there is uncertainty in all of the above points. Taken together, however, we believe them to support 0.75g as being a proper conservative effective acceleration at the DCNGS for a magnitude 7.5 earthquake on the Hosgri fault.



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wel 13

1 BY MR. TOURTELLOTTE:

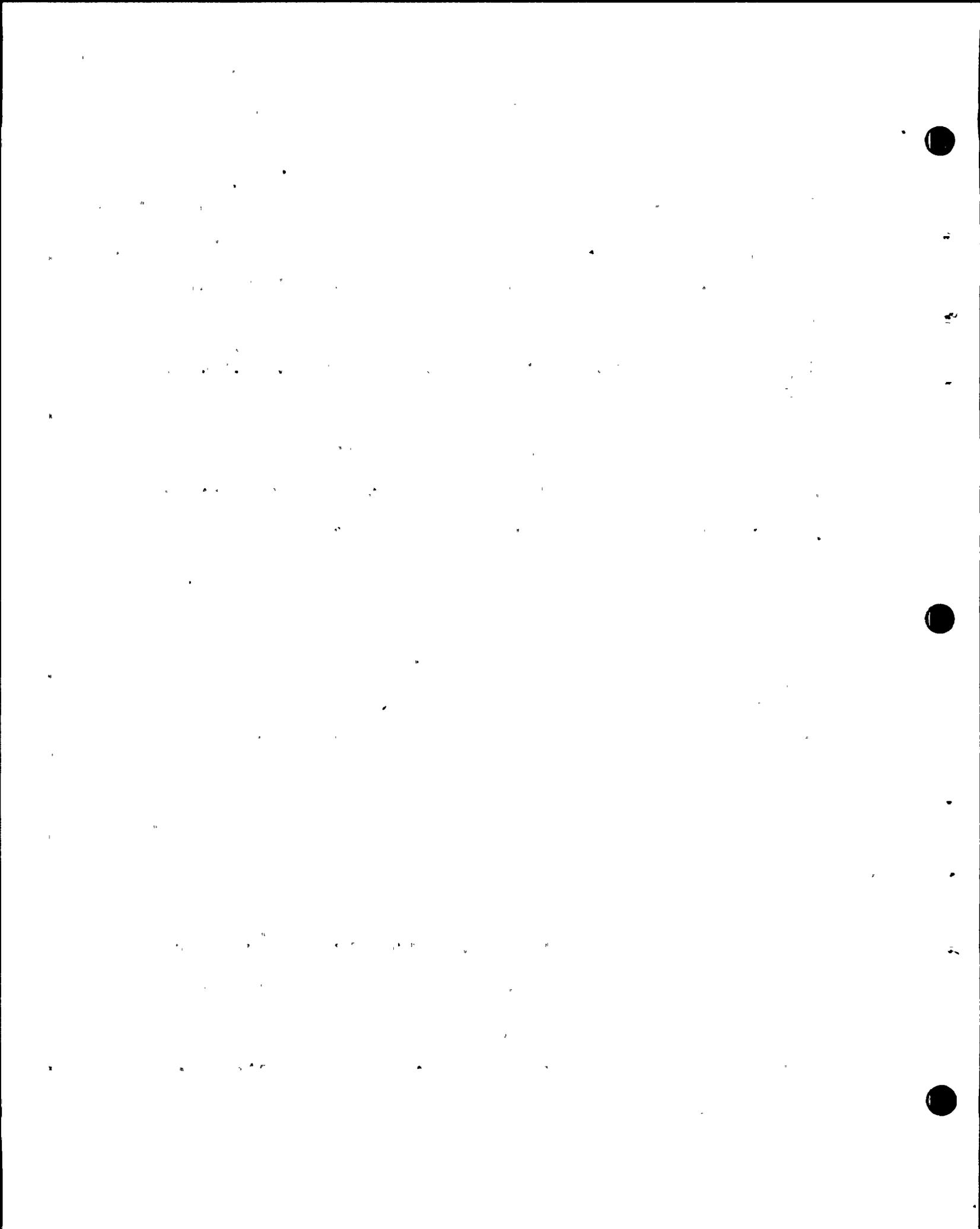
2 Q Dr. Stepp, would you briefly summarize the
3 contents of your testimony?

4 A (Witness Stepp) The testimony actually has two
5 major sections. The first one is principally a historical
6 perspective of the earlier CP review, and of the concerns
7 that were raised subsequent to the CP review during the OL
8 review, and of the investigations that were conducted by
9 the utility and the resolution of those concerns.

10 The second section deals with the basis for the
11 Staff's conclusion concerning seismic and geologic hazards
12 at the Diablo Canyon site. It discusses the length of the
13 Hosgri Fault zone, the relationship of the fault zone to the
14 transverse ranges structure to the south, to the San Simeon
15 fault to the north, the probable amount of movement that has
16 occurred in the fault in the recent geologic past, the
17 location of the 1927 earthquake of November 4 relative to
18 the tectonics of the region, an interpretation of the
19 maximum earthquake credible for the Hosgri fault zone, and
20 a discussion of the ground accelerations at the site from
21 magnitude 7.5 earthquake on the Hosgri fault zone.

22 MR. TOURTELLOTTE: We will offer the panel for
23 cross-examination at this time.

24 MRS. BOWERS: I think we agreed on an order. Mr.
25 Fleischaker, aren't you up first?



wel 14

1 MR. FLEISCHAKER: Yes.

2 CROSS-EXAMINATION

3 Q Dr. Newmark, I want to ask a little bit about your
4 thinking about effect of acceleration -- Dr. Stepp, I want
5 to ask a little bit about your professional training and
6 your experience.

7 Your advanced degrees, I see, were in geophysics,
8 is that correct?

9 A (Witness Stepp) Yes, that's true.

10 Q Now, during the course of that study did you take
11 any courses in structural engineering?

12 A No.

13 Q And since then have you had an opportunity to
14 take courses in structural engineering?

15 A No.

16 Q Have you ever designed a structure?

17 A No.

18 Q Have you ever analyzed or participated in the
19 analysis of the adequacy of a structural design?

20 A No.

21 Q Would you feel that your training or your
22 experience would qualify you to select a zero period limit
23 for a nuclear power plant?

24 A I presume you mean a zero period limit acceleration
25 to anchor a response spectrum?



wel 15

1 Q Correct.

2 A I would have to answer yes in the seismological
3 context of that, but there are elements of it that I would
4 not have the expertise to defend.

5 Q Well, let's separate out here the seismological
6 context from the other context.

7 Do you mean by the seismological context that
8 your training and experience would permit you to talk about
9 the ground motion parameters, like maximum accelerations,
10 velocities and displacements, assuming a certain magnitude
11 distance and soil conditions?

12 A Yes.

13 Q And what -- and you would feel competent in giving
14 to an engineer information that would describe time history
15 or accelerations at the site?

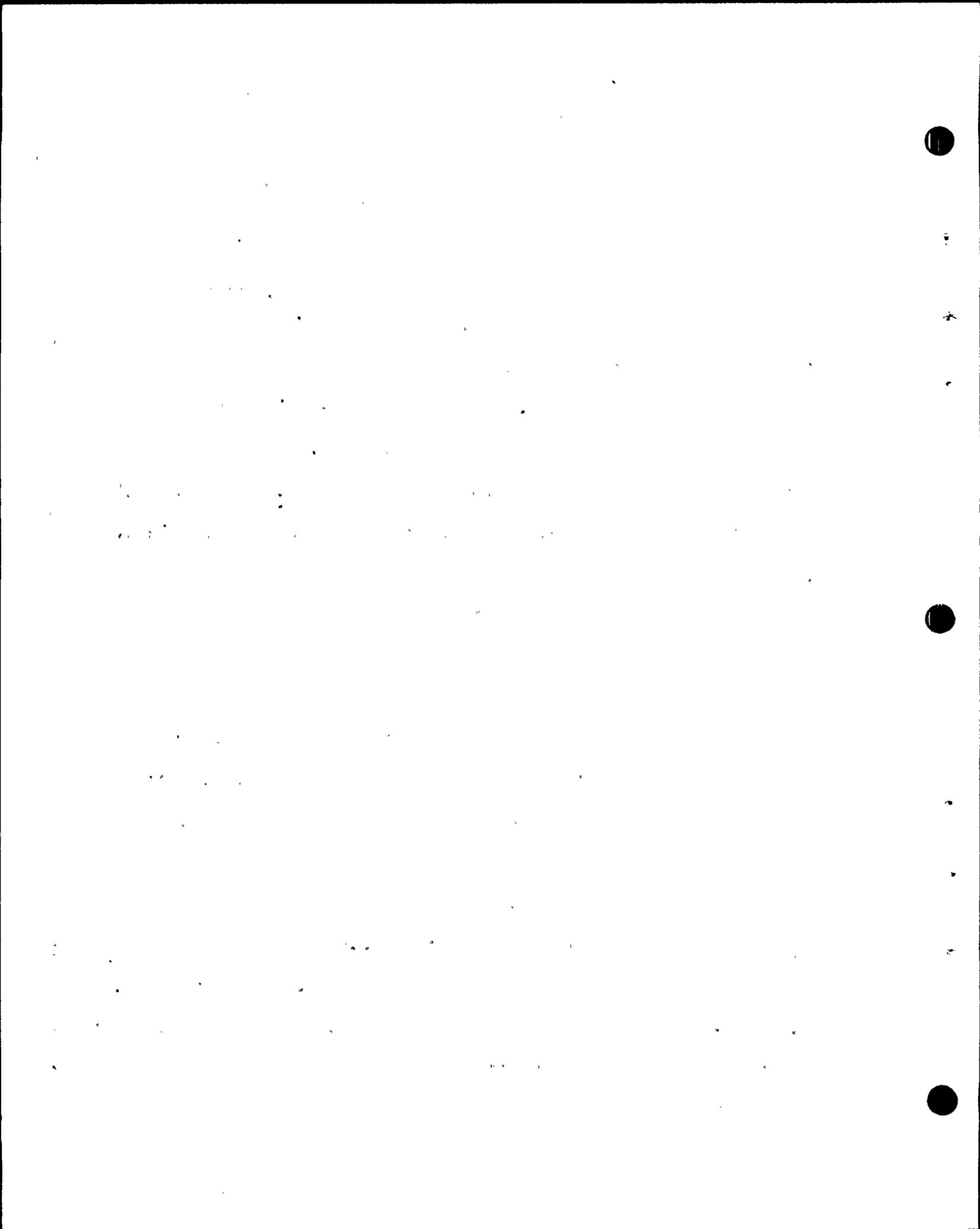
16 A Or spectrum of motion, yes.

17 Q But designating a zero period limit requires
18 additional analysis, isn't that correct?

19 A Not necessarily.

20 If there is a defined spectrum, then certainly it
21 would be within my expertise to assess whether a spectrum
22 anchored at some zero period limit was the proper spectrum
23 or not.

24 Q So that in other words, if there was an assigned
25 spectrum where everybody agreed that what we'll utilize for



wel 16 .

1 this spectrum is the maximum acceleration, then you could go
2 out and select that maximum acceleration, is that correct?

3 A: It wouldn't necessarily be the maximum acceleration,
4 but it would be. I would have the expertise to select an
5 acceleration value which would represent the ground motion
6 for a given earthquake condition when applied to a specific
7 spectrum. I could do that.

8 Q Okay. Would that judgment or that decision
9 require you to make any assessment of the . . . well,
10 wouldn't that be just plugging in the number? I mean would
11 you have to make judgments about structural response in order
12 to do that yourself?

13 A No, I would not have to make judgments about
14 structural response.

15 Q Okay.

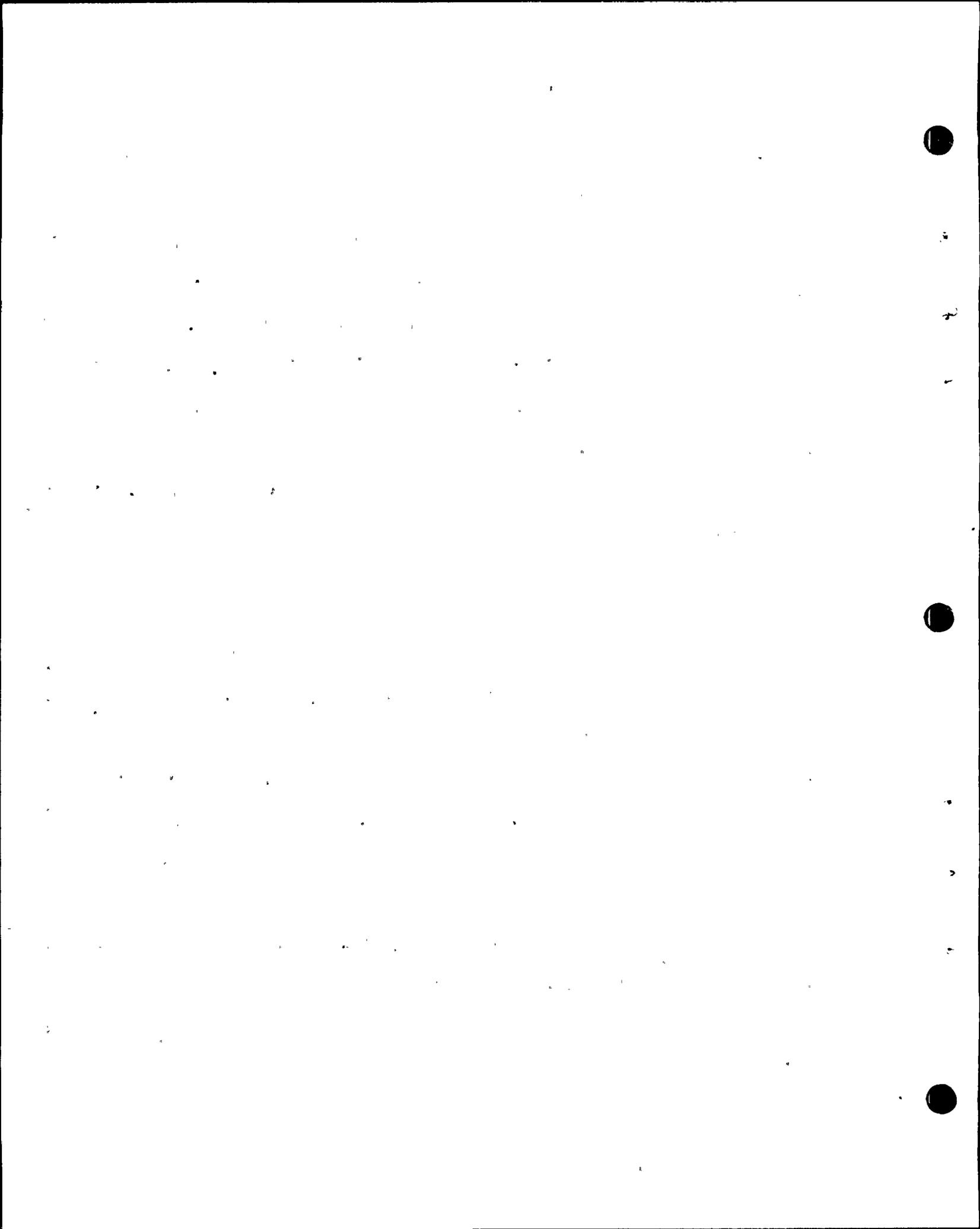
16 Now, in selecting the zero period limit for the
17 Diablo Canyon Nuclear Power Plant, the 0.75g, is it your
18 understanding that certain judgments were made about
19 structural response?

20 A Yes, that is my understanding.

21 Q Well, let me be more specific:

22 If, for example, Dr. Newmark had selected a zero
23 period limit greater than .9g, do you feel that you have the
24 competence to override his judgment?

25 MR. TOURTELLOTT: I object to that question.



1 That's not relevant.

2 MRS. BOWERS: Do you want to respond to the
3 objection, Mr. Fleischaker?

4 MR. FLEISCHAKER: I think it is relevant. I'm
5 trying to define the scope of Dr. Stepp's expertise.

6 MRS. BOWERS: Do you have a position, Mr. Norton?

7 MR. NORTON: You can decipher the scope of one's
8 expertise without asking hypothetical questions that assume
9 facts not in evidence.

10 MR. FLEISCHAKER: Okay. Let me do it a different
11 way.

12 I'll withdraw the question.

13 BY MR. FLEISCHAKER:

14 Q Okay. I think we agree, then, that in designating
15 the 0.0 period limit for Diablo Canyon judgments had to be
16 made about building response, is that correct?

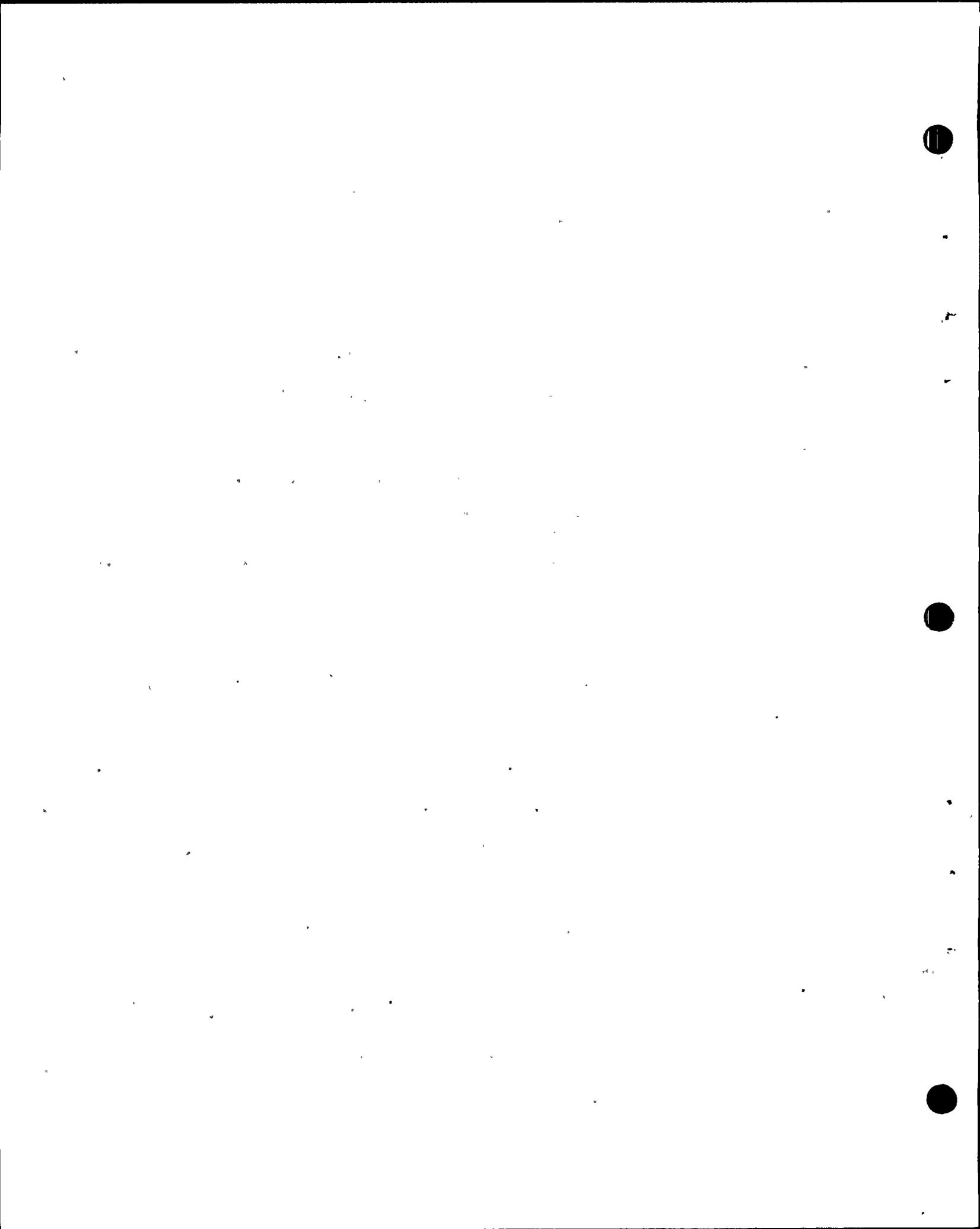
17 A (Witness Stepp) Yes, that is correct. I would
18 really -- I think it's more beneficial to think in terms of
19 in selecting the ground motion in totality, rather than just
20 the zero period limit.

21 And certainly in doing that there were incorporated
22 judgments concerning building response, yes.

23

24

25



MPB4

MPB/agbl

1

Q Well I guess what you're saying is that we had to come to some judgment about the nature of the ground motion at the site first?

2

3

4

A That's correct.

5

6

Q Okay. Now in this case, what was the ground motion that we assumed would occur at the site?

7

8

A From a purely seismological argument, the ground motion that was assumed to occur at the site, as described by USGS testimony, peak acceleration of 1.15g.

9

10

11

Q Okay.

12

So the motion at the site used was described by Table 2 in the USGS circular?

13

A That's correct.

14

15

Q And that was a peak acceleration of 1.15g?

16

A That's correct.

17

Q And a maximum velocity of, was it 53 centimeters per second or -- was it inches?

18

19

Do you know what the maximum velocity is?

20

A I'd have to look at it, I don't recall.

21

Q Okay. We don't need to do that.

22

C11

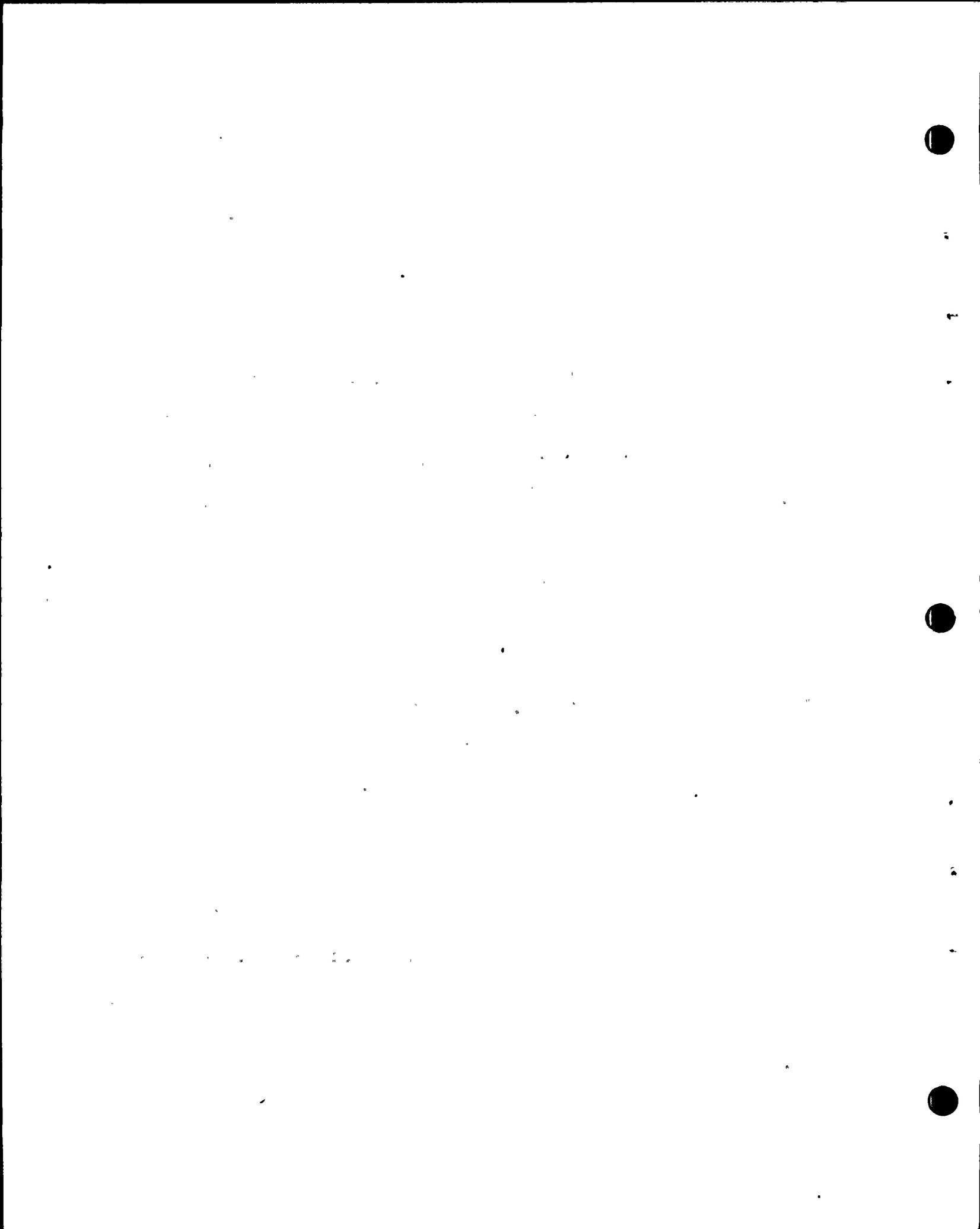
23

Well, when you go from this number 1.15, and all the information that is provided in the USGS Circular 672 and Table 2, and you consider all of that to selecting a 0.75g, isn't that primarily an exercise of -- that falls within the engineering discipline?

24

25

26



MPB/agb2

1 A Engineering considerations were involved in
2 arriving at the ground motion spectrum which was anchored at
3 0.75g, and that did involve engineering considerations and
4 considerations of the free field ground motion as described
5 in Table 2 of Circular 672.

6 Q Well, were there seismological considerations
7 that went into the, deriving the 0.75g from the USGS description?

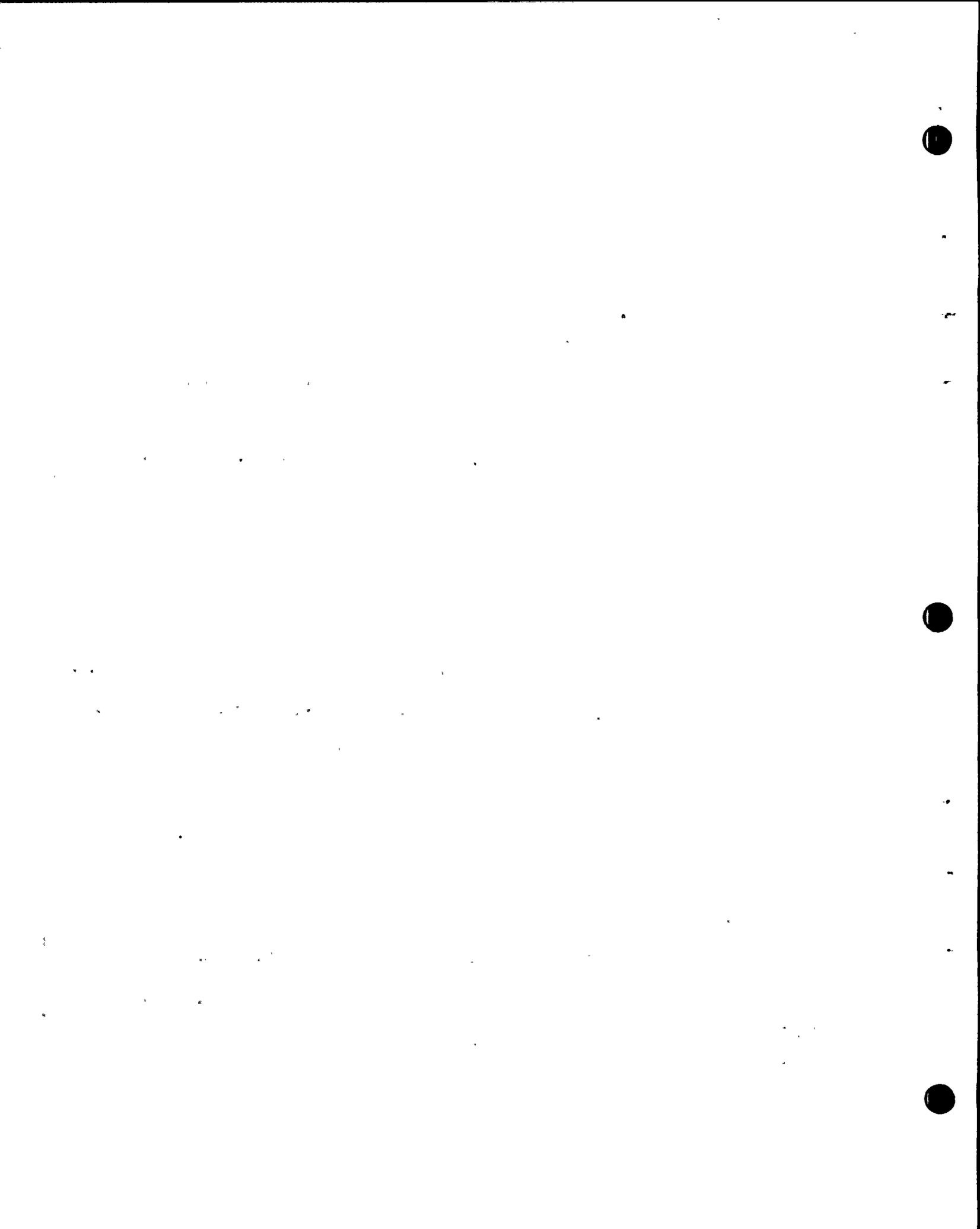
8 A Well, no, not specifically. Again, I would --
9 I think it's proper to talk in terms of the ground motion
10 rather than 0.75g because that's really what is being dis-
11 cussed here.

12 Q Well, that's why I'm a little confused by the
13 statement at the end of Page 35 of your testimony where you
14 say:

15 "Taken together, however, we believe
16 them to support 0.75g as being a proper con-
17 servative effective acceleration at the
18 DCNGS for a magnitude 7.5 earthquake on the
19 Hosgri Fault."

20 And I want to know what it is in your training
21 or your experience that permits you to go from the USGS
22 Circular and the description of the earthquake that is given
23 there and the ground motion parameters, to making some
24 judgment about the 0.75g?

25 A Well that statement, that conclusion is based on



1 several lines of argument that is presented in the testimony
2 prior to the conclusion being stated, and all of those are
3 seismological arguments. None are structural or engineering
4 arguments. And that is the body of expertise and information
5 that permits me to make that conclusion.

6 Q Okay, where are those arguments?

7 A I guess it begins on Page 32, Section E --
8 that's 2E, Section 2E at the bottom of Page 32.

9 Q Well let me see, are these arguments 1 through 5
10 there on Page 33 and 34?

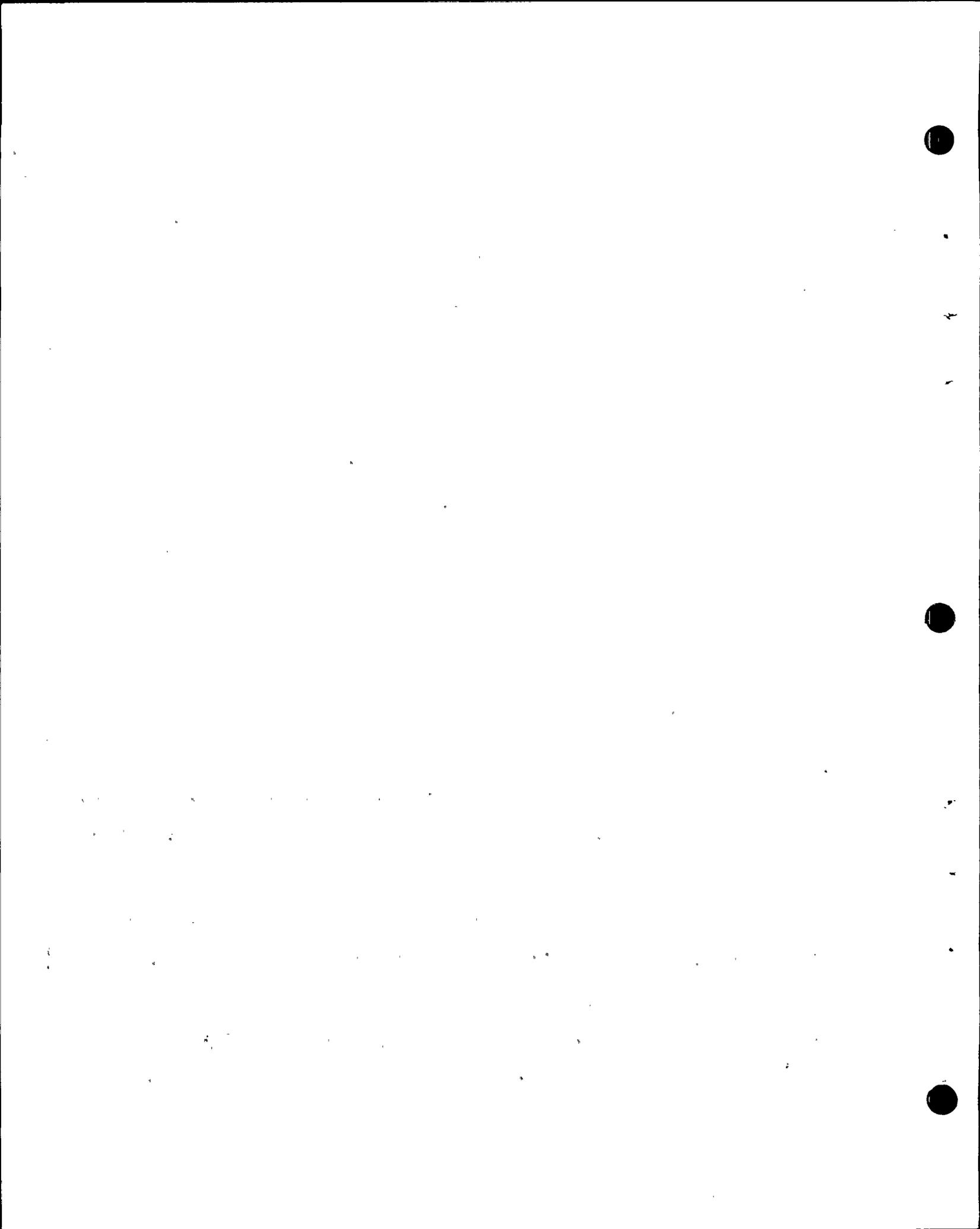
11 A Yes.

12 Q Okay.

13 Well, if you're assuming as given the ground motion
14 parameters as described in Circular 672, which gives you one
15 through nine peaks of acceleration values of maximum velocity
16 and of maximum displacement, if that's a given, what's the
17 point of these arguments?

18 A The Circular 672 ground motion is a free field
19 instrumental ground motion that does not describe a spectrum,
20 it describes in a very loose sort of way the three major
21 parameters of ground motion as a function of earthquake
22 magnitude, that is, peak acceleration, peak particle velo-
23 city and peak displacement.

24 Now what we're discussing here is whether or not
25 0.75g -- or based on seismological argument, is a conservative



1 estimate of peak acceleration for a magnitude 7.5 earthquake
2 and the ground motion as described by Newmark in his report to
3 us. And the arguments that are laid out here are what, in
4 our mind, represent the seismological data which argue that
5 this is a conservative value.

6 Q 0.75g isn't a peak acceleration. I mean, that's
7 the effective acceleration.

8 A Oh no, that is the effective acceleration.

9 Q Okay. So that's the zero period limit.

10 A Right.

11 Q And the peak acceleration that you're assuming
12 is 1.15g, isn't it?

13 A That's correct.

14 Q And in fact, you're given nine peaks of
15 acceleration, aren't you, and so there's no --

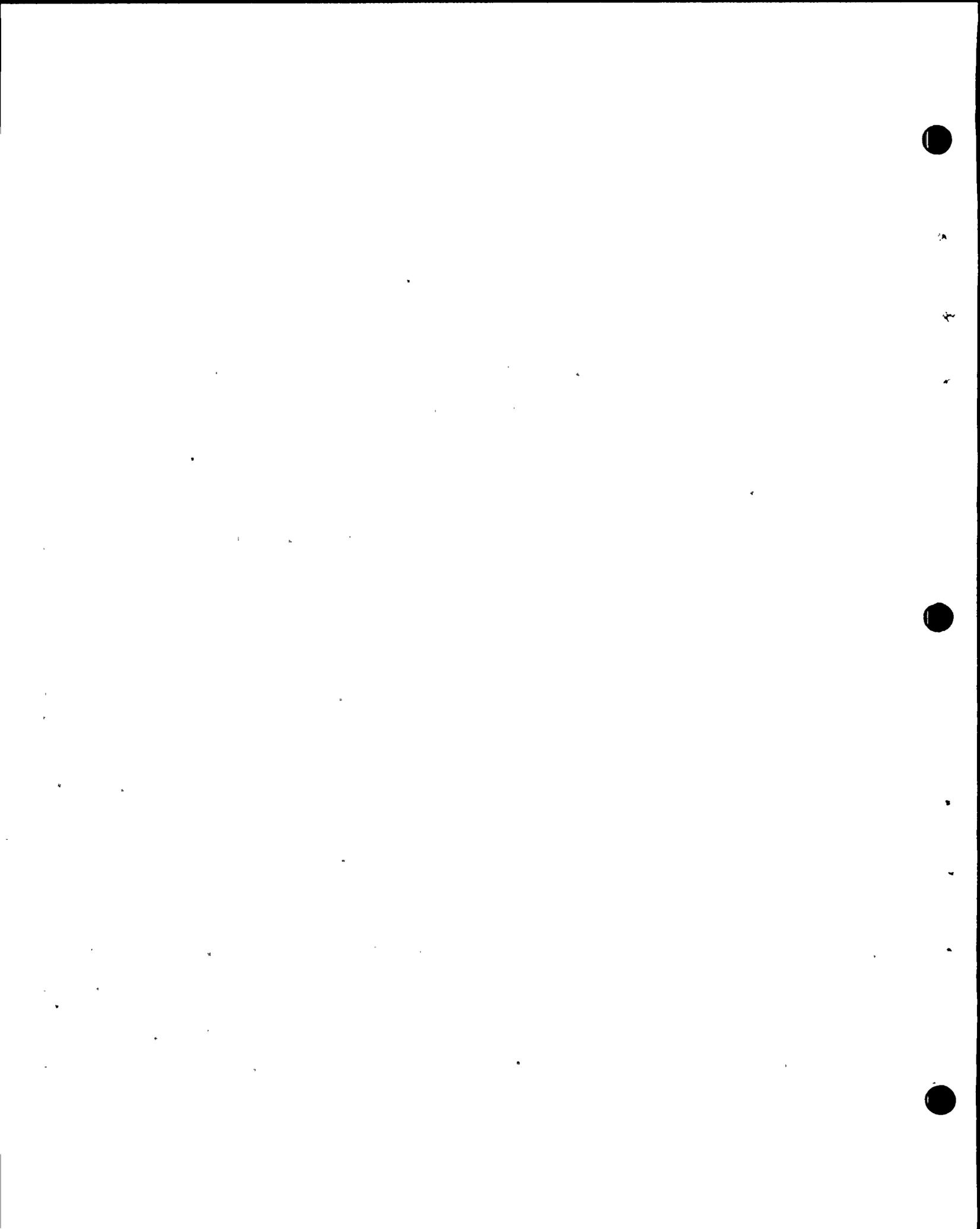
16 A That's correct.

17 Q -- that's the data that you're assuming exists.
18 I mean, that's the earthquake, that's the description of the
19 earthquake at the site, is it not, that you've assumed?

20 A That's the description of the earthquake given
21 in Circular 672 which we consider to be a valid description.

22 Q Okay.

23 So again, let me ask my question: If that is
24 the ground motion, if that's the description of the ground
25 motion what, for example, is the purpose of Argument Number



mpbl
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agb4

1 I here on page 33?

2 A By argument number one, you mean the argument
3 that begins "Peak ground acceleration...?"

4 Q That's correct.

5 A Yes.

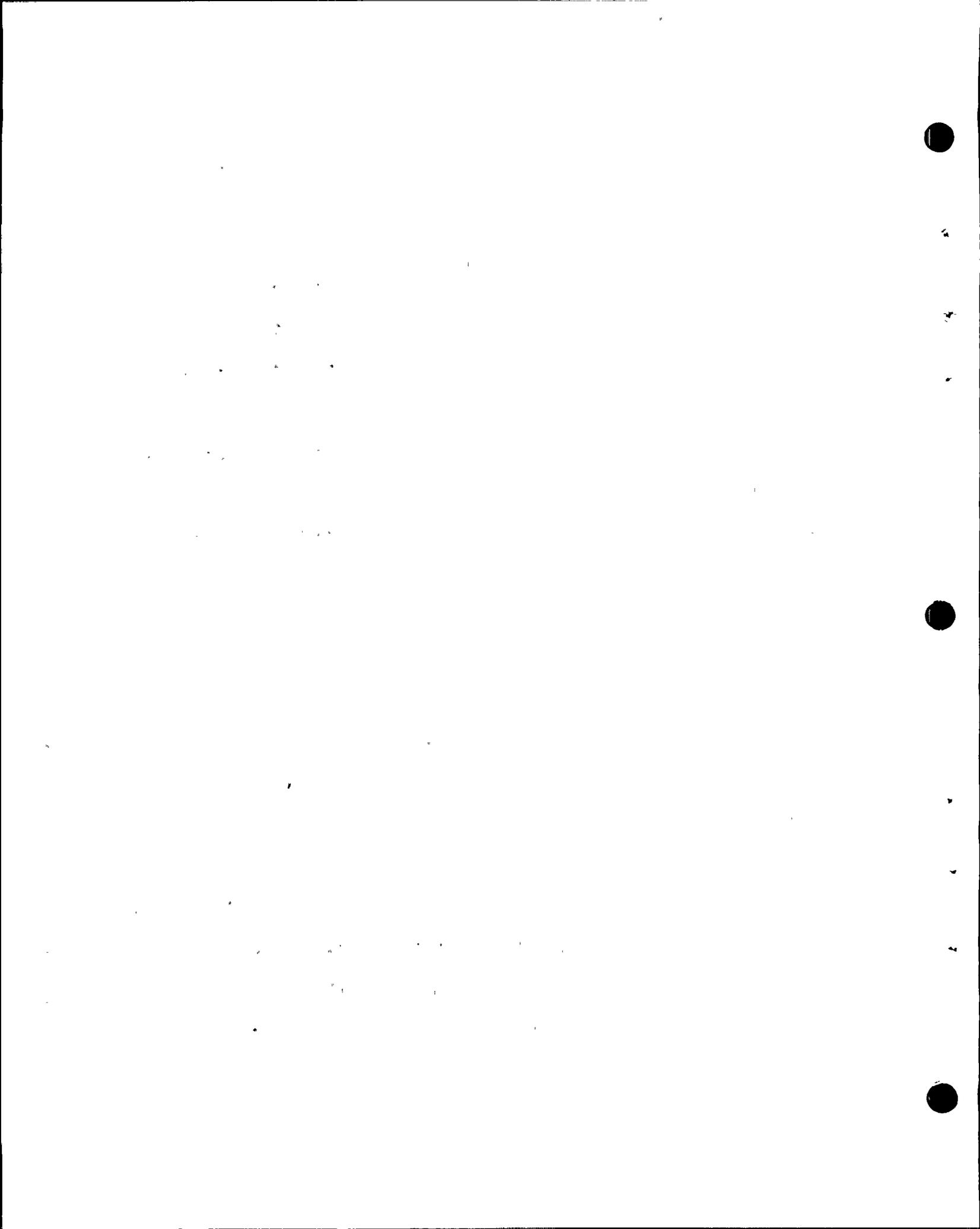
6 This is simply to put forward in the testimony
7 the arguments of Hanks and Johnson concerning peak ground
8 motion values. And those arguments, as it turns out, do
9 indicate that under reasonable conditions, or what are thought
10 to be proper conditions of stress on fault plane, that about
11 .75g is the maximum acceleration one would experience.

12 Q Well, why would we care about that if we have
13 assumed already a maximum acceleration at the site, as well
14 as, you know, the description of the nine peaks that follow --
15 excuse me, the other peaks that follow? Why do we care about
16 number one?

17 We have an earthquake given, we have a description
18 of ground motion that we have to take as given -- or excuse me,
19 the Staff has assumed is given, I understand.

20 MR.NORTON: Excuse me.

21 These questions are becoming multiple and argu-
22 mentative. Mr. Fleischaker is getting pretty excited about
23 something, I'm not sure what; but his questions are getting
24 compound, multiple, and argumentative. And I would appre-
25 ciate it if he would slow down and break them down into



mpb2

1 understandable questions, at least that I can understand.

2 MR. FLEISCHAKER: Strike that question.

3 I agree, it was a multiple question.

4 BY MR. FLEISCHAKER:

5 Q Inasmuch as we have a description of earthquake
6 parameters given to us, which is not only a peak acceleration
7 but all of the following peaks, one through nine, or one,
8 three, five, seven, and nine, why do we care about the
9 Hanks and Johnson presentation here that you mentioned in
10 number one?

11 MR. TOURTELLOTT: I object to the form of the
12 question.

13 Why do we care about it is vague and uncertain
14 and doesn't really mean anything, even if this witness were
15 to answer.

16 MRS. BOWERS: Could you rephrase the question?

17 BY MR. FLEISCHAKER:

18 Q What is the relevance?

19 A (Witness Stapp) This is relevant to the question
20 of the maximum ground motion from a magnitude 7.5 earthquake
21 at a distance of seven kilometers from the source.

22 Q But we have that, don't we? We have a maximum
23 acceleration that we have assumed, isn't that correct?

24 A That's correct.

25 Q Okay.



mpb3

1 Well, let me ask you the same question with
2 respect to number two:

3 Since we have our maximum acceleration and peaks
4 one, three, five, seven, and nine, and the velocity and the
5 displacement, what is the relevance of comment number two?

6 A It's relevant in the same context that the first
7 argument is relevant. That is, that it tends to -- the infor-
8 mation stated here by Hanks and by Kanamori and Anderson
9 tends to suggest that very high accelerations would not be
10 expected at close-in distances to faults in the San Andreas
11 fault system, other than perhaps -- particularly those faults
12 that are strike slip faults sub-parallel to the San Andreas
13 itself.

14 Q But again, we have assumed for purposes of our
15 reanalysis a given acceleration, isn't that correct, as
16 described in USGS?

17 MR. TOURTELLOTTE: I'll object to that question
18 too.

19 I'm not sure that we've assumed that. I don't
20 know exactly where that comes from.

21 What I believe has been testified to is that
22 the reference by USGS was made to Circular 672, which had
23 in it Table 2, and Table 2 shows the figure of 1.15g acceler-
24 ation for a 7.5 earthquake. But we had a considerable
25 amount of testimony yesterday from the USGS witnesses which



mpb4

1 indicated that that was not in and of itself definitive of
2 what the acceleration would be, and that a more particular
3 analysis might be required, A, in specific cases, and, B,
4 where structures were involved.

5 And so I'm not sure what Mr. Fleischaker means
6 when he says that we have a "given". I don't know who the
7 "we" is. But it certainly is an objectionsble question the
8 way it's put, and I don't think that it relates to the record.

9 MRS. BOWERS: Would you like to respond to the
10 objection, Mr. Fleischaker?

11 MR. FLEISCHAKER: Mr. Tourtellotte has confused
12 the testimony of the USGS. What the USGS said was that 672
13 contains their estimation of the ground motion parameters, the
14 ground motion that would exist in the free field. And there
15 might be several ways to derive an effective acceleration
16 for use in the design response spectra.

17 They didn't say that there would be several kinds
18 of ground motion. 672 contains USGS's best judgment as to
19 ground motion.

20 We've also heard from this witness that the NRC
21 has, for its reanalysis, relied on 672, Table 2.

22 MR. NORTON: Mrs. Bowers --

23 MR. FLEISCHAKER: Wait a second.

24 And since we have that as a given, I don't under-
25 stand why it's being -- you know, what the purpose of



mpb5

1 discussing the ground motion here is.

2 I understand the testimony to be that the NRC
3 in its reanalysis relied upon 672. 672 contains a descrip-
4 tion of the ground motion at the site. That description is
5 in peak acceleration and several peaks to follow velocity,
6 and displacement. That's the given. And that's the basis
7 upon which the design response spectra was analyzed.

8 So I'm asking this witness why it is that we're
9 talking about all these different kinds of ground motions
10 when we've all decided -- or at least the NRC, I understood,
11 had decided that 672 was good enough. That contained an
12 adequate description, and that's what they used.

13 MR. TOURZELLOTTE: All right.

14 I think the witness has already answered this
15 question. The question was asked as to how we came up with
16 this .75 and why we came up with it. And I understood the
17 witness to say that Dr. Newmark had proposed this. I believe
18 that's what the testimony itself says, is that he had
19 recommended a design scaled to a .75g, and that the Staff
20 made its own analysis to determine whether that was a con-
21 servative number or not. And they did arrive at the conclu-
22 sion that it was a conservative number for the reasons stated
23 in one through five on pages 33 and 34.

24 And it seems to me that the question has been
25 asked and answered, and there's no real reason to go down one,



mpb6 1 two, three, four, and five, if that's the only purpose of his
2 question.

3 MR. FLEISCHAKER: No, that's the whole point of
4 the cross-examination is that Dr. Stepp doesn't make the
5 decision to take 672 and derive the 0.75 zero period limit.
6 That's Dr. Newmark. He will be on the stand tomorrow. And
7 he is imminently qualified to talk about that decision.

8 MR. TOURTELLOTTE: But that's not the point.

9 MR. FLEISCHAKER: Wait a second.

10 Dr. Stepp's expertise is in describing the ground
11 motion at the site given a 7.5 magnitude earthquake a certain
12 distance from a causative fault assuming a certain soil condi-
13 tion, all right? That's what a seismologist does. That's
14 what he's testified to.

15 Now what he has done is he's gotten together
16 with USGS and the NRC Staff has determined that they will
17 use 672. 672 gives you a ground motion described by one
18 peak and several following peaks of acceleration, velocity,
19 and displacement, all right?

20 So that's where his expertise goes. His expertise
21 went into the decision of selecting 672, not in selecting
22 0.75. That's Dr. Newmark's area of expertise.

23 MR. TOURTELLOTTE: I disagree, because this
24 witness can do one of several things as a seismologist. He
25 can either go out and independently do his own study and come



mpb7

1 up with a ground motion, or someone could give him a ground
2 motion and ask him whether or not that ground motion is a
3 conservative figure or not. And that is exactly what happened.

4 Although it may be Dr. Newmark's figure, for
5 whatever purpose Newmark wanted to come up with it, it never-
6 theless was put to Dr. Stepp as is this conservative or is it
7 not. And he can use his seismological skill and his expertise
8 to look into the evidence that exists and determine whether
9 or not it's conservative; and that's exactly what he's done.

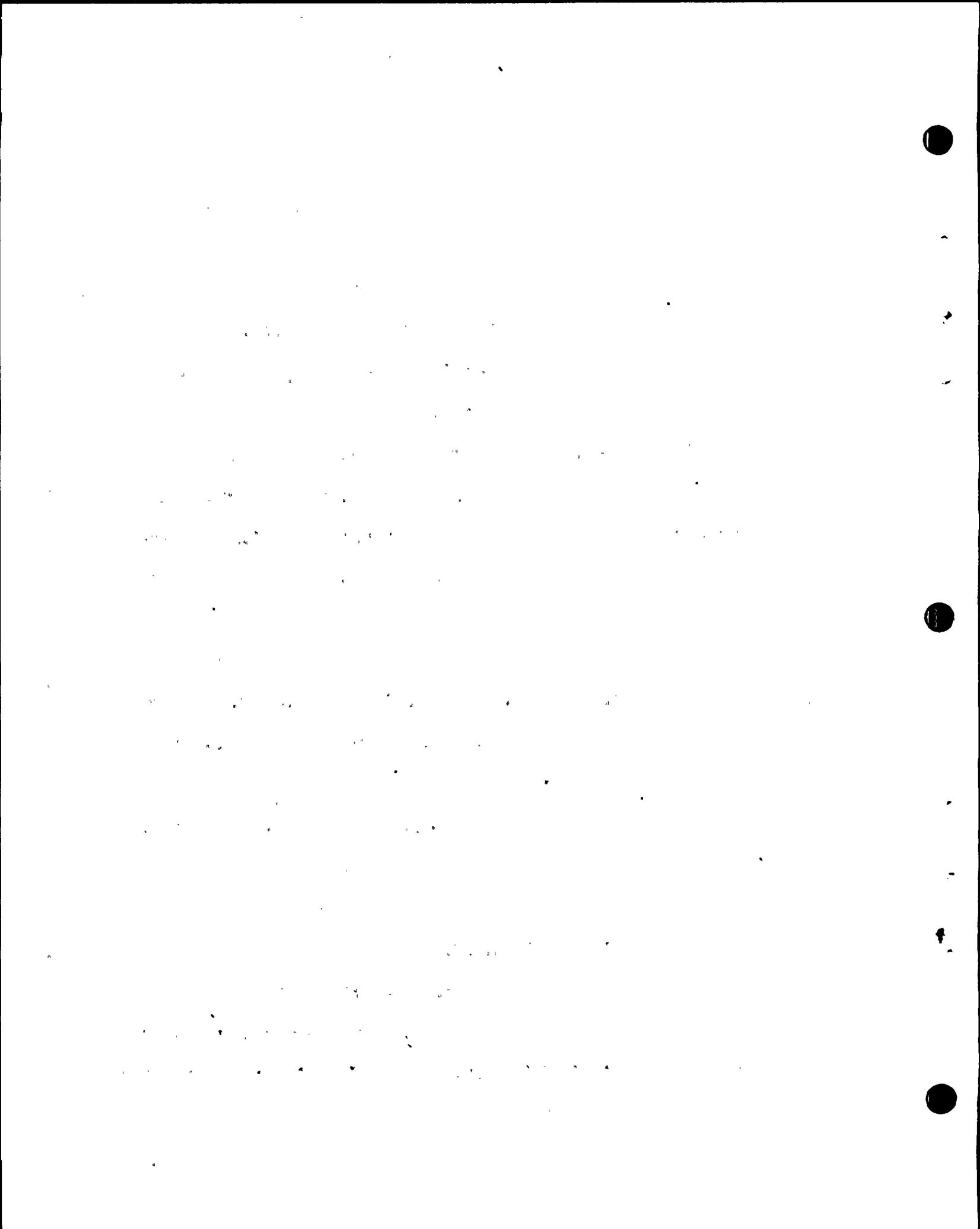
10 It's not a matter that he has to come up with a
11 figure or that he is in any way tied to the figure that's on
12 Table 2 in Circular 672. He's come up with his own independent
13 analysis of whether .75g is a conservative value or not, and
14 he has arrived at the conclusion that it is.

15 MRS. BOWERS: Mr. Tourtelotte, aren't we also
16 hearing questions concerning the observations that are listed
17 on page 33? And I thought you included in your objection that
18 there was no reason to go down through those.

19 Is that part of your objection?

20 MR. TOURTELLOTTE: Well, I believe the question
21 has been asked and answered.

22 Now I don't really see the value of going down
23 through each one, unless he wants to know exactly why those
24 points -- why Dr. Stepp believes that those points enumerated
25 there lead him to the conclusion that .75g is conservative.



mpb8

1 But the tenor of the questions is not that at all.
2 The tenor of the questions is that you're going down through
3 here and making an independent seismological analysis about
4 the validity of the g acceleration, when the g acceleration
5 you ought to be using is in Circular 672, Table 2. And that
6 is an improper -- that's contrary to what this witness has
7 already testified to. And it is an improper way to cross-
8 examine on these particular points.

9 As a trial lawyer, I'm not going to tell you that
10 you can't ask any questions at all about one, two, three,
11 four, and five, but I am simply saying that the manner in
12 which those questions are asked and the purpose for asking
13 them is not a valid purpose.

14 MR. FLEISCHAKER: Well, I'll move on.

15 The only point that I'm seeking to make -- and
16 I think I can demonstrate it for the record -- is an attack
17 on 672, which is --

18 MRS. BOWERS: Well, we have an objection pending.

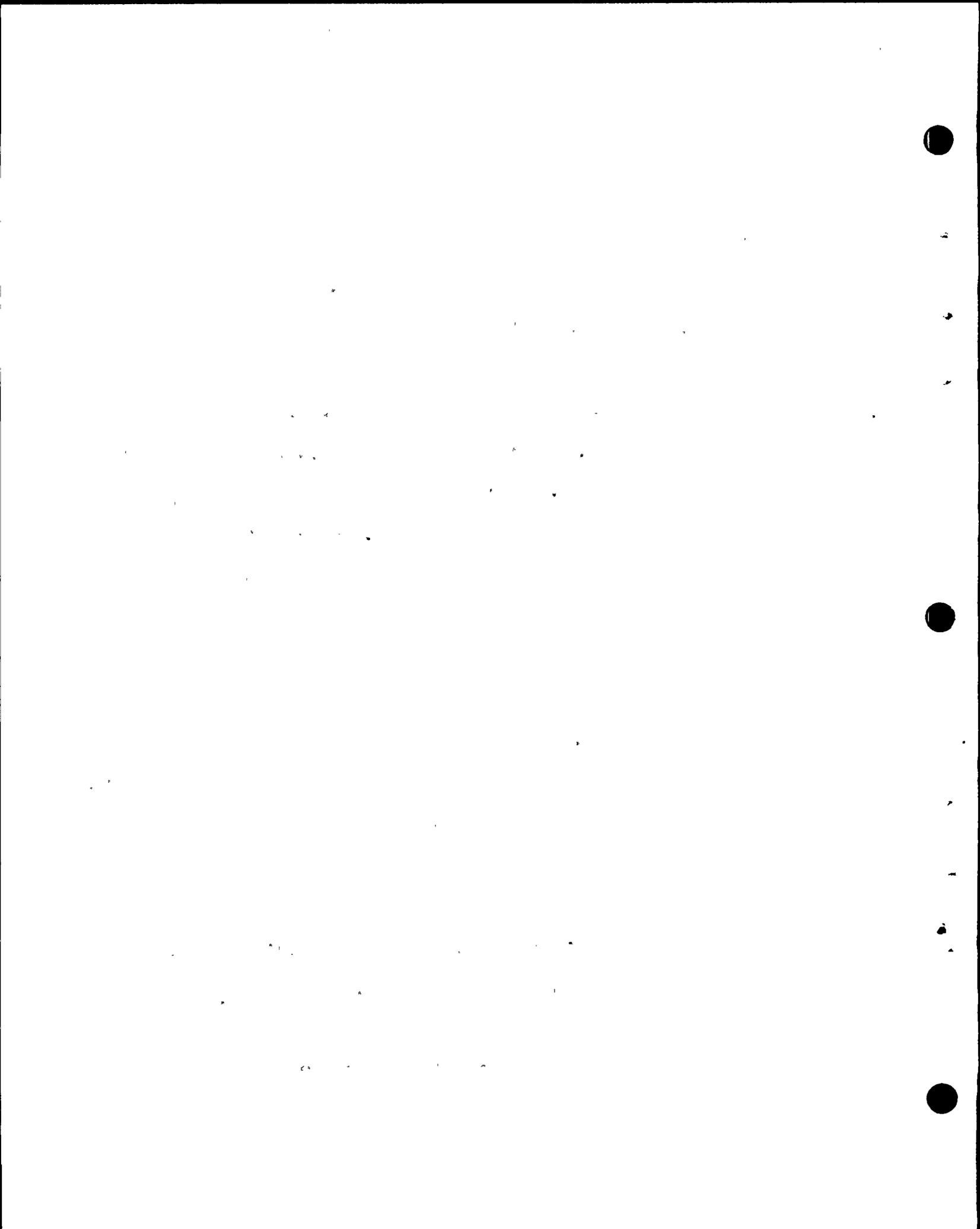
19 Mr. Fleischaker, before we rule on it, your
20 moving on doesn't exactly solve the situation.

21 MR. FLEISCHAKER: Okay, fine.

22 I forget what the objection was to.

23 MR. NORTON: Yes. I'm so hopelessly lost as to
24 what the original objection was to that I can't comment on it.

25 (Laughter.)



mpb9

1

MR. TOURTELLOTTE: Well, why don't we just start

2

from here.

3

I'll withdraw my objection. And Mr. Fleischaker

4

can't remember his question, so we'll go on. And I'll wait

5

for his next question. And if it applies, fine. If it

6

doesn't, we can continue.

7

BY MR. FLEISCHAKER:

8

Q Dr. Stepp, has the Staff or has the Staff not

9

adopted 672 in the description of the 7.5 earthquake in that

10

bulletin as the basis for describing ground motion for the

11

reanalysis of the Diablo Canyon Nuclear Power Plant?

12

A (Witness Stepp) Yes, the Staff has adopted that

13

as the basis for describing free field ground motion for a

14

magnitude 7.5 earthquake.

15

Q Fine.

16

Now let me ask you this:

17

With respect to number one on page 33 here, would

18

you agree or disagree with this statement:

19

"Peak accelerations at a distance

20

approximately equal to ten kilometers in

21

excess of 1g for magnitudes greater than

22

or equal to 4.5 earthquakes are not diffi-

23

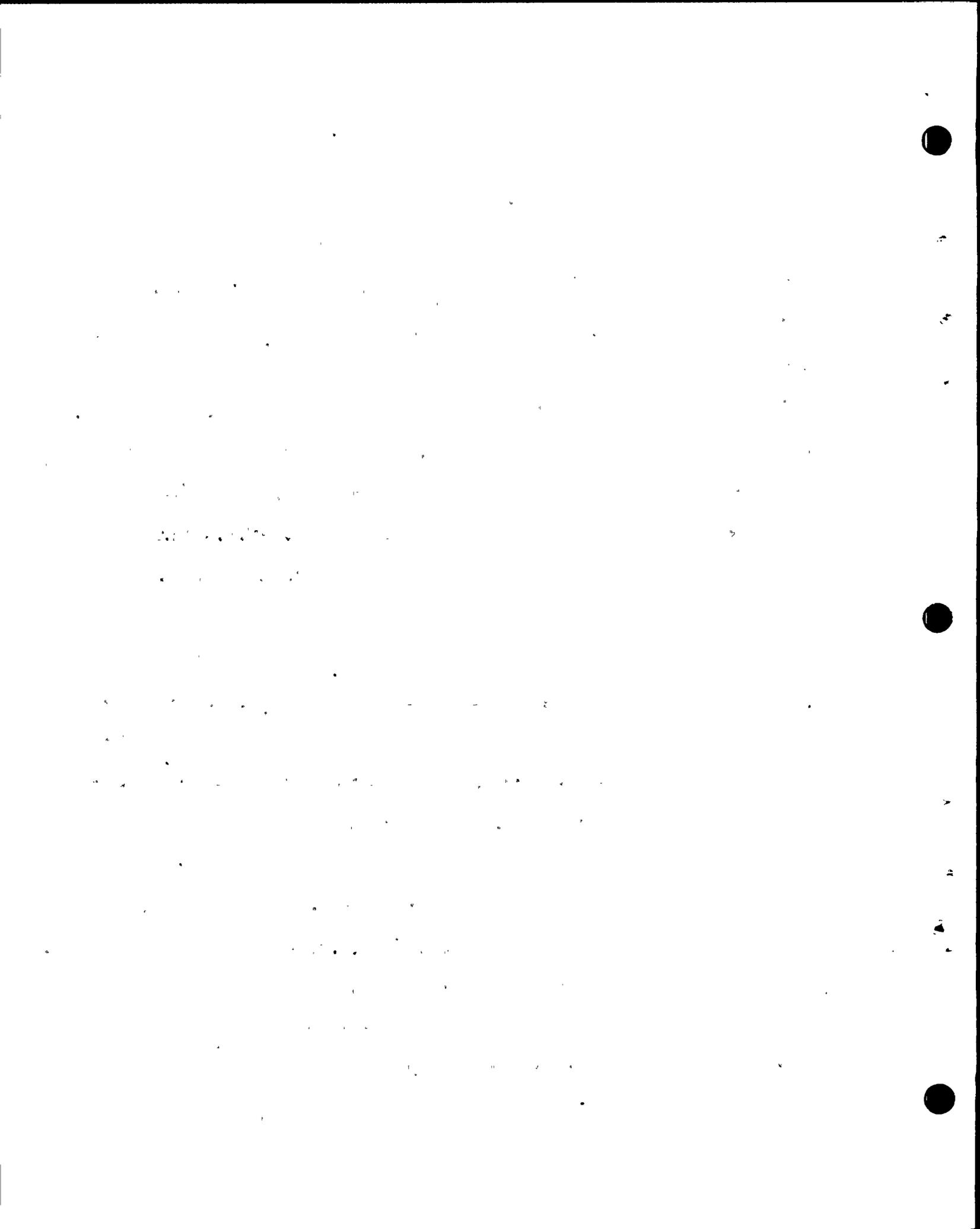
cult to rationalize, and the probability

24

of such an occurrence clearly increases

25

with increasing magnitude."



mpb10 1

MR. TOURTELLOTT: Excuse me, Mrs. Bowers.

2

Could we have a citation of what he's reading

3

from?

4

MRS. BOWERS: Well, you referred to page 33, but

5

I didn't see on that page where you were reading from.

6

MR. FLEISCHAKER: No, I wasn't reading from page

7

33.

8

I was asking him with respect to number one if he

9

would agree with the statement. He's talking about Hanks

10

and Johnson here, and the comment that I just made -- the

11

quotation was from Hanks and Johnson. I'm asking him if he

12

also agrees with that statement from Hanks and Johnson.

13

MRS. BOWERS: Well, just a minute.

14

MR. NORTON: May we have a moment to pull out

15

Hanks and Johnson and give it to the witness so that he can

16

read it in the context in which the question is being asked?

17

When you pull a sentence out of a paper it some-

18

times doesn't mean what it appears to mean.

19

(Pause.)

20

MRS. BOWERS: Was that given an exhibit number?

21

MR. NORTON: No, I don't think it was.

22

MR. FLEISCHAKER: Yes, 47.

23

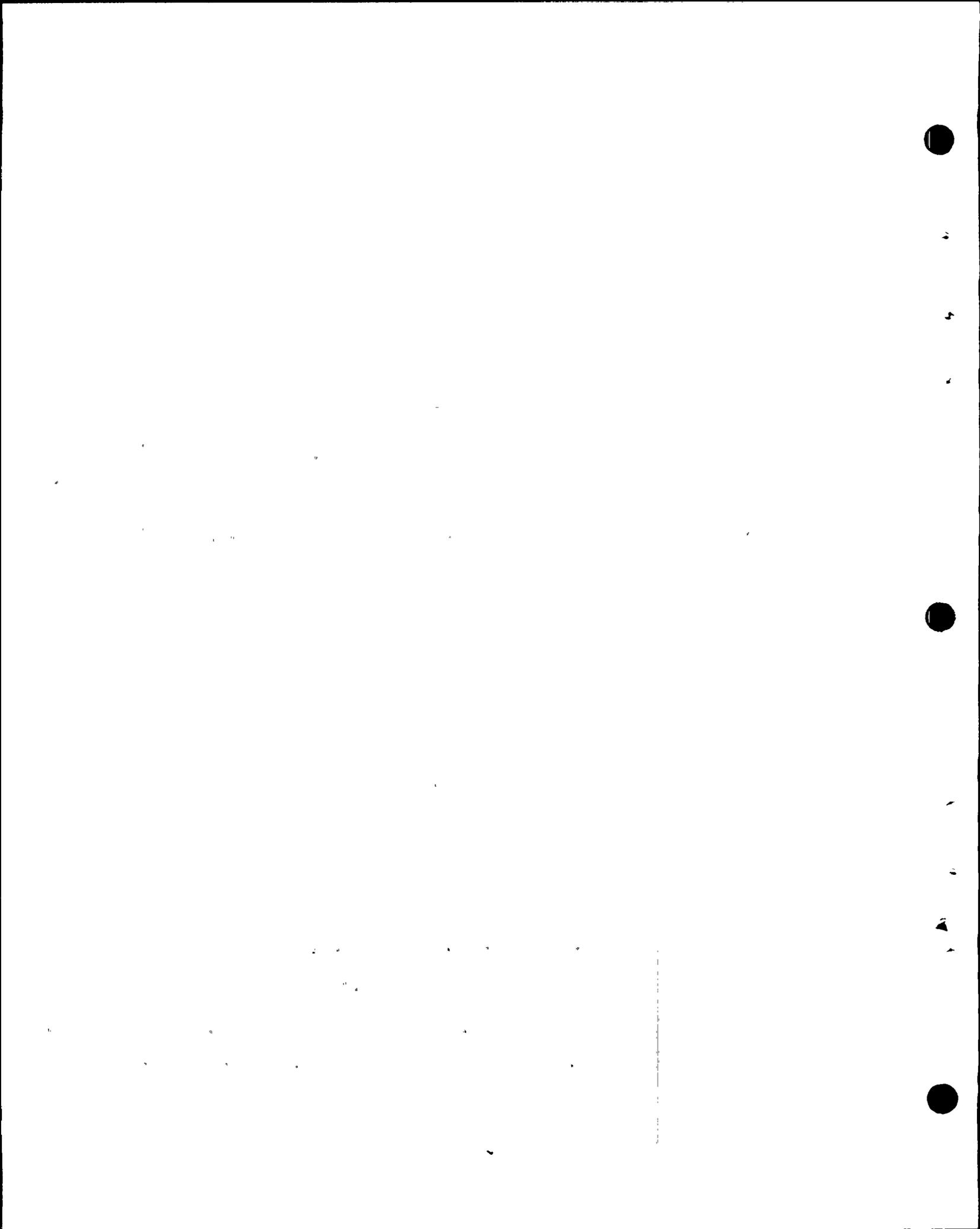
MR. NORTON: Joint intervenors?

24

MR. FLEISCHAKER: Yes.

25

MR. NORTON: May we have a reference to the page



mpbli 1 the quote is on so that we don't have to read the whole thing
2 to find it?

3 MR. FLEISCHAKER: 964 of the abstract is what I
4 have.

5 Let me give you an easier way to find it:

6 BY MR. FLEISCHAKER:

7 Q Under the Dependence on Magnitude, Dr. Stepp, in
8 the third full paragraph in that section.

9 MR. NORTON: How does that paragraph start?

10 MR. FLEISCHAKER: "For this reason alone.."
11 This is the paper. I'm sorry. This third full paragraph.

12 WITNESS STEPP: What page?

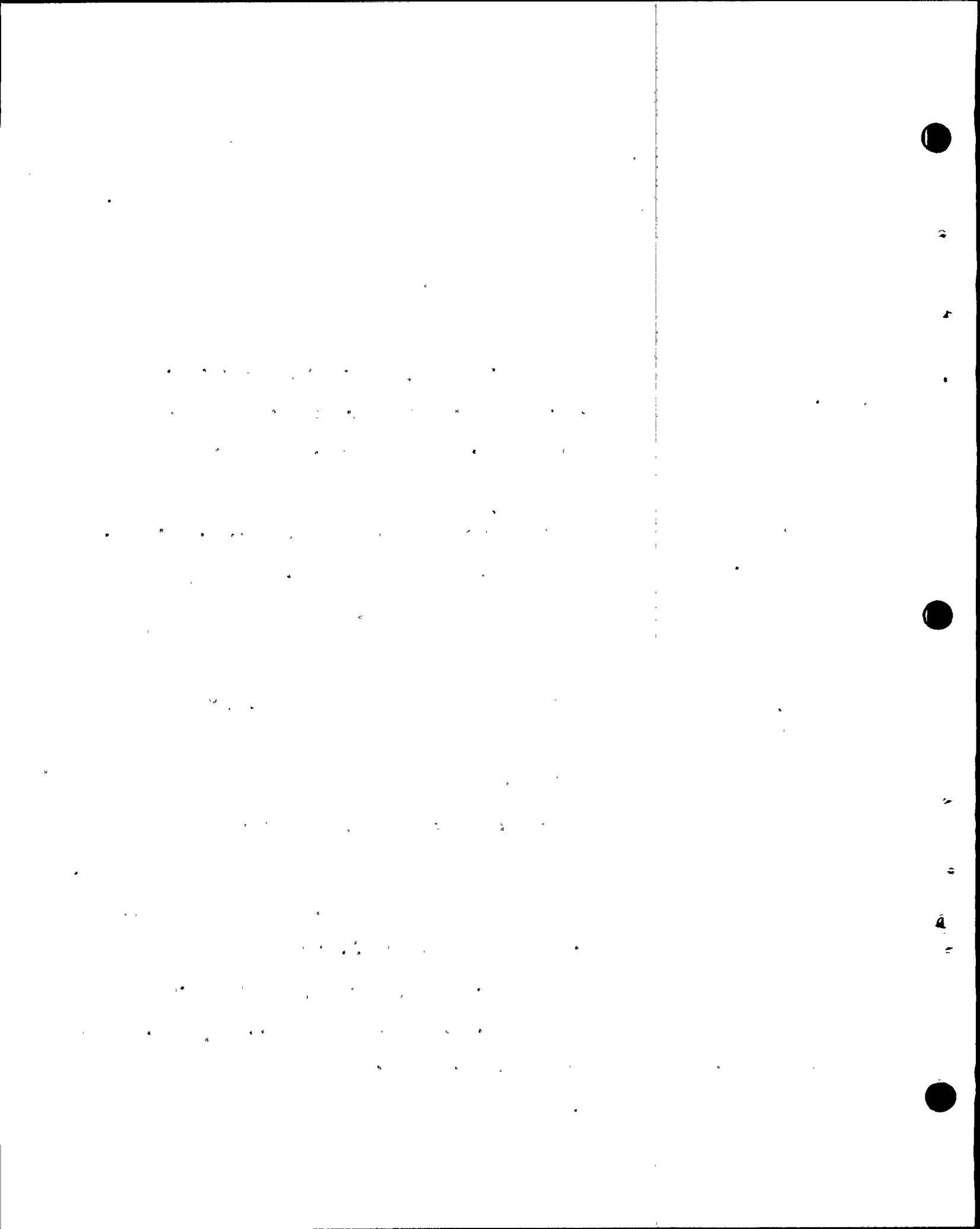
13 MR. NORTON: 964.

14 MR. FLEISCHAKER: The section is entitled
15 "Dependence on Magnitude".

16 WITNESS STEPP: Okay.

17 MRS. BOWERS: Let me check with Mr. Tourtelotte.
18 You made an observation. Was it in the form of
19 an objection after this question was asked, or were you just
20 trying to locate what he was looking for?

21 MR. TOURTELLOTTE: Basically I was trying to find
22 out what he was reading from. I knew he was reading from
23 something, and it's generally considered the practice to let
24 other people know what you're reading from and to provide
25 copies of that for the reason that you don't want something
taken out of context.



MPB5

c9 mpbl

1 (Pause.)

2 MR. FLEISCHAKER: I'm sorry.

3 BY MR. FLEISCHAKER:

4 Q Do you agree with that statement, Dr. Stepp?

5 A (Witness Stepp) Yes.

6 Q Okay.

7 Dr. Stepp, with respect to the statement made
8 under number two there, would you agree that for a given
9 earthquake you are likely to have a wide variation in stress
10 along the fault?

11 A Yes. That's the general belief among seismic-
12 gists. And there seems to be a reasonable support for that.

13 Q So that for a given earthquake you could have
14 areas where you could have -- would those areas of high stress
15 lead, therefore, to high accelerations and velocities?

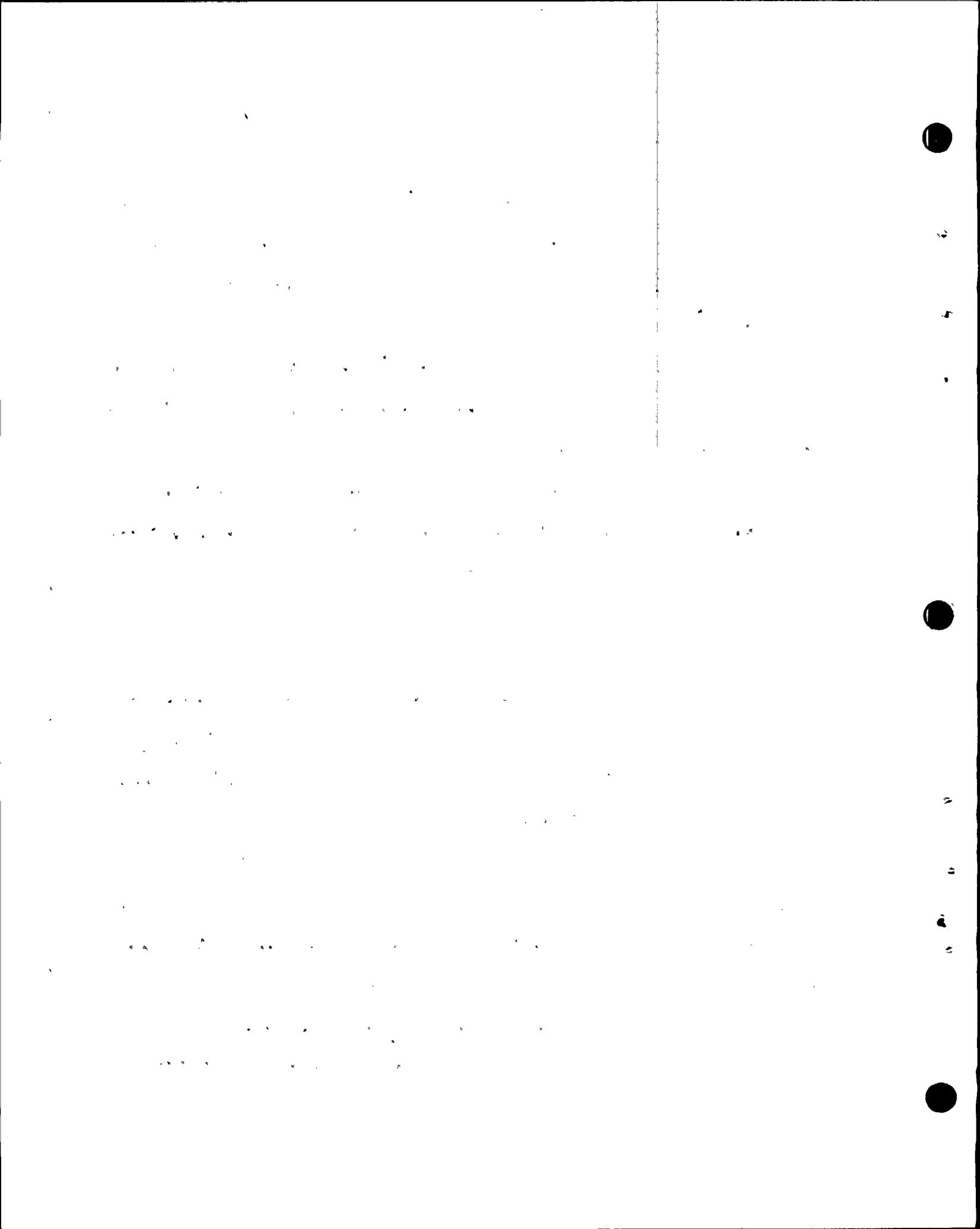
16 A Yes, locally.

17 Q Locally.

18 With respect to number three, do you know whether
19 the USGS, in deriving the description of earthquakes in Table
20 Two, took into account that the accelerations on the Pacoima
21 Dam accelerogram may have been amplified?

22 A I don't think they did specifically. However
23 they did filter the record at, I think, eight hertz or seven
24 hertz, which would have effectively done that.

25 Q With respect to number five on page 34, would you



mpb2 1 agree that where you describe one way of getting some esti-
2 mations of ground motion parameters, and you said in 672 I
3 believe is one way, that is extrapolation from an empirical
4 data base. Another way is to basically derive an attenuation
5 relationship and have a magnitude of distance and source
6 and come up with some estimations.

7 Are there others who have done these kinds of
8 -- derived these attenuation relationships than those that
9 you've listed here?

10 A I'm certain there are others. I'm sure it's not
11 an inclusive list, in fact I know it's not. No effort was
12 made to make it an inclusive list.

13 But these are, I believe, the more recent curves
14 which actually derive from the data themselves. Now Trifunac
15 has a curve available in the literature, but he actually
16 based the attenuation on the Richter magnitude relationship
17 attenuation rather than on a free determination based upon
18 the strong motion data themselves.

19 Actually I think there are two papers, Trifunac
20 and Trifunac and Brady. But I believe both of them use the
21 same attenuation relationship which is actually the Richter
22 magnitude attenuation relationship.

23 Q Well, would his relationship support the 0.75
24 as a conservative value of peak horizontal acceleration?

25 A I frankly have not measured it. But my perception



mpb3

1 is that it would not. That it would come up with a higher
2 value at that distance.

3 Q Are you familiar with Ambraseys attenuation
4 relationship?

5 A No, I am not. I'm not familiar with that. I've
6 seen it referenced in Dr. Brune's testimony, but I don't have
7 a copy of it.

8 Q Just one last thing, Dr. Stapp.

9 Turn to page 33 of your testimony. And at page
10 33 at the top of the page, beginning with the sentence that
11 says "This ground motion...", what ground motion are you
12 referring to?

13 A The ground motion proposed by Dr. Newmark in his
14 report to us as the basis for the reevaluation of the units.

15 Q Did Dr. Newmark propose a ground motion or a
16 design response spectra?

17 A That is a ground motion. The design response
18 spectra describes a particular acceleration value. It des-
19 cribes ground motion.

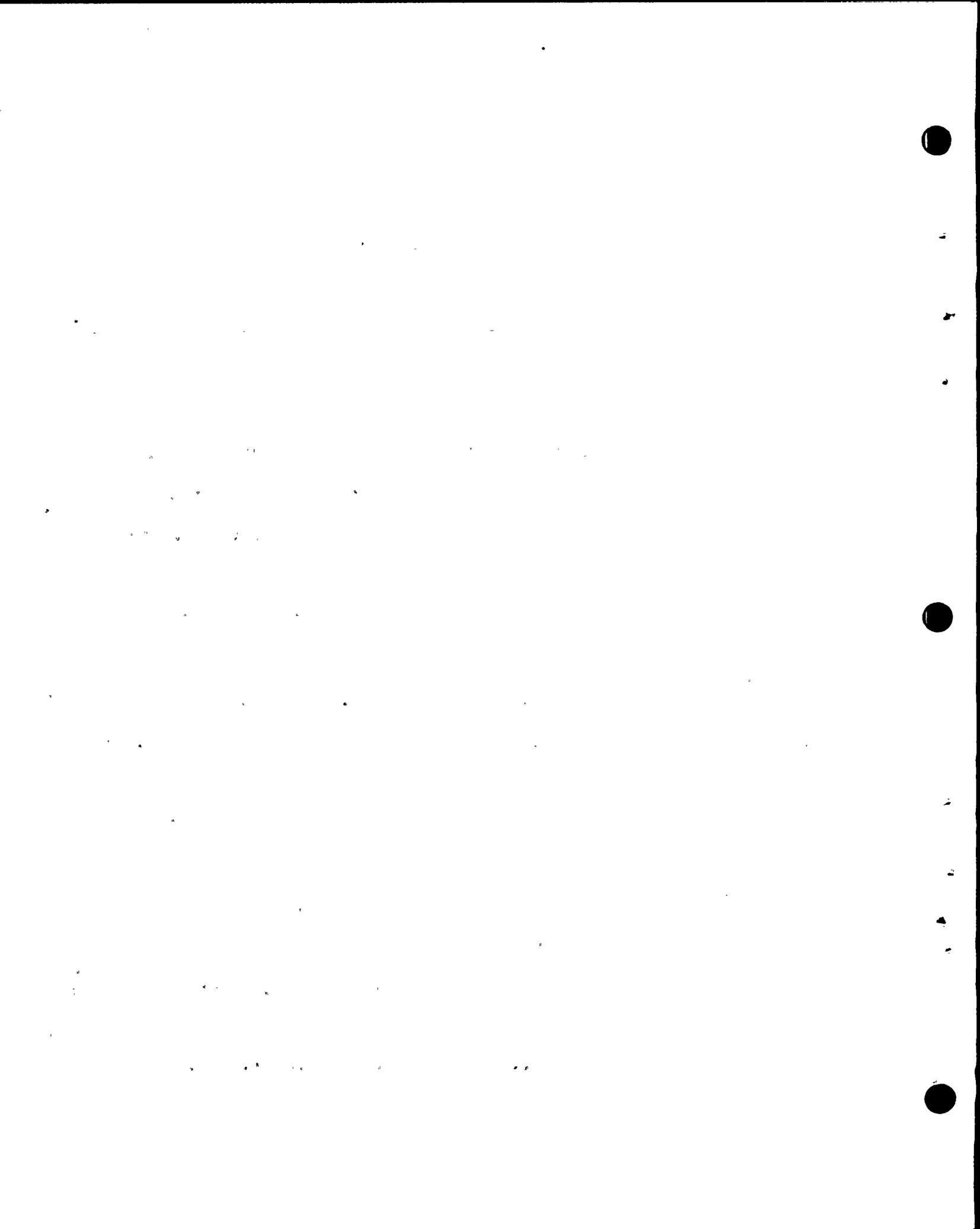
20 Q But it's not ground motion in the free field?

21 A It was not intended to be as described by Dr.
22 Newmark, no.

23 Q It is the ground motion --

24 A For which the units should be reevaluated, yes.

25 Q And it takes into account structural response?



mpb4

1 A That's correct.

2 MR. FLEISCHAKER: I have no further questions
3 of this panel.

4 MRS. BOWERS: Mr. Norton?

5 BY MR. NORTON:

6 Q I take it you're somewhat familiar with Trifunac's
7 paper that was the attenuation curve? It was asked of you
8 by Mr. Fleischaker.

9 Is that the paper that for a distance of ten
10 kilometers a 7.5 magnitude earthquake gives you an average
11 or mean acceleration around $1g$ and one standard deviation
12 removed above that is $2.45g$, and one standard deviation
13 below the mean is less than $0g$, a minus g ? Is that the paper
14 we're talking about?

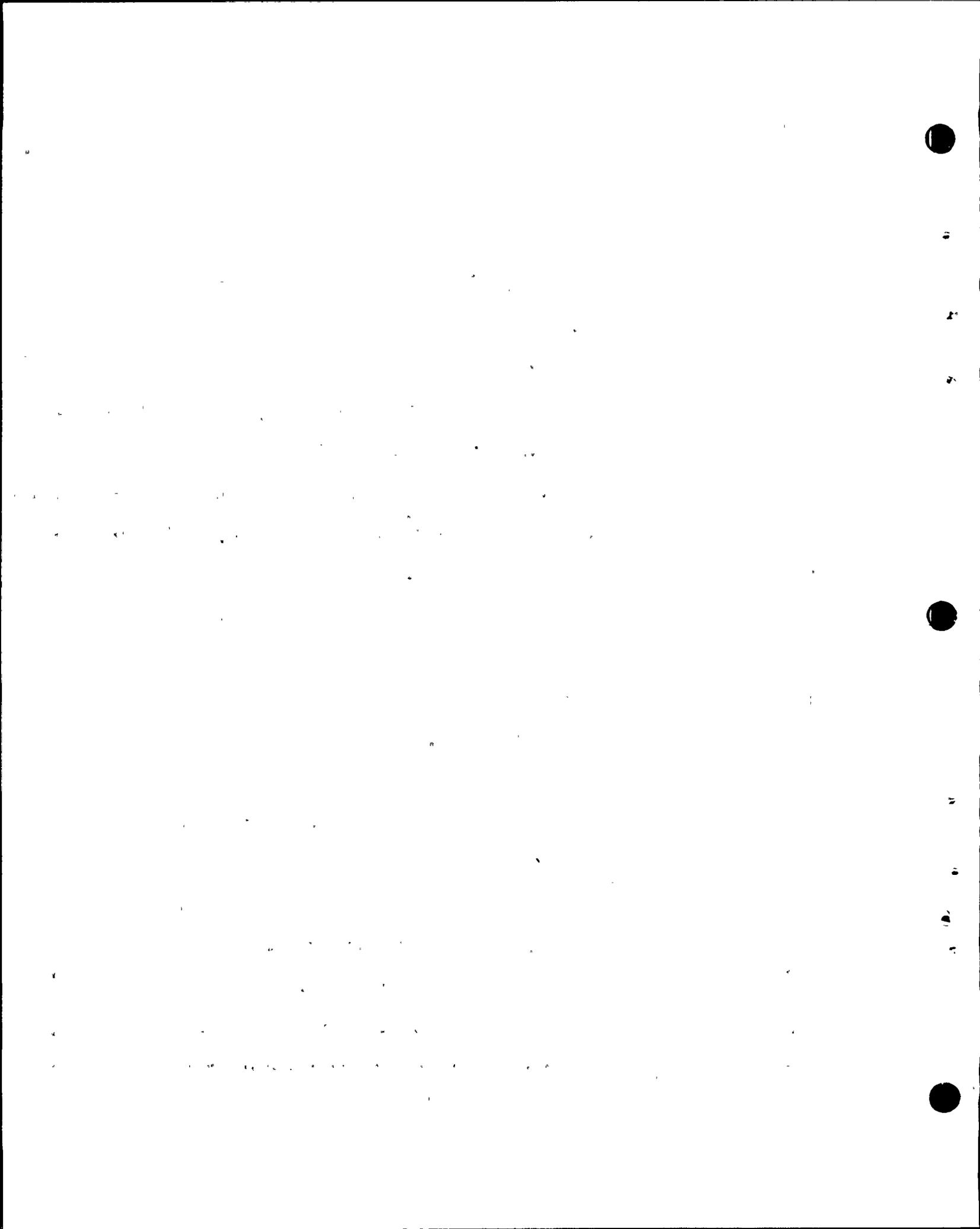
15 MR. FLEISCHAKER: I'd like to know what he's
16 referencing, and I'd like to see the paper, because I don't
17 know that those values are in Dr. Trifunac's --

18 MR. NORTON: Well, I think they're in Dr. Brune's
19 testimony.

20 MR. FLEISCHAKER: I'm not sure you're talking
21 about the same paper.

22 MR. NORTON: Well, that's what I'm trying to find
23 out.

24 You're the one who was just talking about Dr.
25 Trifunac's paper, and I'm trying to find out if that's the



mpb5

1 one.

2 MRS. BOWERS: Well, the witness should answer
3 the question.

4 Is that the paper?

5 WITNESS STEPP: Frankly, I don't know.

6 BY MR. NORTON:

7 Q All right.

8 Just a moment and let me get Dr. Brune's testimony.

9 MR. NORTON: This is the written testimony.

10 MRS. BOWERS: While you're looking for that, I
11 think it would be appropriate to have a ten minute recess.

12 MR. NORTON: I've got it. And this is the only
13 question I have, if you want to finish it up. If you want
14 to take a break, that's fine too.

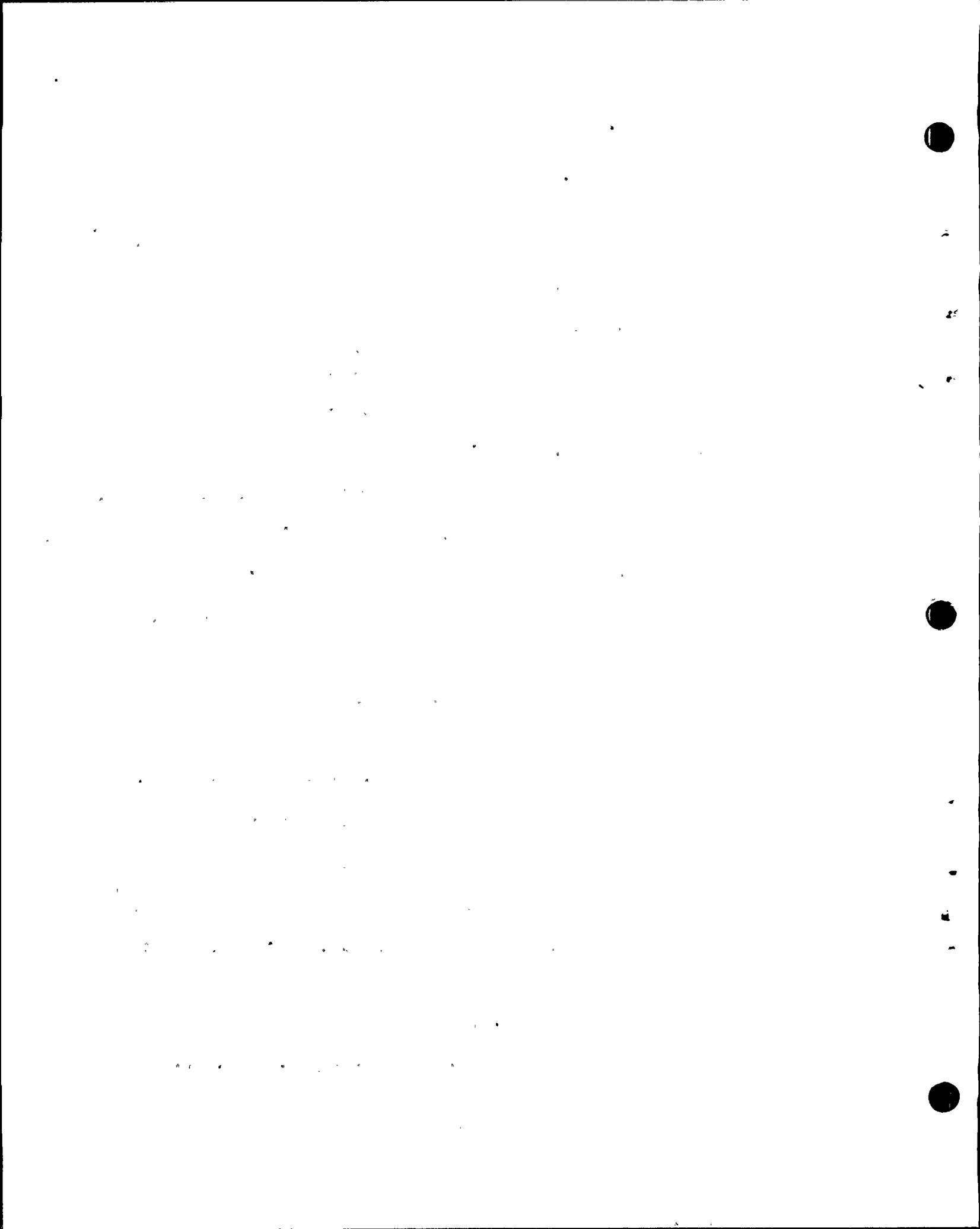
15 I'll be done in 60 seconds.

16 DR. MARTIN: Good.

17 BY MR. NORTON:

18 Q It's on page 3-9 of the Brune testimony. And
19 he talks about:

20 "For the Trifunac curves, the 90 percent
21 confidence limits are about a factor of 2.3
22 above the mean, thus assuming the horizontal
23 accelerations in the Gazli earthquake represent
24 the mean, one would estimate 90 percent confi-
25 dence level accelerations of about .75g times



mpb6

1 2.3 equals 1.73g.⁴

2 This is using the Trifunac curves.

3 MR. FLEISCHAKER: That's an entirely different
4 thing, because I believe that -- he's talking about a 90
5 percent confidence level there.

6 MR. NORTON: That's correct, a 90 percent confi-
7 dence level, nine out of ten earthquakes of that magnitude.

8 And as I understand that --

9 MR. FLEISCHAKER: Nine out of ten means they
10 would all be below that. The mean would be something differ-
11 ent.

12 MR. NORTON: I'm sorry, I don't read it that way,
13 and I don't believe that was Dr. Brune's testimony. But I'd
14 be willing to -- if you want to make it that way, I think
15 we'd be willing to accept the numbers.

16 BY MR. NORTON:

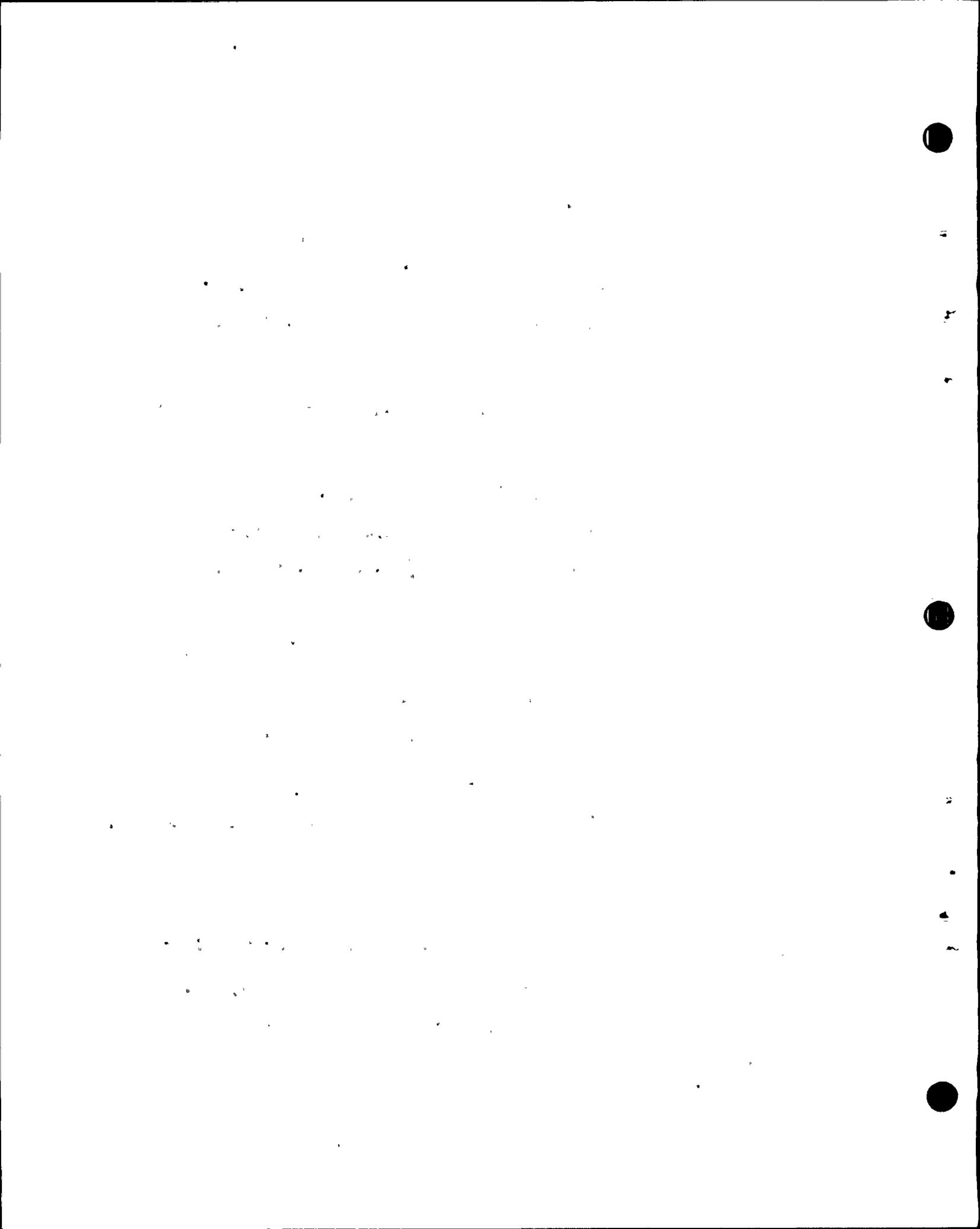
17 Q But is that the Trifunac paper that you were
18 referring to, or that you thought you were referring to in
19 response to Mr. Fleischaker's question?

20 MR. FLEISCHAKER: We still haven't named that.
21 I think it's referred to as number eight here, so you can
22 probably get the name --

23 BY MR. NORTON:

24 Q Is that the paper you were referring to?

25 A (Witness Stopp) Well, there is only one that I'm



mpb7 1 aware of. There's one by Trifunac and one by Trifunac and
2 Brady.

3 Q Okay.

4 And on page 3-7 of that testimony it says

5 "Trifunac", footnote 8, and that's the Trifunac paper:

6 "...gives about 1.7g for the average
7 acceleration near the fault for a magnitude
8 7.5 earthquake and about 4g for the accelera-
9 tion."

10 And it goes on and it says:

11 "The corresponding values at an epi-

12 central distance of ten kilometers are 1.1g

13 and 2.45g respectively."

14 MR. FLEISCHAKER: Could I have a cite to the
15 page? I'm just trying to keep up.

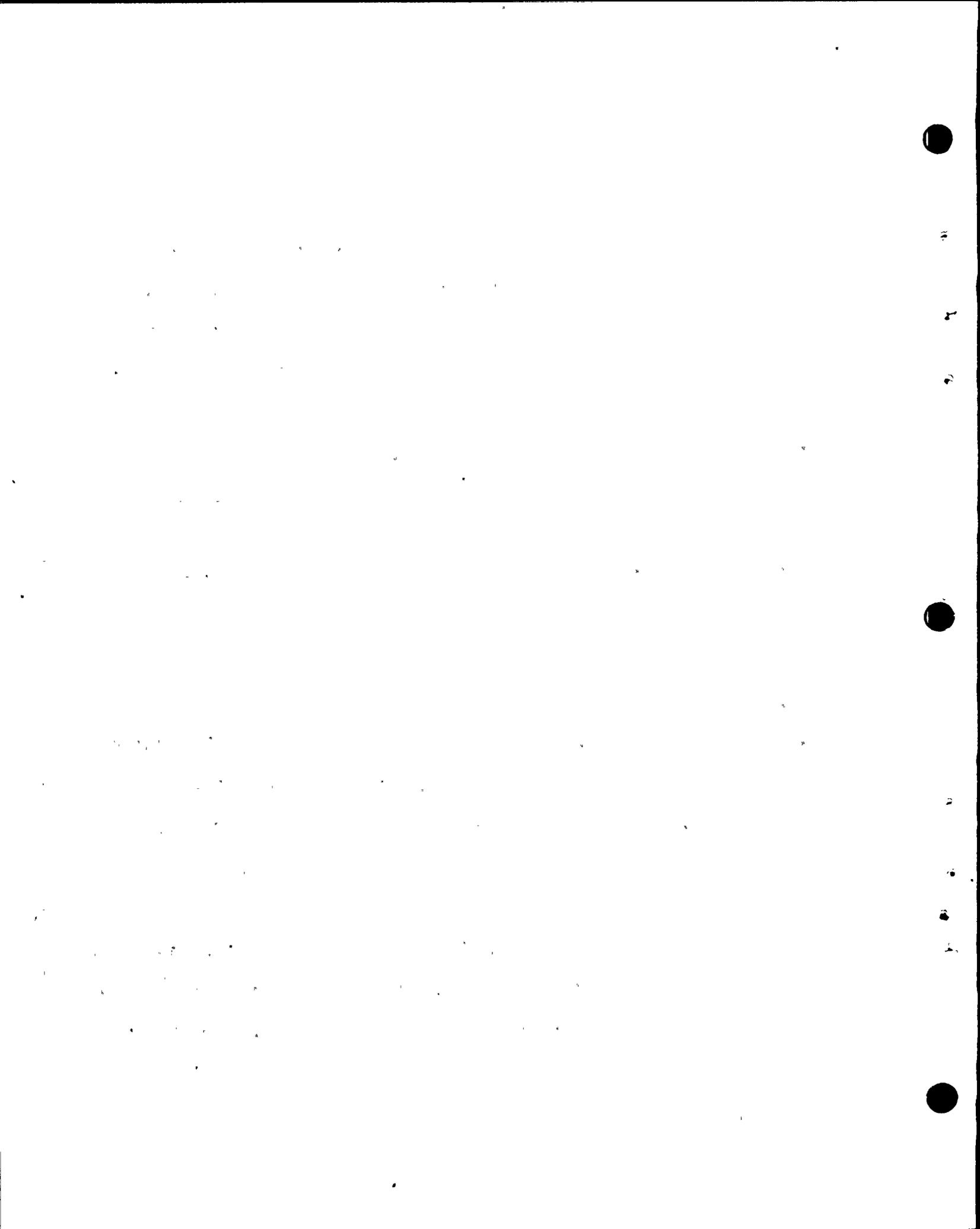
16 MR. NORTON: 3-7 of the Brune testimony.

17 BY MR. NORTON:

18 Q Now as I read that, Dr. Stepp, that means that
19 2.45g is one standard deviation removed from the mean of
20 1.1g. That is an increase of 1.35g.

21 Now if I go the other way one standard deviation
22 below the mean, my simple mind arrives at -.25g. Does your
23 much better seismological mind arrive at the same number as I
24 do?

25 A (Witness Stepp) Yes. But I would characterize



mpb8 1 that as physically unrealizable.

2 (Laughter.)

3 Q Thank you.

4 MR. FLEISCHAKER: I'd move to strike that unless
5 there could be some demonstration of relevance shown about
6 that negative standard deviation number. I don't think
7 there's any seismologist up here who's testified that that
8 makes any difference at all.

9 MR. NORTON: Mr. Fleischaker, I can understand
10 why you would think it wasn't relevant. But I believe that
11 it is very relevant, Mrs. Bowers.

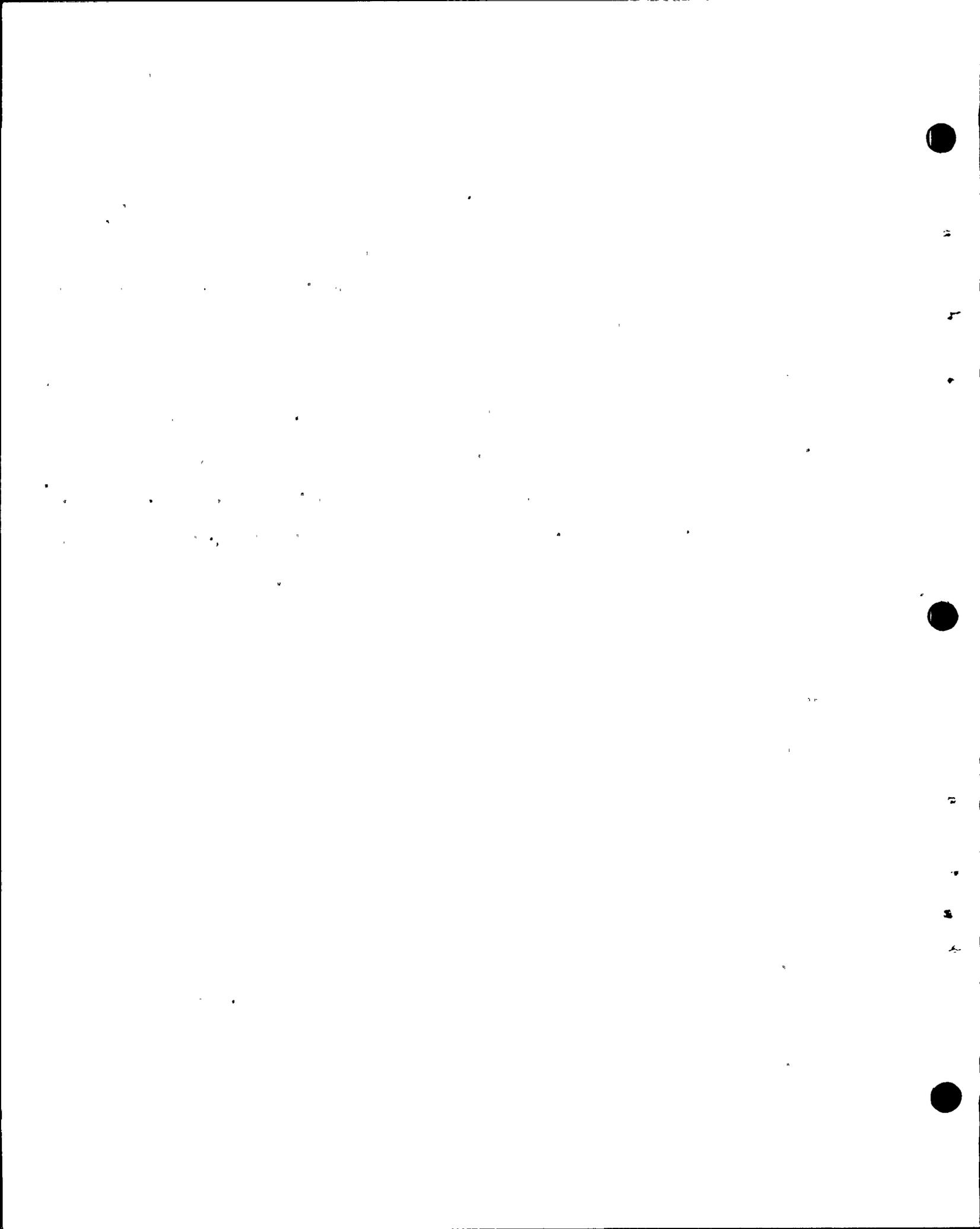
12 MR. FLEISCHAKER: I have a motion pending. I
13 think it's irrelevant.

14 There's no one who said -- it's meaningless
15 information.

16 MRS. BOWERS: Could you respond to the motion?

17 MR. NORTON: Well, I would suggest that Mr.
18 Trifunac's curves are meaningless information, and that's
19 exactly the point and that's why the question and answer
20 are relevant.

21 MR. FLEISCHAKER: If that's true, the same thing
22 applies to Mr. Smith as Dr. Martin pointed out, that if you
23 took some standard deviations with respect to some of his
24 estimates you'd end up with negative numbers and it wasn't
25 meaningful. That's the point.



mpb9

1

MRS. BOWERS: Mr. Tourbellothe? Do you wish to

2

comment?

3

MR. TOURTELLOTHE: No.

4

(The Board conferring.)

5

MRS. BOWERS: Well, the motion to strike is denied.

6

We think the witness responded to the question, and that it

7

has relevancy.

8

And, of course, Mr. Fleischaker, the question

9

really was generated by the testimony of your witness.

10

MR. NORTON: Mrs. Bowers, I'd like to take a break

11

now. I don't think I'm going to have any more questions. But

12

I know you want to take a break, and that's fine with us.

13

MRS. BOWERS: Fine.

14

(Recess.)

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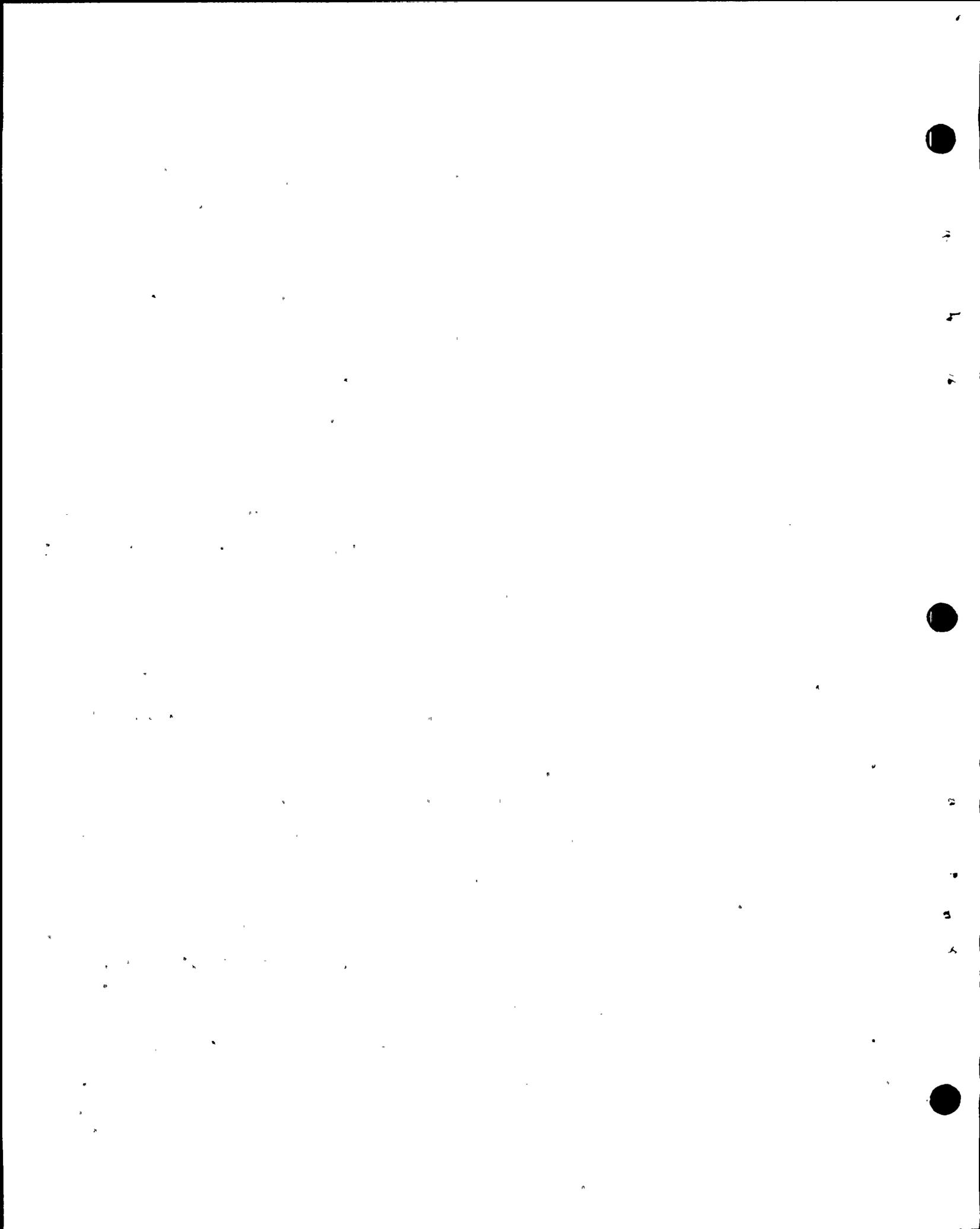
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2A

RB/agbl

C4

1 MRS. BOWERS: We'd like to resume, please.

2 MR. NORTON: We have nothing further.

3 MRS. BOWERS: Mr. Tourtelotte, do you have
4 redirect?

5 MR. TOURTELLOTTE: Maybe the Board would like to
6 go ahead and ask its questions.

7 MRS. BOWERS: The Board has no questions.

8 REDIRECT EXAMINATION

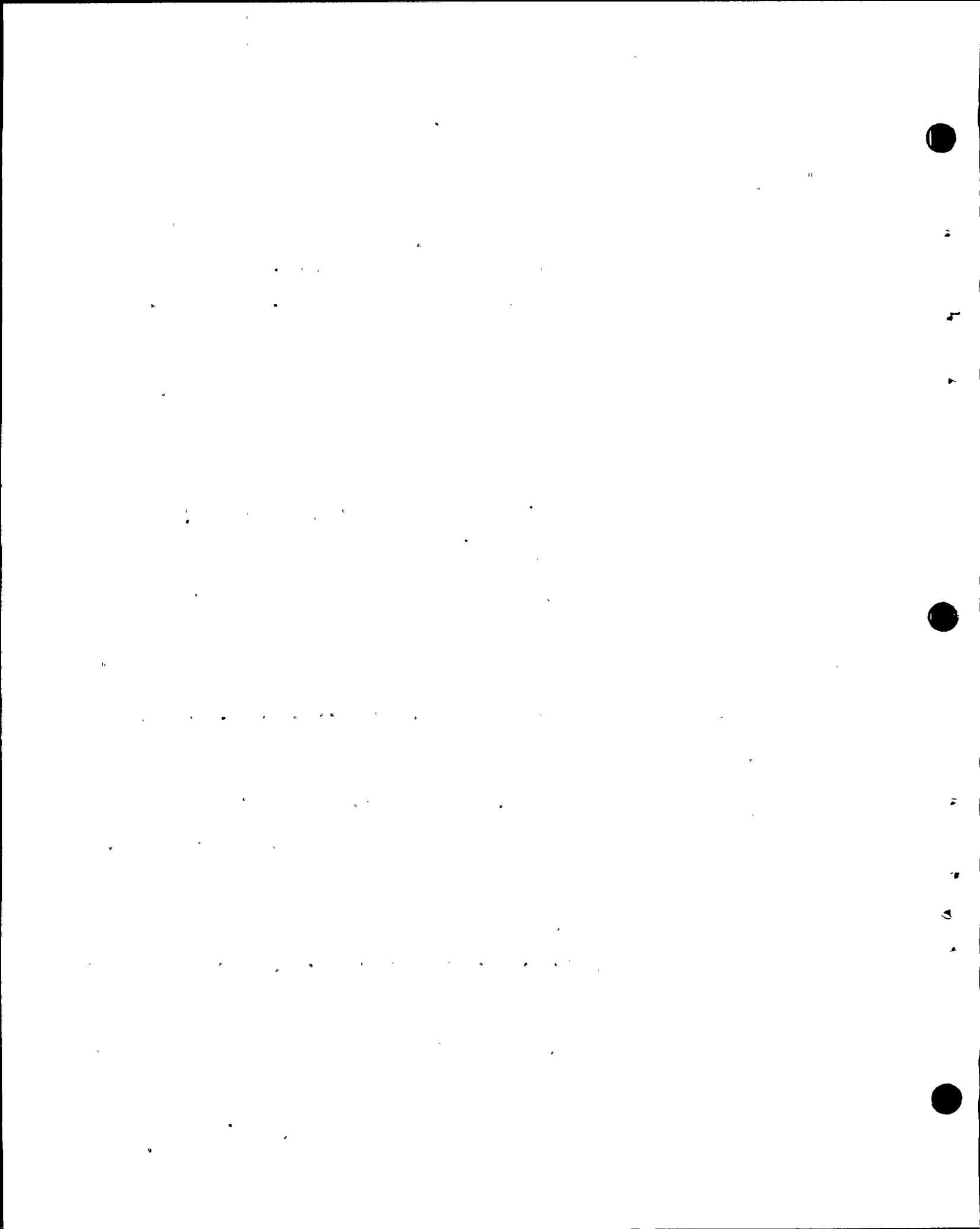
9 BY MR. TOURTELLOTTE:

10 Q. Dr. Stepp, there were a number of questions asked
11 about Circular 672 and the ground motion of 1.15, as designated
12 in Table 2, and also about the 0.75g value which you dis-
13 cussed in the latter part or, more particularly, drew some
14 conclusions about in Pages 32 through 35 of your testimony.

15 Now, could you explain whether these two values
16 are really compatible or incompatible?

17 A. (Witness Stepp) Well they are compatible
18 descriptions of ground motion for magnitude 7.5 earthquake at
19 that distance. In the one case, the Circular 672, Table 2,
20 describes the ground motion in terms of peak values and the
21 number of times those values would be reached or exceeded.

22 Dr. Newmark, in his work, describes ground motion
23 in terms of a response spectrum scaled to a certain level of
24 acceleration. And those are compatible methods of describing
25 ground motion for a given size earthquake at a given distance.



WRB/agb2

1 Now in our testimony, most particularly in
2 Section 2E, we discuss several lines of seismological argu-
3 ment which, in themselves, tend to support the conservatism
4 in Dr. Newmark's assessment of the ground motion at the
5 Diablo Canyon site for a magnitude 7.5 earthquake on the
6 Hosgri Fault.

7 Q Actually, the Staff was given both of those
8 ground accelerations, were they not?

9 A That's correct.

10 Q And the 1.15g acceleration was given by USGS?

11 A That's correct.

12 Q And the 0.75 was given by Dr. Newmark?

13 A That's correct.

14 Q And when you testified earlier that you had
15 accepted the 1.15g acceleration of USGS, you were not in any
16 way implying that you were intellectually writing off on that
17 acceleration as being the only acceptable acceleration?

18 A That's correct. Nor the only acceptable way of
19 describing the ground motion for such an earthquake.

20 Q All right.

21 And I was making an argument of what I perceived
22 your testimony to mean and it is true, is it not, that these
23 items 1 through 5 on Pages 33 and 34 of your testimony are
24 really purely seismological evaluations of a given ground
25 motion?



WRB/agb3

1 A That's correct.

2 Q And it wouldn't make any difference whether you
3 were given that ground motion by a structural engineer or by
4 a train engineer, you could still seismologically, you could
5 tell whether or not that was a conservative value or not?

6 A That's correct. That's the essence of this
7 testimony.

8 MRS. BOWERS: Mr. Tourtallotte, my father was
9 a train engineer, now was that meant as a derogatory remark?

10 MR. TOURTELLOTT: No, I have the utmost respect
11 for train engineers, and I know that other than structural
12 engineers they're probably the only ones who know anything
13 about ground motion.

14 (Laughter, cheers and applause.)

15 And seismologists, of course.

16 (Laughter.)

17 MR. TOURTELLOTT: I have no other questions.

18 MRS. BOWERS: Any emergency questions from the
19 other parties?

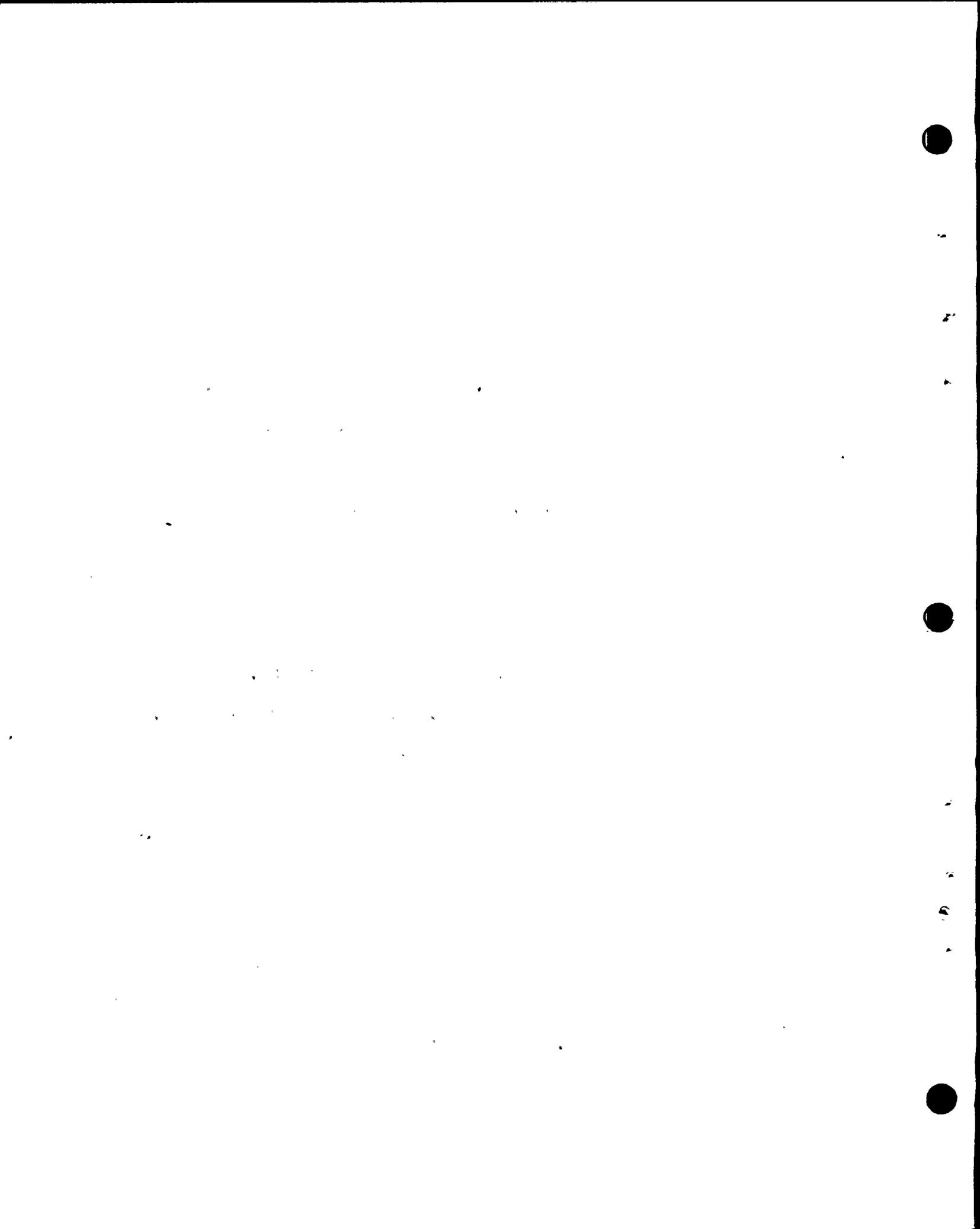
20 (No response.)

21 MRS. BOWERS: Well Mr. Tourtallotte, do you request
22 that this panel be excused?

23 MR. TOURTELLOTT: Yes.

24 MRS. BOWERS: Any objections?

25 (No response.)



WRB/agb4

1 MRS. BOWERS: The panel is excused.

2 (The witness panel excused.)

3 MR. TOURTELLOTT: I would like to call Renner
4 Hofmann.

5 Whereupon,

6 RENNER B. HOFMANN

7 was called as a witness on behalf of the Regulatory Staff,
8 and, having been first duly sworn, was examined and testified
9 as follows;

10 DIRECT EXAMINATION

11 BY MR. TOURTELLOTT:

12 Q Would you state your name, address and occupation,
13 please?

14 A Yes, my name is Renner B. Hofmann. My address
15 is 14608 Brook Meade Drive, Darnestown, Maryland. I'm a
16 seismologist for the Site Safety Standards Branch of the
17 Nuclear Regulatory Commission.

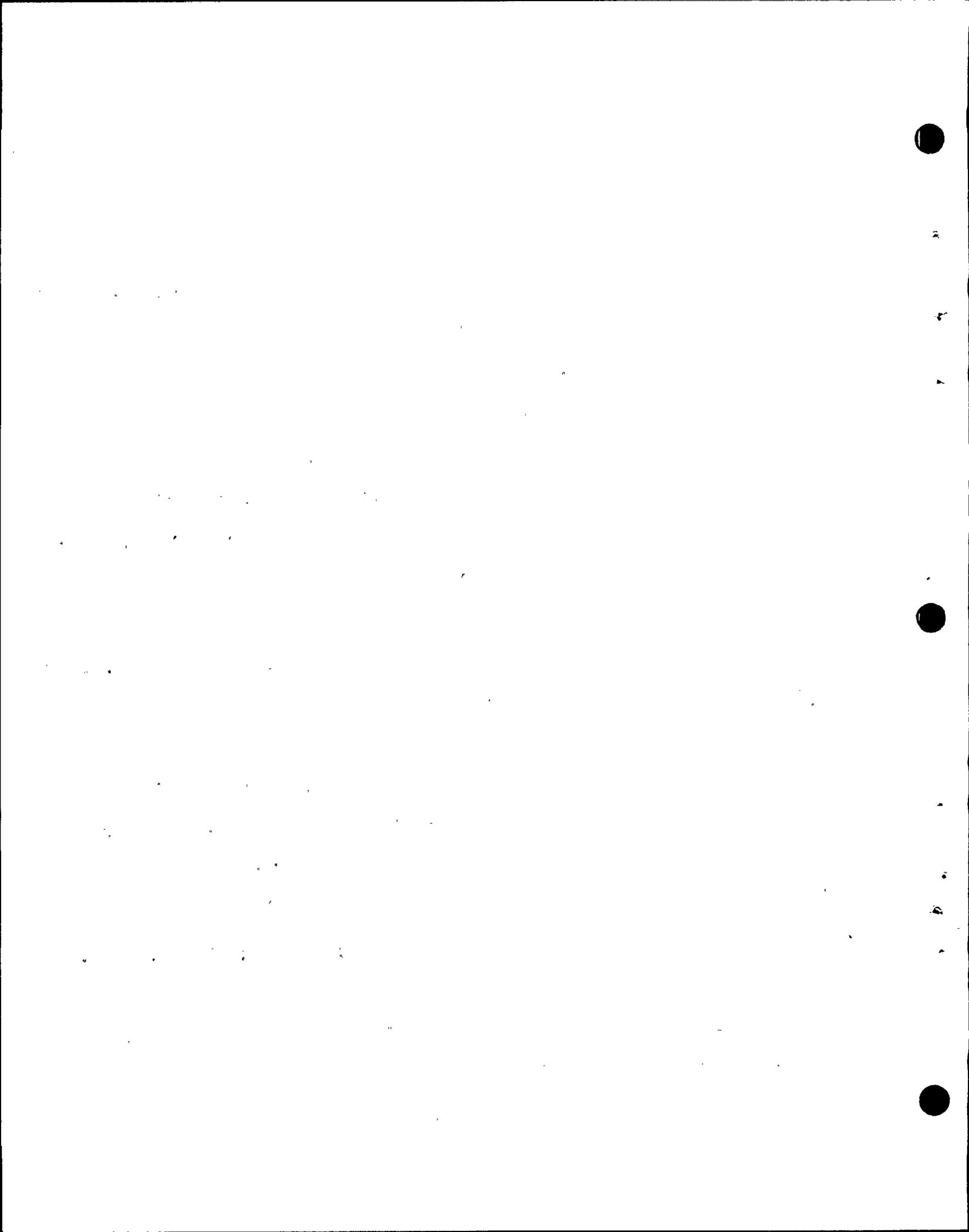
18 Q Mr. Hofmann, did you prepare a Statement of
19 Professional Qualifications for this hearing?

20 A Yes, I did.

21 Q Is it entitled, "Renner B. Hofmann, Seismologist,
22 Site Safety Standards Branch, Office of Standards Development,
23 U.S. Nuclear Regulatory Commission?"

24 A Yes.

25 Q And it consists of four pages with an attached



WRB/agb5¹

list of publications?

2 A That's correct.

3 Q Did you also prepare testimony for this proceeding?

4 A Yes, I did.

5 Q And is that the piece of testimony entitled,
6 "Testimony of Renner B. Hofmann?"

7 A Yes.

8 Q -- concerning Contentions 2 and 9?

9 A That's the way it is entitled, yes.

10 MR. TOURELLOTTE: I would now ask that the
11 professional qualifications and the testimony of Renner B. --

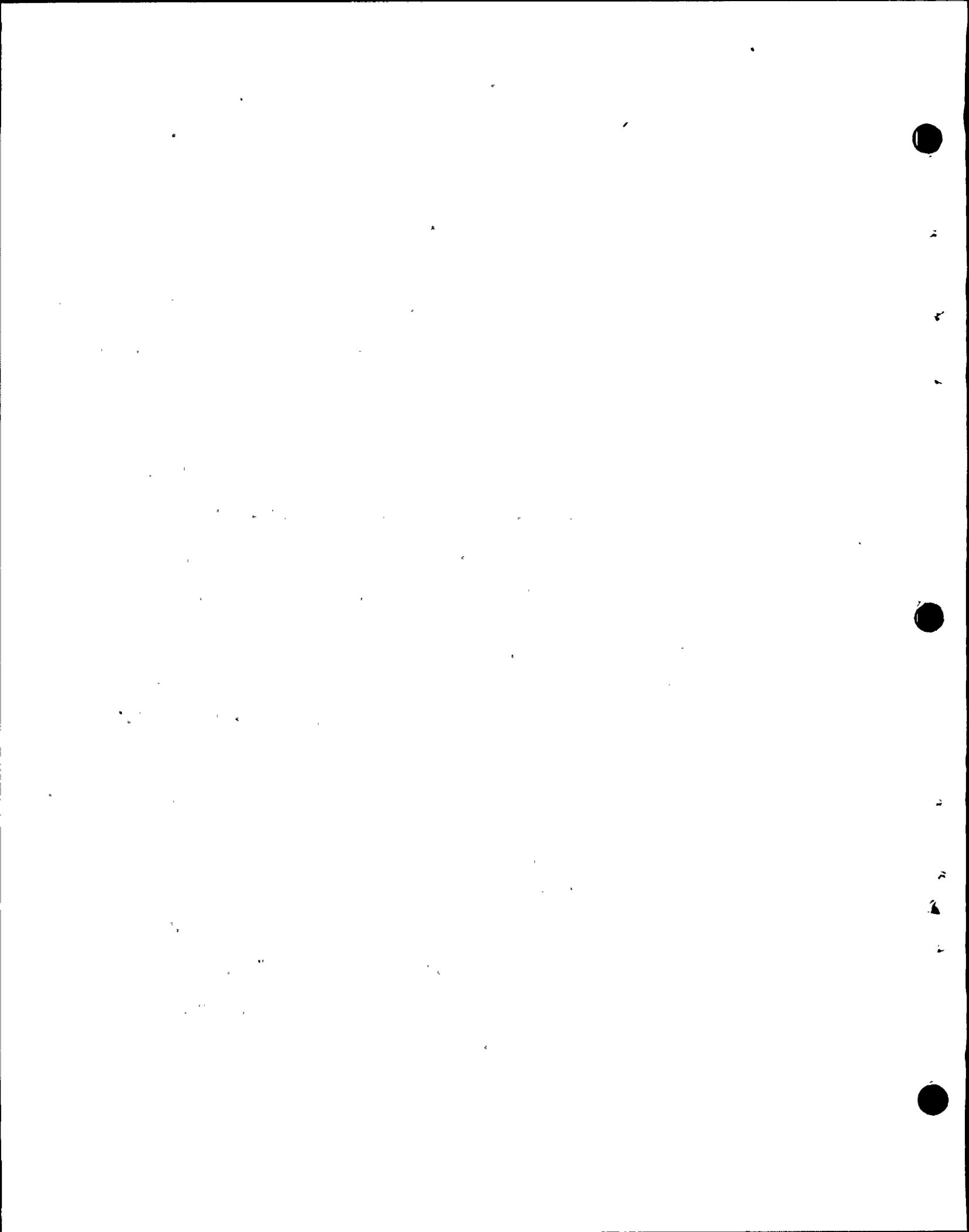
12 I'm sorry.

13 BY MR. TOURELLOTTE:

14 Q Do you have any additions, corrections or deletions
15 to make to either one of these documents?

16 A Yes, the testimony.

17 At the time that I wrote the testimony, I was
18 unaware of the memorandum from L. Dow Davis. I may have had
19 it, but at least it should be corrected. Contention 2 should
20 be Contention 3 on the cover and first page, line one of
21 paragraph two. And the contention which is on the last four
22 lines of page one should be reworded as agreed in L. Dow Davis'
23 letter to the Atomic Safety and Licensing Board panel of
24 April 24, 1978, and that is, a 0.75g acceleration assigned to
25 the safe shutdown earthquake is not an appropriate value for



WRB/agb6

1 the maximum vibratory acceleration that could occur at the
2 site. That is in lieu of what is presently there.

3 On page two, line three and line 10, "contentions"
4 should be "interrogatories."

5 On page four, the first paragraph, the fourth line
6 from the bottom -- my handwriting apparently was hard to read
7 -- excuse me, that is for the second contention, or the
8 second testimony so we'll skip that for a moment.

9 In the first testimony, page six, line 13, the
10 word "and" should be replaced with the following:

11 "For an..." --

12 MR. NORTON: Excuse me. My pages aren't numbered,
13 and when you said line 13 and then the word "and," I didn't
14 catch up with you yet, so could you give us some words
15 surrounding "and" so we can find it a little more readily?

16 BY MR. FLEISCHAKER:

17 Q Fine.

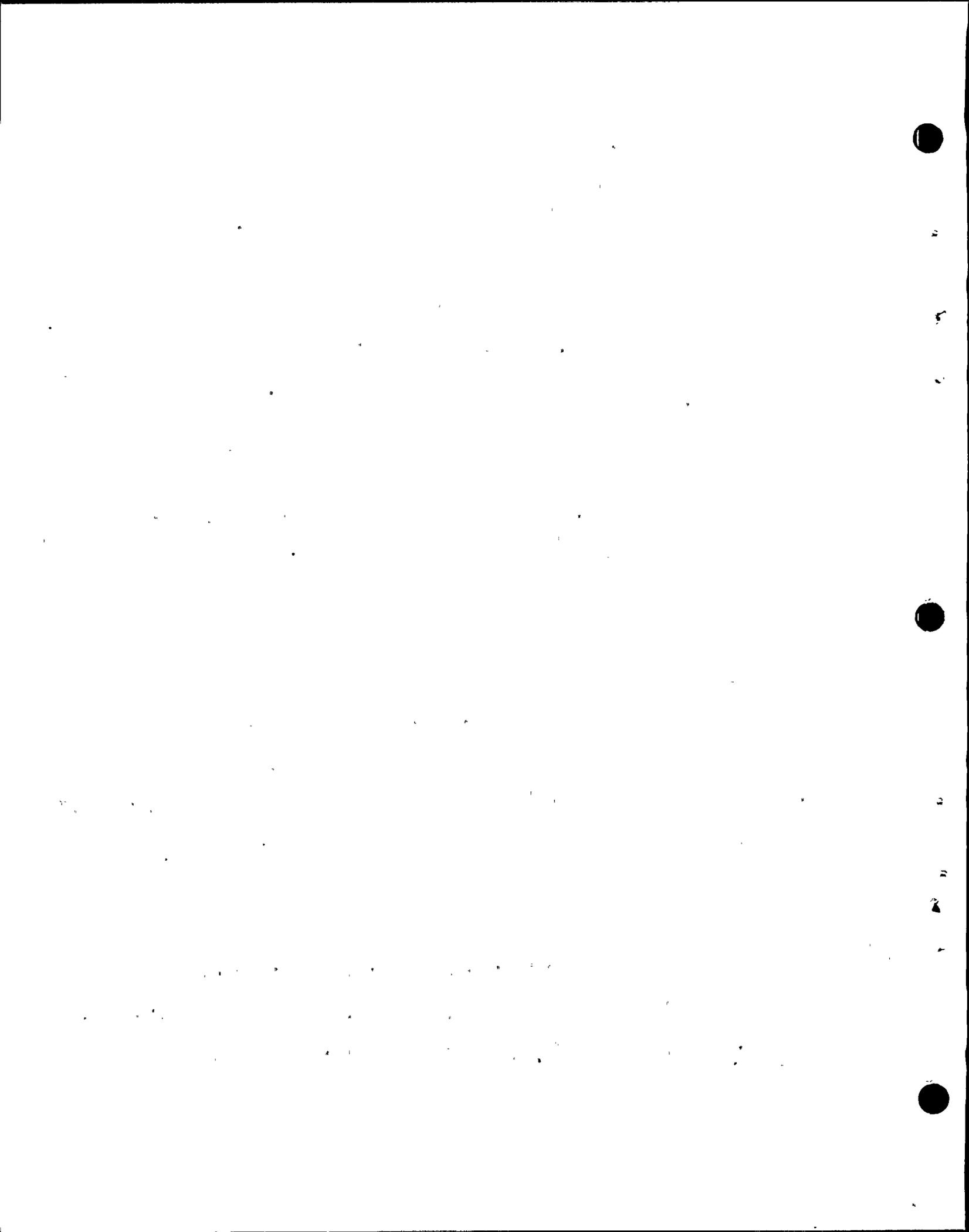
18 A All right.

19 This sentence starts:

20 "USGS Circular 672 recommends a peak
21 acceleration of 0.90g." And that he followed by the
22 word "and," and that "and" should be stricken. "0.90g"
23 should be followed with:

24 "...for a magnitude 6.5 earthquake."

25 Then followed with a new sentence:



WRB/agb7

1 "It also recommends..." -- reading into the
2 "1.15g" et cetera.

3
4 MRS. BOWERS: Could you go through that again?

5 I don't think I got it straight.

6 THE WITNESS: All right.

7 The sentence which begins with:

8 "USGS Circular 572 recommends..." should
9 now read:

10 "USGS Circular 572 recommends a peak
11 acceleration of 0.90g for a magnitude 6.5 earth-
12 quake."

13 MRS. BOWERS: Fine.

14 THE WITNESS: The following sentence should
15 begin:

16 "It also recommends 1.15g...."

17 On the second piece of testimony, there is a
18 page two, and on line four and line 11, the word "contentions"
19 in both places should be changed to "interrogatories."

20 Page one of the second bit of testimony in the
21 second paragraph which reads:

22 "This testimony is in response to
23 Intervenor's Contention Number 9...", the "9" should be
24 "3," and the description of the contention should be as
25 Dow Davis' letter agreed. So that that description would be
stricken which is there and be substituted:



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1 "A 7.5 magnitude earthquake is not
2 an appropriate value for the safe shutdown
3 earthquake."

4 MR. BRIGHT: Are both of these pieces of testimony
5 on Contention 3?

6 THE WITNESS: No, the first one should be 2,
7 I believe -- No, the first one is 3, the second one should
8 be 2, excuse me. I misread it.

9 MR. BRIGHT: The first one is 3 and the second
10 is 2?

11 THE WITNESS: That's correct.

12 Then on page four of the second piece of testimony,
13 from the bottom of the first paragraph six lines up, the
14 sentence reads or the line reads:

15 "...one per length-of-historic-record,
16 there should be 64 M equals 6.3 earthquakes..."

17 That should be "5.3." And in two lines down
18 this is repeated:

19 "All earthquakes of M equals 6.3 should
20 have....," et cetera, that should be "5.3," not 6.3.

21 BY MR. TOURTELLOTT:

22 Q Are those all the corrections?

23 A Yes.

24 Q The cover page, I assume, misspells your name?

25 A Yes, it does.



2B

WRB/agb 9

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MR. TOURTELLOTTE: I would like to ask that the professional qualifications and the testimony of Renner B. Hofmann be incorporated into the record as if read.

MRS. BOWERS: Mr. Fleischaker?

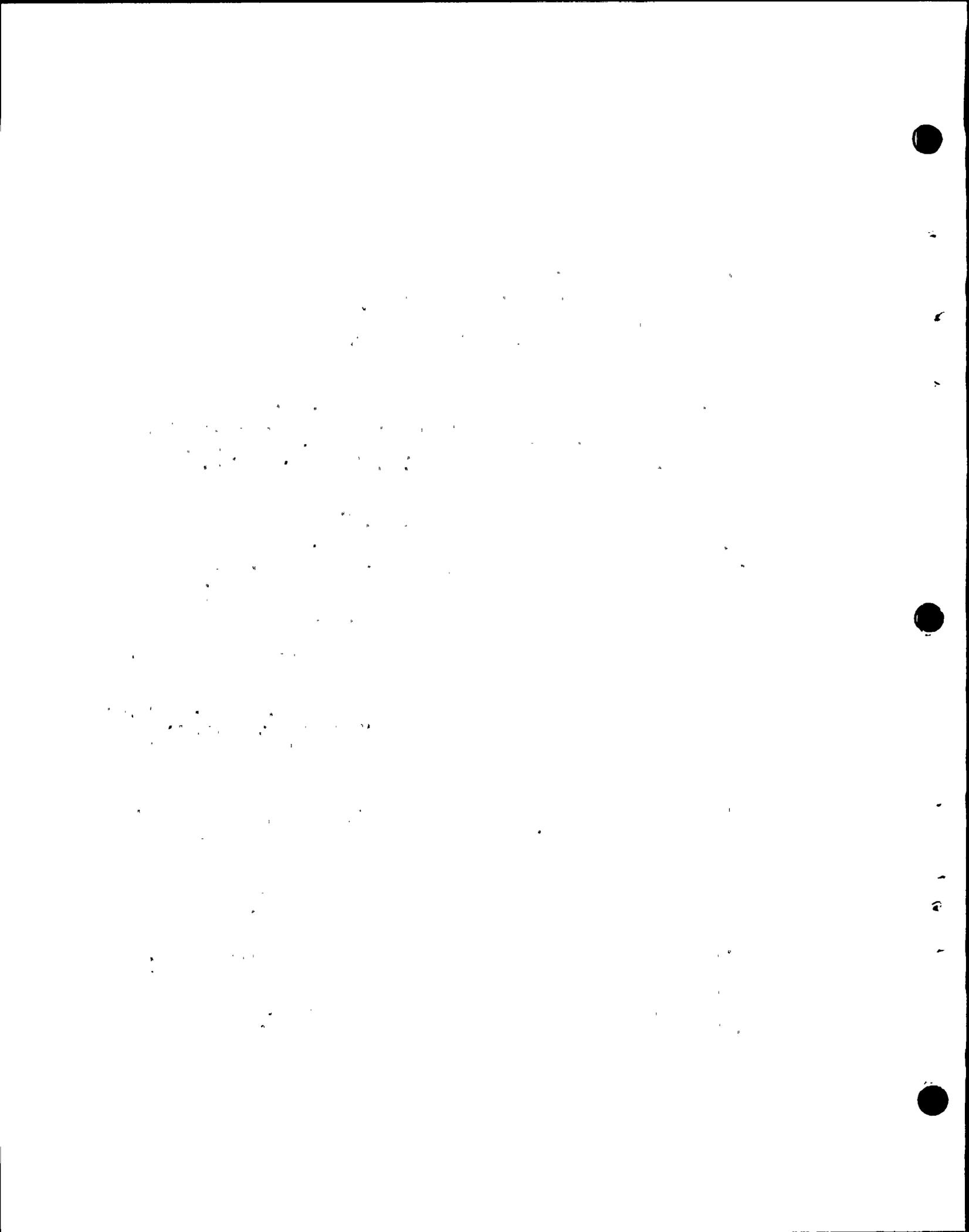
MR. FLEISCHAKER: No objection.

MRS. BOWERS: Mr. Norton?

MR. NORTON: No objection.

MRS. BOWERS: Well the two documents you have identified will be physically inserted in the transcript as if read.

(The documents follow:)



RENNER B. HOFMANN
SEISMOLOGIST
SITE SAFETY STANDARDS BRANCH
OFFICE OF STANDARDS DEVELOPMENT
U. S. NUCLEAR REGULATORY COMMISSION

My name is Renner B. Hofmann. I am employed as a Seismologist for the Site Safety Standards Branch, Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. From October 1974 to July 1978 I was the staff seismological reviewer for the Diablo Canyon Nuclear Power Plant.

Professional Qualifications

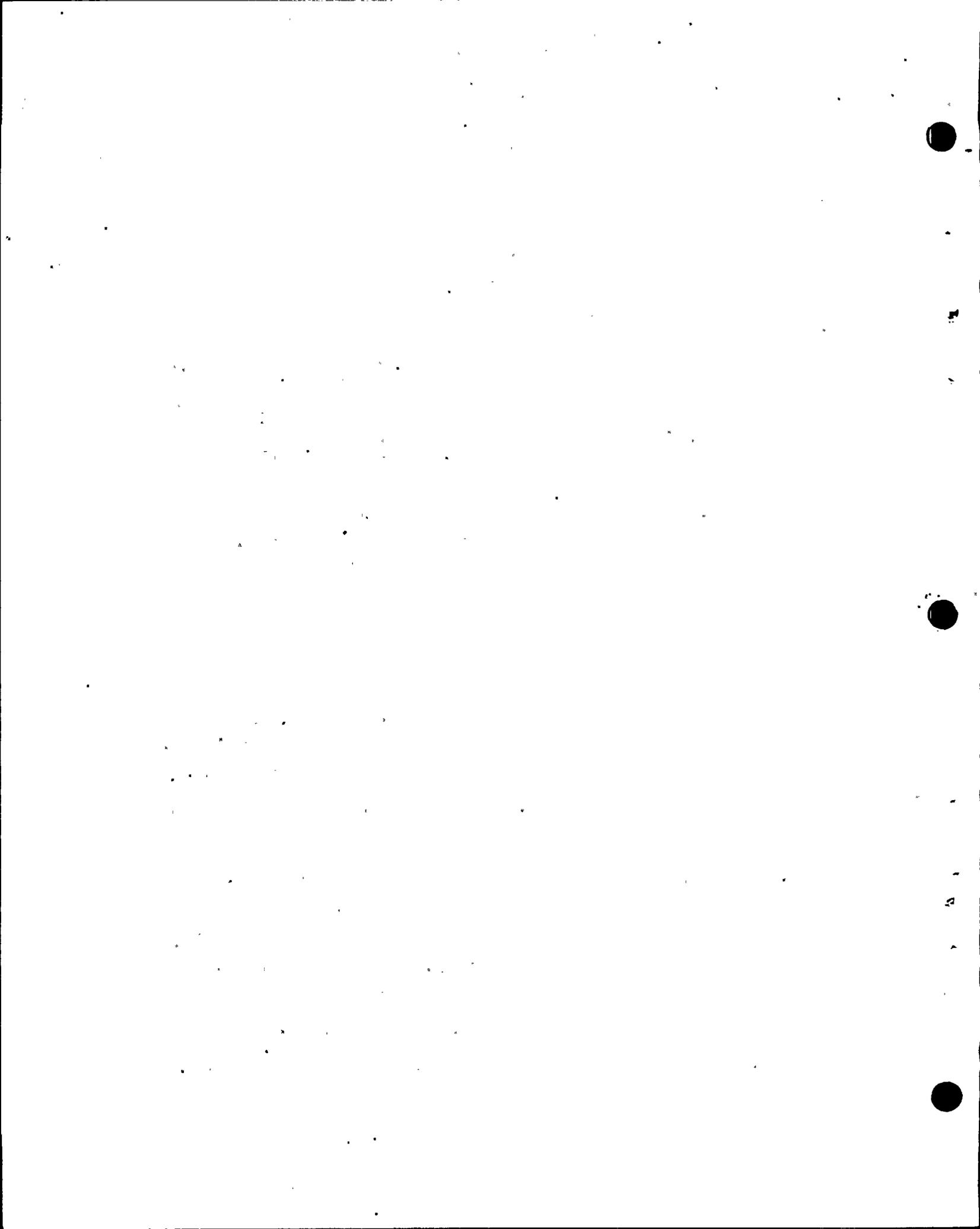
After a year at Rose Polytechnic Institute in Terre Haute, Indiana, and night courses at the University of Indiana, I completed a Bachelor's degree at Wichita University, Kansas, in geology, with a minor in math in 1952 and an M.S. in geophysics (seismology option) from St. Louis University's Department of Engineering, the Institute of Technology, in 1955. This graduate work was sponsored by the U.S. Air Force. From 1957-59, I studied at the Colorado School of Mines in their Sc.D. program for geophysical and geological engineering.

My area of expertise includes earthquake statistics, design-earthquake specification, adequacy of instrumental and analytical procedures and instrumentation design. I am also experienced in geodetic quantification of fault movement and in computer techniques for handling and analyzing seismic data.

I have been with the Office of Standards Development since July 1978 where I provide seismological expertise in the preparation of NRC standards and regulatory guides.

From July 1976 through July 1978, I was Leader of the Geology/Seismology Section of the Geoscience Branch of NRC. From October 1974 to July 1976, I was a seismological reviewer in that Section.

Prior to joining the NRC, I was a private consultant and president of Earth Environment Monitoring, Inc. My clients included the USGS, NOAA, U.S. Army Corps of Engineers, architect engineer and instrumentation firms. The company performed research in seismic monitoring and maintained 300 strong motion accelerographs in northern California and 9 western states.



My work with the Corps of Engineers is published as Report 3, "Factors in the Specification of Ground Motions for Design Earthquakes in California," in their State-of-the-Art for Assessing Earthquake Hazards in the United States series. I was an original reviewer of IO CFR 100 and its Appendix A.

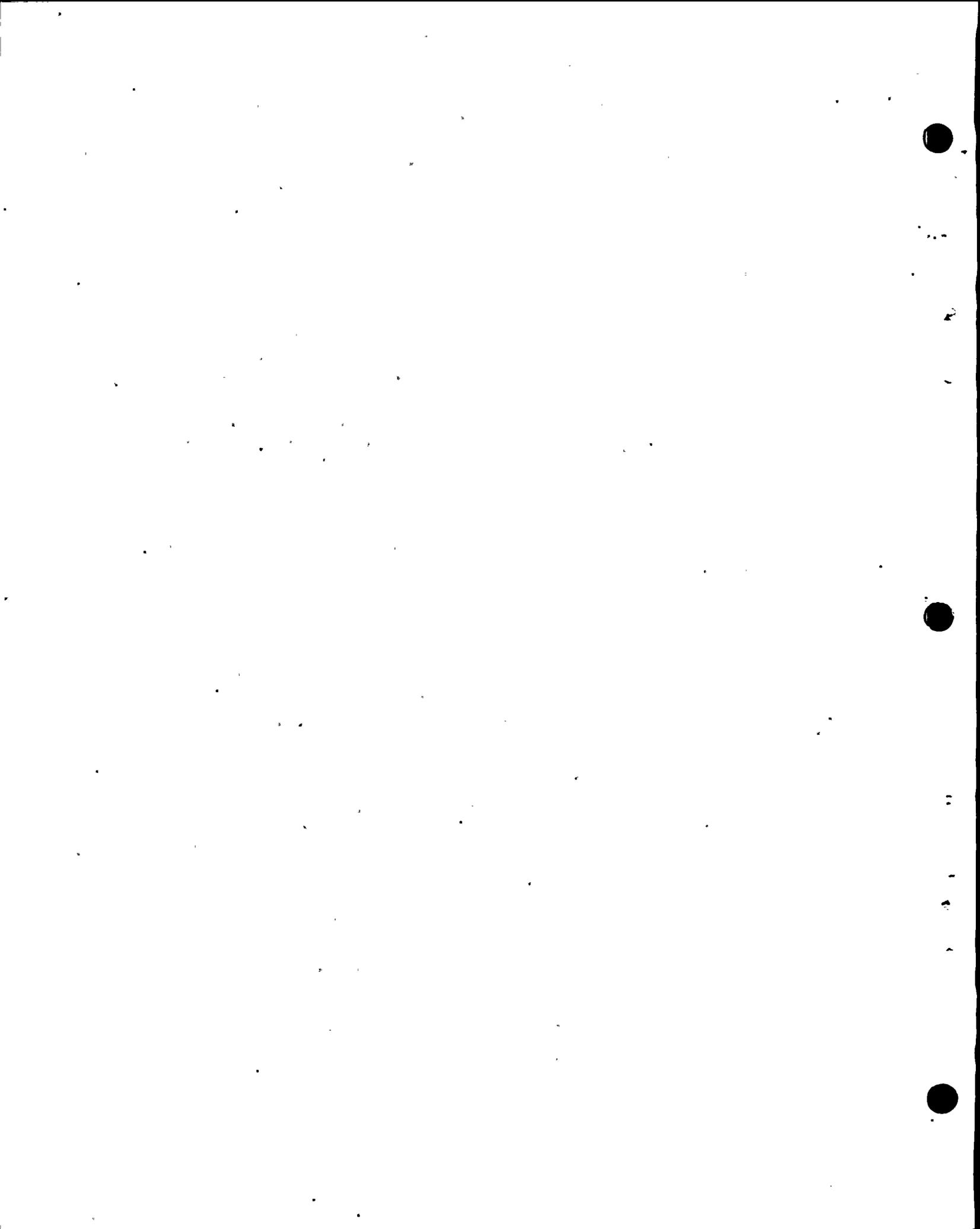
From 1965 through 1970, I was employed by the State of California. I developed an organization plan for the Director of the California Department of Water Resources to implement research activities in earthquakes. I later consolidated ongoing programs and staff into the California Earthquake Engineering office comprised of three subordinate units. I directed the office as Supervisor of Earthquake Engineering, the highest seismologist position in California state government. I also provided seismological consultation to the 4000 engineers and support staff of the California Department of Water Resources. The staff was designing and constructing the \$3,000,000,000 California Water Project. I solved the problem of too many Site reports to prepare in a given length of time with a limited staff by storing all the data for an entire state in a computer data retrieval program. Altogether, about 40 seismic siting reports were prepared for potential dam and power and pumping plant sites within the project.

I initiated telemetered seismic monitoring of project dams and the first inter-network telemetered seismic data exchange. Seven Federal agencies and/or universities participated. We initiated the first use of phase lock loops in FM seismic telemetry.

I developed the concept for a buriable broad-band high-dynamic-range strong motion seismograph and had several (70) units manufactured. I personally assisted in the calibration of the units at the Sandia calibration facility in Albuquerque, N.M. As a byproduct, I determined that the units had a much wider range of application. Both sensitive and strong motion seismographs using this principle have been since marketed by major manufacturers of such equipment.

We performed geodetic monitoring of large sections of the San Andreas fault on an annual basis. I found criteria for and a general correlation between geodetically determined movements of the San Andreas fault system and small earthquakes which subsequently occurred. This was a controversial finding but is recognized as being as valid as other similar work. For example, the work is reviewed by Rikitake, 1977, "Earthquake Prediction." This was an effort by several staff members. Several publications and invited presentations resulted.

From 1961 to 1965, I was a member of the Texas Instruments Geosciences and GSI Research Division technical staff. I determined how to find earthquake magnitudes from any instrument by developing empirical curves correcting such determinations for the frequency band pass of the instrument. Several publications resulted.



I determined a method for finding sensitivity of seismic instruments and arrays to assist in planning Geneva agreement detection stations for nuclear tests. Results were published.

I developed a computer program with another member of the technical staff which replaced the normal functions of a seismologist in identifying seismic phases and the depth and distance of earthquakes. The purpose was to increase the accuracy and profitability of operating the Geneva agreement array stations. Results were published.

I was also involved in a research effort to determine the effect of earth layers on seismic waves through the use of velocity filtering and analysis of leaking mode surface waves. Several publications resulted.

From 1958 to 1961, I was a geophysicist with the U.S. Geological Survey. I persisted in analyzing data following the 1959 Hebgen Lake earthquake after conventional analysis had been completed. I found a strong correlation between energy released and earth tides for that place and time. I was also involved with the early developmental stages of the USGS major crustal refraction program.

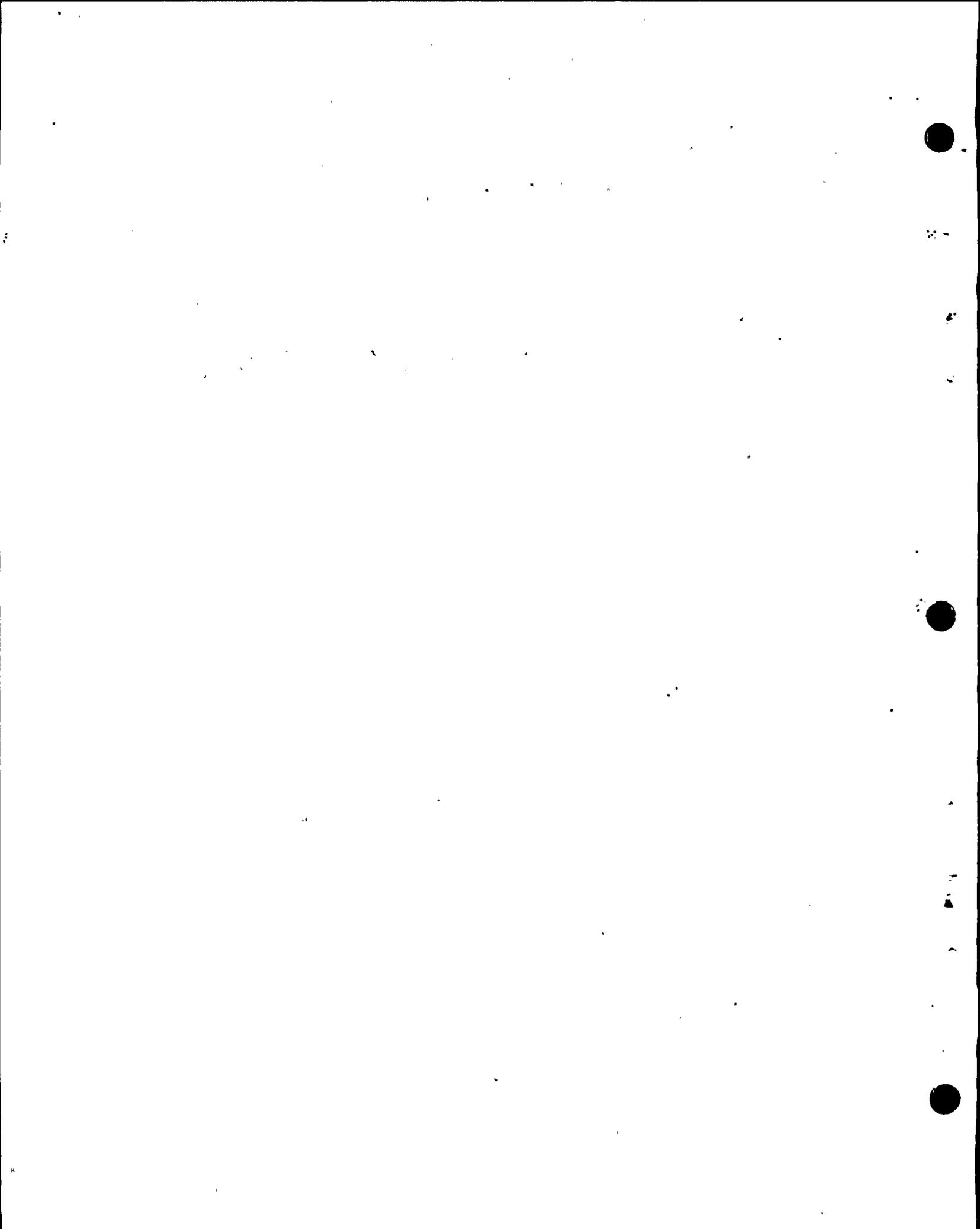
From 1952 to 1957, I was a member of the U.S. Air Force. I served as an R&D officer in seismology and geomagnetism for the USAF Cambridge Research Center in Boston, Massachusetts. I analyzed reflected polarized shear waves and air coupled surface waves to determine ice thickness and geodetic data to determine ice movement in the Arctic.

I have participated in several committees and conferences. Examples are:

- NATO Advanced Study Institute, 1968
- U.S. - Japan Earthquake Prediction Conference, 1966, 1967
- Japan - U.S. Seminar on High Temperature Gas Reactor Safety, 1977
- American Nuclear Society 2.1 Working Group for the Development of Design Earthquakes, 1971-75
- Eldorado County, California Planning Commissioner, 1974
- Review Committee for San Onofre Nuclear Power Plant Model Studies (I organized the Committee), 1978

I have been an invited speaker or guest lecturer or participant at:

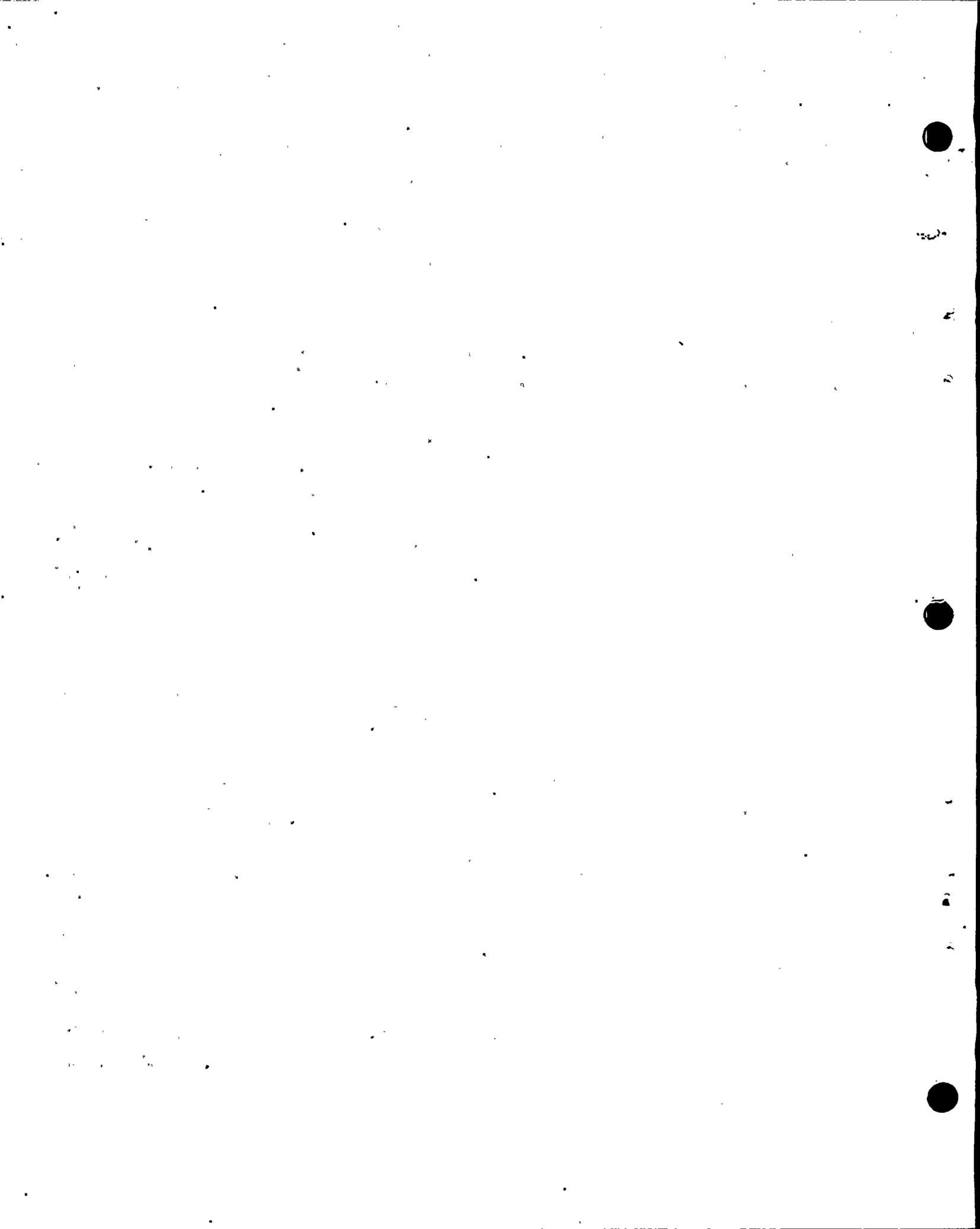
- American Society of Civil Engineers
- Structural Engineers Association of California
- San Francisco Architects Club
- California Department of Water Resources Technical Courses
- U.S. Army Corps of Engineers Engineering Seismology Corp.
- British Broadcasting Corporation television documentary on San Francisco earthquake problems
- Walter Cronkite news program and others



I am a licensed geophysicist in the State of California, GP 63, and hold a Supervisor's Credential for the California Community College system.

I am author or co-author of over 40 technical papers and reports published in technical journals and/or presented at professional meetings. A list is attached.

I hold professional memberships in the American Geophysical Union, Seismological Society of America, Society of Sigma Xi, Arctic Institute of North America, Society of Exploration Geophysicists, and the European Association for Exploration Geophysicists.



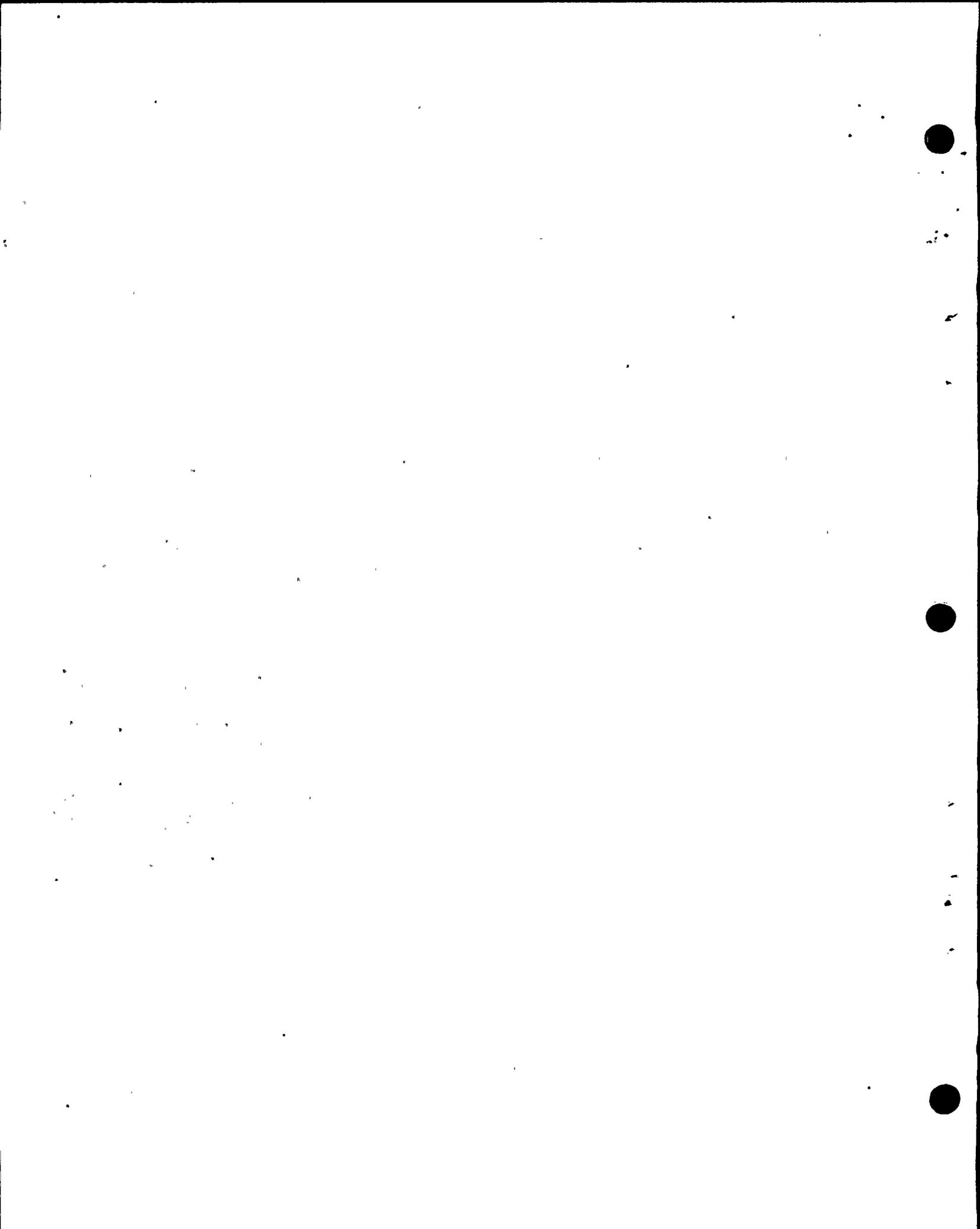
PAPERS PUBLISHED

Title	Year	Author(s)	Journal or Publication
Contribution of Subsoil to 2 - 4 Second Microseisms	1955	R. B. Hofmann	Graduate Research Thesis St. Louis University
Aftershock Energy Release vs Earth Tides.	1961	R. B. Hofmann	USGS Professional Paper 424B, Geophysical Research 1961.
Computer Program for Magnitude Determination and Seismic Data Handling.	1963	R. B. Hofmann R. W. Wylie	Earthquake Notes, Vol. XXXV No. 1-2, 1964.
Magnitude Determination Problems for the Worldwide Collection and Analysis of Earthquake Data Program.	1963	R. B. Hofmann	VESIAC Report No. 4410-71-X of Sp. Studies Conf. No. 4, Seismic Event Magnitude Determination, 11-12 April, Berkeley, CA.
Limitation of Correction Factor Application to Magnitude Formulas.	1963	R. B. Hofmann	VESIAC Report No. 4410-71-X
Magnitude Calculation for the Worldwide Collection and Analysis of Earthquake Data Program.	1963	R. B. Hofmann	VESIAC Report No. 4410-71-X.
Project (VT/1124) to Construct, equip and Operate 3 Seismological Observatories. (Advanced arrays as per Geneva agreement)	1963	H. M. Ricketts L. Strickland and Staff. (R. B. Hofmann, a Principal Contributor)	Texas Instruments Final Report to the Air Force Technical Applications Center. Advanced Res. Projects Agency Order 104-60, 137 pages.
Basic Research in Crustal Studies, Report No. 1. (R. B. Hofmann also a Contributing Author to Report No. 2, 78 pages and Final Report, 401 pages).	1964	S. J. Laster, R. B. Hofmann R. Rodin A. F. Livville J. C. Foreman	Texas Instruments Report to the Air Force Office of Science and Technology, Advanced Res. Projects Agency Order 232-63, 86 pages.
Comparison of Earthquake Magnitude Determination Methods.	1964	R. B. Hofmann F. E. Romberg	VESIAC Report No. 6109 VU.
Location of Aftershocks of the Hebgen Lake Earthquake.	1964	S. W. Stewart R. B. Hofmann W. H. Dixon	In USGS Professional Paper 435, The Hebgen Lake, Montana Earthquake of August 17th, 1959.
Moving Time Window Spectral Process.	1964	A. McGarr R. B. Hofmann G. D. Hair	Geophysics, Vol. XXXIX, No. 2, April 1964, VELA Uniform Special Issue I.
Partfield Earthquakes.	1964	P. W. Morrison R. B. Hofmann J. E. Wolfe	Earthquake Notes, Vol. XXXVII, No. 3
Earthquake Engineering Programs for the California State Water Project.	1964	R. B. Hofmann (Invited Paper)	Proc. 35th Annual Conv. Structural Engineers Assoc. of California, Yosemite Park, CA
Changes in the Rate of Fault Movement Preceding California Earthquakes.	1967	R. B. Hofmann (Invited Paper)	Proc. 2nd U.S.-Japan Conf. on Research Related to Earthquake Prediction, Palisades, N.Y., Pub. by Lamont Geol. Observatory.
Earthquake Damage to Hydraulic Structures in California.	1967	Prepared by R. B. Hofmann D. M. Hill & Staff	Calif. Dept. of Water Resources Bulletin 118-3, 200 pages.
Recent Changes in California Fault Movement.	1967	R. B. Hofmann (Invited Paper)	Stanford University Pub., Geological Sciences, Vol. XI, edited by Dickerson & Granta.
Earthquake Engineering Program.	1968	Prepared by R. B. Hofmann & Staff	California Department of Water Resources Bulletin 118-4, 148 pages.
Geodimeter Fault Movement Investigations in California.	1968	Prepared by R. B. Hofmann J. H. Bennett D. B. Crice E. E. Hagen & Staff	California Department of Water Resources Bulletin 118-6, 183 pages.
Earthquake Prediction from Fault Movement Monitoring in California.	1968	R. B. Hofmann (Invited Paper)	Proc. 3rd U.S.-Japan Conf. on Premonitory Phenomena Associated with Earthquakes, Menlo Park, CA, Pub. by U. S. Geological Survey.
Criteria for Trilateration Lines for Fault Movement.	1970	R. B. Hofmann	Technical Report on Crustal Movement Monitoring, East Bay Council on Surveying & Mapping, edited by J. Carey City of Hayward, CA.

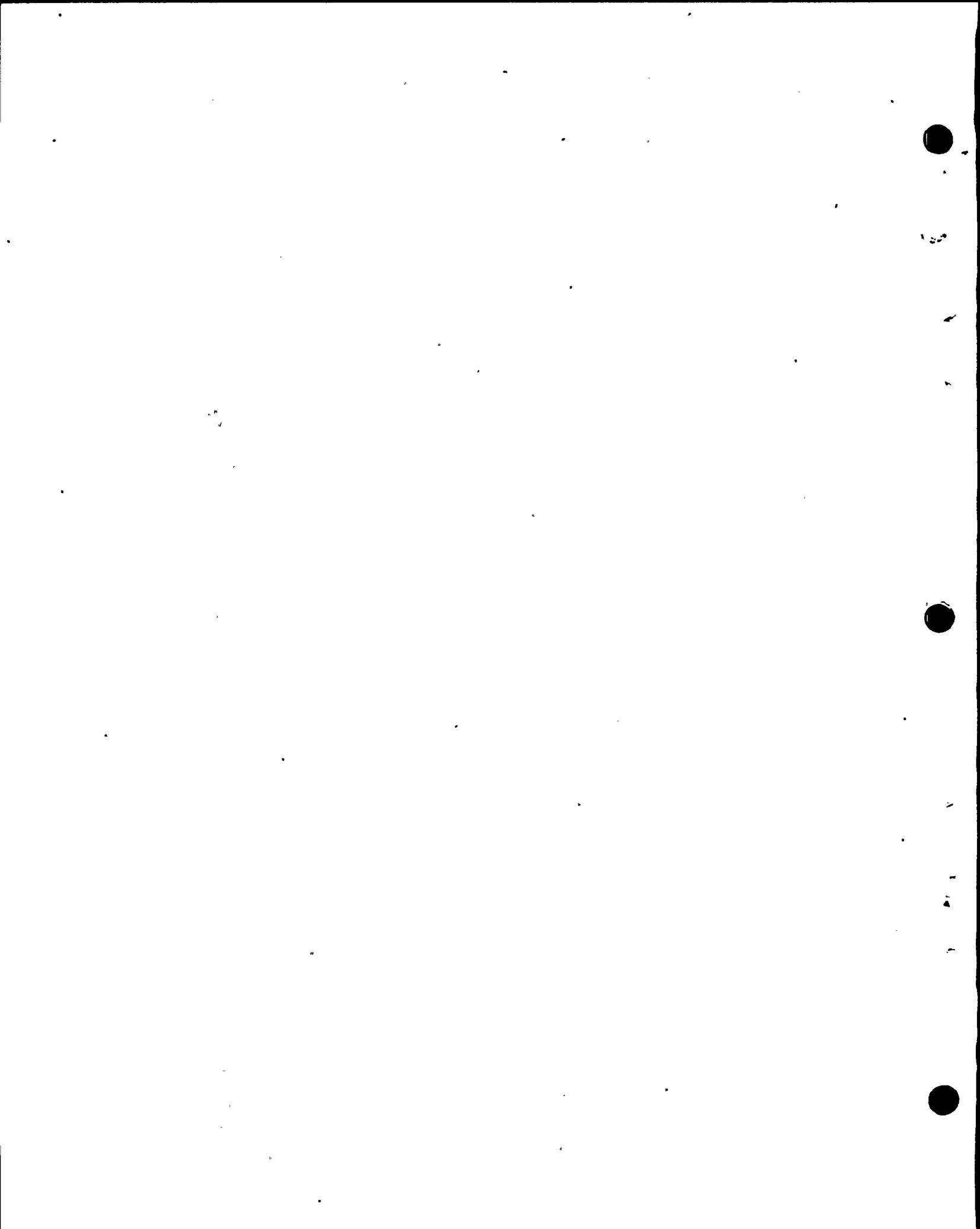
Geodimeter and Laser Ranging Measurements Across the San Andreas Fault System.	1970	R. B. Hofmann (Invited Paper)	In - Laser Applications in the Geosciences, edited by Gaucher and Hall, Pub. by Douglas Adv. Res. Labs, Huntington Beach, CA. 233 pages.
Earthquake Predictions from Fault Movement and Strain Precursors in California.	1970	R. B. Hofmann (Invited Paper) NATO Adv. Study Institute, Univ. of W. Ontario, Canada.	In - Earthquake Displacement Fields and the Rotation of the Earth, edited by L. Mansinha, D. E. Smylie and A. E. Beck. Pub. by Reidel, Dordrecht the Netherlands.
Earthquake Instrumentation for Calif. State Water Project Dams.	1970	R. B. Hofmann G. H. Kruse (Invited Paper)	Proc., Seismic Instrumentation Conf. on Earth and Concrete Dams, Nov. 1969. Pub. by U.S. Army Corps of Engineers Waterways Exp. Station, Vicksburg, Miss. 242 pages.
Seismic Activity and Reservoir Filling at Oroville and San Louis Dams.	1973	R. B. Hofmann (Invited Paper)	American Geophysical Union Monograph No. 17 - Man Made Lakes ...
Factors in the Specification of Ground Motions for Earthquakes in California.	1974	R. B. Hofmann	State of the Art for Assessing Earthquake Hazards in the U.S., Report 3, MP 3-73-1, U.S. Army Corps of Eng. Waterways Exp. Station, Vicksburg, Miss. 33 pages.

PAPERS PRESENTED

Title	Year	Author(s)	Conference or Meeting
Seismic Model Studies in Geology	1964	S. J. Laster R. B. Hofmann	Geological Society of America, Annual Mtg. Miami, Florida.
Application of Multichannel Processing to Analysis of Long Range Refraction Seismograms.	1964	R. B. Hofmann S. J. Laster	Acoustical Society of America, Annual Mtg. Austin, Texas.
Fault Movement in California, 1959-1966.	1966	R. B. Hofmann D. B. Crice J. H. Bennett	American Geophysical Union Meeting, San Francisco, California.
Geodetic Laser Survey System, an Application to Earthquake Prediction.	1966	R. A. Fowler V. Castellano R. B. Hofmann	American Geophysical Union Meeting, San Francisco, California.
Recent Historical Crustal Movement Associated with the June 1966 Partfield Earthquakes.	1967	R. B. Hofmann D. B. Crice J. H. Bennett	Seismological Society of America Annual Mtg. Santa Barbara, Calif.
Multiple Station, Automatic Recording Seismograph for Engineering Applications.	1967	S. D. Schwarz R. B. Hofmann	Seismological Society of America Annual Mtg. Santa Barbara, Calif.
Fault Movements Preceding and Accompanying the 1967 Corralitos and Mt. Hamilton Earthquakes.	1968	R. B. Hofmann	Seismological Society of America Annual Mtg. Tucson, Arizona.
Earthquake Fault Monitoring Procedures and Recent Results.	1968	R. B. Hofmann D. B. Crice E. E. Hagen	American Geophysical Union Meeting, San Francisco, Calif.
Monitoring Earthquakes and Tectonic Movements for the California Water Project.	1968	R. B. Hofmann (Invited Paper)	Western States Water & Power Symposium, Los Angeles, California.
Servo-Accelerometers as Long Period Seismographs.	1968	R. B. Hofmann S. D. Schwarz R. H. Thayer	American Geophysical Union Meeting, San Francisco, Calif.
San Andreas Fault Movement 1968-1969.	1969	R. B. Hofmann R. H. Chapman	American Geophysical Union Meeting, San Francisco, Calif.
Cooperative Seismic Data Exchange.	1970	R. B. Hofmann D. L. Anderson D. Tocher A. Ryall B. J. Morrill K. L. King	Seismological Society of America Annual Mtg. Hayward, California.
Fault Strain and Slip From Recent State of California Geodimeter Measurements.	1970	R. B. Hofmann R. Greensfelder	American Geophysical Union Meeting, San Francisco, Calif.
Probability of a Major Earthquake in California.	1971	R. B. Hofmann	American Geophysical Union Annual Meeting Washington, D. C.
Seismological Factors in Design of Dams to Withstand Earthquakes.	1971	R. B. Hofmann (Invited Paper)	American Society of Civil Engineers National Water Resources Mtg.
Earthquake Energy and Design Earthquake Specification.	1973	R. B. Hofmann	Seismological Society of America Annual Mtg. Golden, Colorado.



Seismic Activity and Reservoir Filling at Oroville and San Luis Dams in California	1973 R. B. Hofmann	In American Geophysical Union Monograph No. 17 "Man Made Lakes ..."
Seismological Factors in Design of Dams to Withstand Earthquakes	Jan 30 1973 R. B. Hofmann	Presented at Am. Soc. of Civil Eng. Nat'l Water Resources Meeting.
Earthquake Energy and Design Earthquake Specification	May 18 1973 R. B. Hofmann	Presented at Seismological Society of Am. meeting, Golden, Colorado
Factors in the Specification of Ground Motions for Earthquakes in California	1974 R. B. Hofmann	Special Publication S-73-1 U.S. Army Corps of Eng. WES, Vicksburg, Miss. 98 pages.
Seismic Siting Procedures for Nuclear Power Plants	Nov. 6&7 1975 R. B. Hofmann invited	Eastern Section, Seismological Soc. of Am. St. Louis, Mo.
Evaluation of Vibratory Ground Motion at Nuclear Power Plant Sites	Sept 15 1977 R. B. Hofmann J. T. Greeves invited	Japan-U.S. Seminar on High Temperature Gas Reactor Safety Technology, Brookhaven National Laboratory, Upton, N.Y. 2 pg summary published in proceedings.
Interpretation and Application of the term "Capable Fault" in Appendix A, 10CFR 100	Nov 7 1977 R. E. Jackson D. R. Budge R. B. Hofmann invited	Am. Soc. of Civil Eng.- Geol. Soc. Am.- Seismological Soc. Am. Symposium on Capable Faulting Seattle, Washington. abstract in GSA Bull.



UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
PACIFIC GAS AND ELECTRIC) Docket Nos. 50-275 O.L.
(Diablo Canyon Nuclear Power Plant,) 50-323 O.L.
Units Nos. 1 and 2)

TESTIMONY OF RENNER B. HOFMANN

My name is Renner B. Hofmann. I am assigned to the Office of Standards Development of the United States Nuclear Regulatory Commission as a Seismologist. I have occupied this position since July of 1978. I was the Principal Seismologist reviewer for Diablo Canyon from October 1974 to July 1978 and was Leader of the Geology/Seismology Section in the Office of Nuclear Reactor Regulation from July 1976 to July 1978. My degrees include an M.S. in Seismology and a B.A. in Geology with a Mathematics minor. Attached is a copy of my curriculum vitae.

This testimony is in response to Intervenor's contention number 2 which read as follows:

What ground acceleration from a 7.50 earthquake on the Hosgri fault do you contend constitutes a proper, conservative value for use in evaluating the seismic safety of the DCNGS? Please state each and every fact upon which you base this contention.

To prepare my analysis, I began by reviewing the Applicant's PSAR. I made site visits, met with the applicant, his consultants, geological survey staff, and NRC consultants. I reviewed the intervenor's contentions literature published by their consultants and other pertinent technical literature. I attended professional society meetings where topics of applicability to the Diablo Canyon application were being reported or discussed. I visited the Shell Oil Company in Houston, Texas to examine the proprietary Seismic Profiles used by Hoskins and Griffiths (1971) to identify the fault now known as the Hosgri fault. I prepared draft responses to the intervenor's contention, met with USGS representatives, legal staff and the Geoscience Branch Chief on several occasions. The Branch Chief subsequently modified and edited my response which now appears as the staff response of October 23, 1978.

In addition, my analysis revealed that The Hosgri fault is relatively long and shallow. The tectonic characteristics of the region indicates that, if a magnitude 7.5 earthquake should occur, on the Hosgri fault it would involve predominately strike slip motion. For this magnitude and a shallow strike slip mechanism, the length of fault rupture would be at least several tens of miles and possibly many tens of miles similar to the long strike slip breaks that have occurred in earthquakes on the San Andreas fault.

Generally, the stresses which lock faults are believed to be lower for strike slip faults than for reverse faults. In the case of a reverse fault, the two sides of the fault are being forced together by tectonic

stresses. This increases the effective stress on the fault as regional stresses increases. Under these conditions the stress can reach extremely high levels before the frictional force is overcome and the fault slips. In the case of strike-slip faults, because the forces are generally parallel with the plane of the fault, the levels of effective stress are not as high as those involved in reverse or thrust faults (Thatcher and Hanks, 1973). Evidence of lower effective stress on faults of the San Andreas system may be seen in the determination of length of rupture versus magnitude. Two such curves were summarized by Hofmann. (1974). Figure 2-1 illustrates the better data of Ambraseys and Tchelenko (1968), which indicates a very wide range of rupture lengths versus magnitude. Figure 2-2 is from Algermissen et. al., (1969), whose data are restricted to the strike-slip San Andreas fault. The latter curve lies approximately along the upper bound of the Ambraseys and Tchelenko data. This suggests that for strike slip faults, much greater lengths of rupture are required on the San Andreas fault than for the entire available data set to generate the same magnitude earthquake. Hence, the higher effective stress across other kinds of faults may be a contributing factor to the generation of large magnitudes from short rupture lengths. This effect may also be observed in the data of Bonilla (1970).

Based on the above it appears that the strike slip earthquakes of the San Andreas system have large source dimensions and may have correspondingly lower effective stress.

The Diablo Canyon site would be in the near field of the postulated event, the distance to the source would be small compared to the size of the source. In this situation the energy available to contribute to peak acceleration is limited to the energy released in a short segment of fault rupture, the length of which equals the distance to the source (Brune, 1970). Thus, a large near field earthquake can be expected to produce smaller peak accelerations than would be indicated by:

- (1) extrapolating from distant events where source size is not large compared to distance, or
- (2) extrapolating from closer events of small magnitude with small source dimensions.

Further, the design significance of peak acceleration is different for near field events. Instrumental records close to the source indicate relatively high values for the highest acceleration peak, with rapidly declining values for subsequent peaks. Further, the higher peaks often do not occur in sequence. This contrasts with recordings from distant events where subsequent peaks may be nearly as high as the highest peak. Because development of high levels of acceleration in response spectra is dependent on repeated pulses, effective acceleration can be lower relative to the maximum peak expected in the near field and yet provide an adequate representation of structural response.

Design spectra are mathematically related to Fourier amplitude spectra. Such a relationship for undamped design spectra was presented by Hudson, 1962. Fourier amplitude and phase spectra define a time function (in this case, the strong motion seismogram). Fourier amplitude spectra alone or the design spectra which may be derived from it, cannot define a unique time function. Rather, they define a family of such functions with various durations and peak amplitudes. In practice synthetic seismograms to test dynamic behavior of structural design may be made with a high amplitude and short duration which develop the same structural response or design spectra as longer lower amplitude seismograms which are more costly to use because of a longer required computer run time. The corollary is that a peak acceleration from a seismogram cannot be used to accurately set a Fourier spectra or design spectra. The use of peak accelerations to set design spectra is conservative but becomes overly conservative when only one or a few peaks are substantially greater than most of the high amplitude portion of the record. An example is the 1971 Pacoima dam record of 1.25 gs. A Regulatory Guide 1.60 design spectra which envelopes the actual calculated design spectra has an anchor point of about .75g. For example, the 1971 Pacoima accelerogram is from the M = 6.5 San Fernando earthquake. However, the Ground motion at the Pacoima dam, strong motion seismograph station appears to have been amplified by topography, structural response of the ridge and by breaking of the seismograph foundation rock and pier. Therefore, the

.75g enveloping design spectra is appropriate for an $M = 6.5$ earthquake only under circumstances identical to the Pacoima dam strong motion instrument. The Diablo Canyon Power Plant site is not on a ridge of rock. It is located on flat ground at the base of a hill. Topographic amplification is not predicted. There is no ridge of rock with its dynamic structural response to contribute to the motion. Cracked foundation rocks and churned ground was found on hilltops following the 1971 San Fernando earthquake. The Diablo Canyon Plant is not on a hilltop and hence is not likely to suffer cracked or broken foundation rock. A magnitude 6.5 earthquake a few kilometers from the Diablo Canyon Plant would, therefore, not produce a free field design spectra with a .75g anchor point. It would produce a design spectra anchored at a lower value. USGS Circular 672 recommends a peak acceleration of .90g and 1.15g for the near field area of an $M = 7.5$ earthquake. This value is less than the 1.25g peak of the Pacoima dam accelerogram recorded under peculiar conditions. Therefore, the .75g design spectra anchor for the proposed $M = 7.5$ earthquake on the Hosgri fault appears conservative.

There are no instrumental records of ground motion close to the source of earthquakes as large as magnitude 7.5. However, intensity data, based on observed effects and damage, are available for such events as well as for smaller quakes. 10 CFR 100 Appendix A requires that such data be considered. Correlations between acceleration and intensity have been made

based on available data. Although there is a great deal of scatter in the correlations, they are useful in bounding the level of effective acceleration. We normally use the correlations of Trifunac and Brady (1975).

The 1906 San Francisco earthquake of magnitude 8.3 provides an example of a large strike-slip earthquake. In this case, Rossi-Forel intensity X or greater occurred only within about a mile and a half of the main rupture of the San Andreas fault. At 3 1/2 miles from the San Andreas fault Rossi-Forel intensities of IX and less were observed along the main break. This corresponds to the Modified Mercalli Intensity of VIII (USGS Circular 1279). The mean acceleration from the Trifunac and Brady curves for Modified Mercalli VIII is approximately .25g. It is difficult to determine the first and second standard deviations because of a lack of data. The data for MM VIII alone indicated a mean value for acceleration which is considerably less than that derived by the 1975 Trifunac and Brady straight line extrapolation from smaller intensities. However, using the straight line extrapolation, it appears that the second standard deviation of acceleration associated with MM VIII is about .54g which is very close to the original double design acceleration used for the Diablo Canyon Plant. The second standard deviation of acceleration would include virtually all the scattered accelerations observed for a given Modified Mercalli intensity.

The Trifunac and Brady 1975 second standard deviation value exceeds the largest acceleration which has been associated with MM VIII. Thus, available

direct evidence does not support effective accelerations from the magnitude 8.3 on the San Andreas fault higher than about .54g at a distance of 3 1/2 miles from the fault.

Another example is the 1927 Point Arguello earthquake, also called the 1927 Lompoc Earthquake of magnitude 7 1/4. There is disagreement about the location of this earthquake and its mechanism. However, the possibility that it occurred on the Hosgri fault was one of the reasons for setting the magnitude for the postulated event. If the isoseismal map of the 1927 earthquake were moved northward along the Hosgri fault to the plant site, the highest observed intensity, at a distance of 3 1/2 miles from the fault, would be the same value as discussed above, Modified Mercalli VIII.

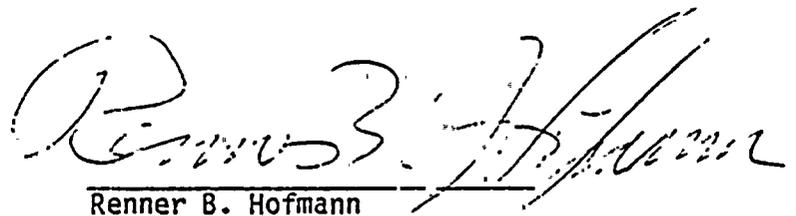
Based on the foregoing considerations, I consider 0.75g to be an acceptably conservative effective acceleration for reevaluating the Diablo Canyon units in consideration of a postulated earthquake of magnitude 7.5 centered on the sector of the Hosgri fault nearest the plant site.

Further, the angle of approach to the structure of the high acceleration seismic waves is important. Work by Bouchon 1978 indicate that high amplitude strong motions near the source are caused by horizontally travelling "surface P waves". Bouchon 1976 modeled mathematically the 1971 San Fernando Earthquake. He determined that high amplitude high frequency

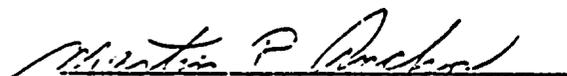
pulses on the Pacoima dam strong motion record represented the Raleigh break out phase, also horizontally travelling. Therefore, although simple body waves and their reflections from a nearby fault plane would arrive at a site with various angles of incidence, peak acceleration pulses appear to be horizontally travelling.

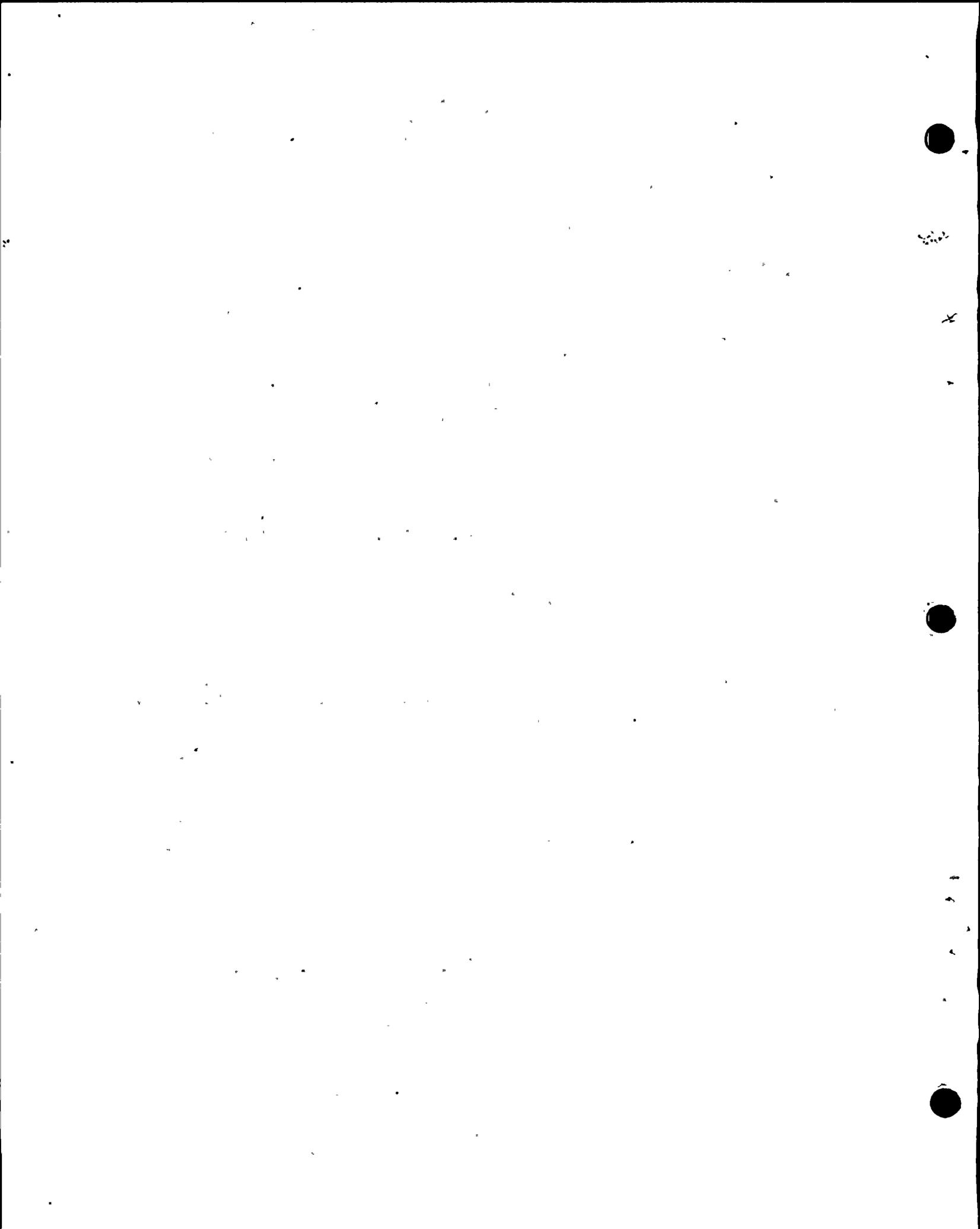
Based on my analysis, I concluded that .75g is a conservative acceleration to reference a free field design (response) spectrum for the Diablo Canyon Nuclear Power Plant.

I hereby certify that the information above is true and accurate to the best of my knowledge.


Renner B. Hofmann

Subscribed and sworn to before
me this 11 day of November 1978


Notary Public
My Commission Expires July 1, 1982



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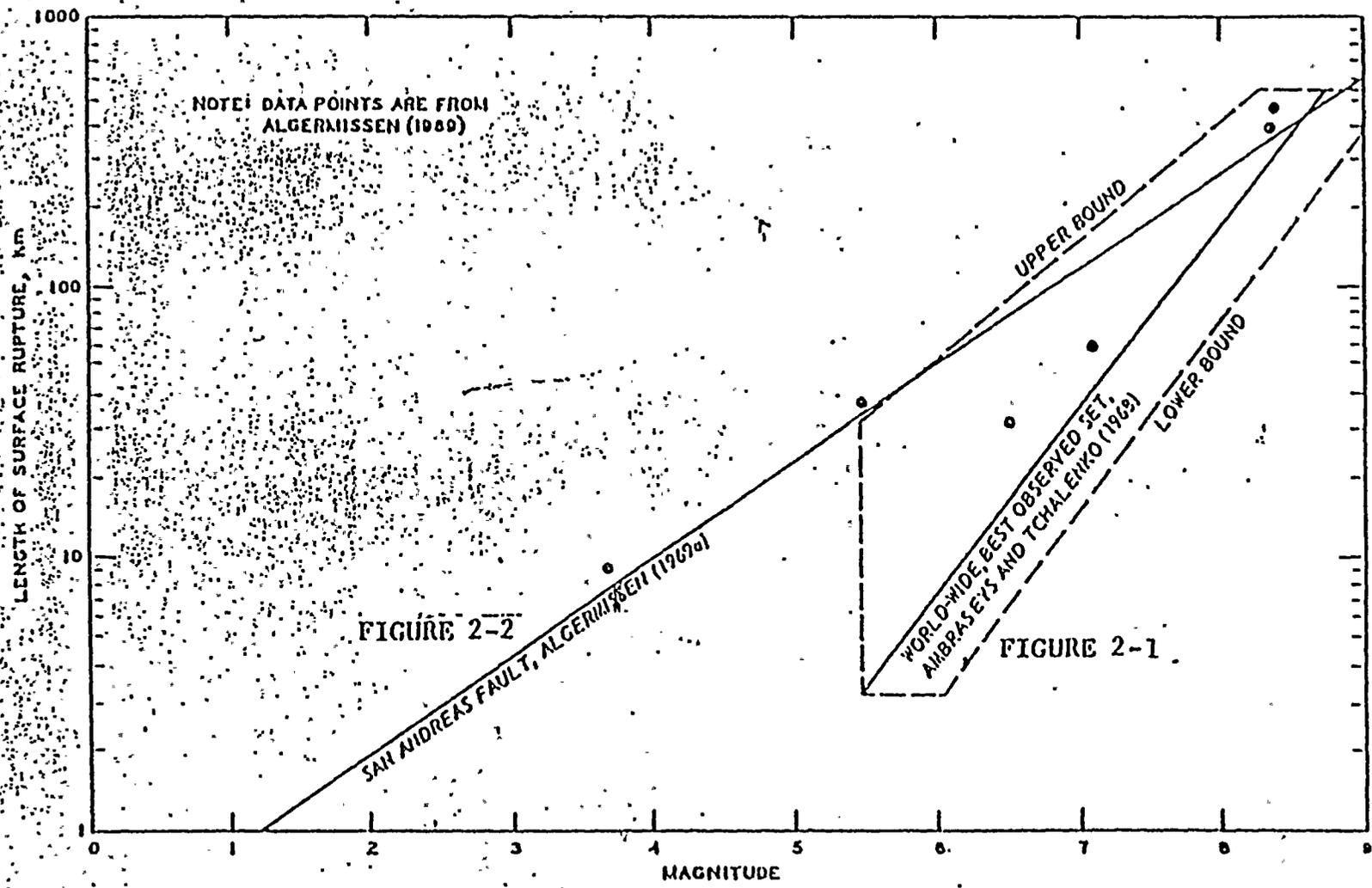


Fig. 1. Length of surface rupture versus magnitude

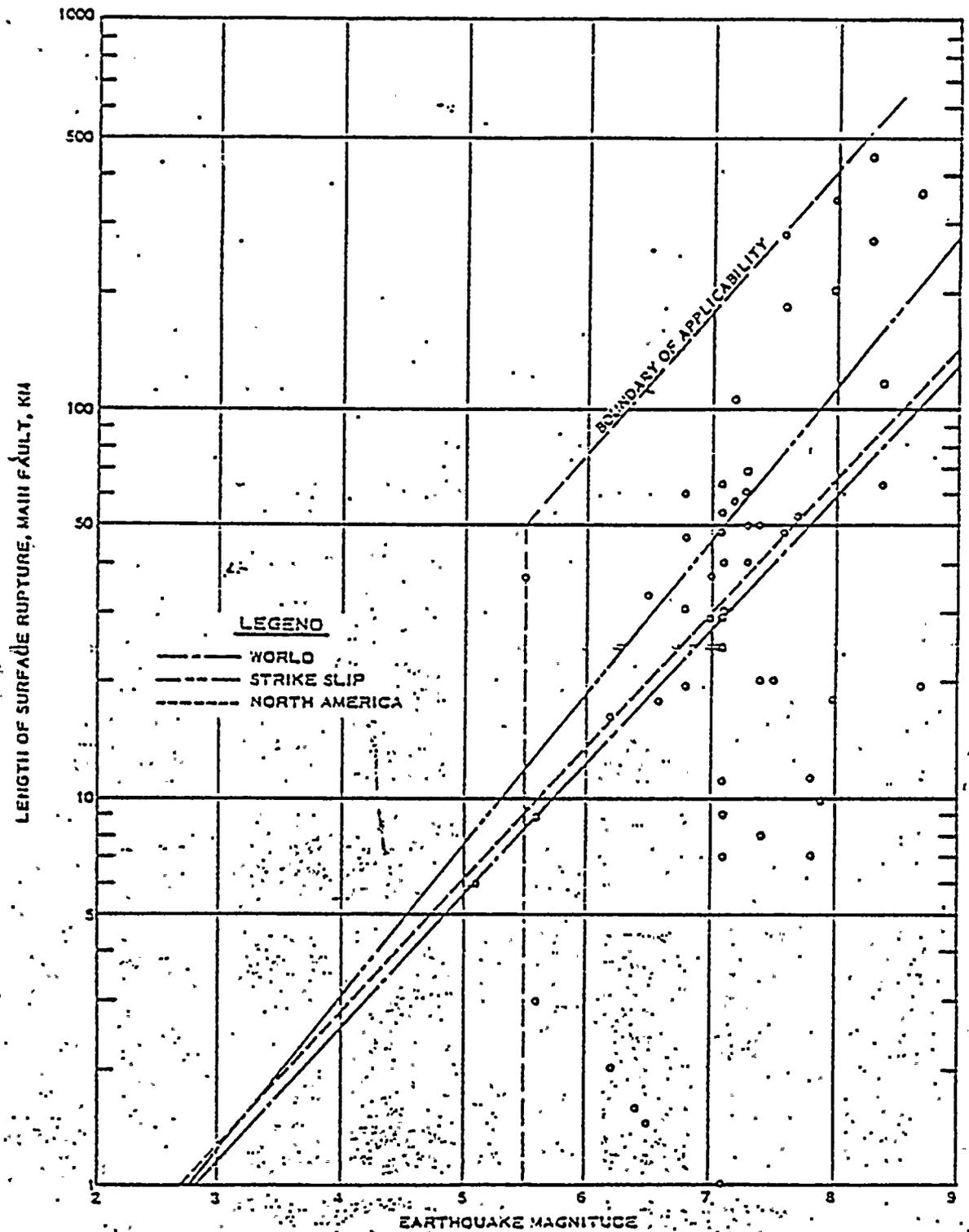


FIGURE 2-3 Length of surface rupture on main fault as related to earthquake magnitude. From Bonilla and Buchanan; ²¹ boundary of applicability added

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) 50-323 O.L.
(Diablo Canyon Nuclear Power Plant,)
Unit Nos. 1 and 2))

TESTIMONY OF RENNER B. HOFMANN

My name is Renner B. Hofmann. I am assigned to the Office of Standards Development of the United States Nuclear Regulatory Commission as seismologist. I have occupied this position since July 1978. I was the principal seismologist reviewer for the Diablo Canyon Nuclear Power Plant from October 1974 to July 1978. I was Leader of the Geology/Seismology Section in the Office of Nuclear Reactor Regulation from July 1976 to July 1978. My degrees include an M.S. in Seismology and a B.A. in Geology with a Minor in Mathematics. Attached is a copy of my curriculum vitae.

This testimony is in response to Intervenor's contention number 9 which read as follows:

Do you contend that the strong (7.3M) earthquake recorded near the central California coast on November 4, 1927 took place on the Hosgri fault? If so, (sic) please identify the fault on which you contend this earthquake did take place.

To prepare my analysis, I began by reviewing the applicant's PSAR. I made site visits, met with the applicant, his consultants, U.S. Geological Survey staff and NRC consultants. I reviewed the intervenor's contentions, literature published by their consultants and other pertinent technical literature. I attended professional society meetings where topics of applicability to the Daiblo Canyon application were being reported or discussed. I visited the Shell Oil Company in Houston, Texas, to examine the proprietary Seismic Profiles used by Hoskins and Griffiths (1971) to identify the fault now known as the Hosgri fault. I prepared draft responses to the intervenor's contention, met with USGS representatives, legal staff and the Geoscience Branch Chief on several occasions. The Branch Chief subsequently modified and edited my response which now appears as the staff response of October 23, 1978.

In addition, my analysis revealed that the "felt" area of the 1927 earthquake is one fourth the size it should be for the 7.3 Richter magnitude assigned on the basis of Dr. Richter's correlation of felt area and magnitude (Richter 1958). Felt areas of California earthquakes are reported in the Earthquake History of the U.S. (Coffman and Van Hare (1971) as that area in which the earthquake was felt within the continental United States. Earthquake felt areas are generally centered over the source of the earthquake. In California, the San Andreas fault system is close to

and parallels the Pacific Ocean shore. Splays of the San Andrea fault system continue to and cross the Mexican border. Consequently, the felt^{areas} of many California earthquakes would continue into areas covered by ocean or into Mexico. These areas are not reported in the Earthquake History of the U.S. and must be compensated for by symmetrical extrapolation about the earthquake source. If the 1927 earthquake is assumed to have occurred on the Hosgri fault, an equal sized felt area seaward of the fault must be considered in addition to the land area on which the earthquake was felt. The generating fault must be considered to be nearly as distant as Byerley's 1930 epicenter to produce the correct felt area for the 1927 earthquake.

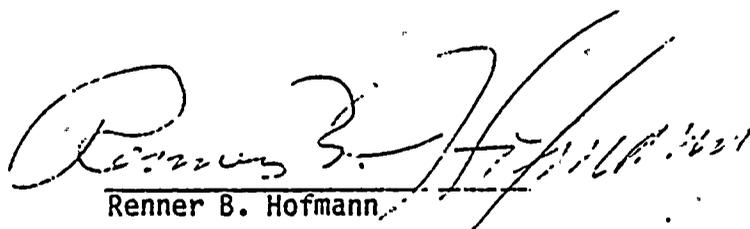
That the Hosgri fault is an unlikely source for the 1927 earthquake is also suggested by the total absence of reported seismicity until recent years. Attached is one sheet of a map summarizing all instrumentally determined epicenters for earthquakes over $M = 3.5$ and locations of major earthquakes in California prior to the availability of instrumentation, (Hill, Moore and Lao, 1962). A few small earthquakes have been relocated in the vicinity of the Hosgri fault (Hileman 1973 and Gawthrop 1975). Earthquakes of this size, $M = 4.5$ or less, are not detectable at great distance. The seismograph stations which recorded them were east of the epicenters. Without seismic stations also distributed west of the epicenters uncertainty in the relocations to a particular fault remain.

If these earthquakes are assumed associated with the Hosgri fault their numbers are too low to support the Hosgri fault as a source for the 1927 earthquake. For each succeeding whole magnitude smaller, 8 times as many earthquakes should be normally observed. Therefore, there should be 8 times as many $M = 6.3$, 64 times as many $M = 5.3$ and 512 times as many $M = 4.3$ earthquakes on the Hosgri fault as there are $M = 7.3$ earthquakes. The California Institute of Technology lists (Hileman 1973) has two $M = 4.5$ entries that could be associated with the Hosgri fault and none of larger size. Thus, if the rate of magnitude 7.3 earthquakes is one per length-of-historic-record, there should be 64 $M = 6.3$ earthquakes and 512 $M = 4.3$ earthquakes. This is not the case. The instrumental record began about 1932. All earthquakes of $M = 6.3$ should have been located. None were located near the Hosgri fault. 1978 minus 1932 is 46 years. On this basis, the return period of an $M = 7.3$ earthquake should be greater than 46×64 or 2,944 years.

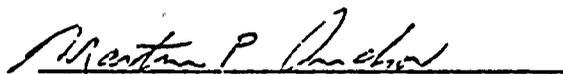
Further, as pointed out in PG&E's docketed material, the normal aftershock activity of an $M = 7.3$ earthquake should have continued from 1927 well into the 1930's with smaller aftershocks continuing for longer periods. Instrumentation installed in the early 1930's did not record such aftershocks that could be attributed to the Hosgri fault.

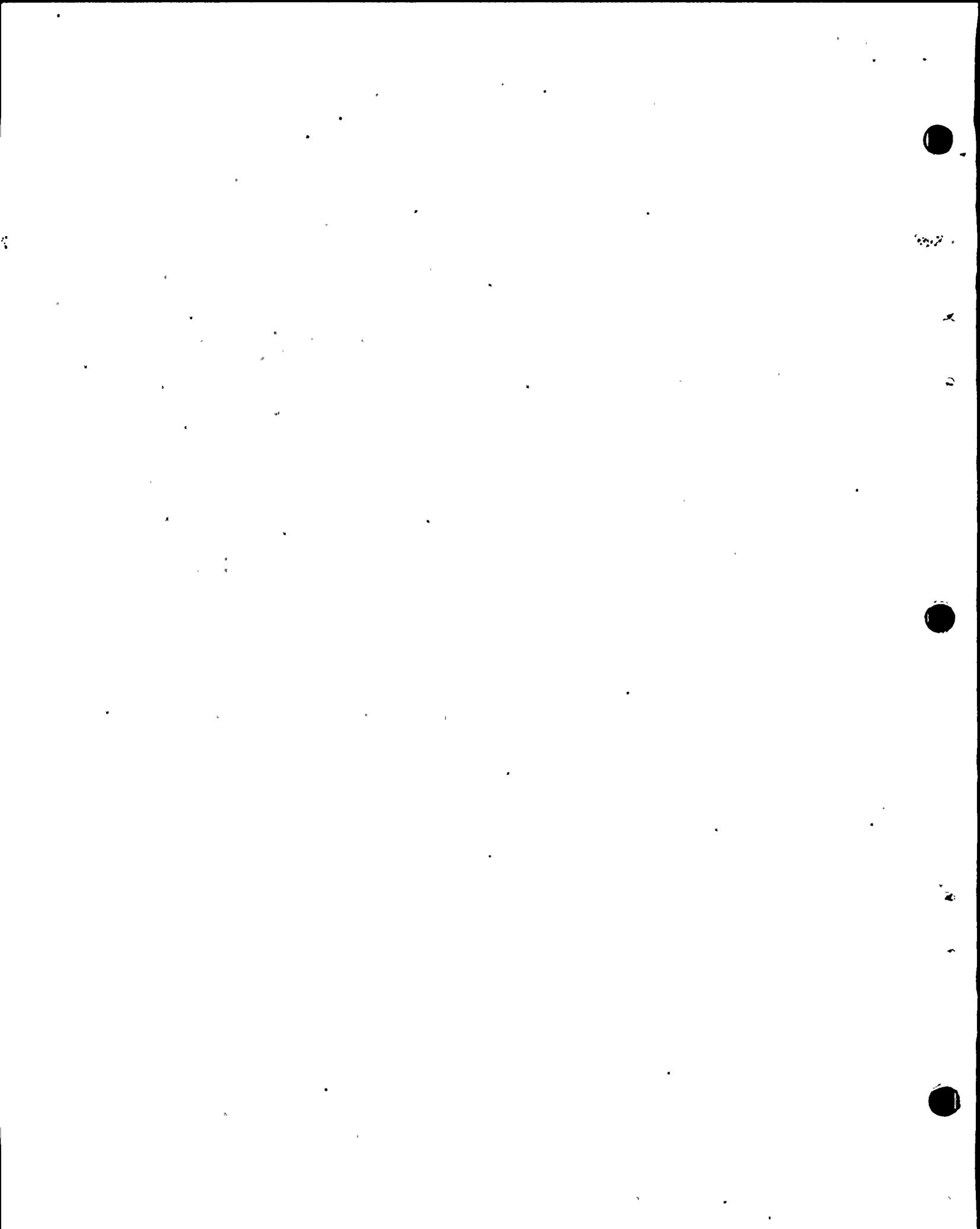
Based on my analysis, I conclude that it is extremely unlikely that the 1927 M = 7.3 Lompoc Earthquake occurred on the Hosgri fault.

I hereby certify that the information above is true and accurate to the best of my knowledge.


Renner B. Hofmann

Subscribed and sworn to before me this 11 day of November 1978.


Notary Public
My Commission Expires July 1, 1982



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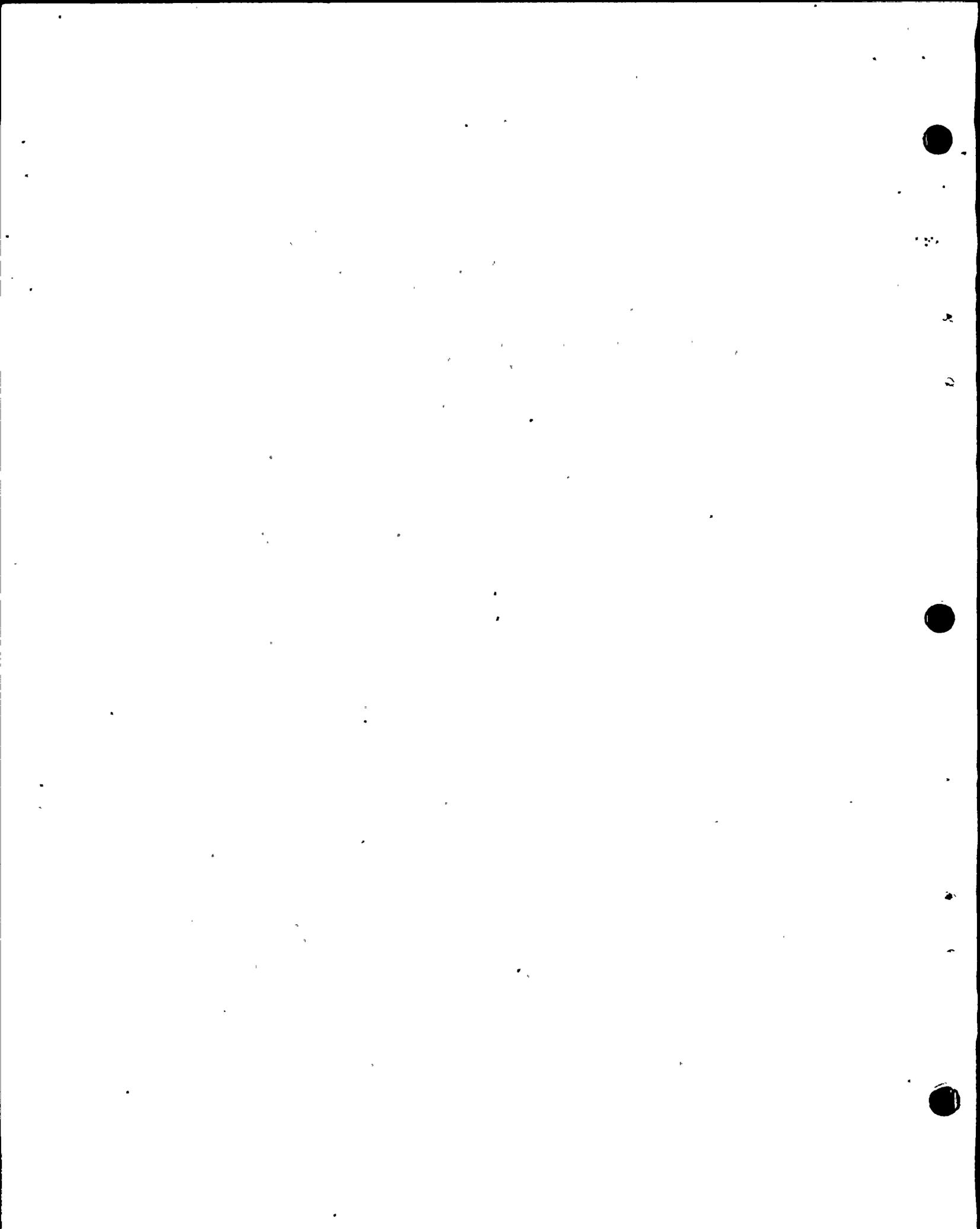
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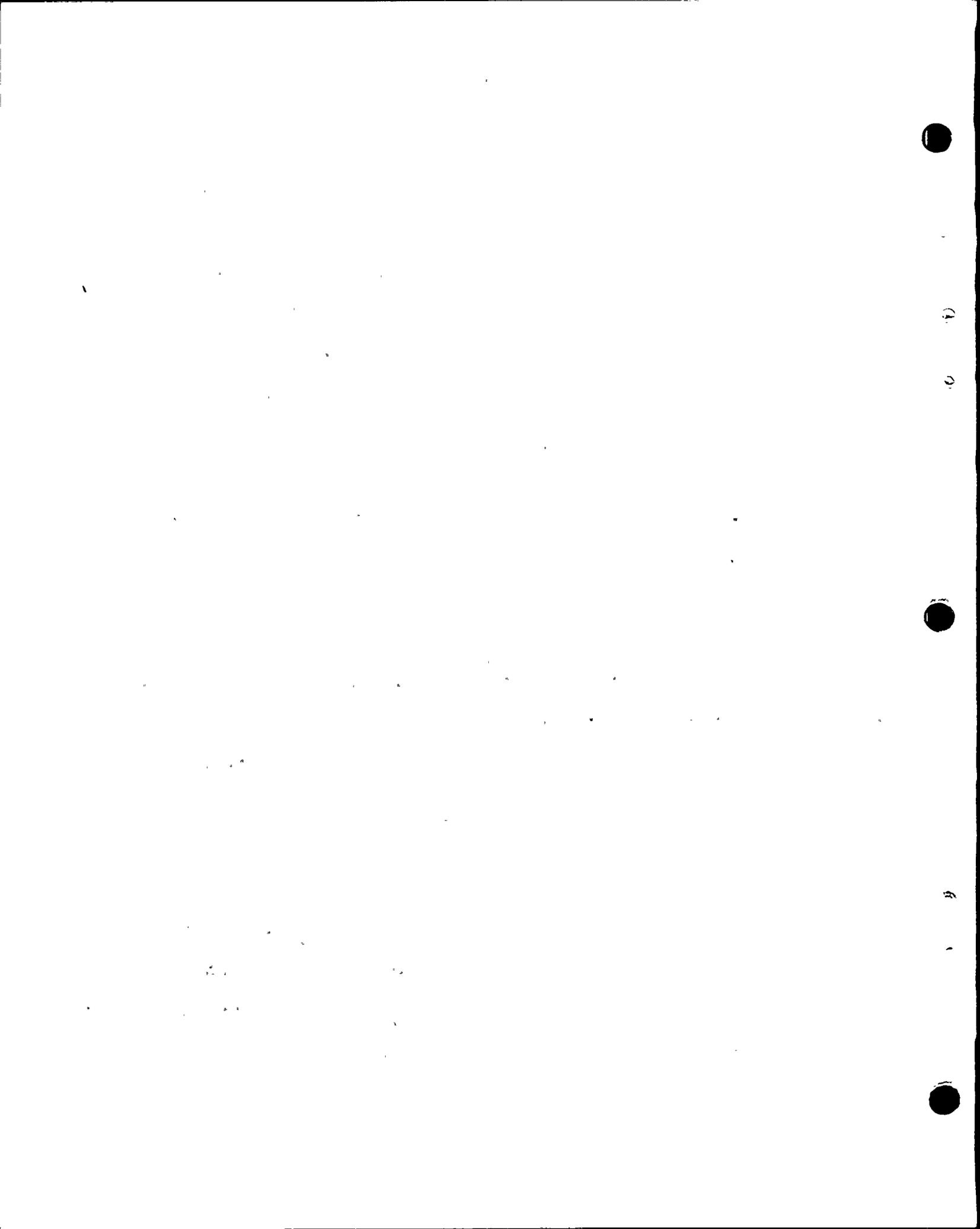
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2Bcont'd

NRE/agbl

THE WITNESS: There is a map referred to in the testimony which apparently was not reproduced, and I've brought copies of it.

MRS. BOWERS: How many copies did you bring? Maybe Mr. Fourtelotte could help us out on this.

Is this going to be a part of the testimony?

THE WITNESS: I don't know. Dennis Allison requested that I bring them.

MR. NORTON: Excuse me. If that's the one referenced in Part Two, the second part of the testimony, I was wondering where it was as I read it.

THE WITNESS: Yes, it says "attached."

MR. NORTON: I'd like to have a copy, if they are available. It's awfully hard for a dissenting opinion to get all of his evidence in.

THE WITNESS: I apologize for being less than skilled.

MR. FLEISCHER: Do you need a good lawyer?

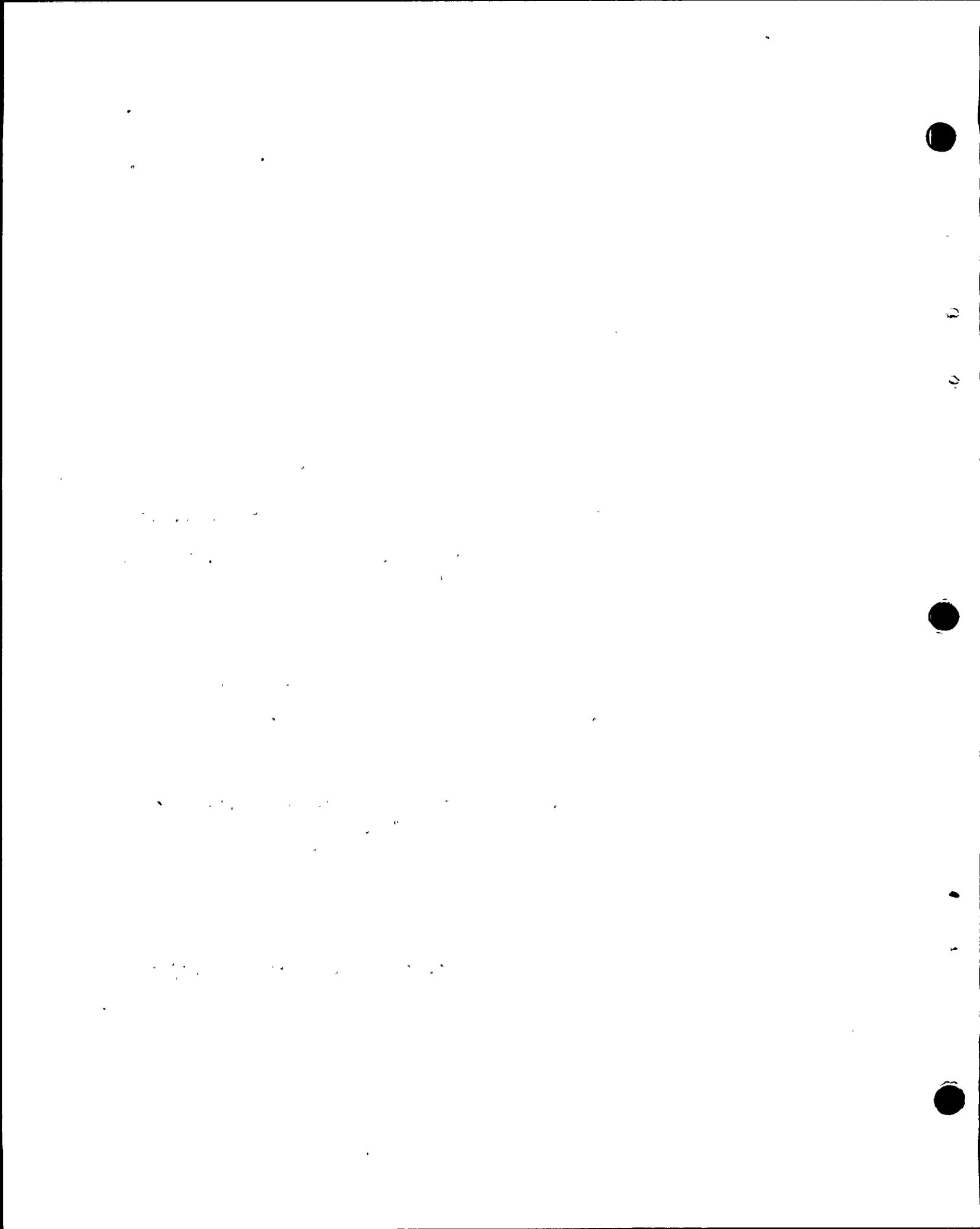
(Laughter.)

MRS. BOWERS: How many copies do you have?

THE WITNESS: I've forgotten. I believe it's 40.

MRS. BOWERS: Well, so that there would be enough so that it could be physically inserted?

MR. FOURTELLOTTE: Yes, we'll attach that to the testimony and give the necessary copies to the Reporter



WRB/agb2

to incorporate in the record.

MRS. BOWERS: Could you peel off some for us now?

MR. TOURNELLOTTÉ: Certainly.

(Copies handed to the Board.)

BY MR. TOURNELLOTTÉ:

Q Mr. Hofmann, could you briefly summarize the contents of your testimony?

A Yes.

There are about nine points in which my professional opinion differed from that which I was allowed to prepare, or in which the way in which I felt the information should be stated was prepared.

I apologise if some of this is repetitive, I have not seen Dr. Stepp's testimony except to glance at it momentarily here. Some of it may be similar.

I did prepare draft responses to the Intervenor's interrogatories some time ago, and those were modified and edited by the Branch Chief and now appear as the Staff response of October 23, 1978, and as they are presently submitted, I have no great difficulties with them.

In addition, my analysis revealed that the Hosgri Fault is relatively long and shallow. The tectonic characteristics of the region indicate that if a magnitude 7.5 earthquake should occur on the Hosgri Fault, it would involve predominantly strike-slip motion.



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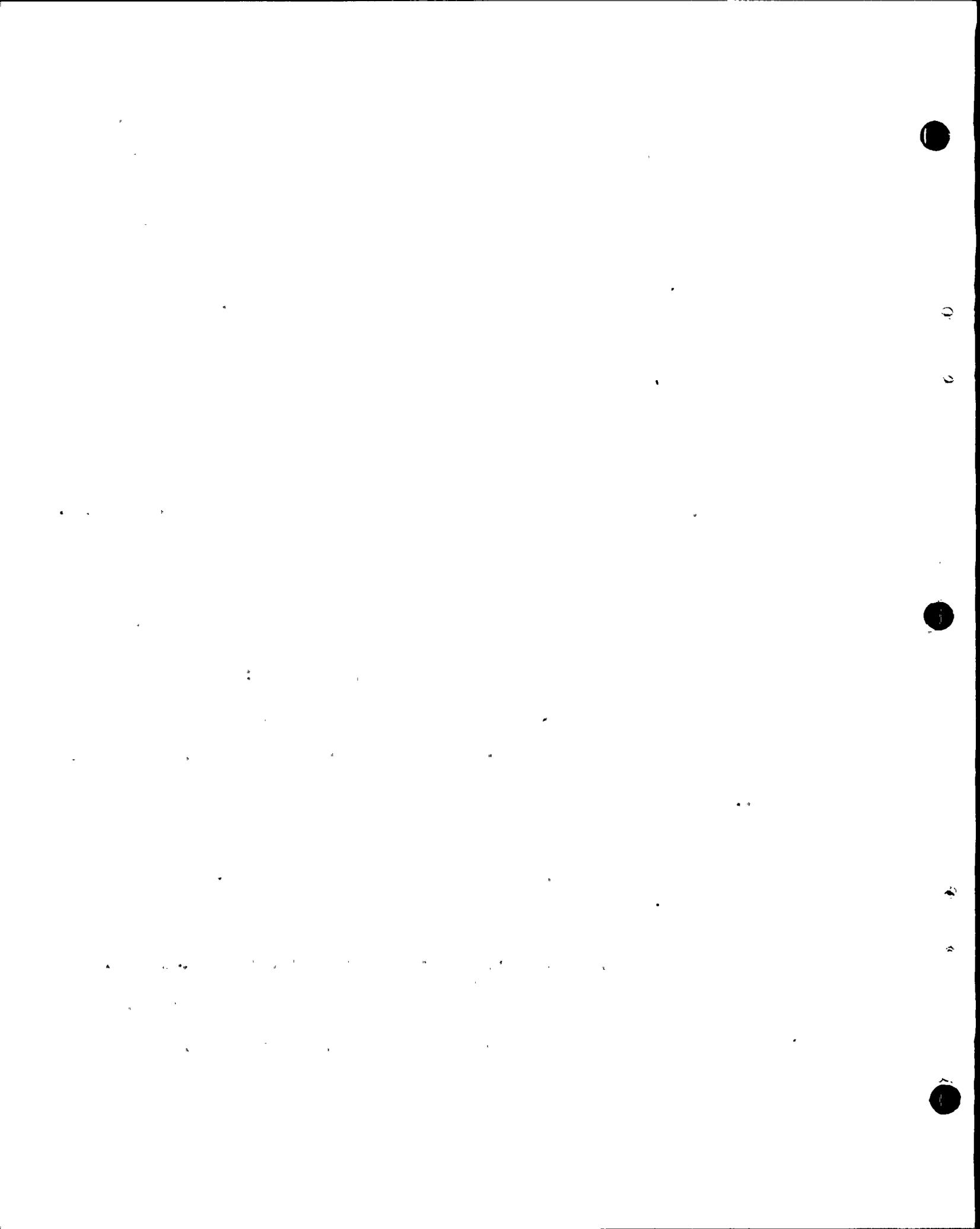
And for this magnitude and shallow strike-slip mechanism, the length of fault rupture would be at least several tens of miles and possibly many tens of miles, similar to the long strike-slip breaks that have occurred in earthquakes on the San Andreas Fault.

As apparently pointed out by Dr. Stepp, strike-slip faults have a generally lower effective stress across them than new compressional failure or thrust-type faults. Thatcher and Hanks, 1973, have discussed that.

I have prepared two curves in my work for the Corps of Engineers in which estimates were made for maximum accelerations on strike-slip faults and on compressional failure faults. The differences are attributable to the geometry of the faulting, that is, the size and geometry of the slip plane area.

And when one looks at the empirical data that has been observed throughout the world, there are differences in the accelerations that are seen at a distance from strike-slip faults and from compressional failure faults.

And in the San Andreas System, in particular, Algermissen and his staff which, I believe, included Dr. Stepp in 1969 summarized such information for the San Andreas Fault -- excuse me, that data has to do with the length of the fault and not the -- the length of the faulting versus magnitude.



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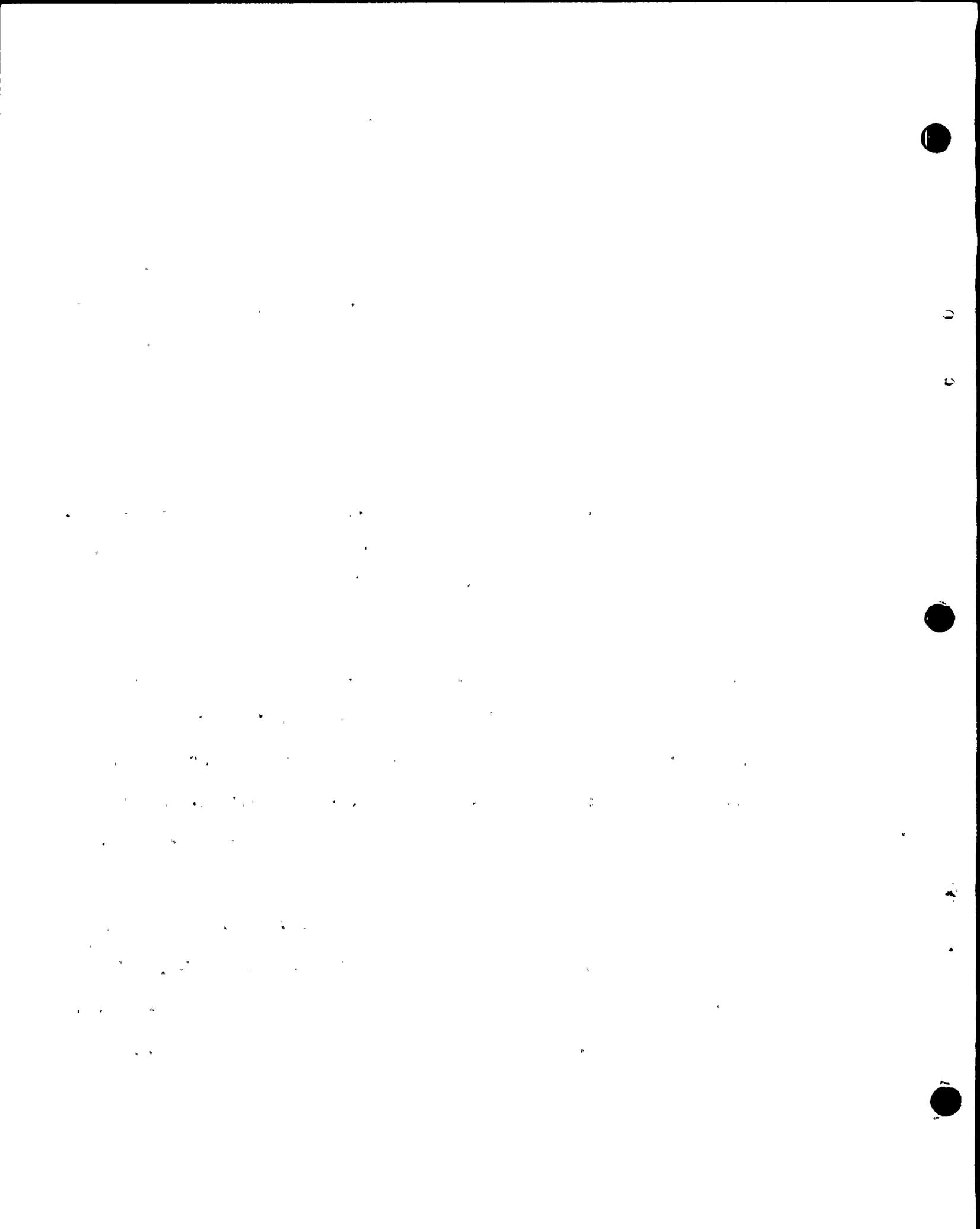
So in as much as the Hosgri would have to be a part of the San Andreas System, I believe it appropriate to use that curve to judge the length of the San Andreas Fault -- to judge the magnitude of a potential earthquake on the Hosgri Fault, rather than from data which has been collected worldwide and put together in one document, such as performed by Dr. Bonilla.

So based on the above, it appears to me that strike-slip earthquakes on the San Andreas System have large source dimensions and correspondingly lower effective stresses.

Now the Diablo Canyon site would be in the near field of the postulated event. The distance to the source would be small compared to the size of the source. And in this situation, the energy available to contribute to peak acceleration is limited to the energy released in a short segment of fault rupture, the length of which equals the distance to the source, and this is developed by Dr. Brune in a paper in 1970.

Therefore, a large near field earthquake can be expected to produce smaller peak accelerations than would be indicated by (1) extrapolating from distant events where source size is not large compared to distance or, (2), by extrapolating from closer events of small magnitude with small source dimensions.

This is important, and I believe that this



NRB/agb5

explains the extremely high accelerations derived by Dr. Trifunac in his estimate of the large accelerations that could occur near a fault.

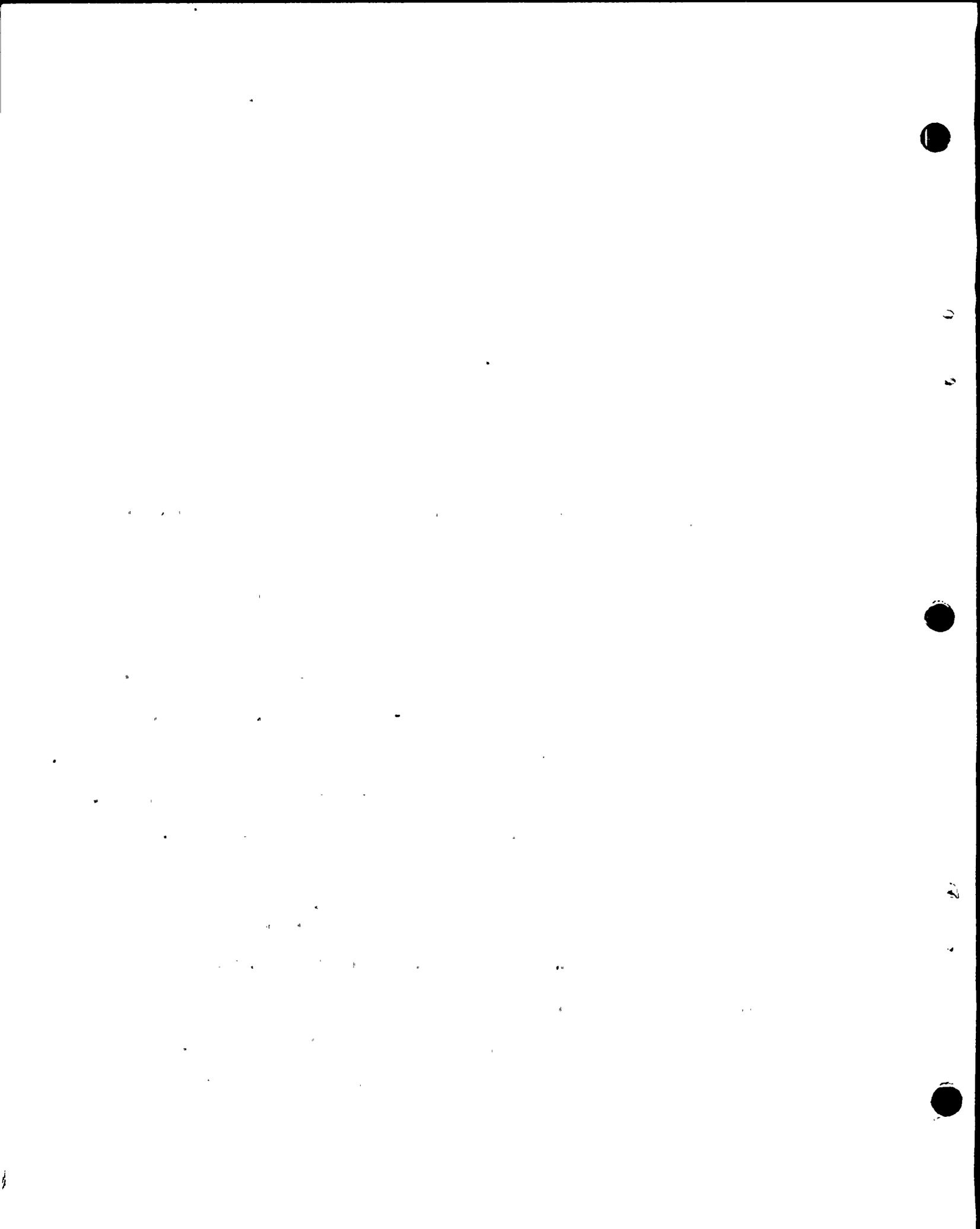
Further, the design significance of peak acceleration is different for near field events. Instrumental records close to the source indicate relatively high values for the highest acceleration peak, with rapidly declining values for subsequent peaks.

Further, the higher peaks do not occur in sequence. This contrasts with recordings from distant events where subsequent peaks may be nearly as high as the highest peak.

Now because of that, the response spectra which is used in design is not driven to the same high levels for near field events with these sporadic high peaks on them as it would be for a distant earthquake which has more nearly equal sized peaks. Therefore, the design spectra, or the response spectra will be of a lower level. And that, too, is important here.

Now, design spectra -- Another point is design spectra are mathematically related to the Fourier amplitude spectra. These relationships were discussed in the literature in the late 1950s and early 1960s. It's a difficult relationship, one of which is presented by Hudson in 1962.

Fourier amplitude and phase spectra, two separate



WBB/agb6
spectra, define a time function --- in this case, the strong motion seismogram.

Fourier amplitude spectra alone or the design spectra which may be derived from it, cannot define a unique time function. Rather, they define a family of such functions with various durations and peak amplitudes.

In practice synthetic seismograms to test dynamic behavior of structural design may be made with a high amplitude and short duration synthetic seismogram which develops the same structural or design spectra response as longer, lower amplitude seismograms.

Engineers frequently do this because it's more costly to run the longer, lower level seismograms.

A corollary of this is that a peak acceleration from a seismogram cannot be used to accurately set a Fourier spectra or design spectra.

The use of peak accelerations to set design spectra is conservative, but becomes overly conservative when only one or a few peaks are substantially greater than the rest of the high amplitude portion of the record.

Now, I go on to describe the 1971 Paccima Dam record of 1.25g's.

If one slides a Regulatory Guide 1.60 design spectral envelope down over the actual calculated design spectra or response spectra from the 1971 Paccima Dam record,



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WRB/agh7

the high frequency anchor point is approximately 0.75g.

Now the Pacoima Dam accelerogram is from a magnitude 6.5 earthquake, not a 7.5 one. However, the Pacoima Dam accelerogram is peculiar in that the strong motion seismograph station appears to -- the strong motion seismogram appears to have been amplified by topography, structural response of the ridge and by breaking of the seismograph foundation rock and pier.

So the 0.75g envelope in design spectra is appropriate only for a 6.5 earthquake under circumstances identical to the Pacoima Dam strong motion instrument.

The Diablo Canyon Power Plant is not on a ridge of rock, it is located on flat ground at the base of a hill. Topographic amplification is not predicted, for example, from a study of Soora, 1972. There is no ridge of rock with its dynamic structural response to contribute to the motion, and I would not expect cracked foundation rocks as they were found -- cracked rocks and churned ground were found only on hilltops, probably as a consequence of amplification, in the 1971 San Fernando earthquake.

So going on then, this kind of thing has apparently been taken into consideration by the USGS in their Circular 672. Now we can get some idea of what might be an appropriate design acceleration by making a comparison.

Circular 672 recommends a peak acceleration of



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HB/agb8
0.90g for a 6.5 magnitude earthquake. And that, we found, has -- or that there were circumstances -- well, let's say recommends a peak acceleration of 0.90g and also recommends 1.15g for the near field of a magnitude 7.5 earthquake.

Now 1.25g's is greater than 1.15g's. So if 0.75g's is appropriate for a peak of 1.25g's, then one could conclude that the zero period anchor for 1.15g should be less than 0.75g.

If one makes that kind of a comparison, you have to conclude that 0.75g would be conservative.

Now, there are no instrumental records -- as we've heard Dr. Bruza say -- close to the source of earthquakes as large as magnitude 7.5. But we do have intensity data to make a comparison. And in fact, 20 CFR Part 100 Appendix A requires that intensity data be considered. In the Eastern United States, we also do not have strong motion data. And there we do use intensity data.

So we have a similar situation: in the near field of large earthquakes in California, we do not have strong motion accelerograms, and in the Eastern United States, we do not have strong motion accelerograms. We may use intensity data to determine what the level of damage that might be expected is.

For that, we can look at magnitude 8.3, San Francisco strike-slip earthquake. That's 8.4, not 7.5. And in that case, an Intensity X or greater occurred only within



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about a mile and a half of the main rupture. 3.5 miles Rossi-Forsal intensities were observed along the main break. This corresponds to a Modified Mercalli Intensity of VIII. And the mean acceleration from the Trifunac and Brady curves for Modified Mercalli VIII is 0.25g, and that's what is used to set the design level of nuclear power plants in the absence of strong motion records.

RR/agb9

and2B

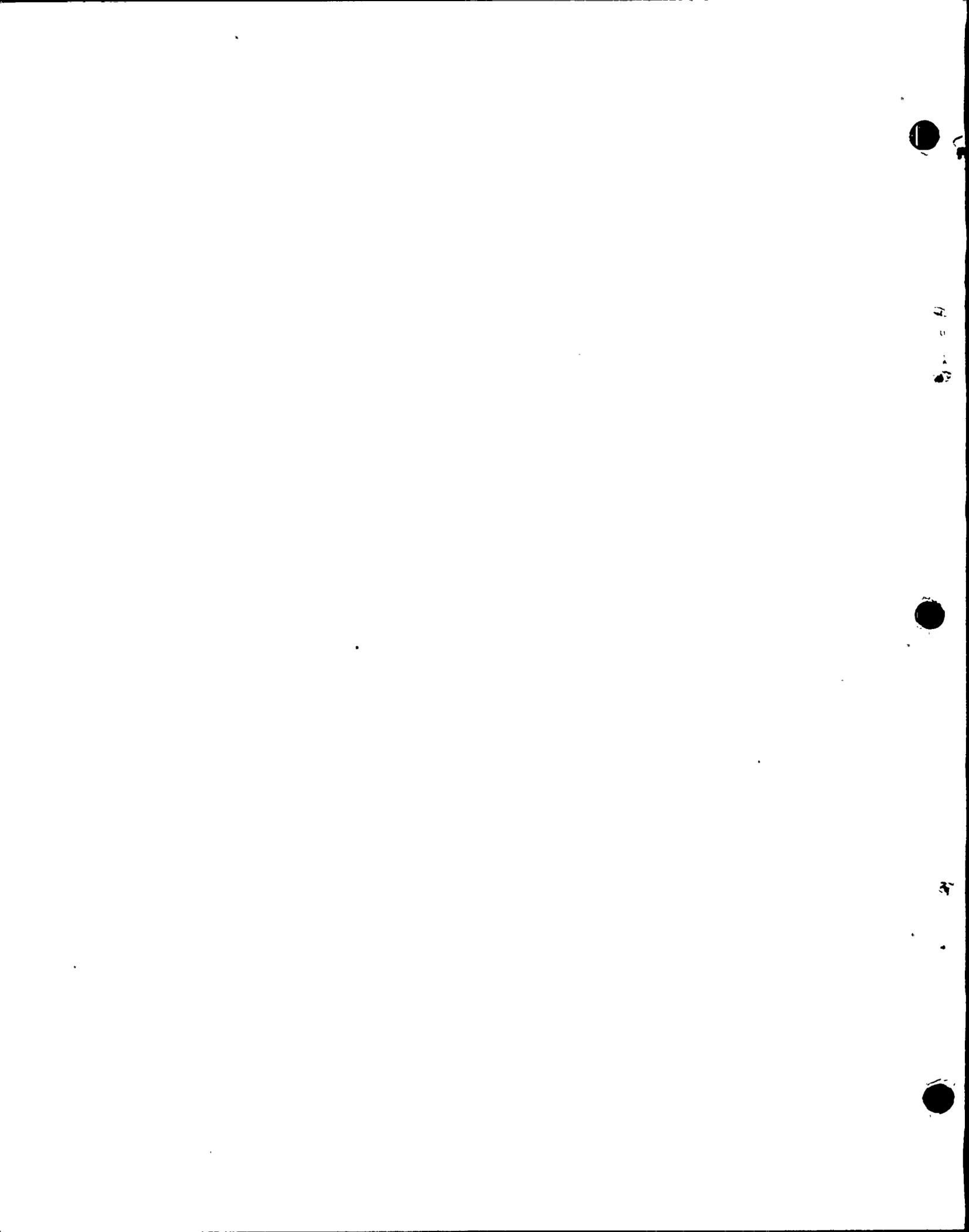


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high amplitude pulses on the Rayleigh wave over which are
represented a Rayleigh's breakdown phase which is also horizontally
travelling.

Therefore, although the reflections from a nearby fault
at various angles of incidence appear to be horizontally travelling.

So I conclude from this that this is a con-
servative acceleration, as evidenced by the lack of
of response, especially for the low frequency.

Now the earthquake occurred on the 1927
earthquake occurred on the 1927 earthquake. I
believe that it did. One of the reasons that I feel it did
not occur on the Hosgri Fault is that the value area of the
1927 earthquake, if one assumes it occurred on the Hosgri
Fault, is about one-fourth of the value area of the 1927
on the basis of Dr. Richards's correlation for the 1927
earthquake.

Because the reported areas, fault areas of earth-
quakes in Coffman and Van Hake in 1971, which is the standard
reference, do not include the areas offshore or in the area
of Mexico, those values have to be corrected to make the
correlation. And it's important to point that out, because



82-0-0



remembers these things are listed in all the papers I
saw in the fault area: further evidence of the earthquake

In fact, the only way we can get the correct
felt area is to assume that the epicenter occurred four miles
to sea, nearly as far as Myring's 1931 epicenter.

The other points I mentioned in the map have to
do with fault has a nearly total absence of small earthquakes
and recent years. Most of the earthquakes that were reported
were attributed to that general zone or to the west, and
that was the purpose of publishing this map.

This map covers the area around the Virginia
area of 1931, and in this area of the Virginia fault zone
find any epicenters that could be associated with the
I think it was the case that the Virginia fault zone
was an active fault out there. And I'm not so sure that there
is an active fault out there now.

Following the discovery of the Virginia fault
some small earthquakes have been reported by Hillman and by
Lawthrop. From the USGS data list there are two of magnitude
about 4.5 that might be described as the Virginia fault.
I know from Richter's relationship that for each succeeding
whole number smaller magnitude there are eight times as many
earthquakes. Consequently we can make some kind of estimate
of the number of earthquakes that should have been seen out
there.

1933/4/30

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PL 04



IN THE MATTER OF

Q Mr. Hoffman, I noted that at the beginning of your testimony to me as I was sitting at the table, you said that you had been in the office of the defendant on the day of the murder, and that you had seen the defendant on that day. Is that correct?

A Yes, that is correct.

Q Now, you said that you saw the defendant on that day. How long after the murder did you see him?

A Several months later.

Q Was it a considerable time after the murder?

A Yes, it was.

Q Now, you said that you saw the defendant on that day. How long after the murder did you see him?

A Yes, there was.

Q Now, you mentioned that you saw the defendant on that day. How long after the murder did you see him?

A Yes, there was.

Q Now, you mentioned that you saw the defendant on that day. How long after the murder did you see him?

A Yes, there was.

NRS. BOWERS: Will you please state the date of that point. It was suggested at the time of the trial.

BY NRS. BOWERS:

Q Let me ask you that question, Mr. Hoffman.

A Yes, that is correct.



12/1/44



12/1/44



I listened to your summary of the... as a non-seismologist, it is... important to take care...

This difference in... working in that situation and, as a... I agree to...

Well I know that... was kind of surprised... I thought you were going to end...

Well... for the Diablo Canyon... appears to be considerably... .75g as a design spectral anchor...

Well, what do you think would be appropriate?

Well, judging from the... appears that...



7-1-1952



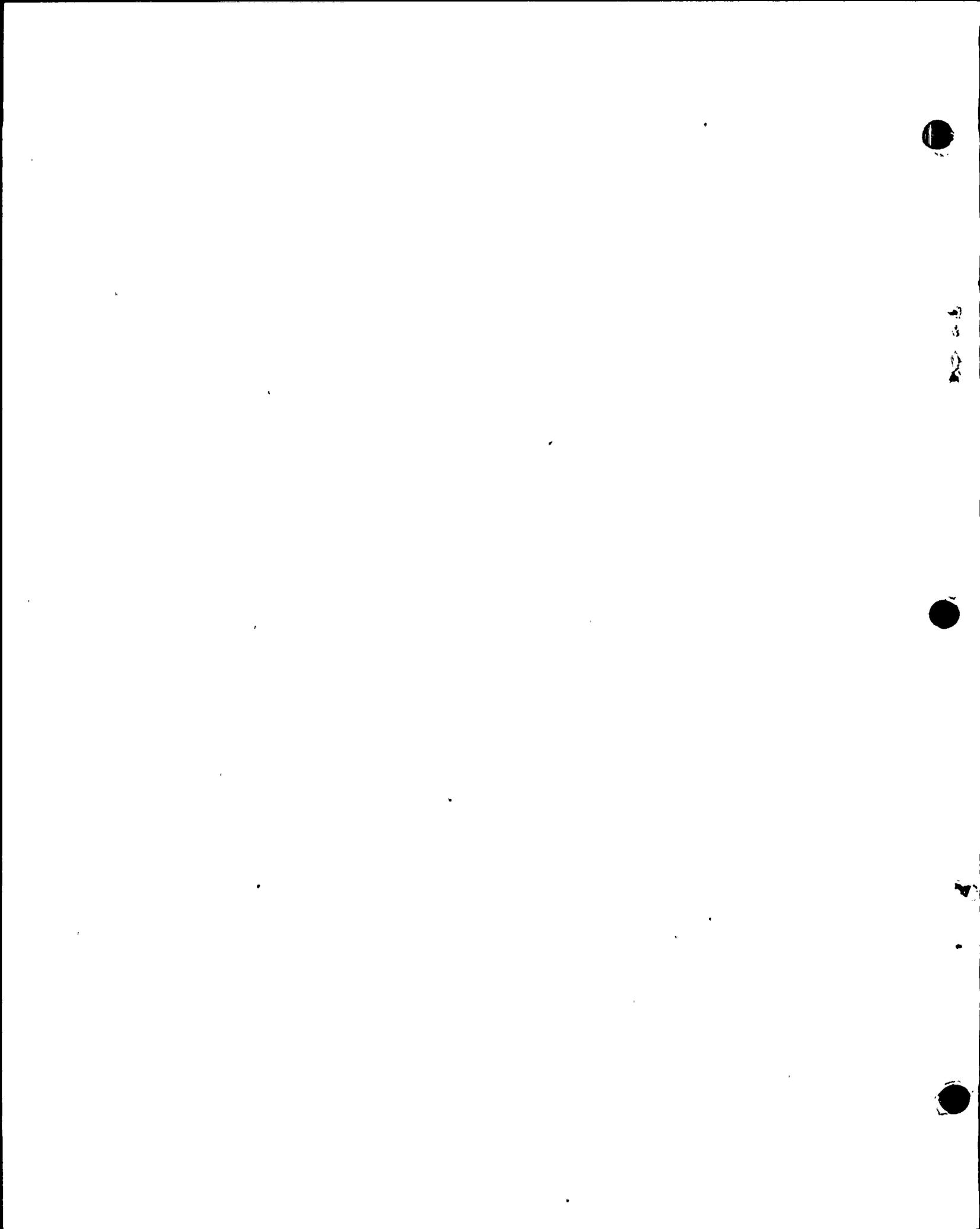
... in the area, and have no ...
eastern United States, and we look a little or second standard
... as he is as it can ...
... of the application ...

I believe ...
is an honest attempt to ...
...
... I do not believe ...

Yes, I would say ...
... of the application ...
... the relationship ...
... conclusion is, except ...

...
... because of ...
... testimony it seemed so ...
... value. And yet the bottom line was ...

A The bottom line is that ...
... One would indeed be ...
... value ...



disagree?

THE WITNESS: Yes, sir.

Q. Now, would you say that the assignment of the 1917

7.3 earthquake to the Meguid is equally unreasonable?

THE WITNESS: Yes, sir.

Q. Now, you said that the assignment of the 1917

7.3 earthquake to the Meguid is equally unreasonable.

THE WITNESS: Yes, sir.

Q. Now, would you say that the assignment of the 1917

7.3 earthquake to the Meguid is equally unreasonable?

THE WITNESS: Yes, sir.

Q. Now, would you say that the assignment of the 1917

7.3 earthquake to the Meguid is equally unreasonable?

THE WITNESS: Yes, sir.

Q. Now, would you say that the assignment of the 1917

7.3 earthquake to the Meguid is equally unreasonable?

THE WITNESS: Yes, sir.

Q. Likewise, you think the assignment of the 1917

7.3 earthquake to the Meguid is equally unreasonable?

THE WITNESS: Yes, sir.

Q. All right.

THE WITNESS: Yes, sir.



100-100





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2 MRS. BOWEN: Well, you're talking about
3 the late thoughts. So why don't you go ahead.

4 MR. WOOD: Yes, I'm going to do that.

5

6

7 Q Mr. Hoffman, if you're talking about
8 conservation activities which are of the order
9 of millions of dollars, are you talking about
10 sums of magnitude?

11 A In my opinion, if you're talking about
12 conservation activities, I think you're talking
13 about sums of magnitude which are of the order
14 of millions of dollars. I think you're talking
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100 of millions of dollars. I think you're talking

MR. WOOD: Thank you.

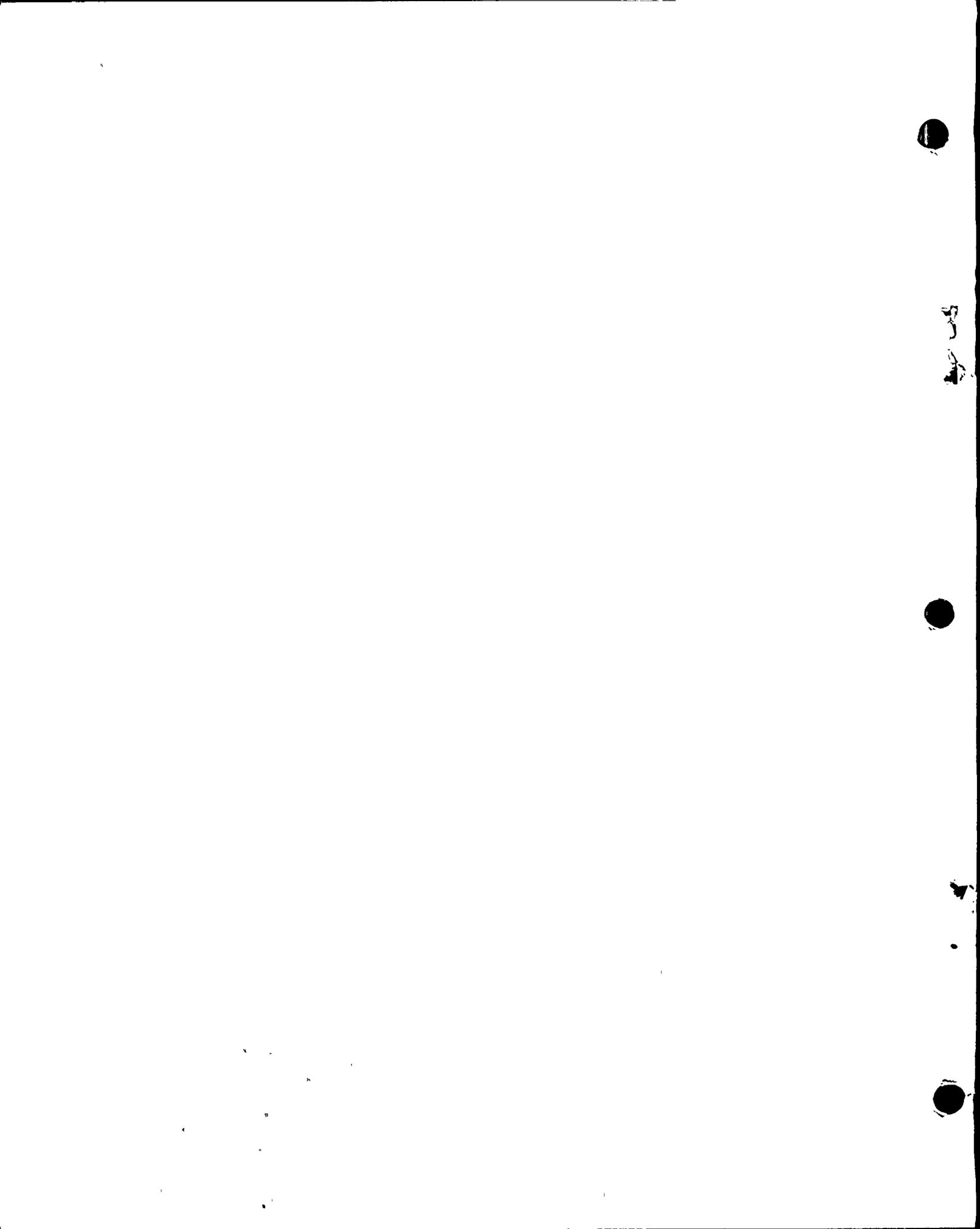
MR. HOFFMAN: I'm going to do that.

MRS. BOWEN: Yes.

REDIRECT EXAMINATION

BY MR. HOFFMAN:

Q Mr. Hoffman, you stated in your professional
qualifications that you worked for some time in California.
Now how did you come out here?



4 Enriches the California law, for instance, with

5 A Yes.

6 Q So as to make the Agency, the Board, and the
7 questions about the relative positions of the Agency and
8 and the Board, and the relative positions of the
9 in accordance with the law, and the relative positions
10 the Staff's position, is it correct to say that
11 the one that you reports is more in line with

12 A It is more in line with the law, and the
13 the relative positions of the Agency and the Board.

14 Q And I really didn't see the point, but you
15 while ago, and I don't know if you are

16 When I made the report, and he didn't have any-
17 thing to do with this, because the thing that I was writing
18 about was, there was a lawyer problem, and I was talking
19 about the conflict between you and Dr. Stapp, and what the
20 manifestations of that problem, and what the consequences

21 A I don't know, really. The conflict between a psycho-
22 gist or sociologist to make that judgment. It is not within
23 my scope. I don't know. Certainly there is a problem.

24 Q But, in any event, I think one of the concerns
25 of the Board might have been that you didn't file a disciplinary
26 opinion, and that you were, in fact, in violation of the



10/10/10



I requested a transfer, and that when a transfer was granted I was told that I had to go to the office of the company and get my ID request in writing.

A I requested a transfer, and that when a transfer was granted I was told that I had to go to the office of the company and get my ID request in writing.

MR. TOWNMAN: ...
MRS. BOWERS: ...
MR. TOWNMAN: ...

(Witness excuses.)

MRS. BOWERS: ...

MR. TOWNMAN: ...

As it would please the Board, if my husband had to call into a conference call in the morning at 9:30 a.m., and we will continue as a ...

MRS. BOWERS: Well, ... doesn't go on and on and on, we'll plan to ...

MR. TOWNMAN: We'll present Dr. Townman's tomorrow morning.

MRS. BOWERS: Fine. Well, we'll hope to ...

