

NUCLEAR REGULATORY COMMISSION

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016 Phil

IN THE MATTER OF:

PACIFIC GAS & ELECTRIC COMPANY

(Diablo Canyon Units 1 and 2)

Docket Nos. 50-275  
50-323

Place -

Date -

Avila Beach, California

22 December 1978

Pages

6863 - 6949

Telephone:  
(202) 347-3700

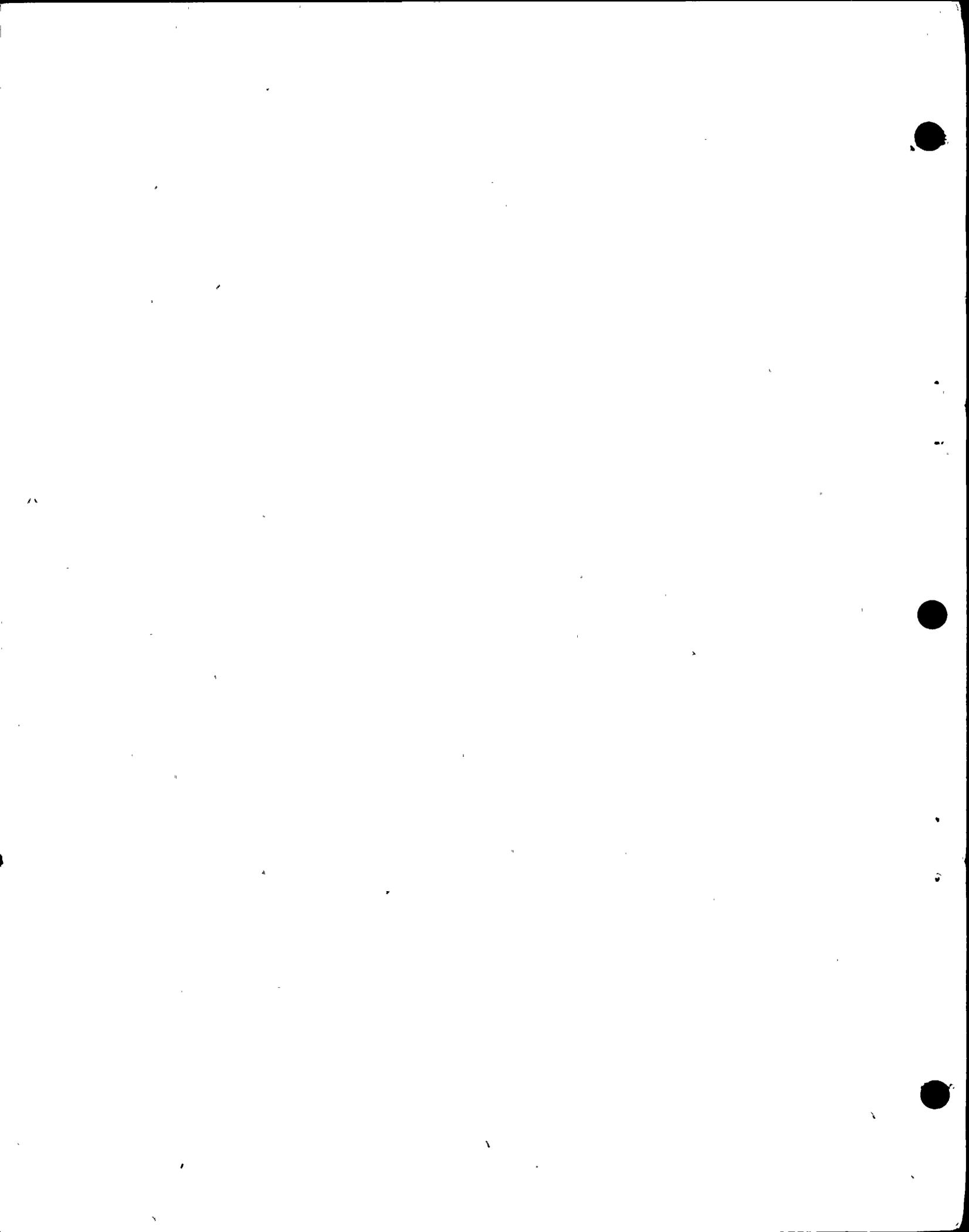
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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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In the matter of:

PACIFIC GAS & ELECTRIC COMPANY

(Diablo Canyon Units 1 and 2)

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Docket Nos. 59-275  
50-323

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

Friday, December 22, 1978.

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

BEFORE:

ELIZABETH BOWERS, Esq., Chairman,  
Atomic Safety and Licensing Board.

DR. WILLIAM E. MARTIN, Member.

GLENN O. BRIGHT, Member.

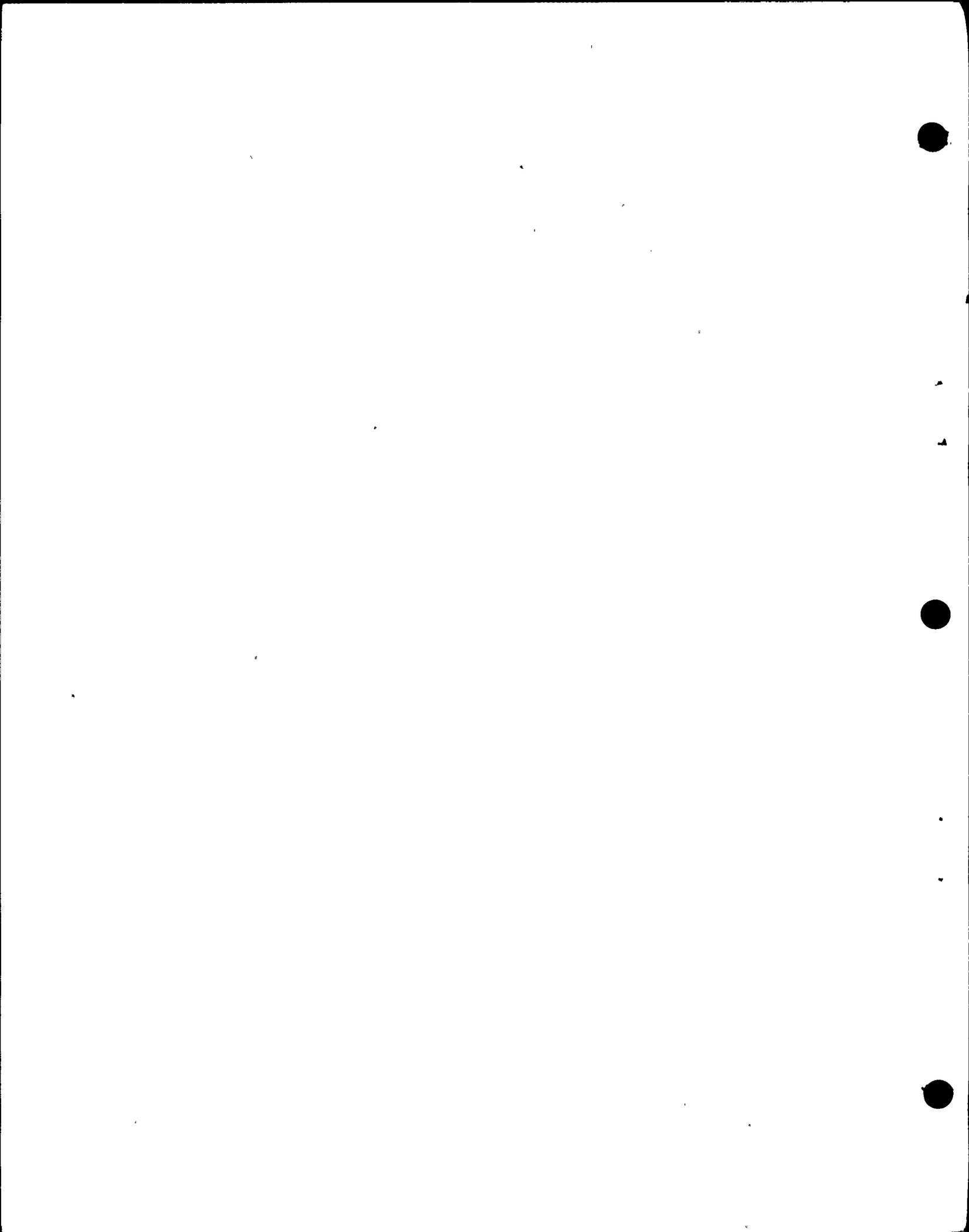
APPEARANCES:

On behalf of Applicant, Pacific Gas & Electric Company:

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

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

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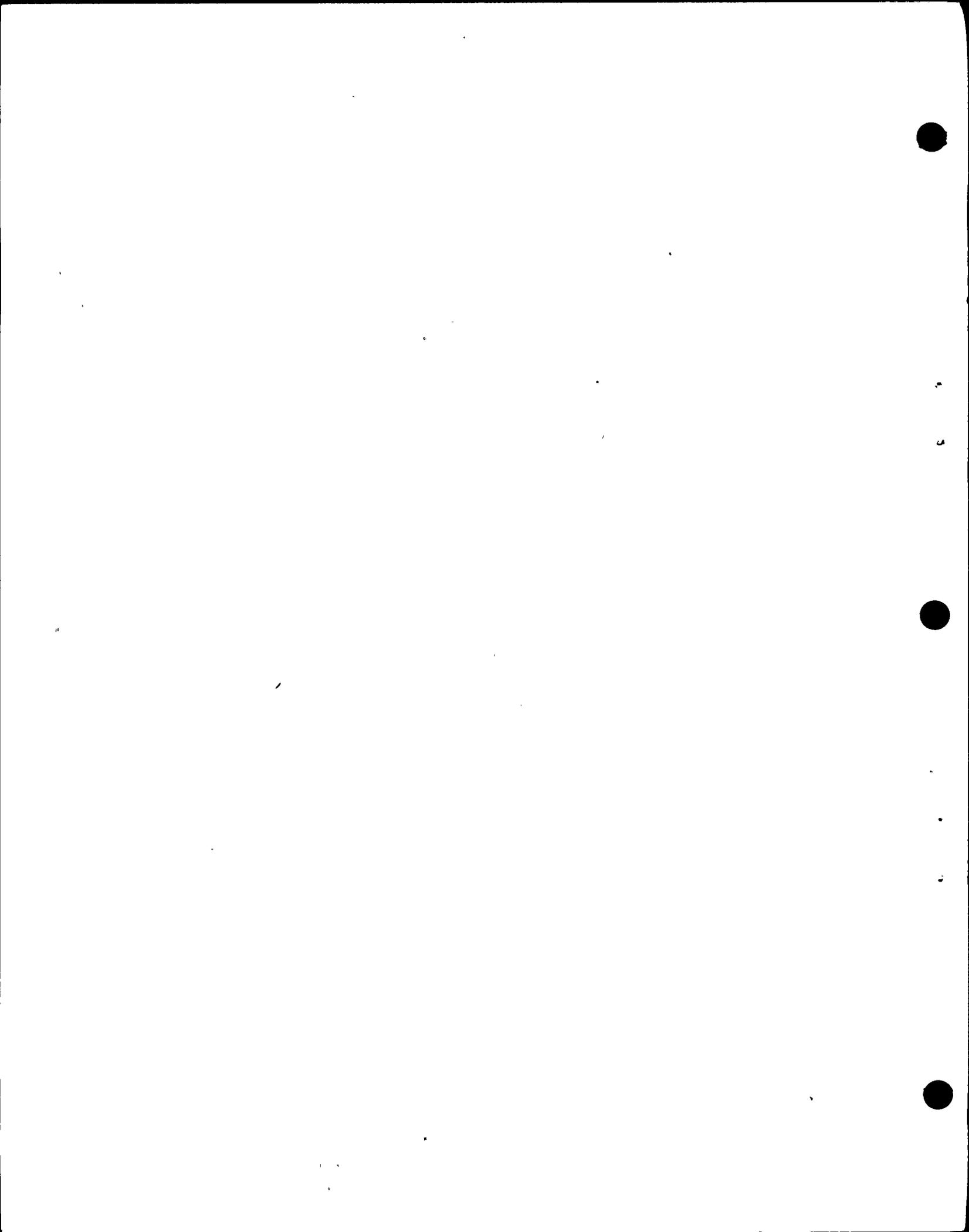
On behalf of the Joint Intervenors:

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

STEPHEN KRISTOVICH, Esq., Center for Law in  
the Public Interest, 13203 Santa Monica Blvd.,  
Los Angeles, California 90067.

On behalf of the Regulatory Staff:

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



12/22/78

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C O N T E N T S

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| <u>Witnesses</u> | <u>Direct</u> | <u>Cross</u> |
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| John B. Hoch | 6866 | 6880 |
|--------------|------|------|

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|                 |      |      |
|-----------------|------|------|
| Vincent J. Ghio | 6930 | 6943 |
|-----------------|------|------|

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| <u>Exhibits</u> | <u>IDEN.</u> | <u>EVI.</u> |
|-----------------|--------------|-------------|
|-----------------|--------------|-------------|

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|--|------|------|
| App. A Operating License Application and<br>Amendments thereto | 6926 | 6926 |
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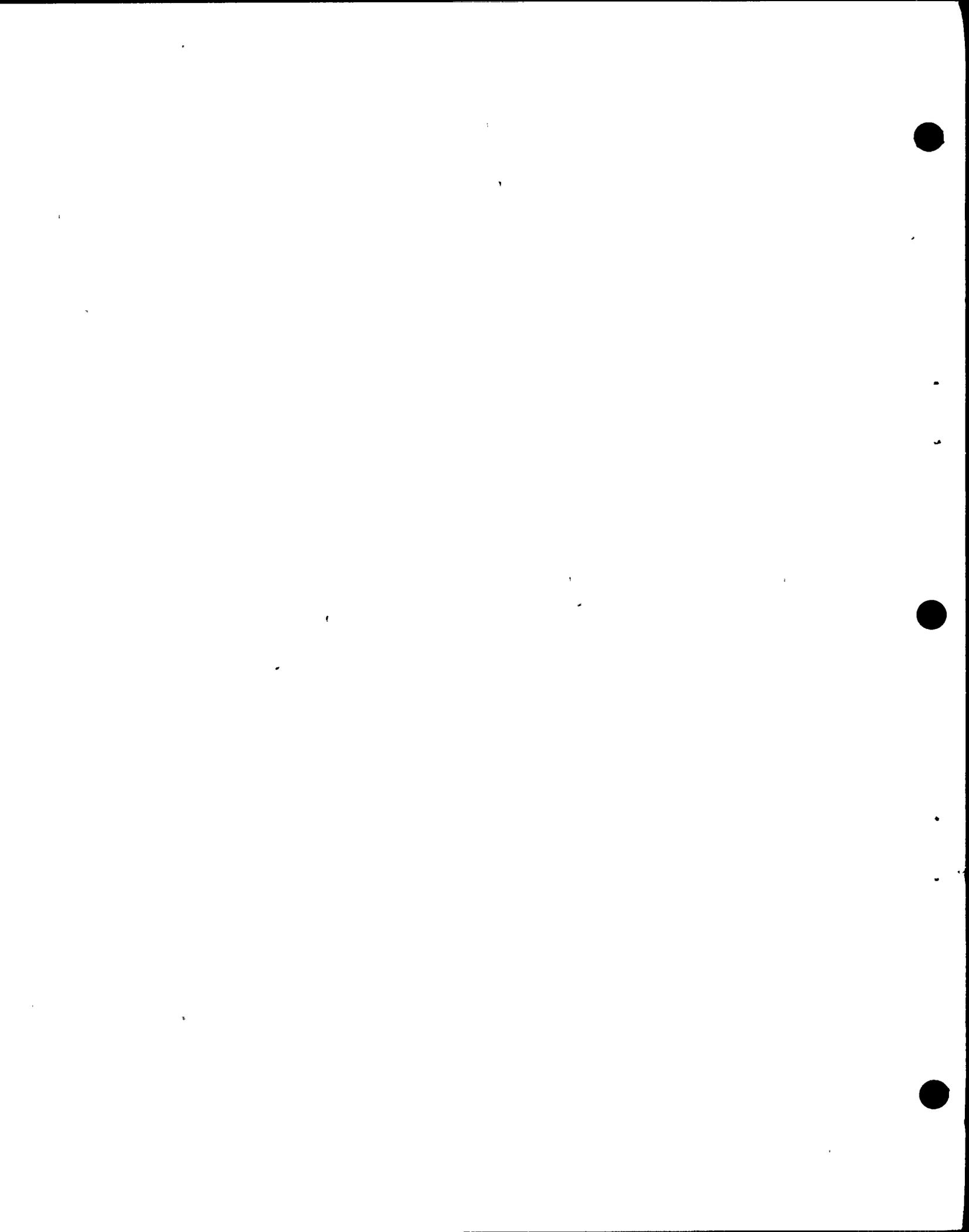
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P R O C E E D I N G S

MRS. BOWERS: We would like to begin.

Mr. Fleischker is not going to be here, do I understand? He did want to wish everybody a Merry Christmas.

Whereupon,

JOHN B. HOCH

was called as a witness on behalf of the Applicant and, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. NORTON:

Q Mr. Hoch, do you have in front of you a copy of your professional qualifications?

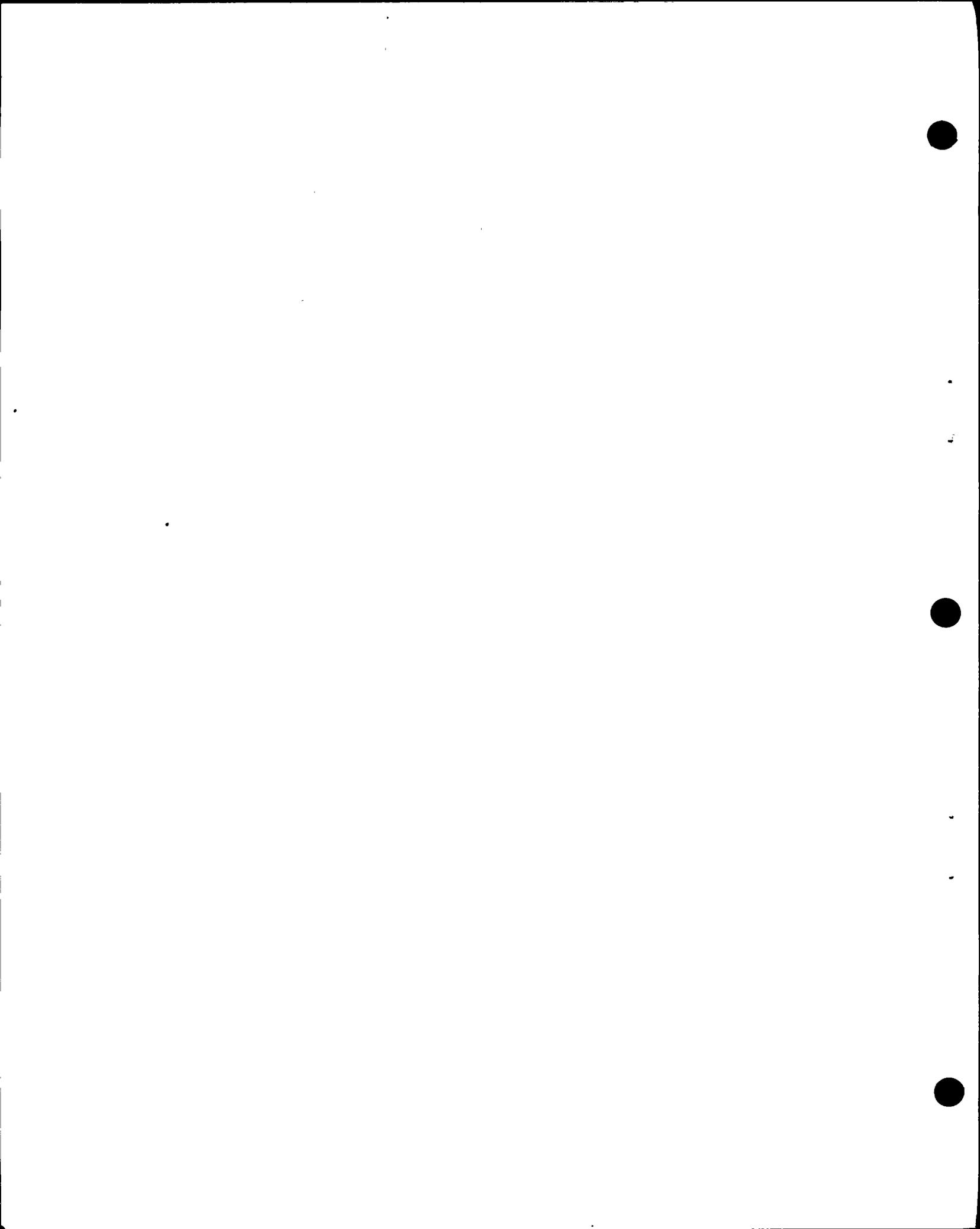
A Yes, I do.

Q And are they a true and correct copy of those qualifications which were filed as an exhibit in this matter?

A Yes.

Q Could you briefly summarize your professional qualifications and experience that have led you to be here today?

A Yes. I've been with Pacific Gas and Electric Company off and on let's say since 1958. I have experience with the company in the areas of power plant operation, start-up, and the design of fossil fuel and nuclear power plants over that period of years, going from engineering design work to supervision of that work, and finally to my present position



eb2 1 which I've had since January of 1977 as Project Engineer for  
2 Diablo Canyon, with responsibility for directing the engineer-  
3 ing activities of the project.

4 Q Mr. Hoch, do you have a copy of the testimony  
5 that has been prepared in this matter?

6 A Yes, I have.

7 Q All right.

8 Do you have any corrections to make to that testi-  
9 mony?

10 A Yes, I have several.

11 Q All right.

12 Could you set them forth at this time, please?

13 A On page 7 at line 5, the word "six" in that line  
14 was correct at the time the testimony was written. It now  
15 should read "seven." The Seismic Evaluation report is now a  
16 seven-volume report.

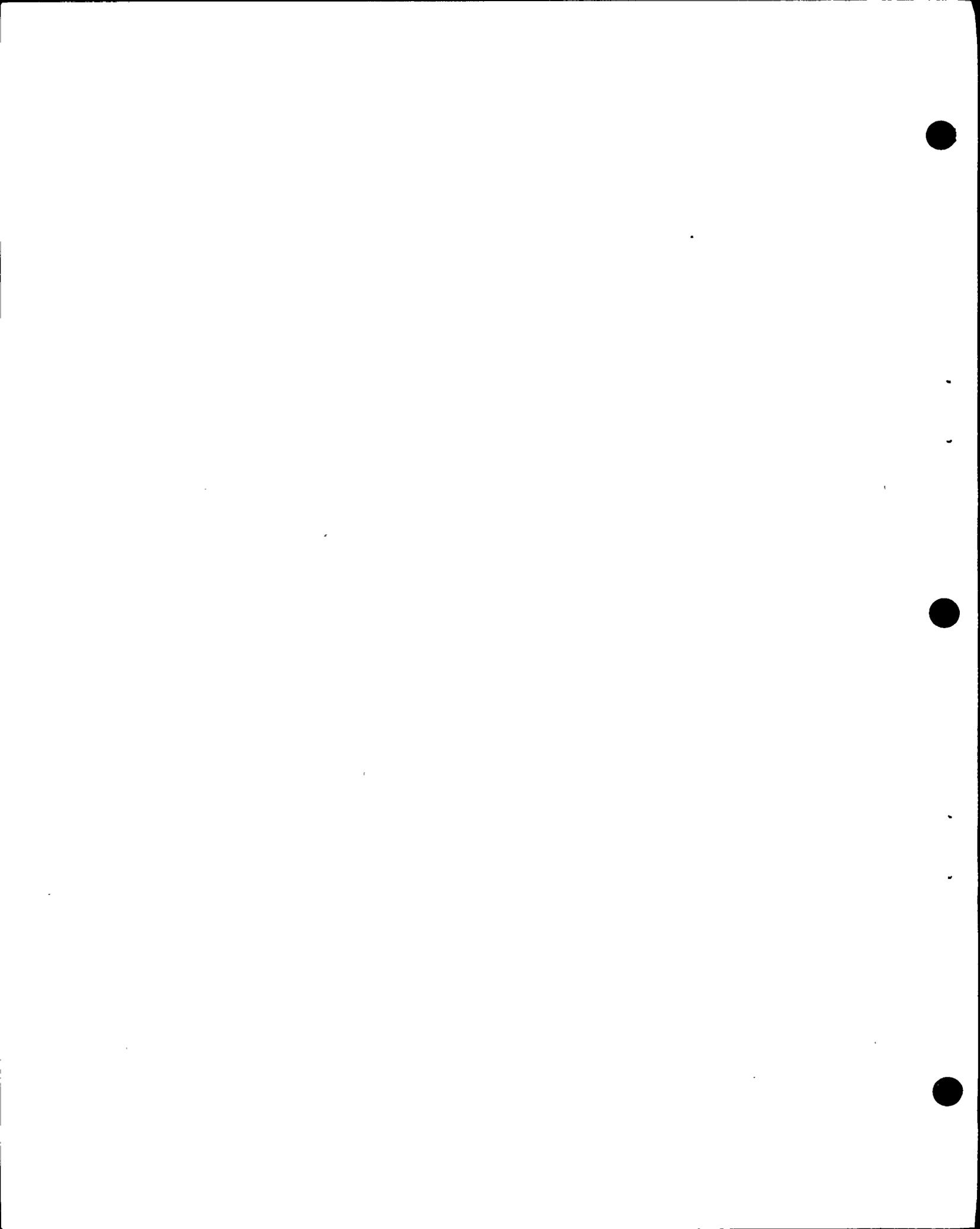
17 MPS. BOWERS: I'm sorry, we were talking about  
18 other things. What page, please?

19 THE WITNESS: Page 7 of the written testimony,  
20 line 5. The word "six" should be changed to "seven," so it  
21 reads "....now consisting of seven volumes...."

22 BY MR. NORTON:

23 Q Do you want to move on to the next one?

24 A At line 25 of that same page -- well, let's call  
25 it 25-1/2 I guess, the written testimony says "Lawson



eb3

1 Associates." It should read "Harding-Lawson Associates,"  
2 H-a-r-d-i-n-g-Lawson Associates.

3 On page 8 of the written testimony at line -- let's  
4 call it 3-1/2 since this is single spaced, the name of  
5 Dr. Gerald Frazier was inadvertently omitted from the list.

6 On page 14, at line 15, there's a typographical  
7 error. That line should read:

8 "....classified meet the intent of  
9 Safety Guide 29,"  
10 rather than 19.

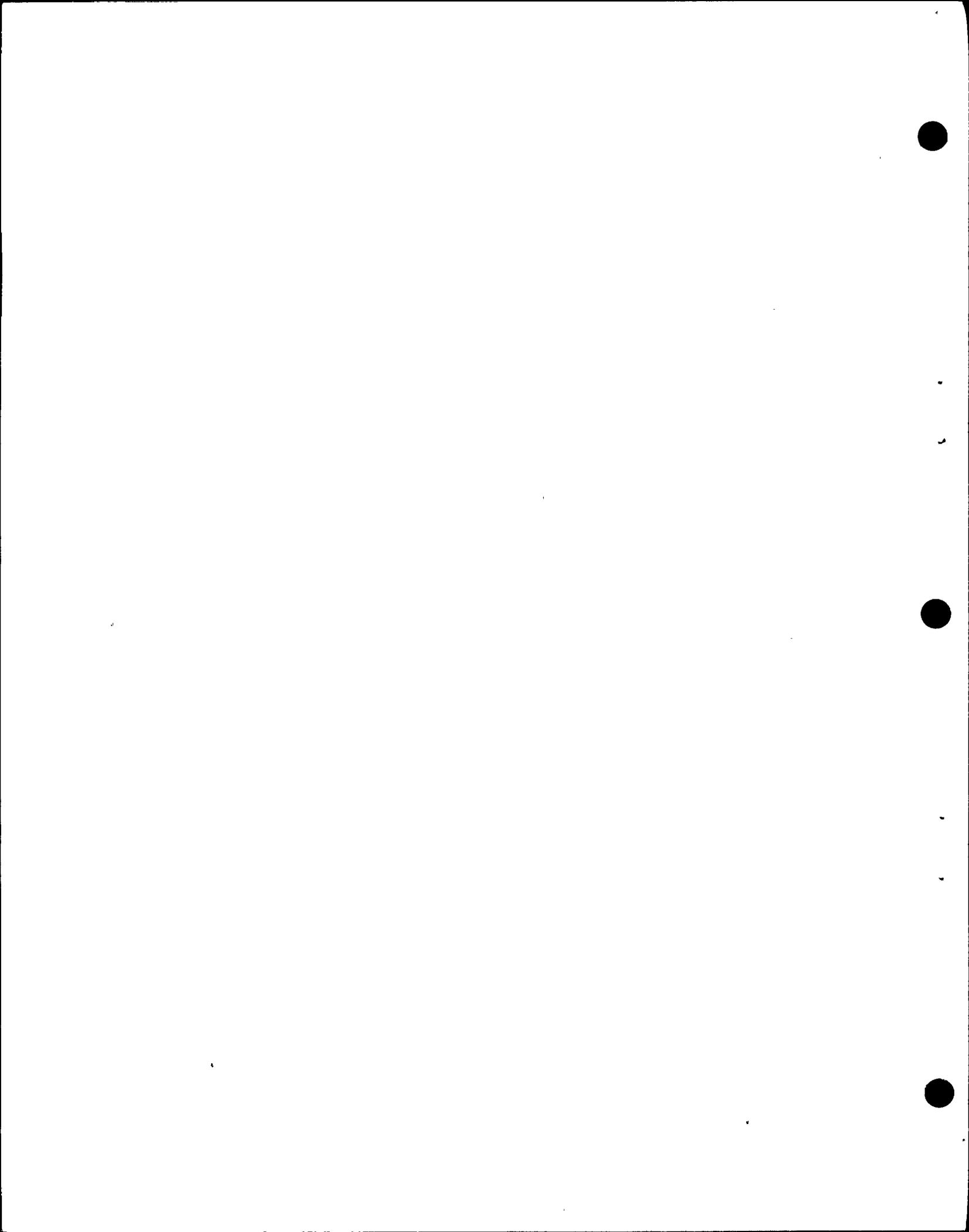
11 Those are the only corrections I have.

12 Q Mr. Hoch, would you briefly summarize your testi-  
13 mony at this time?

14 A Yes, I'll do that very briefly.

15 The witnesses and panels we've had over the last  
16 three weeks have discussed the subjects of geology, seismology,  
17 those things leading to development of the seismic inputs  
18 for the design of Diablo Canyon and the seismic inputs for  
19 use in the Hosgri evaluation of Diablo Canyon.

20 My testimony is directed toward the seismic design  
21 of the units themselves, that is, the capability of the plant  
22 to accommodate the seismic inputs, both those associated  
23 with the original design basis seismic events which we've  
24 referred to during these hearings as the design earthquake  
25 and the double-design earthquake, and with the postulated



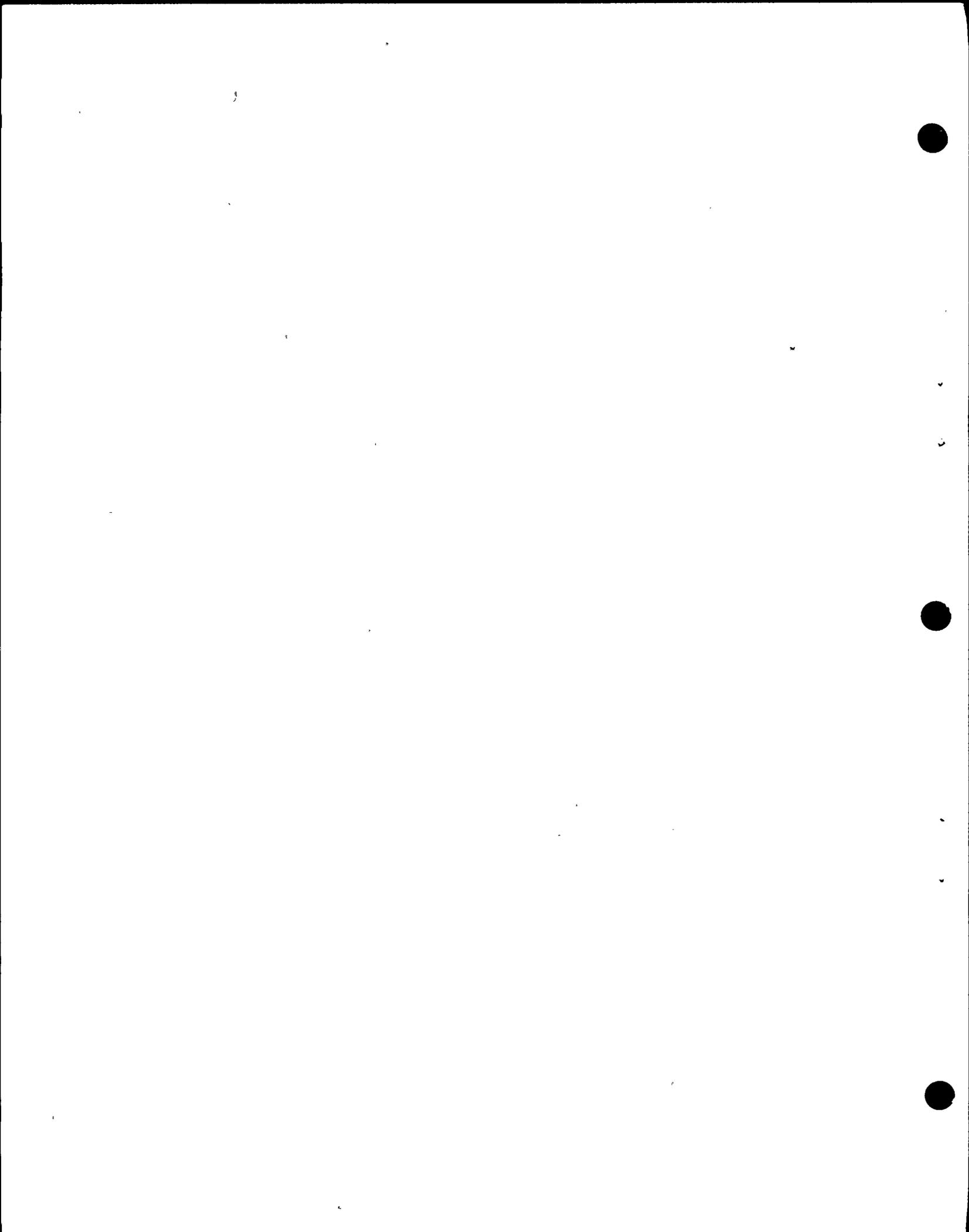
eb4

1 Hosgri seismic event.

2 My testimony gives some historical background  
3 concerning the original seismic design basis for the plant,  
4 the manner in which the seismic design basis was approved  
5 and used in connection with issuance of construction permits  
6 for the plant. It describes in some detail the fact that  
7 during the course of design and construction of the plant,  
8 there were some changes in NRC rules and regulations and in  
9 the guidance provided by the Nuclear Regulatory Commission  
10 in its Regulatory Guides which were formerly called Safety  
11 Guides. And I have discussed how those changes in the regula-  
12 tions and regulatory guidance were incorporated into the  
13 design of the plant during the period of construction.

14 I continue in the written testimony with describ-  
15 ing the historical background, the sequence of events  
16 beginning with the tendering of the company's operating license  
17 application in July of 1973, continuing with the Staff's  
18 evaluation of the adequacy of the original seismic design  
19 basis for Diablo Canyon, their conclusions as published in  
20 the original Safety Evaluation for Diablo Canyon published  
21 in October of 1974.

22 Then my testimony continues with a description  
23 of the events which were described in more detail in  
24 Mr. Bettinger's testimony leading to the Regulatory Staff's  
25 requirement that the plant's capability be evaluated for an



eb5

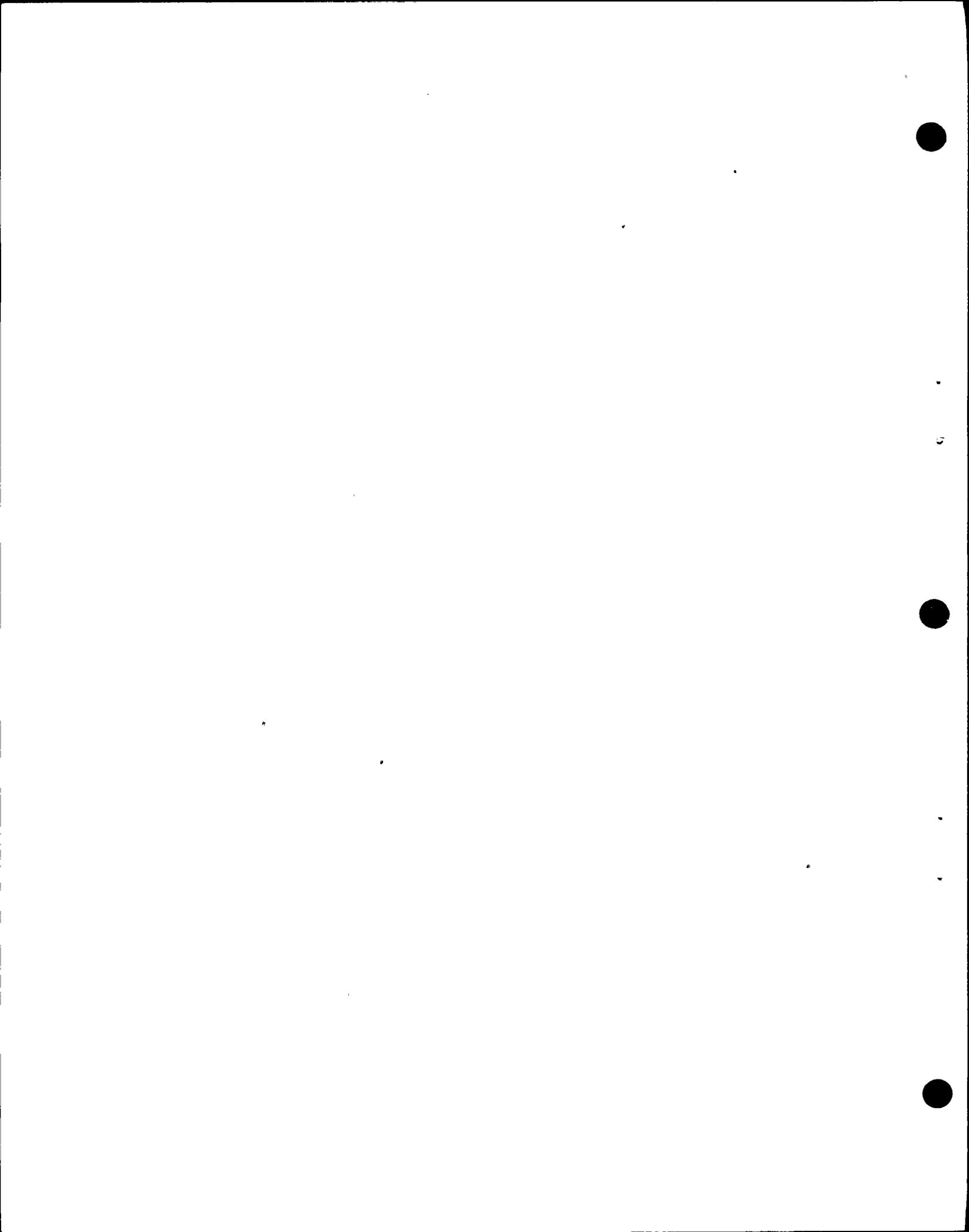
1 assumed magnitude 7.5 earthquake on the Hosgri Fault in addi-  
2 tion to those earthquakes which had previously been considered  
3 in the original seismic design basis for the plant.

4 My testimony continues with a description of some  
5 of the steps which were necessary in order to perform the  
6 seismic evaluation -- what we've called here the Hosgri  
7 seismic evaluation, relating that before proceeding with that  
8 evaluation it was necessary to develop not only the response  
9 spectra which have been discussed by previous witnesses and  
10 previous panels but also detailed criteria for use in the  
11 evaluation.

12 This detailed criteria was developed by PG&E and  
13 its consultants and also by the Regulatory Staff, and the  
14 first portion of the criteria was finalized and the evaluation  
15 I guess we can say formally began in February of 1977.

16 In discussing the Hosgri seismic evaluation I've  
17 referred to the report on the Hosgri seismic evaluation, the  
18 seven-volume report which we've been using extensively during  
19 these proceedings. My written testimony makes a statement  
20 which I firmly believe, that the Hosgri seismic evaluation is,  
21 to the best of my knowledge, the most complete and comprehen-  
22 sive study ever made of the seismic capability of a nuclear  
23 power plant.

24 After relating some of the consultants, some of  
25 the firms and individuals which PG&E has employed in the



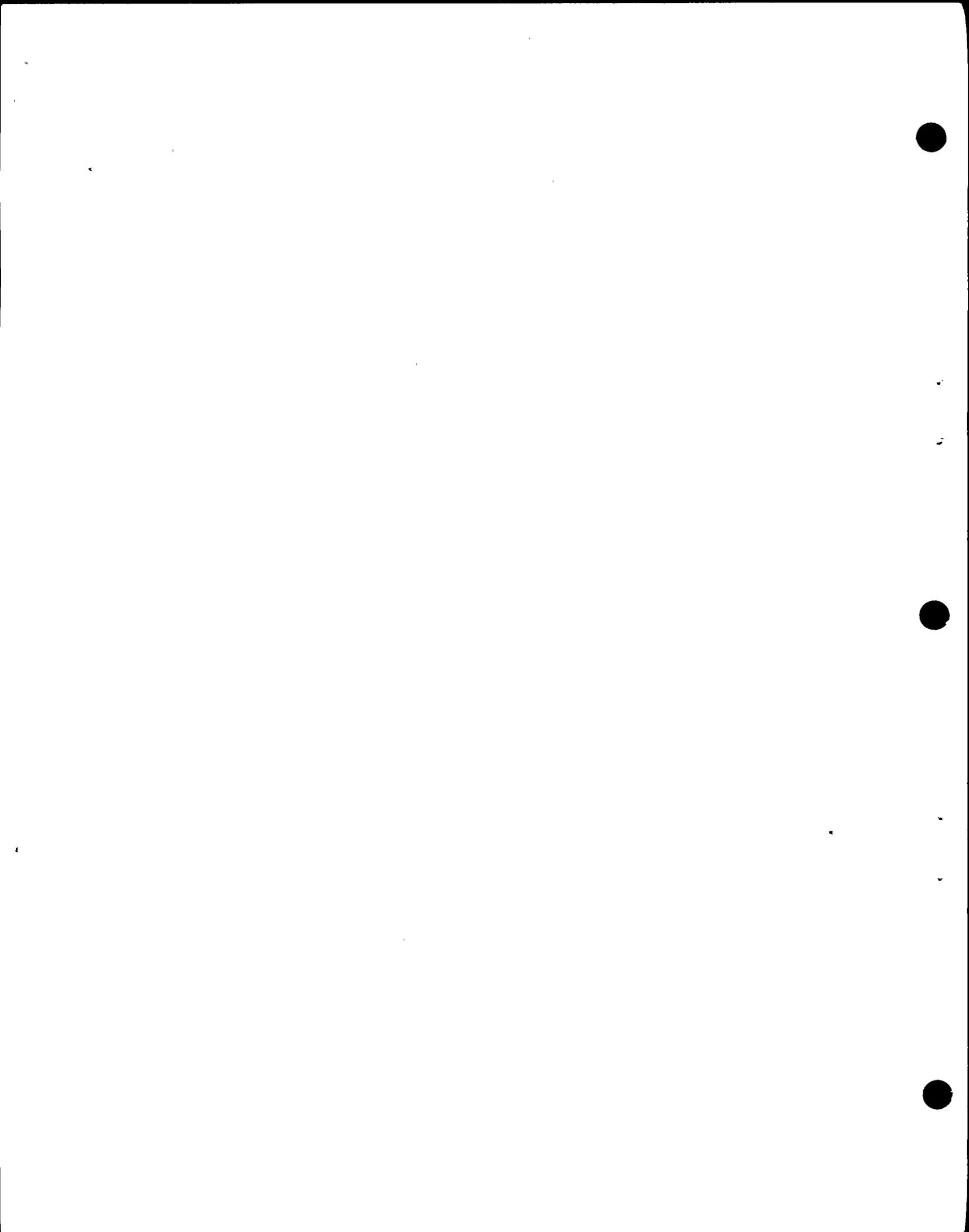
eb6

1 Hosgri seismic evaluation, many of these or some of these  
2 at least also discussed in Mr. Bettinger's previous testi-  
3 mony, my written testimony proceeds to address in some de-  
4 tail each of Intervenor's contentions, and the numbering here  
5 of these contentions is taken from Mr. Tourtellotte's --  
6 excuse me, from Mr. Davis' letter to the Board dated April  
7 24th, 1978.

8 My testimony addresses in some detail each of the  
9 contentions, II-A-4, II-A-5, II-A-6, and II-A-7. So I would  
10 like to very briefly state the subject of each of those  
11 contentions and what my conclusion is in the written testimony.

12 Intervenor's Contention II-A-4 is directed toward  
13 the operating basis earthquake and after discussing the  
14 operating basis earthquake, PG&E's submittal to the Staff of  
15 information relating to the probability of the operating  
16 basis earthquake and the acceptability of the original design  
17 earthquake for the plant as the operating basis earthquake,  
18 I have concluded in my written testimony that the use of an  
19 operating basis earthquake of .2g, that is, the original  
20 design earthquake for the plant at Diablo Canyon, does not  
21 create an undue risk to the public health and safety, and  
22 that it fully complies with the over-all intent of 10 CFR  
23 Part 100, Appendix A.

24 Intervenor's Contention II-A-5 is essentially a  
25 rewording of some of the language from 10 CFR Part 100,



eb7

1 Appendix A, and is addressed to whether the Applicant --  
2 whether we have adequately demonstrated compliance with the  
3 regulations for the safe shutdown earthquake.

4 The safe shutdown earthquake of course, as deter-  
5 mined by the Regulatory Staff, the Staff has concluded that  
6 the postulated Hosgri seismic event is indeed the safe shut-  
7 down earthquake for the plant as required by the regulations.  
8 And so my testimony is addressed to what extent the Applicant  
9 has demonstrated compliance with the regulations for the  
10 Hosgri seismic event and cites certain conclusions by the  
11 Regulatory Staff in its Safety Evaluation Reports and by the  
12 Advisory Committee on Reactor Safeguards.

13 And I have concluded in my written testimony that  
14 as Project Engineer for Diablo Canyon, I reviewed those  
15 structures, systems and components considered in the Hosgri  
16 seismic evaluation and I've concluded that all the items  
17 required to meet applicable NRC regulations have been in-  
18 cluded in that evaluation, and that the information we sub-  
19 mitted in support of our application has adequately demon-  
20 strated the seismic qualification of those structures, systems,  
21 and components.

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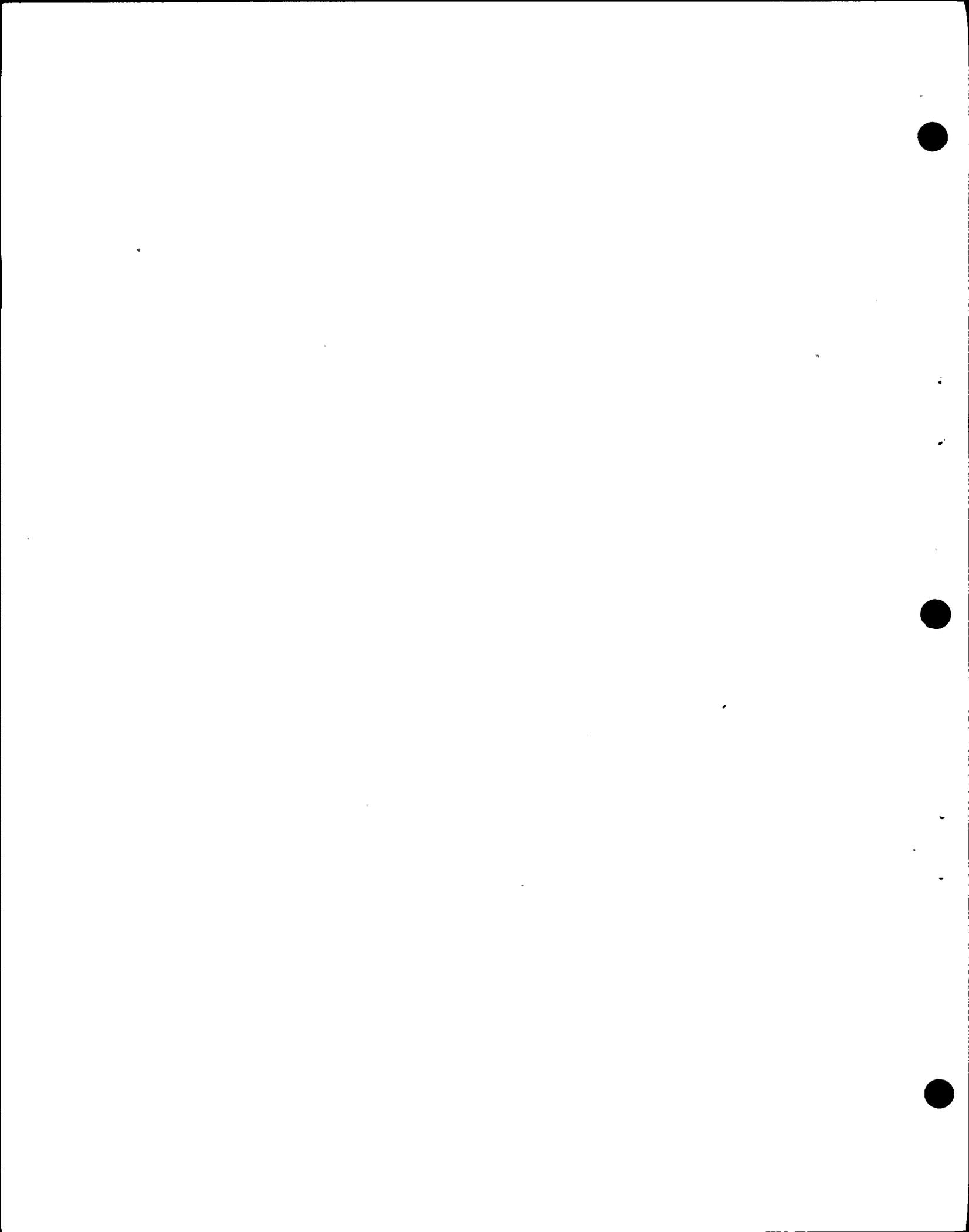
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1B wbl 1 Intervenor's contention II-A(6) is related to  
2 the applicant's demonstration that structures, systems and  
3 components required to remain functional for the operating  
4 basis earthquake, that that demonstration has been adequately  
5 made, that they will indeed remain functional. And in my  
6 written testimony I address the demonstrations that the  
7 applicant has made, the conclusions of the Regulatory Staff  
8 and Safety Evaluation Reports, and the conclusions of the  
9 Advisory Committee on Reactor Safeguards.

10 I conclude in the written testimony that, as  
11 Project Engineer for Diablo Canyon, I've reviewed the work  
12 done incorporating the original seismic design basis for the  
13 plant in the Diablo Canyon design, and that the seismic  
14 design basis included the design earthquake which is the  
15 operating basis for the plant and, consequently that we have  
16 adequately demonstrated compliance with the applicable NRC  
17 rules and regulations.

18 The final contention addressed in my testimony,  
19 that is, Intervenor's Contention II-A(7) is concerned with  
20 whether the applicant has demonstrated adequately that the  
21 necessary safety functions would be maintained for the safe  
22 shutdown earthquake where, in safety related structures,  
23 systems and components, the design for strain limits is in  
24 excess of the yield point. And later, much more detailed  
25 testimony will discuss those areas, those places in the Diablo



wb2

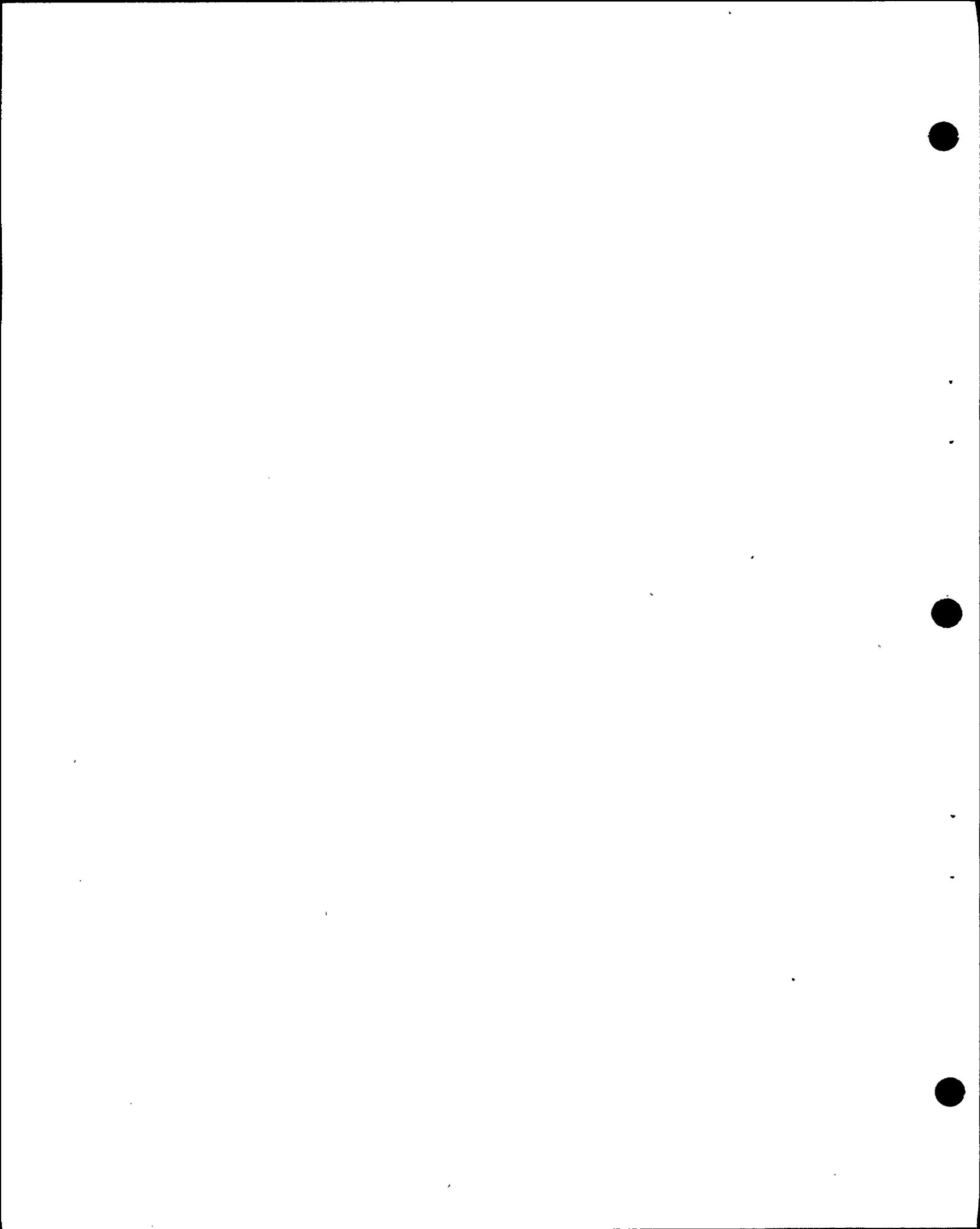
1 Canyon plant where the evaluation has determined that there  
2 are indeed stresses or strains in excess of yield.

3 I've discussed that matter very briefly in my  
4 testimony, and let me take just a little bit of time with  
5 that, if I could.

6 There are only a very limited number of locations  
7 in Diablo Canyon structures where the results of the Hosgri  
8 seismic evaluation do indeed indicate stresses beyond the  
9 yield point of the material. This has been discussed in some  
10 detail in prior testimony and will be discussed in my more  
11 detail in subsequent testimony.

12 For components at Diablo Canyon the important  
13 criteria for -- in relation to the safe shutdown earthquake  
14 is indeed functionality rather than level of stress or  
15 strain, and, indeed, for the Hosgri seismic evaluation where  
16 components were qualified by test, functionality was demon-  
17 strated during the tests. So, in relation to the subject of  
18 stresses or strains beyond yield, that consideration really  
19 isn't relevant to the subject of functionality.

20 For equipment that was qualified in the evaluation  
21 by analysis which had to perform some function by moving,  
22 by opening and closing, by pumping fluids or by otherwise  
23 performing an active safety function, specific special criteria  
24 were used to assure that any deformations which might take  
25 place as a result of seismic loadings, or as a result of



eb1

fls wb2

1 seismic loadings in combination with other operating loads  
2 would not prevent performance of the active safety function.

3 For certain Diablo Canyon components such as  
4 piping systems, the acceptance criteria employed for stresses  
5 and strains in the evaluation were drawn from recognized  
6 industry codes and standards. These codes and standards do  
7 indeed allow, in certain instances, one of these being --  
8 well, I'll use the term "faulted condition," and I can define  
9 that later if it is required -- do indeed use for a faulted  
10 condition -- that is, seismic levels corresponding to a safe  
11 shutdown earthquake -- do indeed allow stresses somewhat  
12 beyond the yield point of the material involved.

13 It has been demonstrated from long use of these  
14 codes, and the codes themselves in their formulation very  
15 carefully considered the appropriateness of allowing these  
16 stresses or strains to go beyond yield.

17 In my written testimony I conclude that wherever  
18 the Hosgri seismic evaluation has shown that stresses or  
19 strains beyond the yield point would be calculated for load-  
20 ing combinations related to the postulated Hosgri event --  
21 that is, the safe shutdown earthquake -- all necessary  
22 safety functions will be maintained and the plant complies with  
23 all applicable NRC rules and regulations, including that  
24 portion of Appendix A to 10 CFR Part 100 from which Inter-  
25 venors' contention was drawn.



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MR. NORTON: We have no further direct.

We would like to at this time incorporate Mr. Hoch's testimony as though read.

MRS. BOWERS: The qualifications are already in, but you are also going to put those in as if read? Is that right?

MR. NORTON: Yes.

MRS. BOWERS: And the testimony.

Mr. Kristovich?

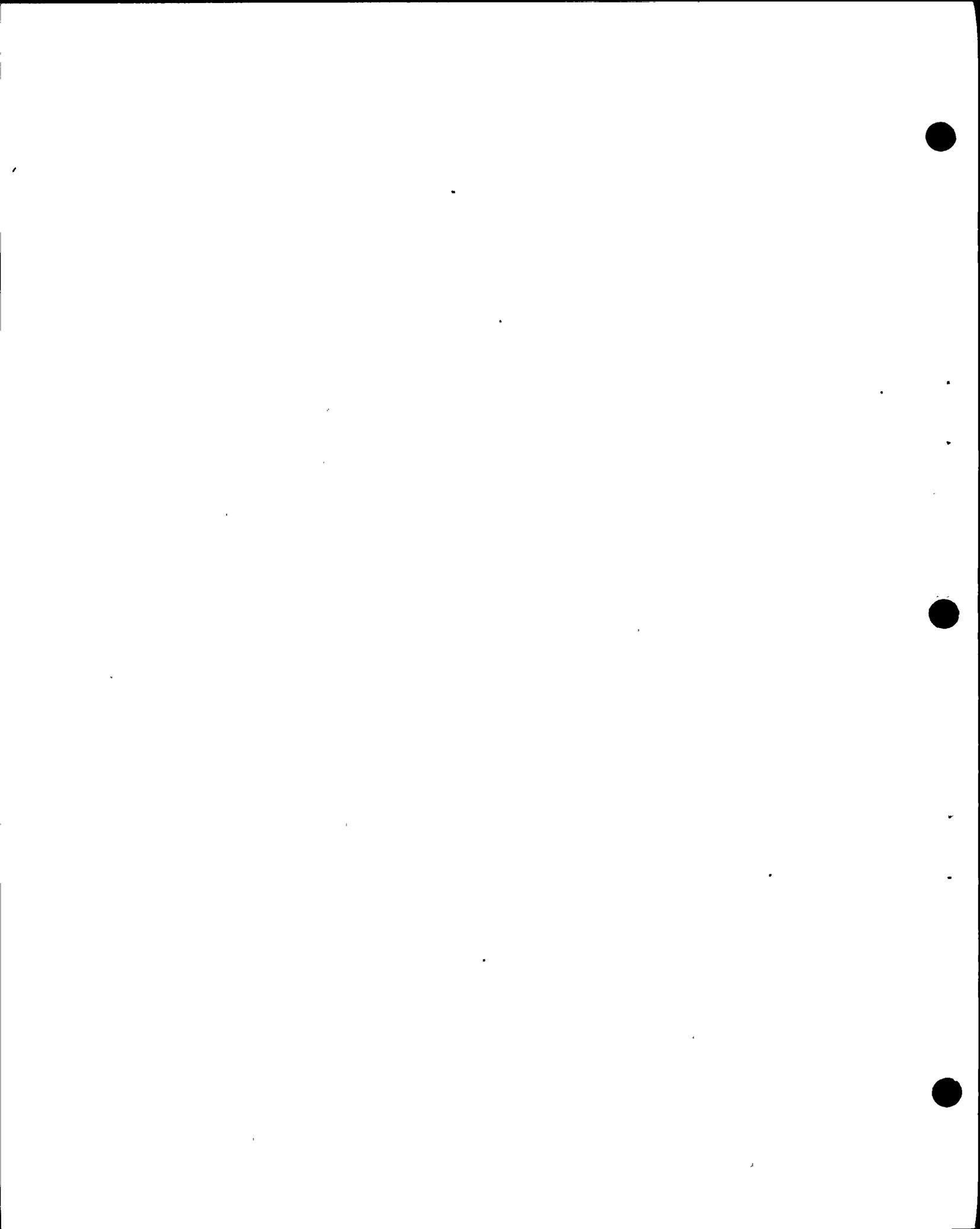
MR. KRISTOVICH: Mrs. Bowers, we would object and move that the testimony at page 8, line 2, through page 9, line 10, be struck on the ground that the --

MRS. BOWERS: Just a minute. Give us those references again, please.

MR. KRISTOVICH: Page 8, line 2, through page 9, line 10.

We move that that testimony be struck on the ground that practice and procedure digests of the Nuclear Regulatory Commission at Section 3.10.3 states, and I quote:

"Because the ACRS is not subject to cross-examination, the ACRS letter cannot be admitted for the truth of its contents, nor may it provide the basis for any findings where the proceeding in which it is offered is a contested one."



eb3

1 And it cites Arkansas Power and Light Company,  
2 ALAS-94.

3 MR. NORTON: This is in here in the historical  
4 section. Perhaps Mr. Kristovich's point is well-taken if  
5 indeed the letter were being offered as evidence of the truth  
6 of the matter stated therein. However, it's an historical--  
7 You know, this has been a long, long process and it is really  
8 to inform the Board as to how we got here.

9 I have no objection to a qualifier in the record  
10 that it indeed is not in for the truth of the matter stated  
11 therein, however, but I don't see any need to strike it. The  
12 ACRS letter is of course a part of the record in these pro-  
13 ceedings in its totality.

14 So, you know, the motion is well-taken if one  
15 were to assume this were for the truth of the matter stated  
16 therein but it was not; it's just historical background as  
17 to how we got here.

18 MRS. BOWERS: The Staff?

19 MR. TOURTELLOTTE: Well, with the understanding of  
20 that qualification, it seems it could remain there since the  
21 only purpose of striking it would be to make it clear in the  
22 record that this is not going to be relied upon for evidence.  
23 It certainly cannot be relied upon for evidence, but as a  
24 matter of historical narrative, the letter itself will be in  
25 the record, also not for the truth of the matter asserted



eb4

1 but simply to demonstrate that the requirements of the Atomic  
2 Energy Act as amended have been met.

3 MRS. BOWERS: Mr. Kristovich?

4 MR. KRISTOVICH: Well, in that case it's cumula-  
5 tive because it is in the SER Supplement.

6 MR. NORTON: Well, I would suggest, you know, to  
7 strike from line 2 of page 9, "The final paragraph of that  
8 letter is quoted below," to strike that sentence and the quote,  
9 the fact that the letter was issued is not -- that isn't  
10 a matter of proof, that we have to show you that the letter  
11 was submitted, so we have no objection to having the quote  
12 from the letter struck.

13 MR. KRISTOVICH: That will be fine.

14 MRS. BOWERS: On page 9, beginning at line 2,  
15 the words, "The final paragraph...." down to the end of the  
16 quote will be stricken.

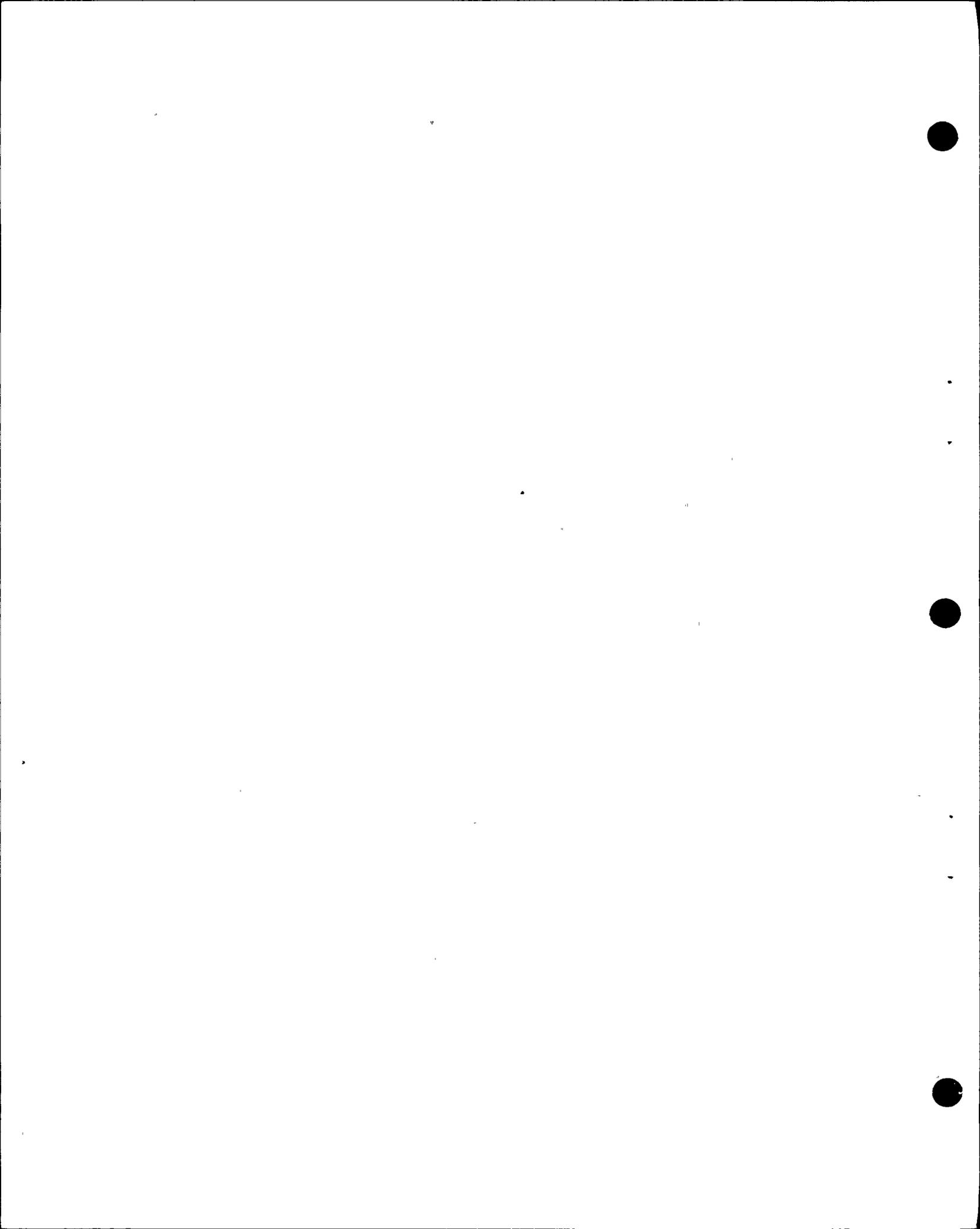
17 Anything else, Mr. Kristovich?

18 MR. KRISTOVICH: No, that's all-- Well, of course  
19 we have cross-examination.

20 MRS. BOWERS: Mr. Tourtellotte, Mr. Norton has  
21 asked that the testimony be physically incorporated in the  
22 record.

23 MR. TOURTELLOTTE: No objection.

24 MRS. BOWERS: Well, the testimony and the quali-  
25 fications will be physically incorporated in the transcript

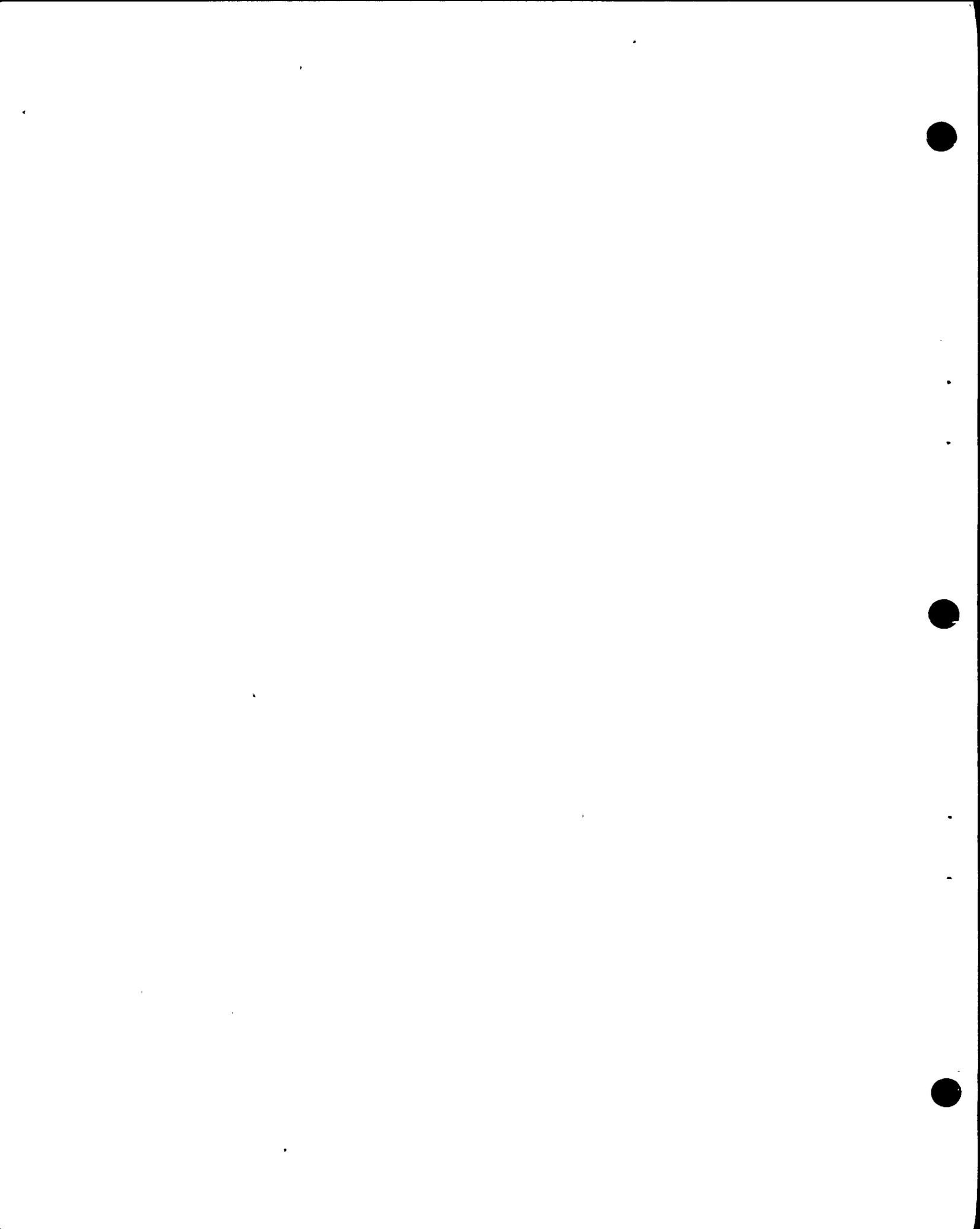


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as if read.

(The professional qualifications and the  
testimony of John B. Hoch follow:)



1 UNITED STATES OF AMERICA  
2 NUCLEAR REGULATORY COMMISSION

3 BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

4 In the Matter of ) Docket Nos. 50-275  
5 PACIFIC GAS AND ELECTRIC COMPANY ) 50-323  
6 (Diablo Canyon Nuclear Power ) Applicants Ex. No. 7  
7 Plant, Units No. 1 and 2) December 1978

8 PROFESSIONAL QUALIFICATIONS  
9 OF WITNESSES FOR  
10 PACIFIC GAS AND ELECTRIC COMPANY

11 Name: John B. Hoch

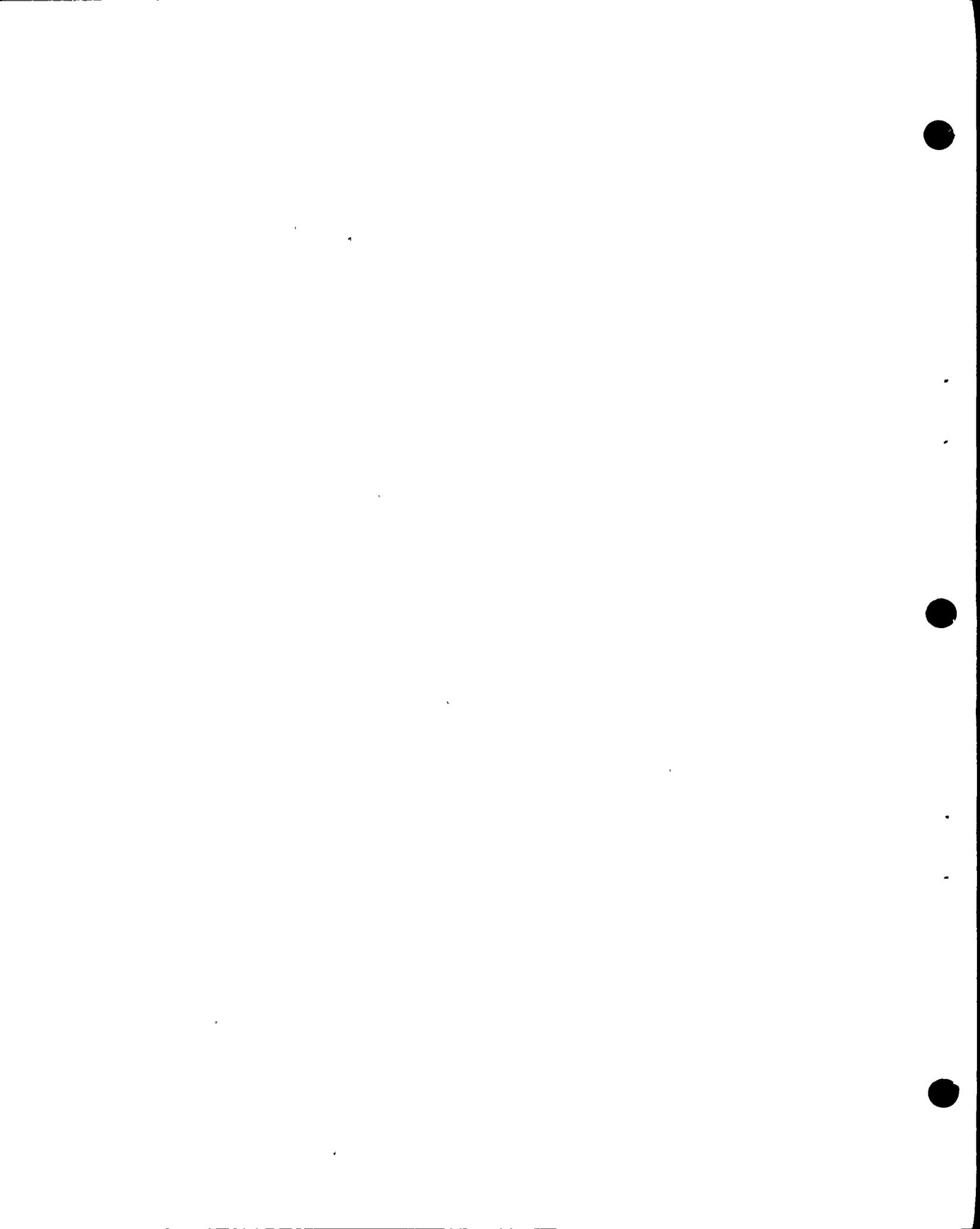
12 Title or Position: Project Engineer

13 Degrees: BS Mechanical Engineering, University of Idaho,  
14 1959; Graduate Study - U.C. Berkeley College of  
15 Engineering, 1961-1962

16 Professional Experience: Registered Mechanical Engineer,  
17 State of California; Registered Nuclear Engineer,  
18 State of California; Employed by PGandE since  
19 1958. Experience as follows:

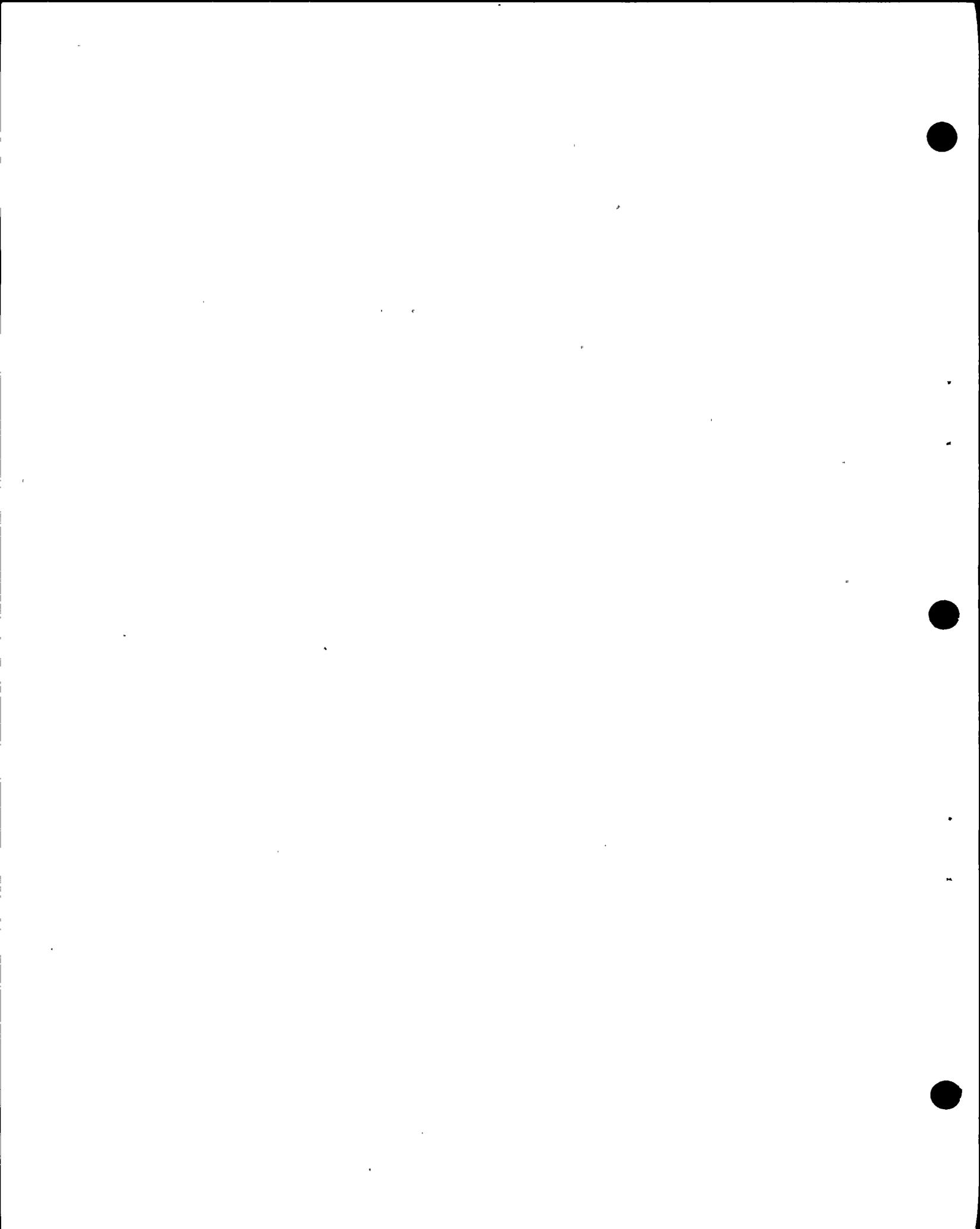
20 1958-1961--Power Plant Engineer at Contra Costa  
21 and Pittsburg Power Plants. Start-up Engineer at  
22 Pittsburgh Power Plant.

23 1962-1969--Mechanical Engineer. Performed mechan-  
24 ical design for fossil and nuclear projects.



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1970-1973--Mechanical Engineer. Performed preliminary design and licensing for Mendocino Nuclear Project.  
June 1973-January 1977--Senior Mechanical Engineer. Licensing Engineer for the Diablo Canyon Project.  
January 1977-Present--Project Engineer for the Diablo Canyon Project.



1 TESTIMONY OF  
2 JOHN B. HOCH  
3 ON BEHALF OF  
4 PACIFIC GAS AND ELECTRIC COMPANY  
5 DECEMBER 4, 1978  
6 DOCKET NOS. 50-275, 50-323

7 My name is John B. Hoch. I am the Project Engineer  
8 for Pacific Gas and Electric Company for Diablo Canyon Units  
9 1 and 2, with responsibility for directing the engineering  
10 activities of the project.

11 My testimony today deals with the seismic design  
12 of the Diablo Canyon units and the plant's capability to  
13 accommodate seismic inputs associated with both the original  
14 design basis seismic events and the postulated Hosgri seismic  
15 event. This testimony is directed to Intervenors' contentions  
16 IIA4, IIA5, IIA6, and IIA7 as set forth in Mr. Dow Davis's  
17 letter to the Atomic Safety and Licensing Board dated April 24,  
18 1978.

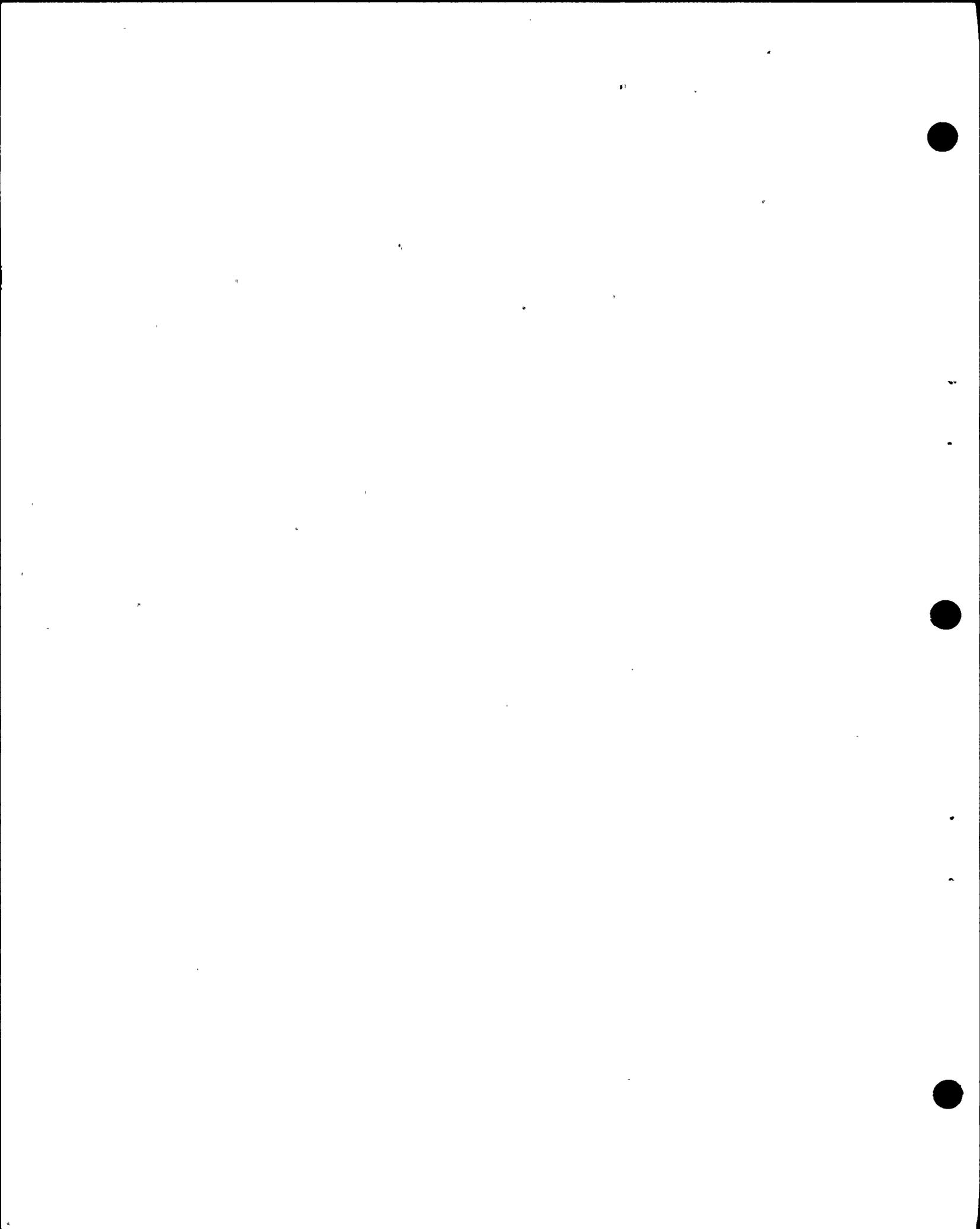
19 Previous testimony has described the development  
20 of the seismic design basis originally established for the  
21 plant and approved by the Atomic Energy Commission in con-  
22 nection with the issuance of construction permits for the  
23 units.

24 The Preliminary Safety Analysis Reports submitted  
25 by the Company in support of its applications for construction  
26 permits for the Diablo Canyon Units contained descriptions  
of the seismic design basis, i.e. of the characteristics of  
the Design Earthquake and Double Design Earthquake, and of



1 the criteria to be employed in incorporating the seismic  
2 design basis in the design of the plant. The construction  
3 permit applications were reviewed by the AEC Regulatory  
4 Staff and the seismic design criteria was modified in some  
5 respects to meet the Staff's requirements. Seismic design  
6 criteria were also reviewed and approved by the Advisory  
7 Committee on Reactor Safeguards. The construction permits  
8 for the units required that the approved seismic design  
9 criteria be used in the design of the plant. This seismic  
10 design criteria met all applicable regulatory requirements  
11 in effect at the time of issuance of the construction permits.

12           During the course of design and construction, a  
13 number of changes and additions were made to AEC Rules and  
14 Regulations, as contained in Title 10 of the Code of Federal  
15 Regulations. Wherever these changes and additions were  
16 required to be applied to the Diablo Canyon Units, they were  
17 incorporated in design or procedures, as appropriate. In  
18 many instances, even though new regulatory requirements were  
19 not required to be applied to Diablo Canyon but were specif-  
20 ically applicable only to plants for which construction  
21 permits were issued after adoption of the new requirement,  
22 the Company chose to implement the new requirements, to the  
23 extent practicable, in the Diablo Canyon design. One example  
24 of this is the application of General Design Criteria, now  
25 set forth in Appendix A to 10 CFR Part 50. Proposed General  
26 Design Criteria were first published by the AEC on July 11,



1 1967, and were the basis for design and construction of the  
2 plant. The General Design Criteria were subsequently published  
3 in 10 CFR 50 on February 20, 1971, and included some changes  
4 from the proposed version. The Company attempted to comply,  
5 whenever practicable, with the newer criteria.

6 The design and construction period also saw the  
7 development and use of Safety Guides (subsequently called  
8 Regulatory Guides) by the Regulatory Staff as a means of  
9 setting forth the Staff's interpretation of the regulations  
10 and establishing detailed criteria and methodology acceptable  
11 to the Staff for complying with the regulations. It should  
12 be noted here that these Regulatory Guides are not regulations  
13 and that criteria and methodology other than that given in  
14 Regulatory Guides may be acceptable to the Staff as meeting  
15 the requirements of NRC Rules and Regulations. As these  
16 Regulatory Guides were issued, the guidance they contained  
17 was incorporated, where practicable, in Diablo Canyon design  
18 and procedures or justification for using other criteria or  
19 methodology was established.

20 The Company's Operating License application,  
21 supported by a Final Safety Evaluation Report (FSAR) was  
22 submitted to the Atomic Energy Commission on July 10, 1973.  
23 Following the addition to the FSAR of information requested  
24 by the Regulatory Staff, the application was docketed on  
25 October 2, 1973.

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1           The Final Safety Analysis Report contains the  
2 information required, by 10 CFR Part 50 including a detailed  
3 description of the seismic design basis and of criteria and  
4 methodology employed in the seismic design of the plant.

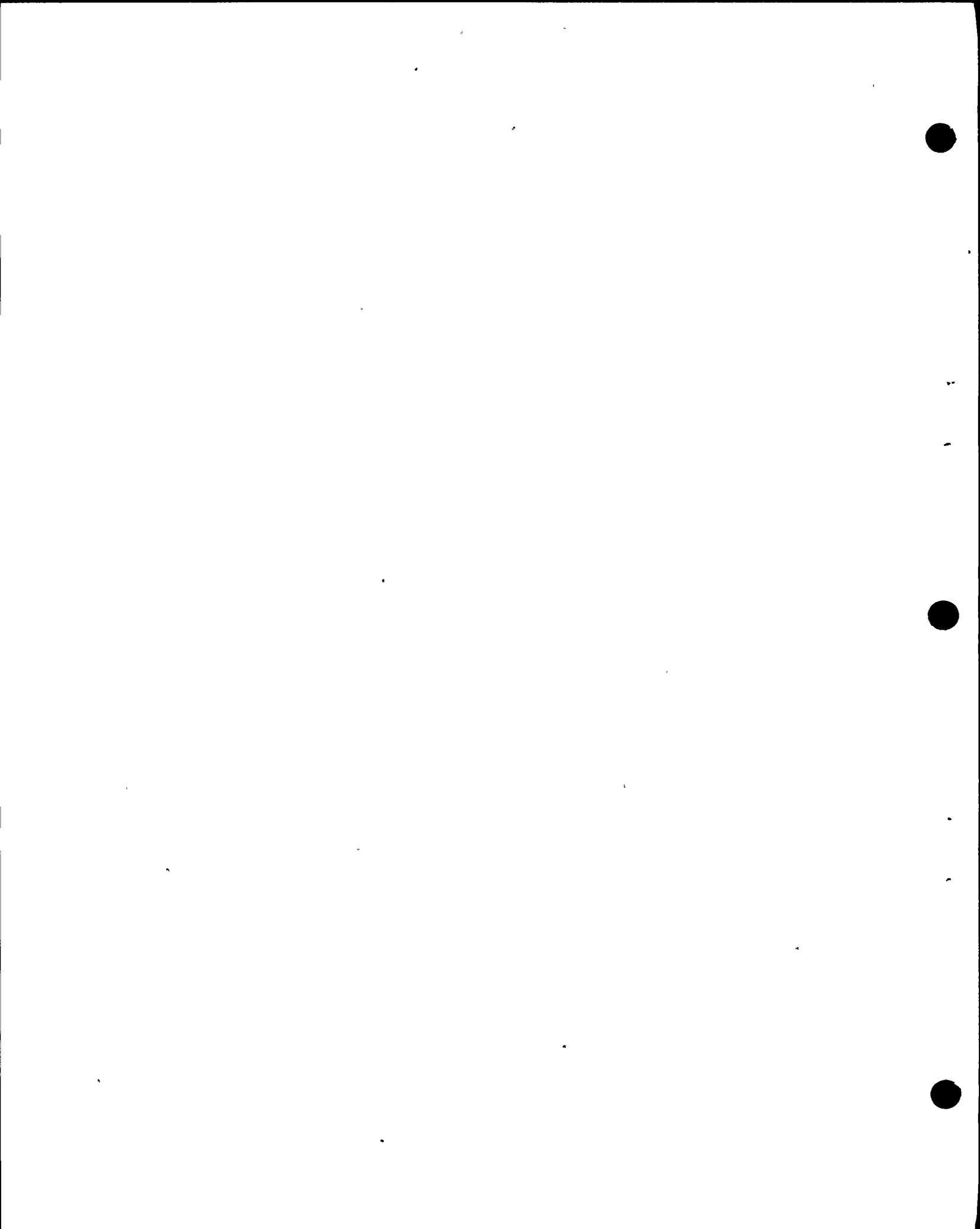
5           On October 16, 1974, the AEC Regulatory Staff  
6 published its first Safety Evaluation Report in connection  
7 with the Diablo Canyon Operating License application. In  
8 this report the Staff included its evaluation of the seismic  
9 design criteria employed in the plant design. With respect  
10 to Seismic Classification, the Regulatory Staff stated that:

11                   "We have concluded that structures,  
12 systems and components important to  
13 safety that are designed to withstand  
14 the effects of the safe shutdown earth-  
15 quake and remain functional have been  
16 properly classified as Seismic Category I  
17 items in conformance with the Commission's  
18 regulations, the applicable Regulatory  
19 Guide, and industry standards. Design  
20 of those items in accordance with Seismic  
21 Category I requirements provides reason-  
22 able assurance that the plant will  
23 perform in a manner providing adequate  
24 safeguards for the health and safety of  
25 the public." [Pp. 3-2 and 3-3.]

19           With respect to Seismic Design, the Regulatory  
20 Staff stated that:

21                   "We have reviewed the FSAR and  
22 applicable Amendments and find the  
23 seismic system and subsystem dynamic  
24 analysis methods and procedures proposed  
25 by the applicant to be acceptable."  
26 [Pg. 313.]

25           Subsequent consideration of the Hosgri fault and  
26 its potential as a causative mechanism for a seismic event



1 resulted in the NRC Regulatory Staff's requirement that the  
2 plant's capability be evaluated for an assumed magnitude 7.5  
3 earthquake on the Hosgri fault in addition to the earthquake  
4 considered in the original seismic design basis. The Staff's  
5 conclusions stated in the October 16, 1974, Safety Evaluation  
6 Report remain valid with respect to the Design Earthquake  
7 and Double Design Earthquake which were the original seismic  
8 design basis for the Diablo Canyon Units. This evaluation  
9 of the plant's capability to accommodate these earthquakes  
10 is an integral part of the NRC Staff's evaluation of the  
11 adequacy of the Diablo Canyon seismic design.

12 Previous testimony has described the developments  
13 which led to the NRC Regulatory Staff's requirement that the  
14 plant's capability be evaluated for a magnitude 7.5 earthquake  
15 assumed to occur on the Hosgri fault. My testimony is  
16 concerned with the manner in which this evaluation was  
17 conducted, the results of the evaluation, and the adequacy  
18 of the plant modifications made to accommodate the seismic  
19 inputs associated with the postulated Hosgri seismic event.

20 Before proceeding with the Hosgri seismic evaluation,  
21 it was necessary to develop both response spectra for the  
22 various plant structures and detailed criteria for the  
23 evaluation. Development of response spectra has been described  
24 in previous testimony.

25 The detailed evaluation criteria was developed by  
26 the Company and its consultants, in cooperation with the



1 Regulatory Staff and its consultants. The first portion of  
2 this criteria was finalized in a meeting with the Regulatory  
3 Staff on February 4, 1977.

4 A detailed description of each portion of the  
5 Hosgri Seismic Evaluation will be presented in later testimony.  
6 Consequently, I will describe the evaluation only in an  
7 overall sense. I believe the Hosgri Seismic Evaluation to  
8 be the most complete and comprehensive study ever made of  
9 the seismic capability of a nuclear power plant. The evalua-  
10 tion considered all plant structures, systems, and components  
11 required to remain functional during and following the  
12 postulated Hosgri seismic event in order to assure:

- 13 (1) The integrity of the reactor coolant pressure  
14 boundary;
- 15 (2) The capability to shut down the reactor and  
16 maintain it in a safe condition;
- 17 (3) The capability to prevent or mitigate the  
18 consequences of accidents which could result  
19 in potential offsite exposures comparable to  
20 the guideline exposures of 10 CFR Part 100.

21 These structures, systems, and components are precisely  
22 those required to remain functional to meet the requirements  
23 given in 10 CFR Part 100, Appendix A, for the "Safe Shutdown  
24 Earthquake".

25 In parallel with the Hosgri Seismic Evaluation,  
26 the Company and its consultants have completed numerous



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1 studies which support the adequacy of the criteria employed  
2 in that evaluation. The description of the Hosgri Seismic  
3 Evaluation, its results, and the studies supporting the  
4 evaluation criteria are contained in an extensive report,  
5 now consisting of six volumes, entitled "Seismic Evaluation  
6 for Postulated 7.5M Hosgri Earthquake" and hereafter referred  
7 to as the "Hosgri Report." This report was initially submitted  
8 to the NRC on June 5, 1977 as Amendment 50 to the Diablo  
9 Canyon Operating License application, and it has subsequently  
10 been revised and expanded in later Amendments.

11 In addition to Company personnel, to assist in the  
12 Hosgri evaluation the Pacific Gas and Electric Company has  
13 employed the services of a number of consultants, consulting  
14 firms, contractors, and suppliers, who have provided profes-  
15 sional opinions, made studies, performed seismic and other  
16 analyses, conducted in-situ and shake-table seismic testing,  
17 or otherwise provided inputs to the Hosgri Seismic Evaluation.  
18 Individuals and firms were selected for their capabilities  
19 and expertise and include acknowledged authorities and  
20 experts in a number of fields relevant to the evaluation.  
21 The following firms and individuals were involved with work  
22 related to the Hosgri Seismic Evaluation and its related  
23 studies:

24 ANCO Engineers  
25 Earthquake Engineering Services  
26 EDS Nuclear  
Lawson Associates  
URS/John A. Blume & Associates, Engineers

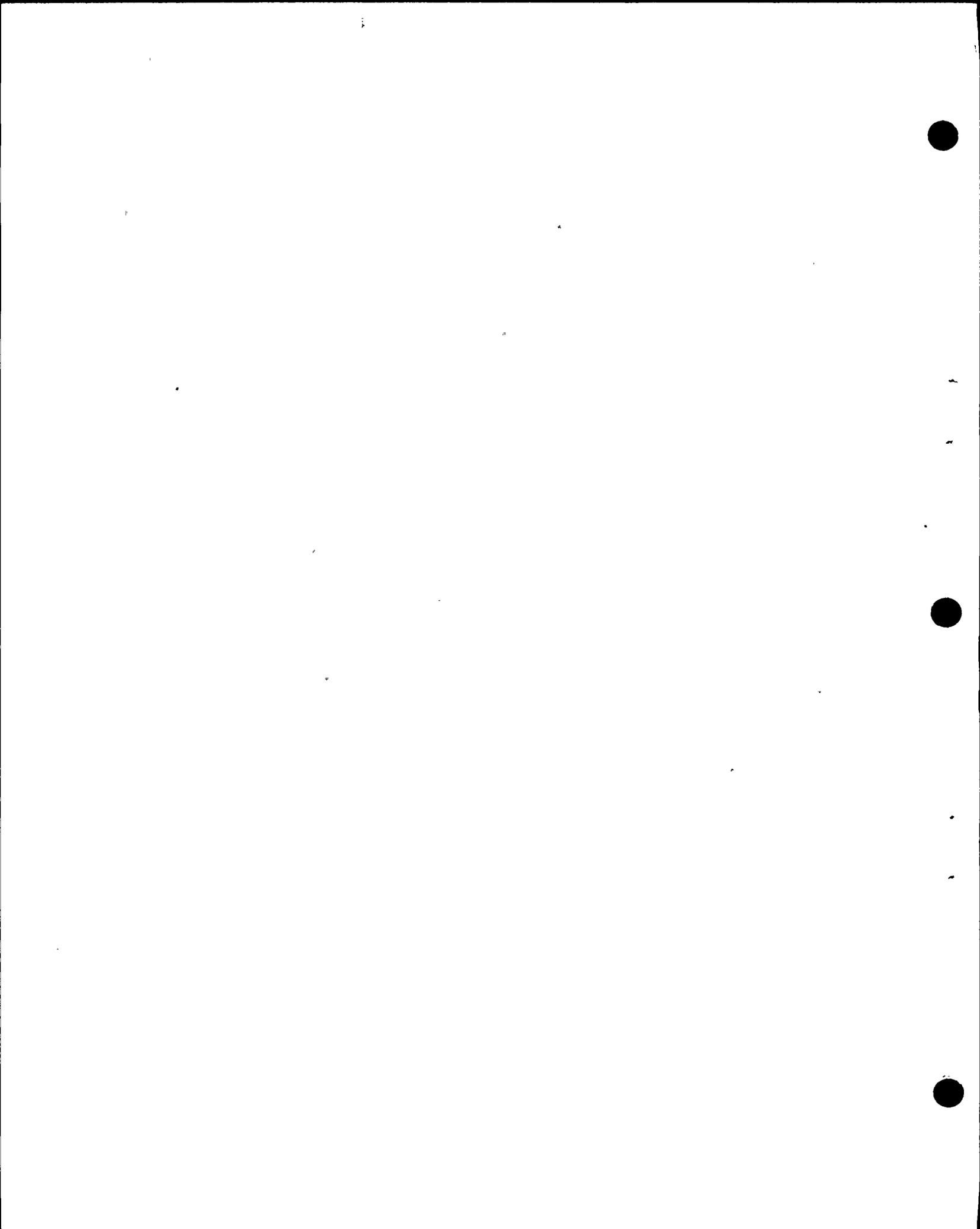


1 Westinghouse Electric Corporation  
Wyle Laboratories  
2 Dr. Jack D. Benjamin  
Dr. Bruce A. Bolt  
3 Dr. C. Allin Cornell  
Mr. Douglas H. Hamilton  
4 Dr. John Lysmer  
Dr. H. Bolton Seed  
5 Dr. Stewart W. Smith

6 During the course of the Hosgri Seismic Evaluation,  
7 whenever a structure, system, or component was identified  
8 which did not meet the established acceptance criteria for  
9 seismic capability, design modifications were implemented to  
10 assure that the acceptance criteria are met. These modifi-  
11 cations are described in the Hosgri Report and will be  
12 discussed in greater detail in later testimony.

13 The criteria, methodology, and results of the  
14 Hosgri evaluation, as well as the design of necessary  
15 modifications have undergone extensive review by the NRC  
16 Regulatory Staff. Since submittal of the first portion of  
17 the evaluation on June 5, 1977 the Regulatory Staff has been  
18 continuously involved with this review. To the best of my  
19 knowledge, the scope and depth of the Regulatory Staff's  
20 review is unprecedented in the field of nuclear reactor  
21 regulation.

22 The Hosgri evaluation and the seismic capability  
23 of the Diablo Canyon plant have also been the subject of  
24 thorough and lengthy review by the Advisory Committee on  
25 Reactor Safeguards (ACRS). On July 14, 1978, following its  
26 most recent series of meetings on Diablo Canyon, the ACRS



1 reported on its review in a letter to NRC Chairman Joseph M.  
2 Hendrie. The final paragraph of that letter is quoted  
3 below:

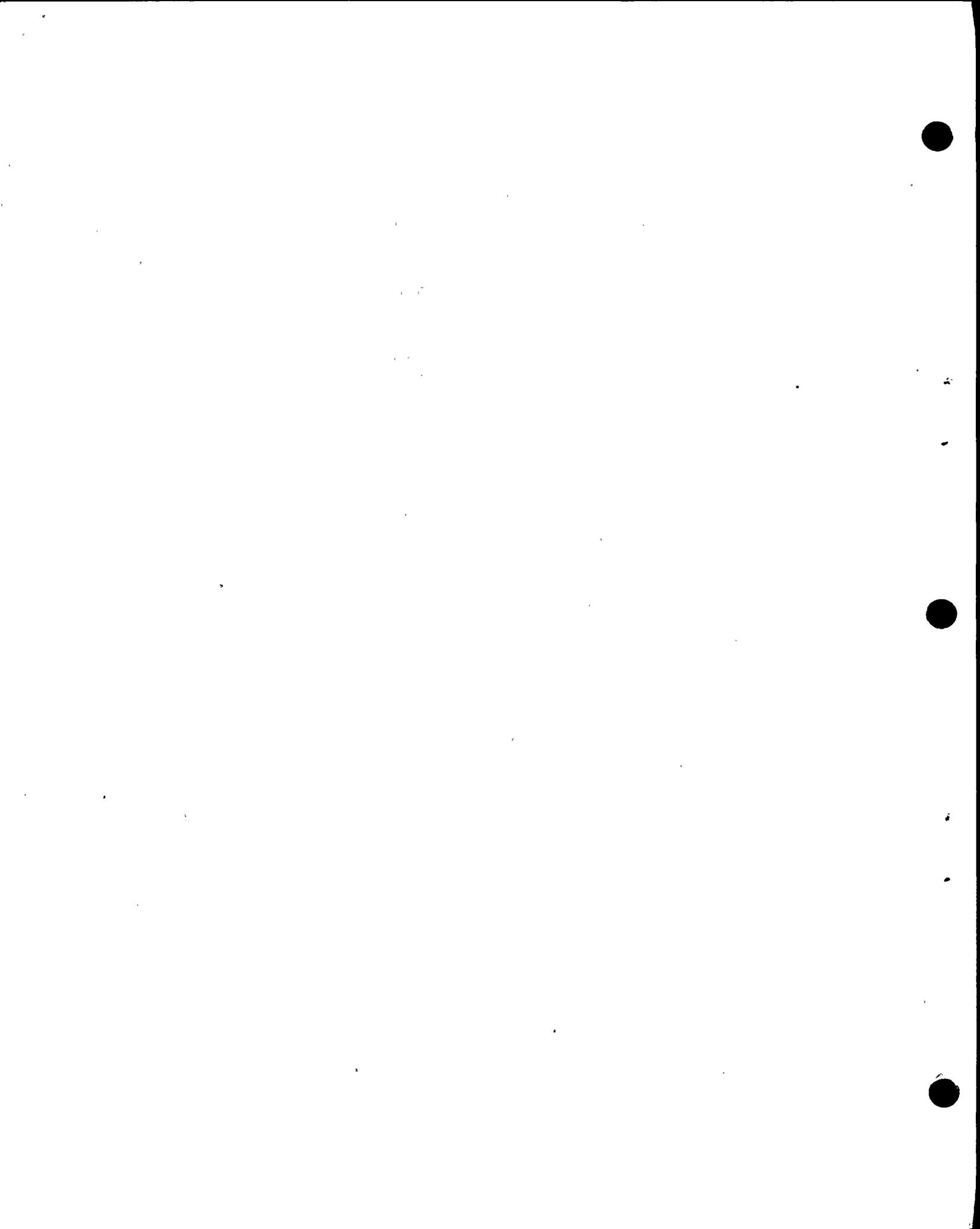
4 "The Advisory Committee on Reactor  
5 Safeguards believes that, if due con-  
6 sideration is given to the items men-  
7 tioned above, and subject to satisfac-  
8 tory completion of construction, plant  
9 modifications, and preoperational  
10 testing, there is reasonable assurance  
11 that the Diablo Canyon Nuclear Power  
12 Station Units 1 and 2 can be operated at  
13 power levels up to 3338 and 3411 MWt for  
14 Units 1 and 2, respectively, without  
15 undue risk to the health and safety of  
16 the public."

17 The remainder of my testimony addresses separately  
18 Intervenors' contentions IIA4, IIA5, IIA6, and IIA7 and  
19 concludes that these contentions either have no basis in  
20 fact or are not relevant to the issue of whether the Diablo  
21 Canyon units can be operated without undue risk to the  
22 health and safety of the public.

23 Intervenors' contention IIA4 is as follows:

24 "The maximum vibratory acceleration of  
25 0.2g for the operating basis earthquake  
26 is not one-half of the maximum vibratory  
acceleration of the safe shutdown  
earthquake."

27 In response to a verbal request from the Regulatory  
28 Staff, the Company provided to the Staff, in a letter dated  
29 April 11, 1978, information justifying the continuing use of  
30 the Design Earthquake having a maximum vibratory ground  
31 acceleration of 0.2g as the Operating Basis Earthquake for  
32 the plant. The Regulatory Staff accepted this justification

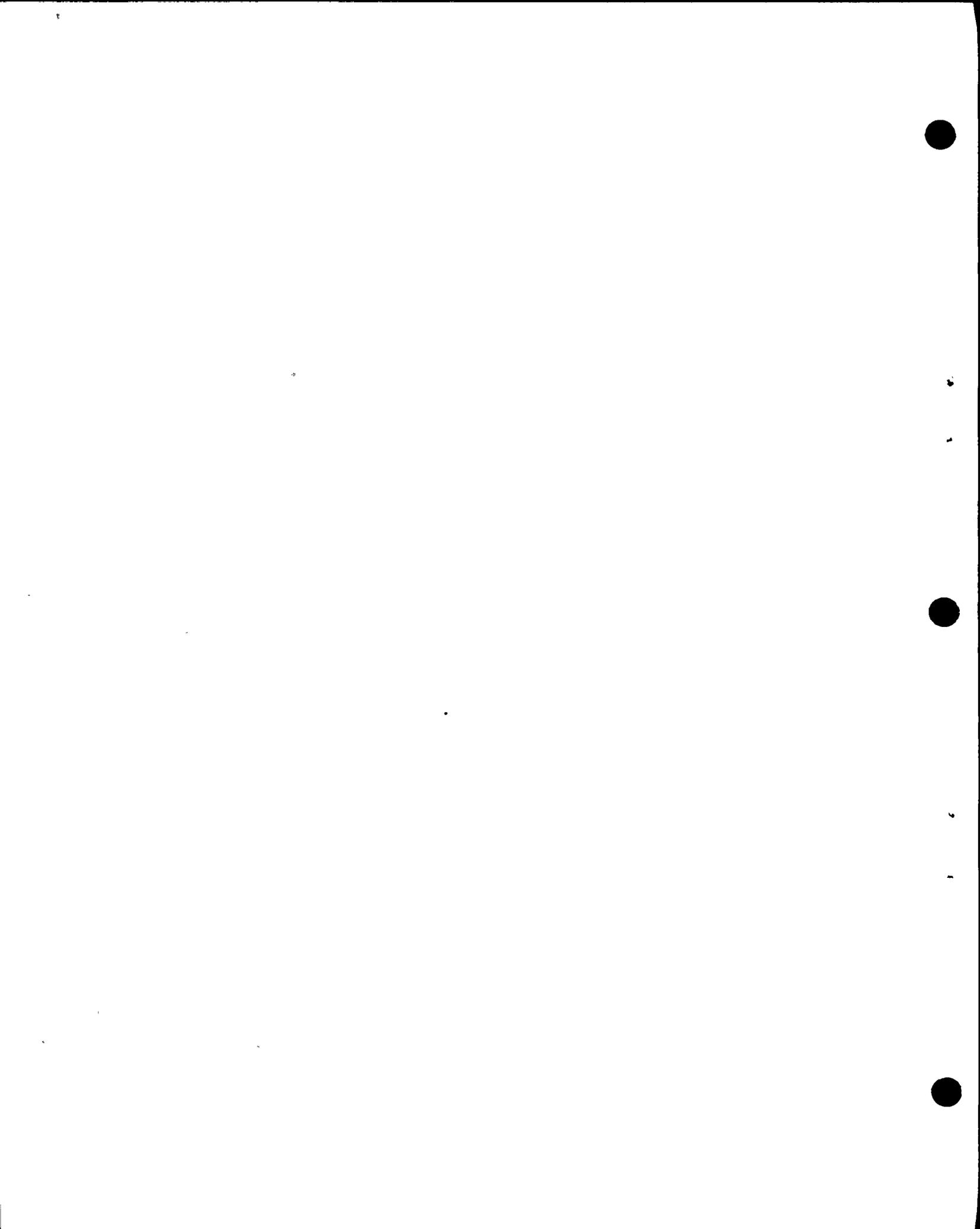


1 in Supplement No. 7 to its Safety Evaluation Report (pp.  
2 2-5).

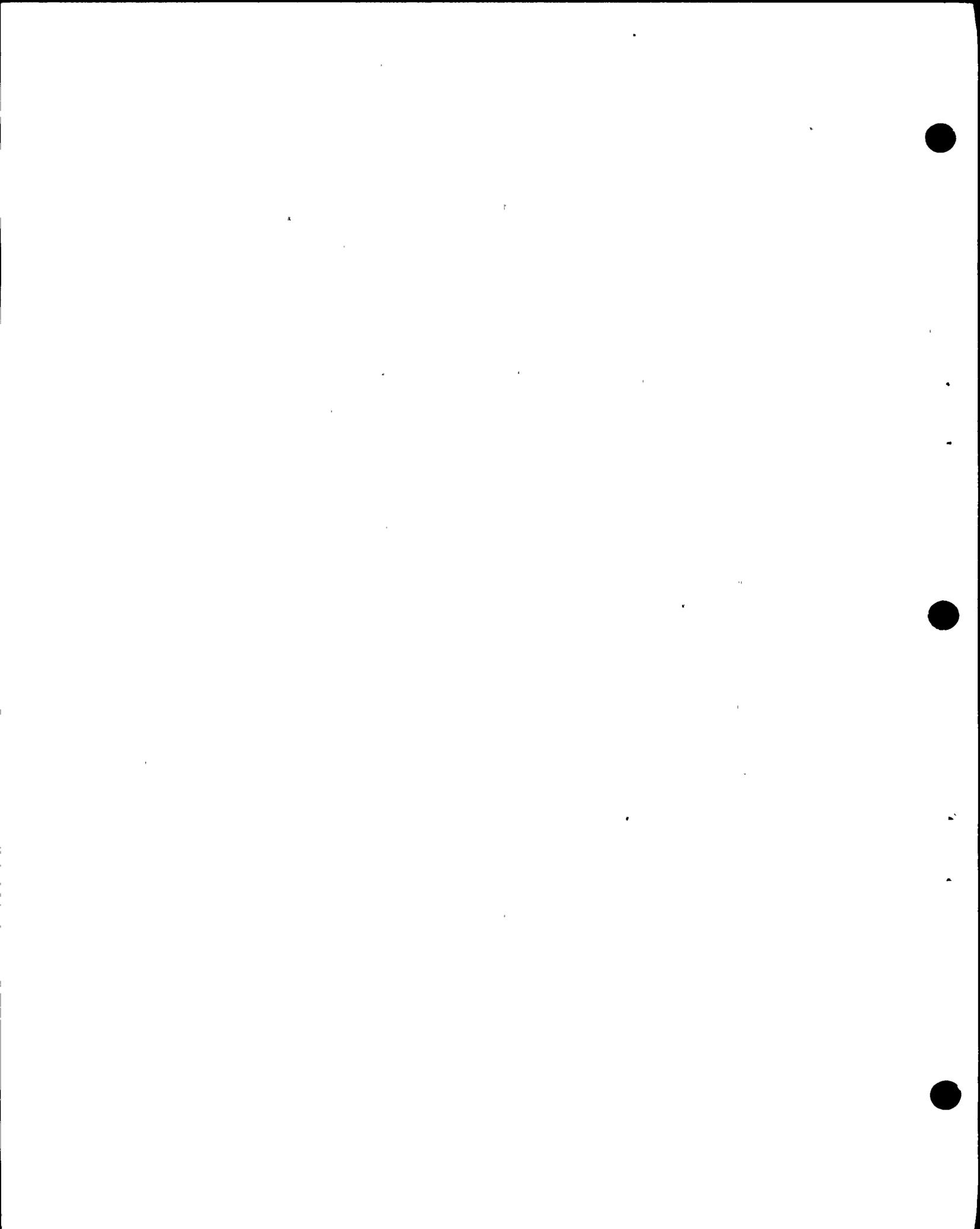
3 The NRC Regulatory Staff has also accepted for a  
4 number of plants (e.g., Byron, Braidwood, Clinton, Koshkonong,  
5 Marble Hill and Phipps Bend) an Operating Basis Earthquake  
6 having a maximum vibratory ground acceleration less than  
7 one-half of the Safe Shutdown Earthquake. The basis for  
8 establishing the Operating Basis Earthquake for these plants  
9 was a probabilistic analysis estimating the exceedance  
10 probability and return period. In licensing actions for at  
11 least one of these plants the Regulatory Staff stated its  
12 acceptance criteria for an Operating Basis Earthquake.  
13 These criteria are given below, as reported in the transcript  
14 of the 205th General Meeting of the Advisory Committee on  
15 Reactor Safeguards, Thursday, 5 May 1977, Page 67, Lines 16  
16 through 25:

17 "the Operating basis earthquake as  
18 defined by Appendix A is an earthquake  
19 which would reasonably be expected to  
20 affect the plant site during the operat-  
21 ing life of the plant. Based on this  
22 definition, the Staff considers that an  
23 earthquake that exhibits an exceedance  
24 probability of no more than 30 percent  
25 and a return period of approximately 110  
26 years to represent an event which could  
reasonably be expected to affect the  
plant site and produces a conservative  
acceleration level for the operating  
basis earthquake."

25 Since construction permits have been issued for  
26 several of the plants named above, both the Advisory Committee



1 on Reactor Safeguards and Atomic Safety and Licensing Boards  
2 for those applications would appear to have also accepted  
3 the Staff's position. The Company's letter of April 11,  
4 1978 on this subject cited the results of several analyses  
5 made by the Company and its consultant which estimate  
6 exceedance probabilities and average return periods for  
7 various values of peak instrumental and peak effective  
8 acceleration at the Diablo Canyon site. The results of  
9 these analyses have been submitted in support of the operating  
10 license application for Diablo Canyon and are included as  
11 report D-LL 11, D-LL 28, D-LL 41, and D-LL 45 in Appendix D  
12 to the Hosgri Report. The analyses considered the factors  
13 of regional and local geology and specific characteristics  
14 of local subsurface material as required by Section III(d)  
15 of Appendix A to 10 CFR Part 100. Since the analyses employed  
16 a number of variations in methodology, the results show a  
17 range of exceedance probabilities and average return periods  
18 for a given site acceleration. For a peak instrumental  
19 acceleration (maximum vibratory ground acceleration) at the  
20 site of 0.20g, the lowest average return period computed by  
21 any of the methods used in the analyses is 275 years. The  
22 corresponding exceedance probability for a 40 year plant  
23 lifetime is approximately 14.5 percent. The Company believes  
24 that 275 years is a very conservative estimate of the average  
25 return period associated with the Design Earthquake for  
26 Diablo Canyon. Since this average return period is more



1 than twice the 110 year period specified in the Regulatory  
2 Staff's stated acceptance criteria, it is clear that the  
3 Design Earthquake should be acceptable as the Operating  
4 Basis Earthquake for the Diablo Canyon Units.

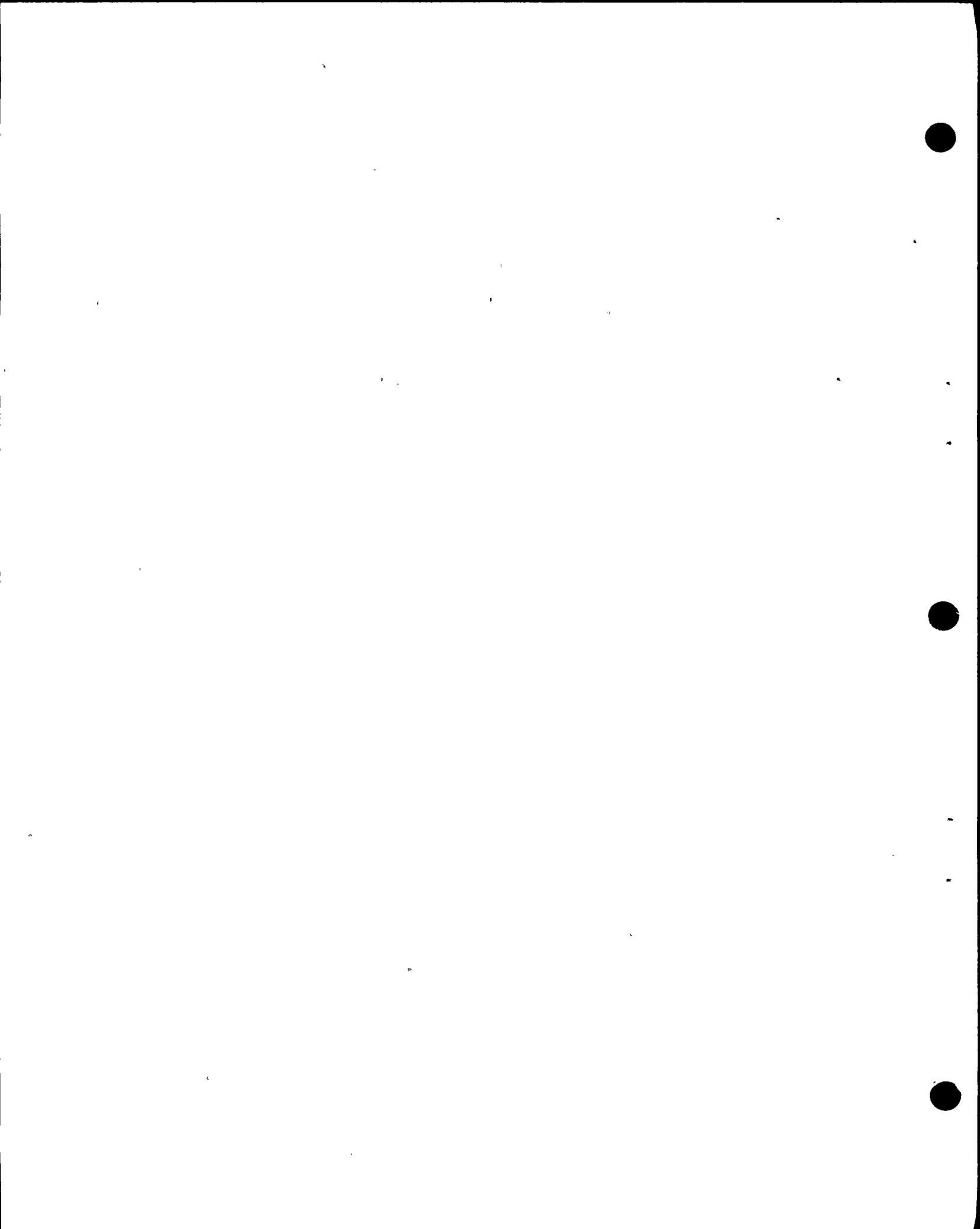
5           These considerations were extensively discussed  
6 with the Advisory Committee on Reactor Safeguards, during  
7 its Subcommittee meeting for Diablo Canyon on June 15, 1978.  
8 In its July 14, 1978 letter on Diablo Canyon, the Committee  
9 found an Operating Basis Earthquake with an acceleration of  
10 0.20g acceptable.

11           It is my opinion that the use of an Operating  
12 Basis Earthquake of 0.2g at Diablo Canyon does not create an  
13 undue risk to the public health and safety and fully complies  
14 with the overall intent of 10 CFR Part 100, Appendix A.

15           Intervenors' contention IIA5 is as follows:

16           "The Applicant has failed to demonstrate,  
17 through the use of either appropriate  
18 dynamic analyses or qualification tests  
19 (or equivalent static load method where  
20 appropriate), that Category I structures,  
21 systems, and components will perform as  
22 required during the seismic load of the  
safe shutdown earthquake, including  
aftershocks and applicable concurrent  
functional and accident-induced loads,  
and that Category I structures, systems  
and components will be adequate to  
assure:

- 23           (A) the integrity of the reactor  
24           coolant pressure boundary,  
25           (B) the capability to shut down  
26           the reactor and maintain it in  
a safe condition, or

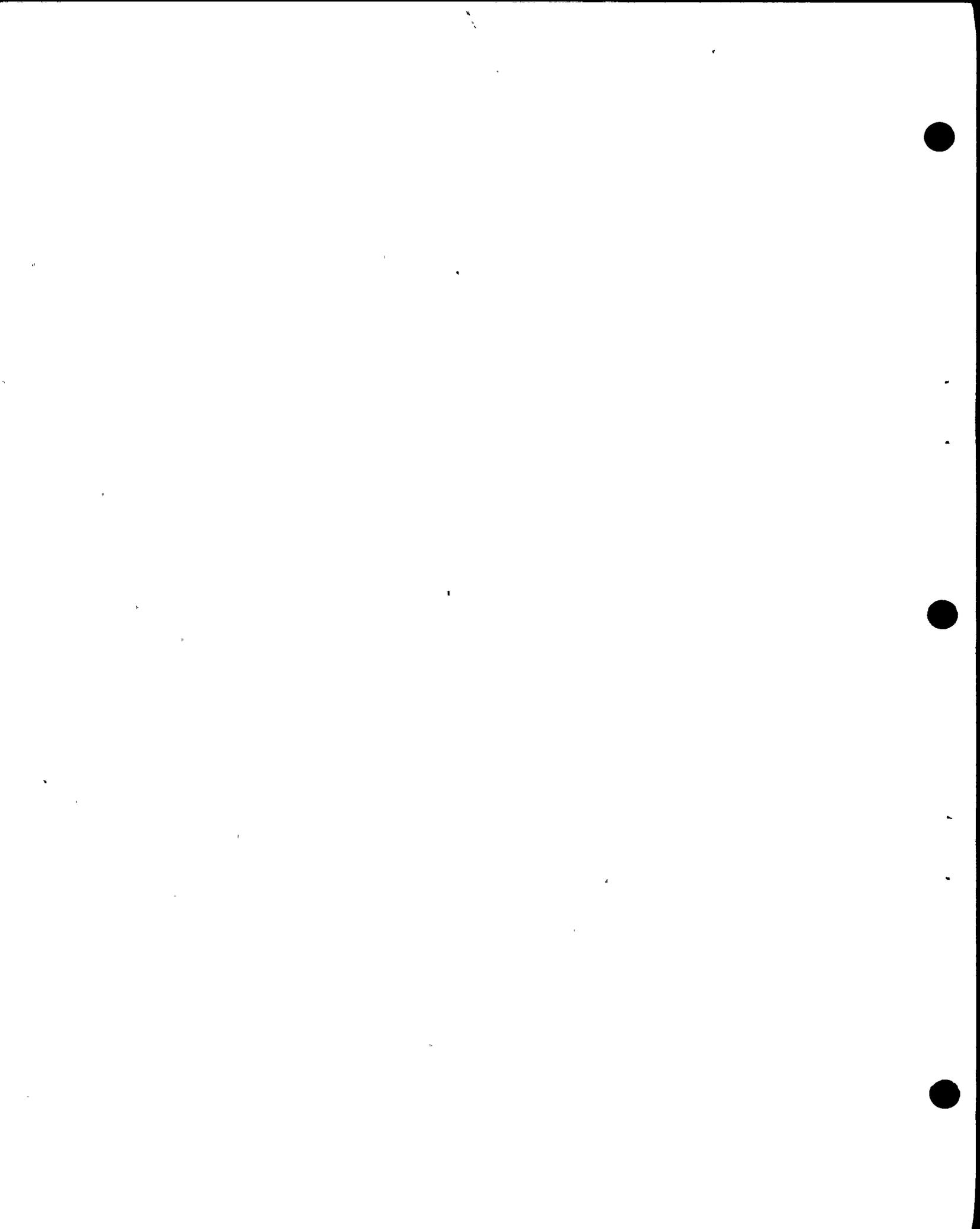


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(C) the capability to prevent or mitigate the consequences of accidents which could result in excessive offsite exposure."

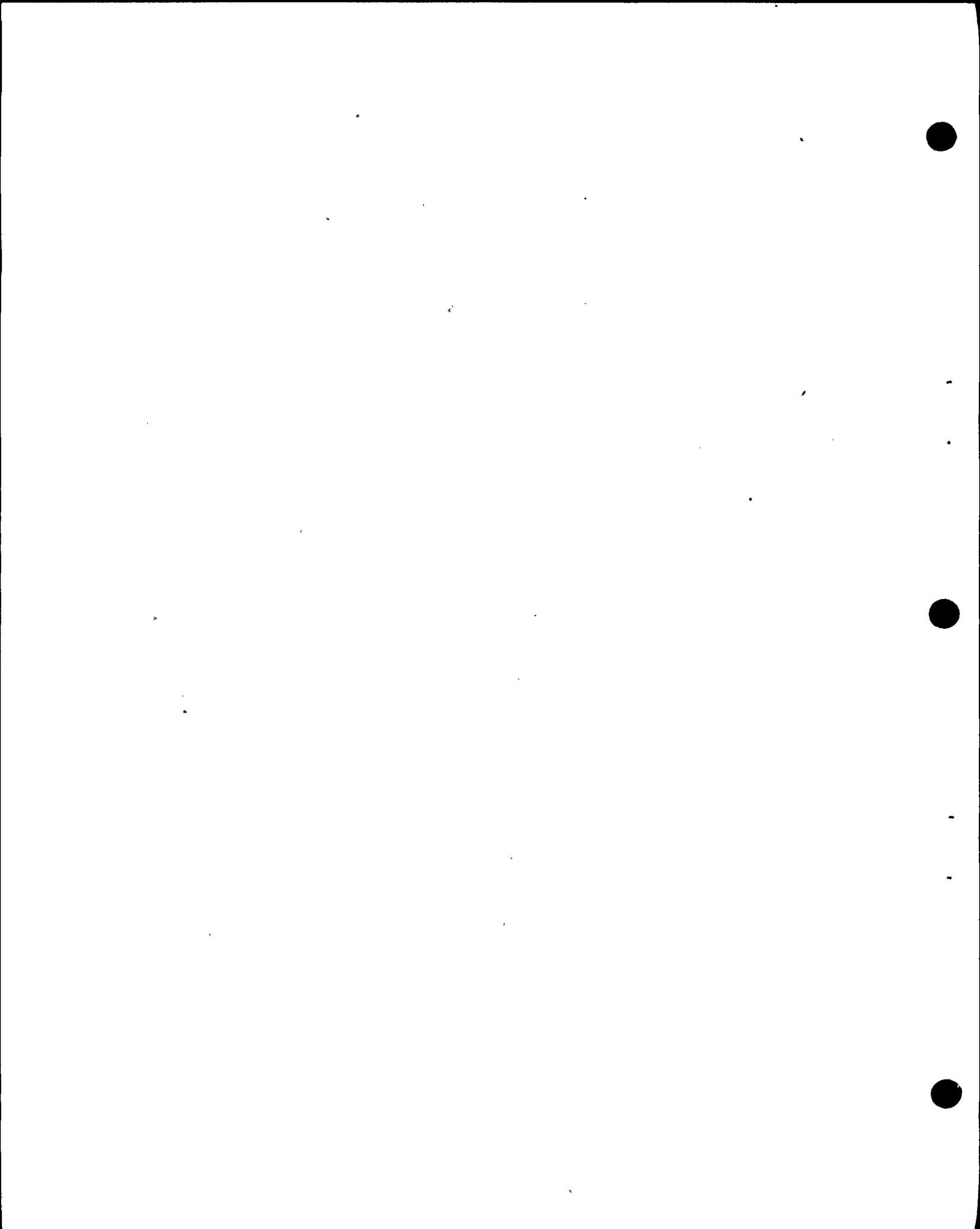
The word of intervenors' contention appears to have been abstracted, with some wording changes, from Section VI(a)(1) of Appendix A to 10 CFR Part 100, which, together with General Design Criterion 2 given in Appendix A to 10 CFR Part 50, are the portions of NRC Rules and Regulations applicable to the seismic adequacy of structures, systems, and components for the Safe Shutdown Earthquake. The design and construction of Diablo Canyon, intervenors' allegations notwithstanding, meets the requirements of these portions of the Regulations.

As described in Section 3.2 of the Final Safety Analysis Report for the Diablo Canyon Units, the seismic classification terminology used by the Company for Diablo Canyon was established prior to the adoption of standard terminology for this purpose. Consequently, the seismic classification "Design Class I," rather than "Category I" has been used for Diablo Canyon structures, systems, and components necessary to assure (1) the integrity of the reactor coolant pressure boundary, (2) the capability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the guideline exposures of



1 10 CFR Part 100. This definition of Design Class I contained  
2 in Section 3.2.1 of the Final Safety Analysis Report meets  
3 precisely the requirement of Section VI(a)(1) of Appendix A  
4 to 10 CFR Part 100. The classification terminology "Category I"  
5 was first established in AEC Safety Guide 29, which was  
6 issued after design and construction of the Diablo Canyon  
7 plant had progressed substantially. Safety Guide 29 provided  
8 guidance for determining the structures, systems, and com-  
9 ponents which should be designed to remain functional in the  
10 event of a Safe Shutdown Earthquake. Although the use of  
11 the classification terminology "Design Class I" has been  
12 continued for Diablo Canyon to the present time, it corre-  
13 sponds directly to "Category I" as originally used in Safety  
14 Guide 29 and the structures, systems, and components so  
15 classified meet the intent of Safety Guide 19. Safety  
16 Guide 29 was subsequently re-issued as Regulatory Guide 1.29,  
17 Regulatory 1.29 Rev. 1, and Regulatory Guide 1.29 Rev. 2.  
18 The Diablo Canyon classification system also meets the  
19 intent of this latest revision.

20 The Hosgri Seismic Evaluation considered and has  
21 established the seismic capability of all Diablo Canyon  
22 structures, systems, and components designated as Design  
23 Class I which current regulatory practice, as established in  
24 NRC Regulatory Guides and Standard Review Plans, would  
25 require to be designated Category I. In some instances,  
26 since Diablo Canyon structures, systems, and components were



1 assigned seismic design classification prior to the issuance  
2 of definitive guidance by the Regulatory Staff, some systems  
3 and components were classified as Design Class I which would  
4 not be required to be designated Category I by current  
5 regulatory practice. In addition, certain structures, such  
6 as the turbine building and the major portion of the intake  
7 structure, which were not designated as Design Class I but  
8 whose failure could affect the functioning of Design Class I  
9 structures, systems and components, have been treated as  
10 Design Class I for the purpose of the Hosgri Seismic Evaluation.  
11 Seismic analysis of these structures and the design and  
12 implementation of any modifications found necessary to meet  
13 the criteria established for the Hosgri Seismic Evaluation  
14 have been handled in strict compliance with Design Class I  
15 requirements. This procedure meets the requirements of NRC  
16 Rules and Regulations and follows the guidance provided in  
17 Regulatory Guide 1.29.

18 As Project Engineer for Diablo Canyon, I have  
19 reviewed those structures, systems, and components considered  
20 in the Hosgri Seismic Evaluation and I have concluded that  
21 all items have been included to meet the requirements of the  
22 applicable portions of NRC Rules and Regulations, including  
23 Section VI(a)(1) of Appendix A to 10 CFR Part 100.

24 The NRC Regulatory Staff, in Supplement No. 7 to  
25 its Safety Evaluation Report, published the results of its  
26 evaluation of seismic classification for Diablo Canyon. In

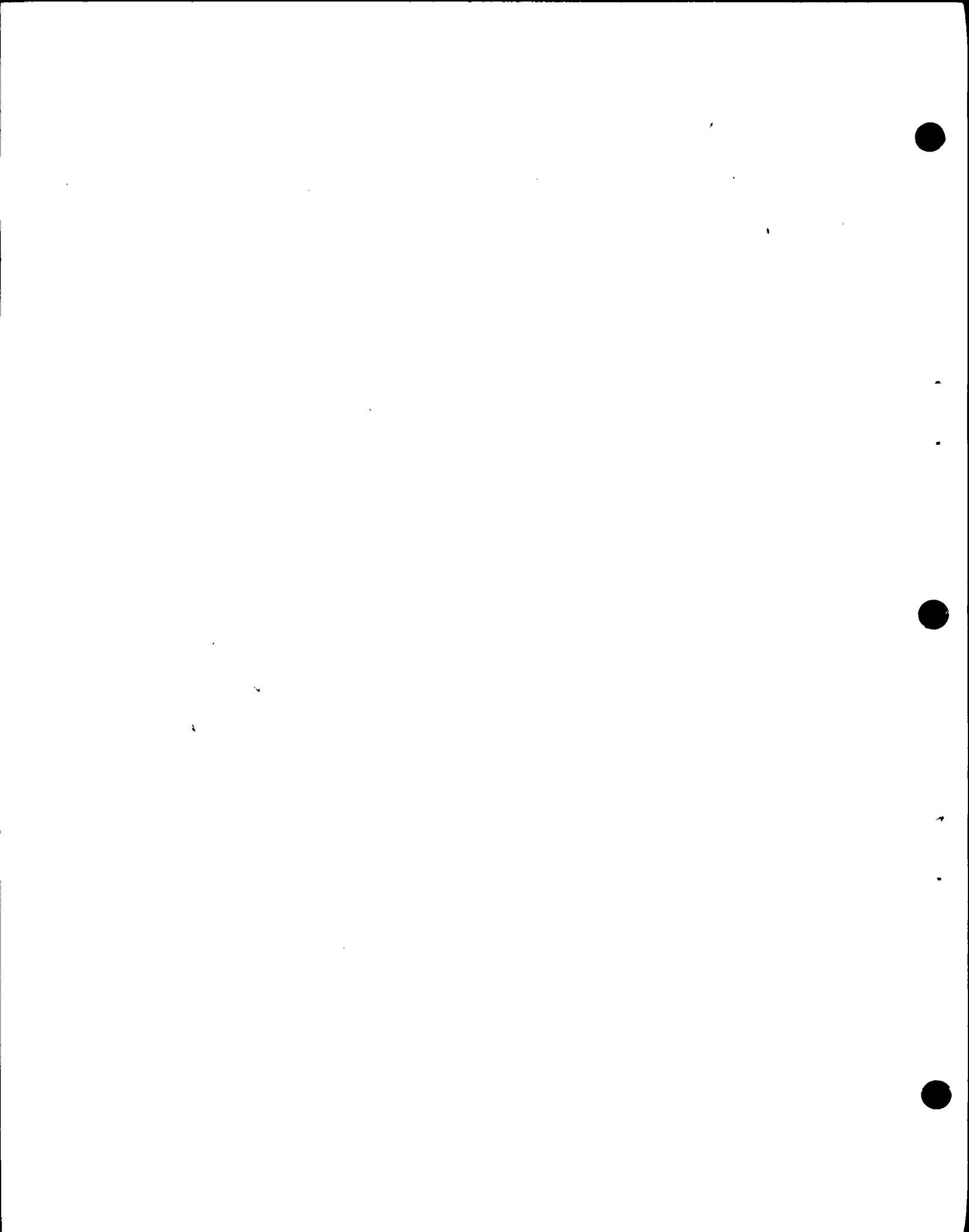


1 Section 3.2.1. of SER Supplement No. 7 the Regulatory Staff  
2 concludes that:

3 ". . . As in the original review, we  
4 have concluded that structures, systems  
5 and components important to safety that  
6 are designed to withstand the effects of  
7 a Hosgri event and remain functional  
8 have been properly classified in con-  
9 formance with the Commission's regulations,  
10 the applicable Regulatory Guide and  
11 industry standards. In accordance with  
12 our normal acceptance criteria, qualifi-  
13 cation of these items for the Hosgri  
14 event provides reasonable assurance that  
15 the plant will perform in a manner  
16 providing adequate safeguards for the  
17 health and safety of the public with  
18 respect to earthquake safety."

19 The Advisory Committee on Reactor Safeguards, in its review  
20 of the Diablo Canyon application, also reviewed the structures,  
21 systems, and components considered in the Hosgri Seismic  
22 Evaluation. The Committee's letter of July 14, 1978 demon-  
23 strates that it also found the extent of the items included  
24 acceptable.

25 With respect to demonstrating that the requirements  
26 of Section VI(a)(1) of Appendix A to 10 CFR Part 100 have  
27 been met by the use of a suitable analysis or a suitable  
28 qualification test, I believe adequate demonstration to be  
29 contained in the Hosgri Report, supported by detailed  
30 calculations and test reports which have been reviewed by  
31 the Regulatory Staff and which have been made available to  
32 Intervenors. The Hosgri Seismic Evaluation did take into  
33 account concurrent functional and accident-induced loads in



1 addition to seismic loads and the results show that the  
2 necessary structures, systems and components will perform  
3 their intended safety functions. The relationship of after-  
4 shocks to the Hosgri seismic event has been described in  
5 previous testimony. Later testimony will describe in detail  
6 the structures, systems, and components considered in the  
7 Hosgri Seismic Evaluation, the criteria and methodology  
8 employed, the tests and the analyses made, and the manner in  
9 which concurrent functional and accident-induced loads were  
10 taken into account.

11 As Project Engineer for Diablo Canyon, I have  
12 reviewed the work done in connection with the Hosgri Seismic  
13 Evaluation. It is my conclusion that the Diablo Canyon  
14 plant meets the requirements of all applicable NRC Rules and  
15 Regulations, including the requirements of Section VI(a)(1)  
16 of Appendix A to 10 CFR Part 100.

17 Intervenors' contention IIA6 is as follows:

18 "The Applicant has failed to demonstrate,  
19 through the use of either appropriate  
20 dynamic analyses or qualification tests  
21 (or equivalent static load methods where  
22 appropriate), that all structures,  
23 systems and components of the nuclear  
24 power plant necessary for continued  
25 operation without undue risk to the  
26 health and safety of the public will  
remain functional and within applicable  
stress and deformation limits when  
subjected to the effects of the vibra-  
tory motion of the operating basis  
earthquake in combination with normal  
operating loads."



1           The wording of Intervenor's contention appears to  
2 have been abstracted, with some wording changes, from  
3 Section VI(a)(2) of Appendix A to 10 CFR Part 100, which,  
4 together with General Design Criterion 2 given in Appendix A  
5 to 10 CFR Part 50, are the portions of NRC Rules and Regu-  
6 lations applicable to the seismic adequacy of structures,  
7 systems, and components for the Operating Basis Earthquake.  
8 The design and construction of the Diablo Canyon Units meet  
9 the requirements of these portions of the Regulations.

10           The Operating Basis Earthquake for Diablo is the  
11 Design Earthquake which formed a part of the original seismic  
12 design basis for the plant.

13           Those Diablo Canyon structures, systems, and  
14 components which are necessary for continued operation  
15 without undue risk to the health and safety of the public  
16 are designated as Design Class I in accordance with the  
17 Diablo Canyon seismic classification system. This seismic  
18 classification system, and its conformance to applicable NRC  
19 Rules and Regulations, has been described previously in my  
20 testimony related to Intervenor's contention IIA5.

21           Design Class I components at Diablo Canyon are  
22 designed to remain functional and within applicable stress  
23 and deformation limits when subjected to the effects of  
24 vibratory motion of the Design Earthquake in combination  
25 with normal operating loads. The engineering method used to  
26 ensure that these structures, systems, and components are



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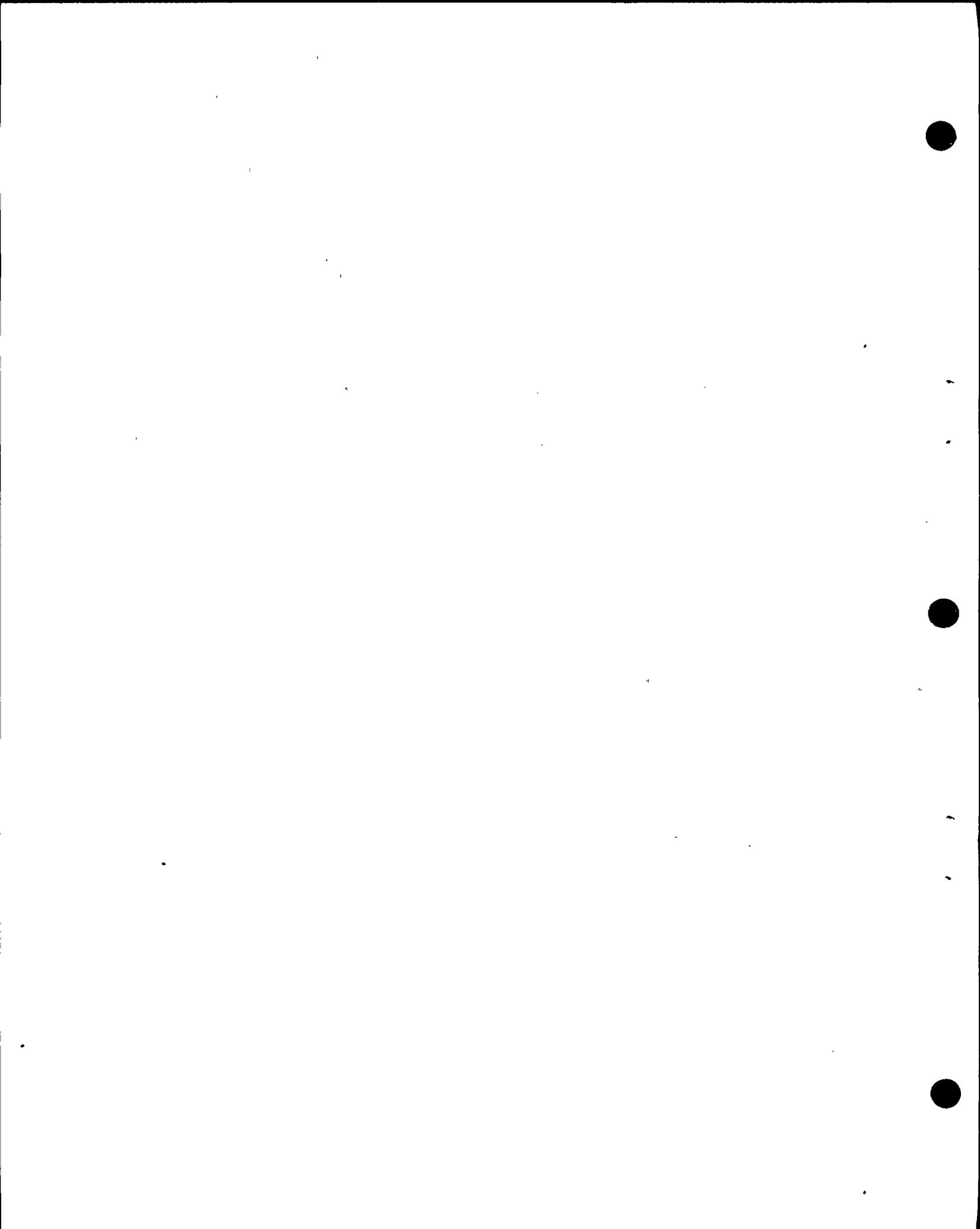


1 capable of withstanding the effects of the Design Earthquake,  
2 as well as the stress and deformation limits employed, are a  
3 part of the seismic design criteria approved in connection  
4 with issuance of construction permits for the Units. The  
5 seismic design criteria were employed in the design and  
6 construction of the Units and are described in detail in the  
7 Diablo Canyon Final Safety Analysis Report. The design  
8 criteria included use of analyses and qualification tests  
9 and considered the combination of seismic and other con-  
10 current normal operating loads.

11 Adequate demonstration that the requirements of  
12 Section VI(a)(2) of Appendix A to 10 CFR Part 100 have been  
13 met is provided in the Final Safety Analysis Report for  
14 Diablo Canyon, supported by detailed calculations and tests  
15 reports which have been reviewed by the Regulatory Staff and  
16 which have been made available to Intervenors.

17 Earlier in my testimony, I cited the conclusions  
18 of the NRC Regulatory Staff with respect to the original  
19 seismic design of the Diablo Canyon Units, as published in  
20 its first Safety Evaluation Report for the plant on  
21 October 16, 1974. In Section 3.7 of Supplement No. 7 to the  
22 Staff's Safety Evaluation Report, published May 26, 1978,  
23 the Regulatory Staff stated the following with respect to  
24 the original seismic design:

25 "In Section 3.7 of the Safety  
26 Evaluation Report, we discussed the  
applicant's original seismic design



1 methods and procedures and found them  
2 acceptable in relation to the original  
3 seismic design criteria. This conclu-  
4 sion has not been changed.

5 "With regard to the design earthquake  
6 or operating basis earthquake, we have  
7 concluded in Section 2.5 of this supple-  
8 ment that the original operating basis  
9 earthquake remains unchanged for this  
10 site. Accordingly, there is no need for  
11 any further work by the applicant with  
12 regard to operating basis earthquake  
13 design matters."

14 The manner in which the plant's original seismic  
15 design basis, including the Design Earthquake, was incorpo-  
16 rated in the design of the plant has been discussed in  
17 detail in a number of meetings with the Advisory Committee  
18 on Reactor Safeguards. The Committee's conclusions stated  
19 in its July 14, 1978, letter on Diablo Canyon indicate its  
20 satisfaction with this matter.

21 Later testimony will describe in detail the  
22 structures, systems, and components considered in the seismic  
23 design of the plant, the criteria and methodology employed,  
24 the analyses made and qualification tests conducted and the  
25 manner in which concurrent operational loads were taken into  
26 account.

As Project Engineer for Diablo Canyon, I have  
reviewed the work done in incorporating the original seismic  
design basis for the plant into the Diablo Canyon design.  
This seismic design basis included the Design Earthquake,  
which is the Operating Basis Earthquake for the plant. It



1 is my conclusion that the Diablo Canyon plant meets the  
2 requirements of all applicable NRC Rules and Regulations,  
3 including the requirements of Section VI(a)(2) of Appendix A  
4 to 10 CFR Part 100.

5 Intervenor's contention IIa7 is as follows:

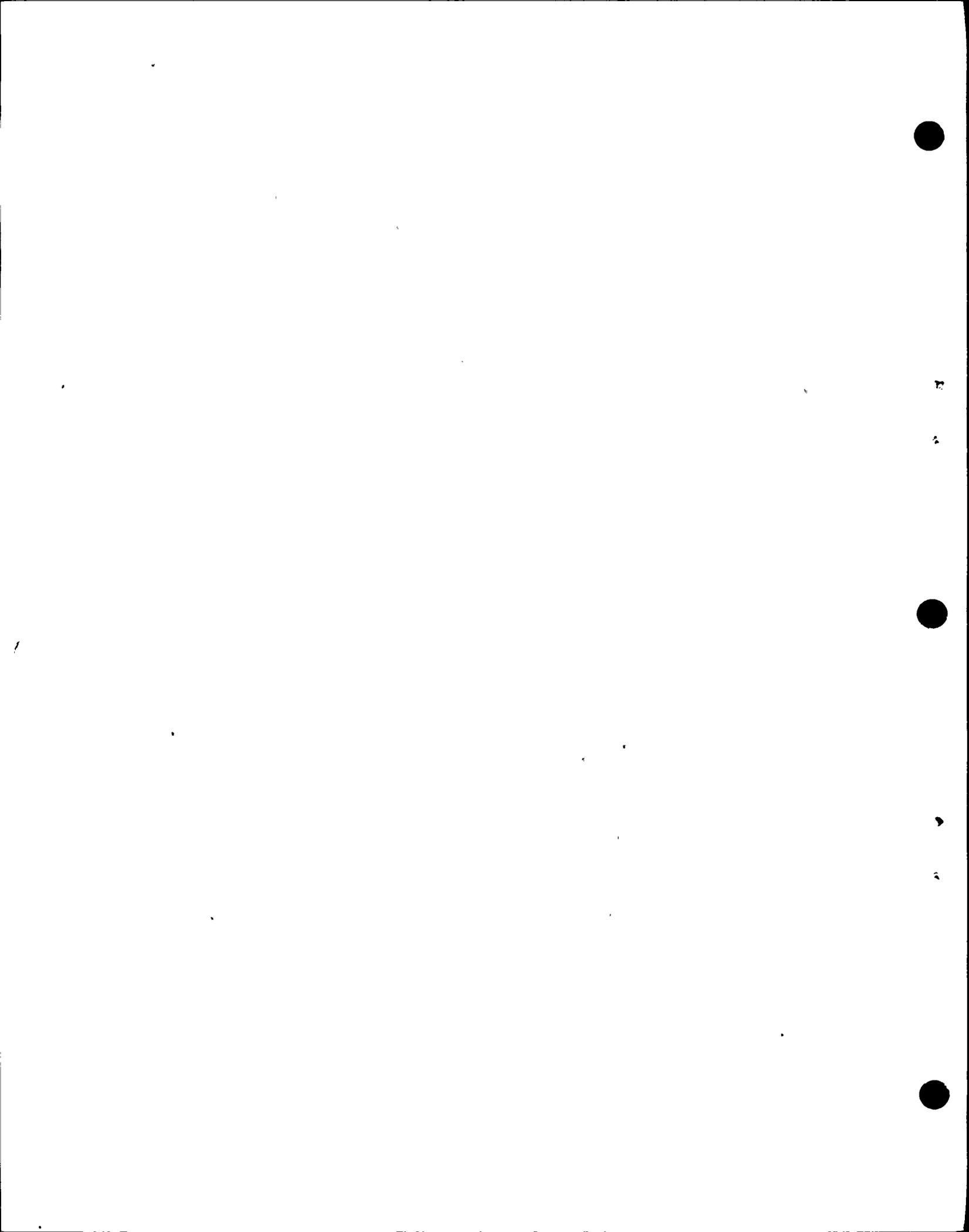
6 "The Applicant has failed to demonstrate  
7 adequately that necessary safety functions  
8 are maintained during the safe shutdown  
9 earthquake where, in safety-related  
structures, systems and components, the  
design for strain limits is in excess of  
the yield strain."

10 The wording of Intervenor's contention appears to  
11 have been abstracted from a portion of Section VI(a)(1) of  
12 Appendix A to 10 CFR Part 100, although Intervenor has  
13 chosen to omit important language from that portion of the  
14 Regulation. The wording of that portion of the Regulation  
15 related to Intervenor's contention is as follows:

16 "It is permissible to design for strain  
17 limits in excess of yield strain in some  
18 of these safety-related structures,  
19 systems, and components during the Safe  
20 Shutdown Earthquake and under the postu-  
lated concurrent conditions, provided  
that the necessary safety functions are  
maintained."

21 Because later detailed testimony will be presented  
22 concerning the acceptance criteria employed in the Hosgri  
23 Evaluation and the results of that evaluation, I will limit  
24 the scope of my testimony at this time to some very general  
25 observations and conclusions.

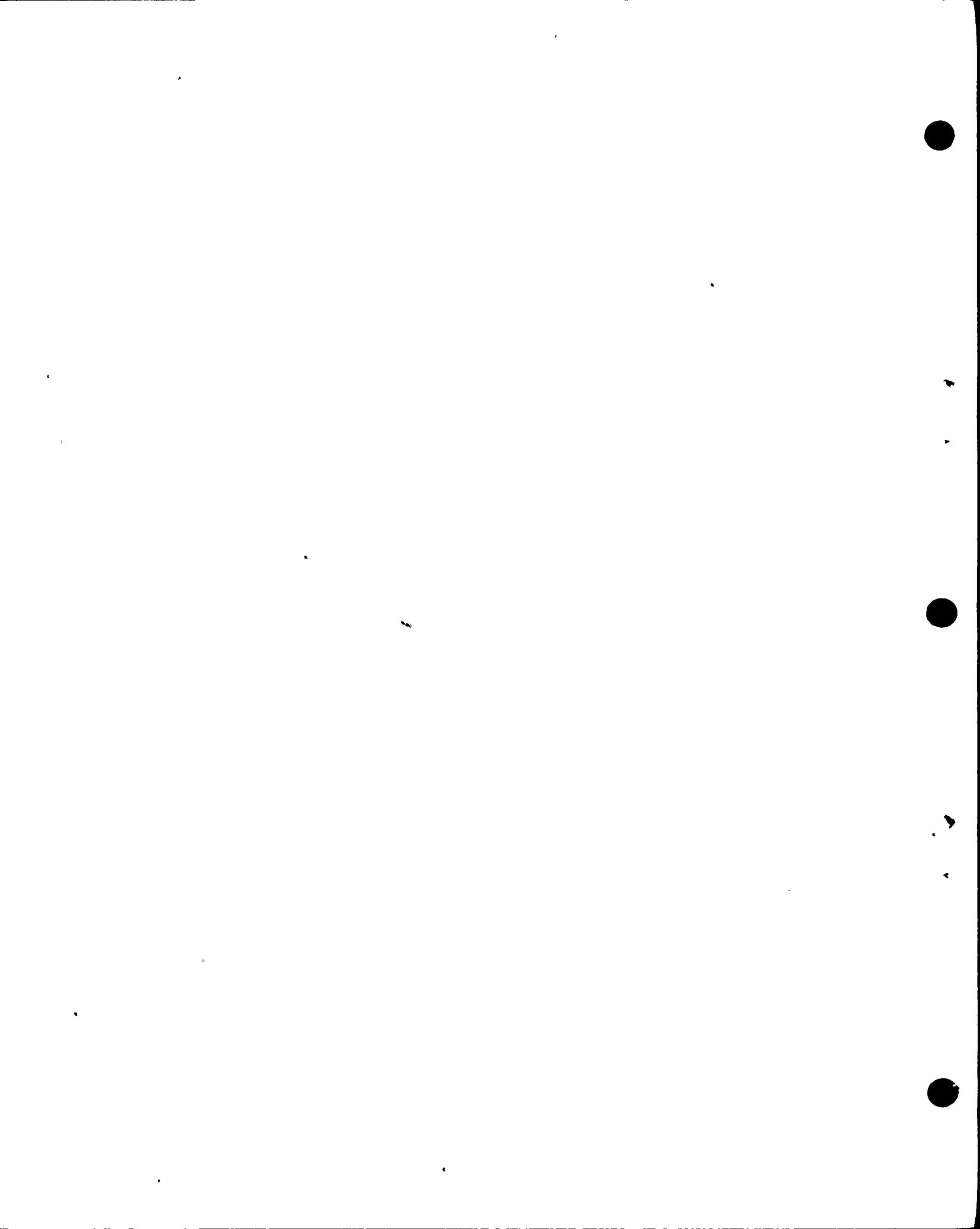
26



1           For Diablo Canyon structures, the acceptance  
2 criteria employed in the Hosgri Seismic Evaluation allowed  
3 stresses or strains beyond yield only in very limited situa-  
4 tions and under conditions where such yielding could not  
5 affect the performance of necessary safety functions. Only  
6 in a very few locations in Diablo Canyon structures did the  
7 results of the Hosgri Seismic Evaluation indicate stresses  
8 beyond the yield point of the material. The associated  
9 deformations have been carefully evaluated to assure that  
10 all necessary safety functions are maintained.

11           For these components qualified by test for the  
12 postulated Hosgri event, functionality was demonstrated  
13 during the test as well as after the test if such function-  
14 ality was required in order for the component to perform its  
15 intended safety function. For equipment qualified by  
16 analysis which must move, open or close, pump fluids, or  
17 otherwise perform an active safety function when subject to  
18 seismic loadings, special criteria were developed and applied  
19 to assure that deformations as a result of seismic loadings  
20 would not prevent performance of the active safety function.

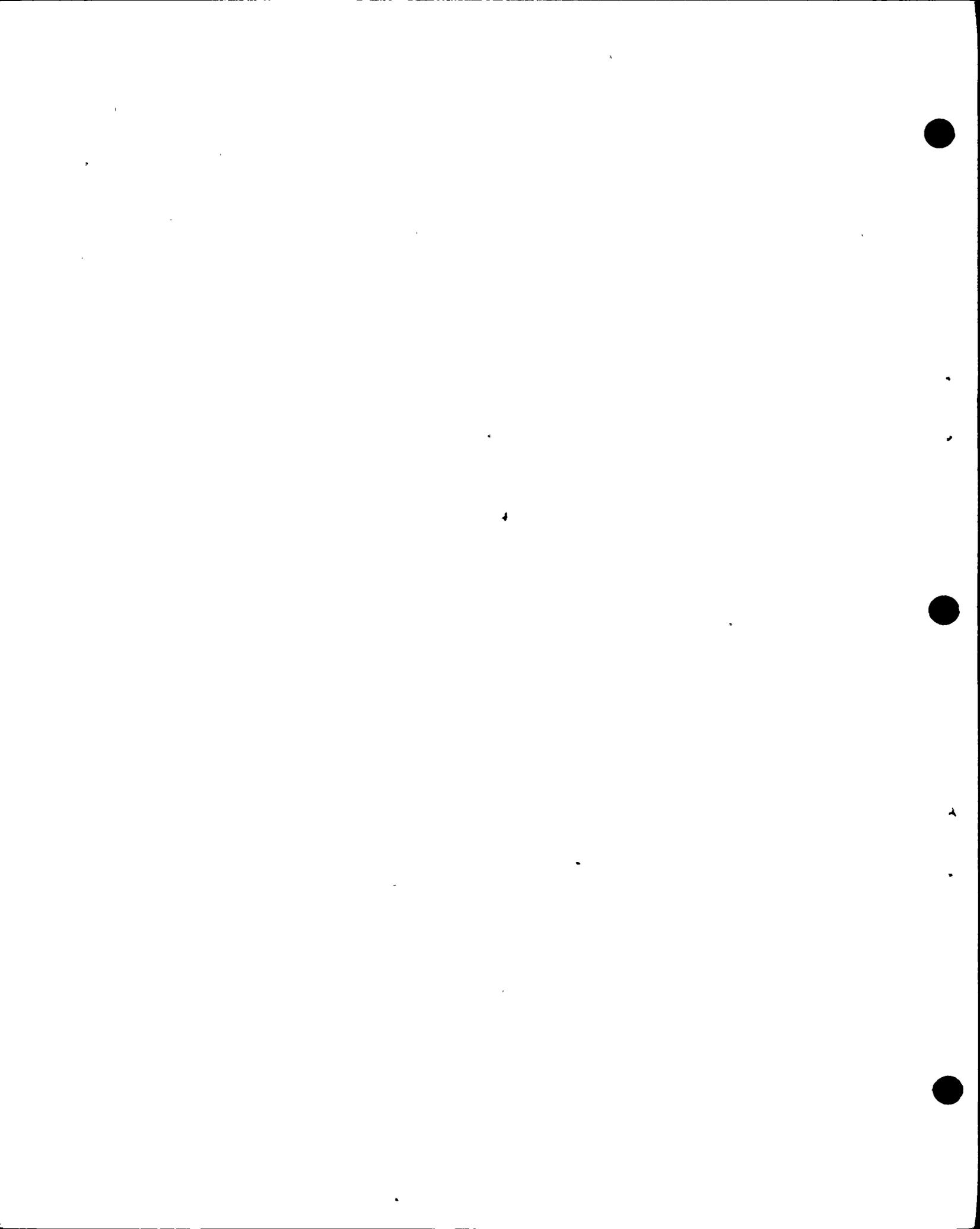
21           For certain Diablo Canyon components, such as  
22 piping systems, the acceptance criteria for stresses employed  
23 in the Hosgri evaluation were in accordance with accepted  
24 industry codes and standards. For loading combinations  
25 associated with a Safe Shutdown Earthquake, these acceptance  
26 criteria do, indeed, allow calculated stresses (or strains)



1 beyond the yield point of the material. These codes and  
2 standards, and the stresses allowed, are drawn from extensive  
3 experience with the piping and materials involved and are  
4 specifically formulated to assure that when stresses  
5 calculated by code approved methods are below allowable, the  
6 necessary integrity of the piping will be maintained.

7           It is my conclusion that wherever the Hosgri  
8 Seismic Evaluation has shown that stresses or strains beyond  
9 the yield point would be calculated for loading combinations  
10 related to the postulated Hosgri event, all necessary safety  
11 functions will be maintained and the plant complies with all  
12 applicable NRC Rules and Regulations, including that portion  
13 of Section VI(a)(1) of Appendix A to 10 CFR Part 100 related  
14 to Intervenors' contention.

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2 MRS. BOWERS: Mr. Norton, do you have further  
3 direct?

4 MR. NORTON: No, I have no further direct.

5 MRS. BOWERS: Mr. Kristovich?

6 CROSS-EXAMINATION

7 BY MR. KRISTOVICH:

8 Q Mr. Hoch, what was your involvement in Diablo  
9 Canyon before you were Project Engineer?

10 A My original involvement was as an engineer  
11 working on the project doing design, purchasing equipment,  
12 designing systems. Subsequently I became Licensing  
13 Engineer for the project, that is, with responsibility for  
14 NRC licensing matters.

15 Q So when did your involvement begin with  
16 Diablo?

17 A Approximately mid-1968.

18 Q I'd like to direct your attention to Page Two  
19 of your testimony. Beginning at Line Two, you state:

20 "The construction permit applica-  
21 tions were reviewed by AEC Regulatory Staff  
22 and the seismic design criteria was modified  
23 in some respects to meet the Staff's require-  
24 ments."

25 In what respects?

A I can't give you the details about that. It



agb2

1 certainly is always the case, to the best of my knowledge,  
2 that in the regulatory review -- in the NRC Staff review  
3 of anything, including the seismic design basis, that certainly  
4 the basis as proposed by the Applicant -- I would be sur-  
5 prised if it ever exactly meets the Staff's requirements  
6 and certainly, to the best of my knowledge, is always  
7 modified. But I can't give you the details in which it  
8 was modified.

9 Q Also on Page Two, beginning on Line Nine,  
10 you state:

11 "This seismic design criteria met  
12 all applicable regulatory requirements in  
13 effect at the time of issuance of the con-  
14 struction permits."

15 What were these regulatory requirements at that  
16 time?

17 A Well that body of requirements contained in  
18 NRC rules and regulations. They have certainly been in  
19 existence --

20 Q What seismic design requirements at that time?

21 A If I'm not mistaken, Appendix A to 10 CFR  
22 100 had been issued prior to Unit Two construction permit  
23 issuance in draft form. It was a proposed regulation.

24 Certainly prior to the issuance of construction  
25 permits for either of the units, the general design criteria



agb3

1 Appendix A to 10 CFR Part 50, did exist and does contain a  
2 requirement for seismic design.

3 Q Do you know when the draft form of Appendix A  
4 was issued?

5 A Appendix A to Part 50 or Part 100?

6 Q Right -- I'm sorry, to Part 100.

7 A To Part 100?

8 Q Yes.

9 A If I'm not mistaken, and I'm going from memory  
10 here, if I'm not mistaken the proposed version of that  
11 regulation was issued some time in 1971. And I believe that  
12 regulation became effective in 1973. I could be wrong on  
13 those dates, but I believe that's correct.

14 In other words, what I'm saying is that certainly  
15 the regulations did include requirements for seismic design  
16 in the general design criteria prior to the adoption of  
17 Appendix A to Part 100.

18 MR. BRIGHT: Could I clear up a small point  
19 here that's bothering me?

20 You say: "This seismic design criteria..."  
21 Now do you mean these seismic design criteria? Are we  
22 talking about one criterion or several criteria?

23 THE WITNESS: We're talking about really a  
24 whole body of criteria.

25 MR. BRIGHT: Okay. So in quotes would be,



agb4

1. "these seismic design criteria." Okay.

2. MR. NORTON: We have another correction to the  
3. transcript then.

4. (Laughter.)

5. Mrs. Bowers, for the record, Appendix A was  
6. added November, 1973, effective December 13, 1973, 38  
7. Federal Rules 31281. That's 10 CFR Part 100 Appendix A.

8. BY MR. KRISTOVICH:

9. Q Mr. Hoch, directing your attention to Page  
10. Three, on Lines Four and Five you state:

11. "The Company attempted to comply,  
12. whenever practicable, with the newer criteria."

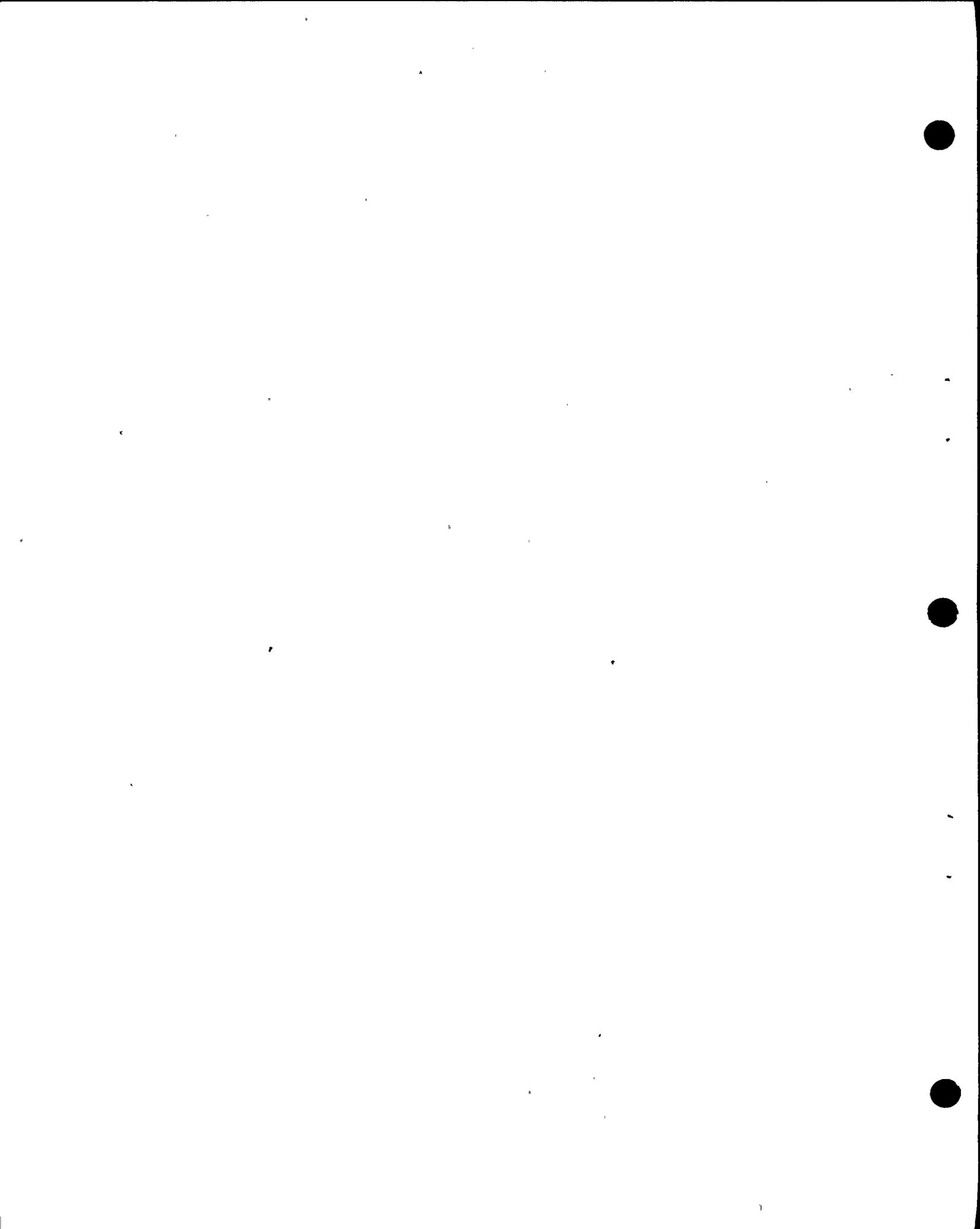
13. And I believe the newer criteria is referring  
14. to Appendix A to 10 CFR Part 50.

15. Which criteria were not practicable for the  
16. company to comply with?

17. A I won't go through this in detail, but I can  
18. get an FSAR if you like. There's an entire section in  
19. Chapter One of the FSAR which addresses in detail the  
20. comparison between each general design criterion as originally  
21. incorporated in Appendix A that is used in the original  
22. design of the plant and the change in each of the general  
23. design criteria as Appendix A to 10 CFR Part 50 was  
24. issued in 1971.

25. The FSAR contains a detailed comparison of

3.060



agb5

1 each and every one of those, and it would take me even with  
2 the guidance of the FSAR, some length of time to go through  
3 each one of those.

4 MR. NORTON: Mrs. Bowers, I don't think that's  
5 necessary at all. The FSAR is in evidence, and it's en-  
6 cumbent upon the Intervenor to review that FSAR and not  
7 have it read to them during cross-examination.

8 MR. KRISTOVICH: I didn't ask Mr. Hoch to read  
9 it to me. Just giving me a citation to the FSAR would be  
10 fine.

11 THE WITNESS: Well I'm familiar with that  
12 material, and I'm completely able to go through each and  
13 every one of those comparisons if you'd like.

14 MR. KRISTOVICH: If you could just give a  
15 citation?

16 THE WITNESS: Chapter One of the FSAR. I don't  
17 know the subchapter heading.

18 MR. NORTON: I'm sure Intervenors are capable  
19 of looking up the subheadings of Chapter One of the FSAR.  
20  
21  
22  
23  
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1 BY MR. KRISTOVICH:

2 Q Mr. Hoch, still on page 3, at lines 15 and the  
3 subsequent few lines you state:

4 "As these Regulatory Guides were  
5 issued, the guidance they contained was  
6 incorporated, where practicable..."

7 Which of the current Regulatory Guides has the  
8 company not complied with?

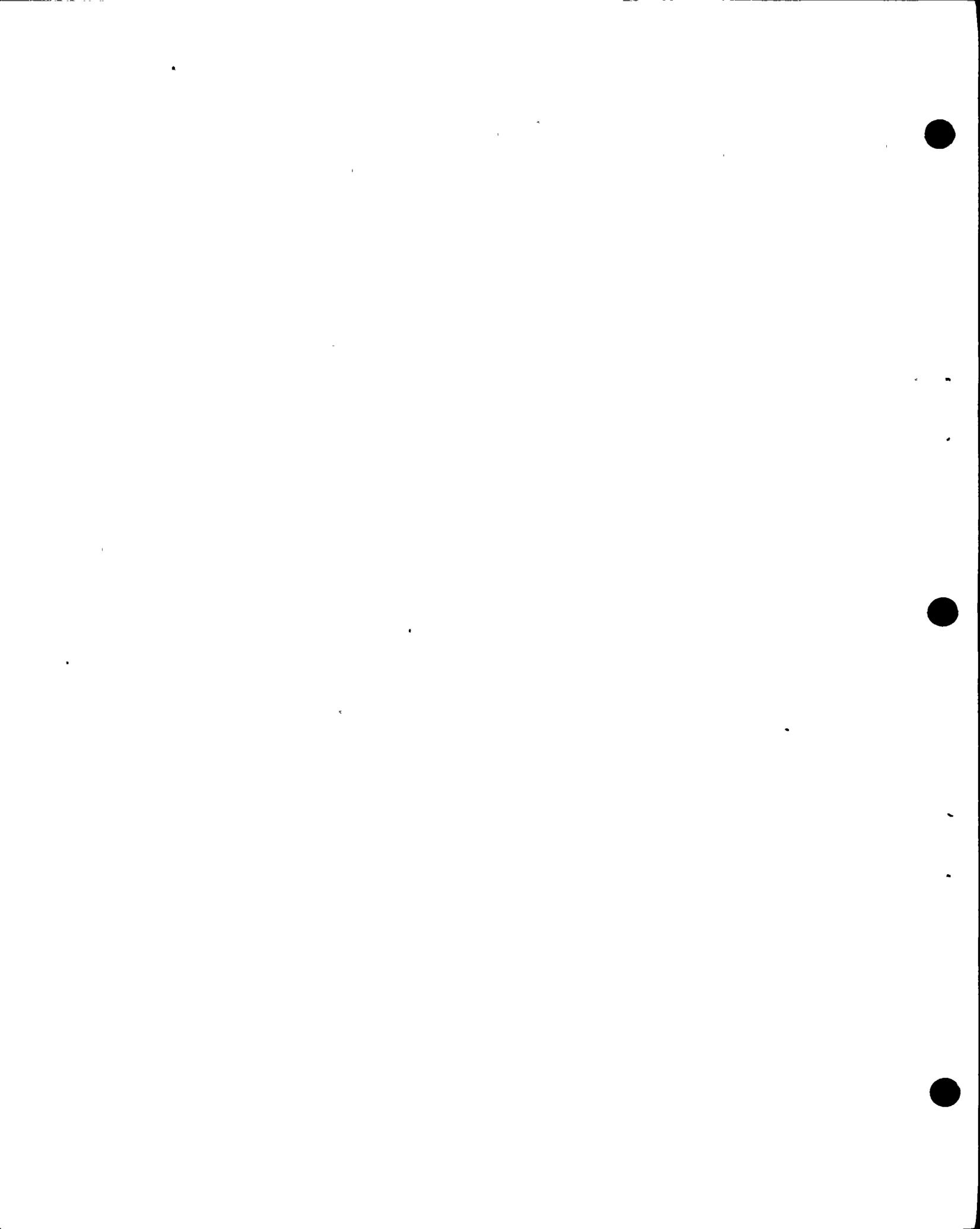
9 A Oh, a number.

10 MR. NORTON: I object.

11 That assumes facts not in evidence when he says  
12 "which of the regulatory guides has the company not complied  
13 with". We argued about this, if you will recall, at great  
14 length in Los Angeles in a prehearing conference. And the  
15 intervenors at that time attempted to put into controversy  
16 in this matter as to whether the Applicant was required to  
17 comply with new regulations.

18 It was decided by this Board after being argued  
19 by the Staff and Applicant that they were only required to  
20 comply with applicable regulations. And as regulations  
21 obviously keep changing over the years, you can't keep  
22 retrofitting a plant to comply; so you must comply with  
23 applicable.

24 The question is now which regulations don't you  
25 comply with. The testimony here is that the plant complies



mpb2 1 with all applicable regulations. And I think questions  
2 must be framed in that regard as to whether or not there is  
3 compliance with applicable regulations -- or regulatory  
4 guides, excuse me.

5 MR. KRISTOVICH: Mrs. Bowers, I believe the  
6 testimony states:

7 "As these Regulatory Guides were  
8 issued, the guidance they contained was  
9 incorporated, where practicable..."

10 This is Mr. Hoch's testimony. I'm asking him  
11 which Regulatory Guides was it not practicable to comply  
12 with.

13 MR. NORTON: That was not the question.

14 MRS. BOWERS: I thought that was the question.

15 MR. NORTON: He said which regulatory guides  
16 did you not comply with.

17 MRS. BOWERS: Well, he may have worded it a  
18 little differently, but I understood that he was asking for  
19 an identification of those where it was not practicable.

20 MR. NORTON: All right.

21 We have no problem with that question.

22 MR. KRISTOVICH: I'll rephrase it in that regard.

23 BY MR. KRISTOVICH:

24 Q Which of the Regulatory Guides was it not --  
25 well, which of the current Regulatory Guides has it not been



mpb3 1 practicable for the company to comply with?

2 A Let me get this into a little perspective first.

3 I presume -- I'm sure you understand that a  
4 regulatory guide is not a regulation, and that it's guidance,  
5 and that each one says explicitly on the cover that the  
6 regulatory guide demonstrates a way or ways acceptable to  
7 the Staff of complying with a portion of the regulation, and  
8 that other procedures or methodology will be accepted provid-  
9 ing justification is supplied and the Staff agrees that the  
10 other procedures or methodology accomplishes the same thing  
11 or provides an acceptable level of safety, if you will, to  
12 conform to the regulations.

13 In issuing regulatory guides it's become stand-  
14 ard Staff practice in recent years, over the last two or  
15 three, to include so-called "vintaging" in each regulatory  
16 guide. That is to say, in the body of the regulatory guide  
17 or in the front of the regulatory guide, to what plants that  
18 regulatory guide is applicable, that is plants with construc-  
19 tion permits issued after such and such a date, or an operat-  
20 ing license issued after such and such a date.

21 The intent of my statement here was to say that  
22 where a regulatory guide is required to be applied to Diablo  
23 Canyon, that is where the vintaging would include Diablo  
24 Canyon, we have either complied explicitly with the guide,  
25 that is, complied with the letter of the guide, with its



mpb4 1 intent, or we provided to the Staff and the Staff has accept-  
2 ed justification for what we've done; while not meeting the  
3 strict letter of the regulatory guides it provides an equal  
4 level of safety.

5 And there are a number of regulatory guides in  
6 that status, and I can't go through them in detail from  
7 memory. I can, given some time, go through them in detail  
8 again, going through chapter one of the FSAR and through  
9 each regulatory guide in detail. There are some 100 and --  
10 I don't know how many regulatory guides now with a number  
11 of the regulatory guides having subparts. But that would  
12 be quite an involved job. We can certainly do it.

13 MR. NORTON: Mrs. Bowers, I don't think it's  
14 incumbent upon the Applicant to do such a chore. If the  
15 intervenors feel that there is a regulatory guide that has  
16 not been complied with, then they can bring forth that  
17 specific regulatory guide and ask questions about it. But  
18 to ask the witness to go through 100-plus regulatory guides  
19 and tell how it was complied with in each instance,  
20 doesn't -- well, it may accomplish something; it may accom-  
21 plish taking up another two or three days of the hearing.  
22 But other than that it doesn't accomplish anything.

23 MRS. BOWERS: Mr. Kristovich, can you respond  
24 to what's essentially an objection?

25 MR. KRISTOVICH: Mrs. Bowers, the question was



mpb5 1 only asked because it appears Mr. Hoch is using his testi-  
2 mony to paint the impression that the company has complied  
3 with the federal regulations and complied with the federal  
4 regulatory guides where practicable, and that the company has  
5 made a huge effort.

6 We would just like to know where it hasn't been  
7 practicable. We just want to flush this out a little bit,  
8 and to see which regulatory guides they haven't complied  
9 with and which they have complied with.

10 MR. NORTON: Mrs. Bowers, it is the testimony  
11 of this witness under oath that they have been complied with.

12 MR. KRISTOVICH: Yes, we're just trying to  
13 flush it out a little more and find out where.

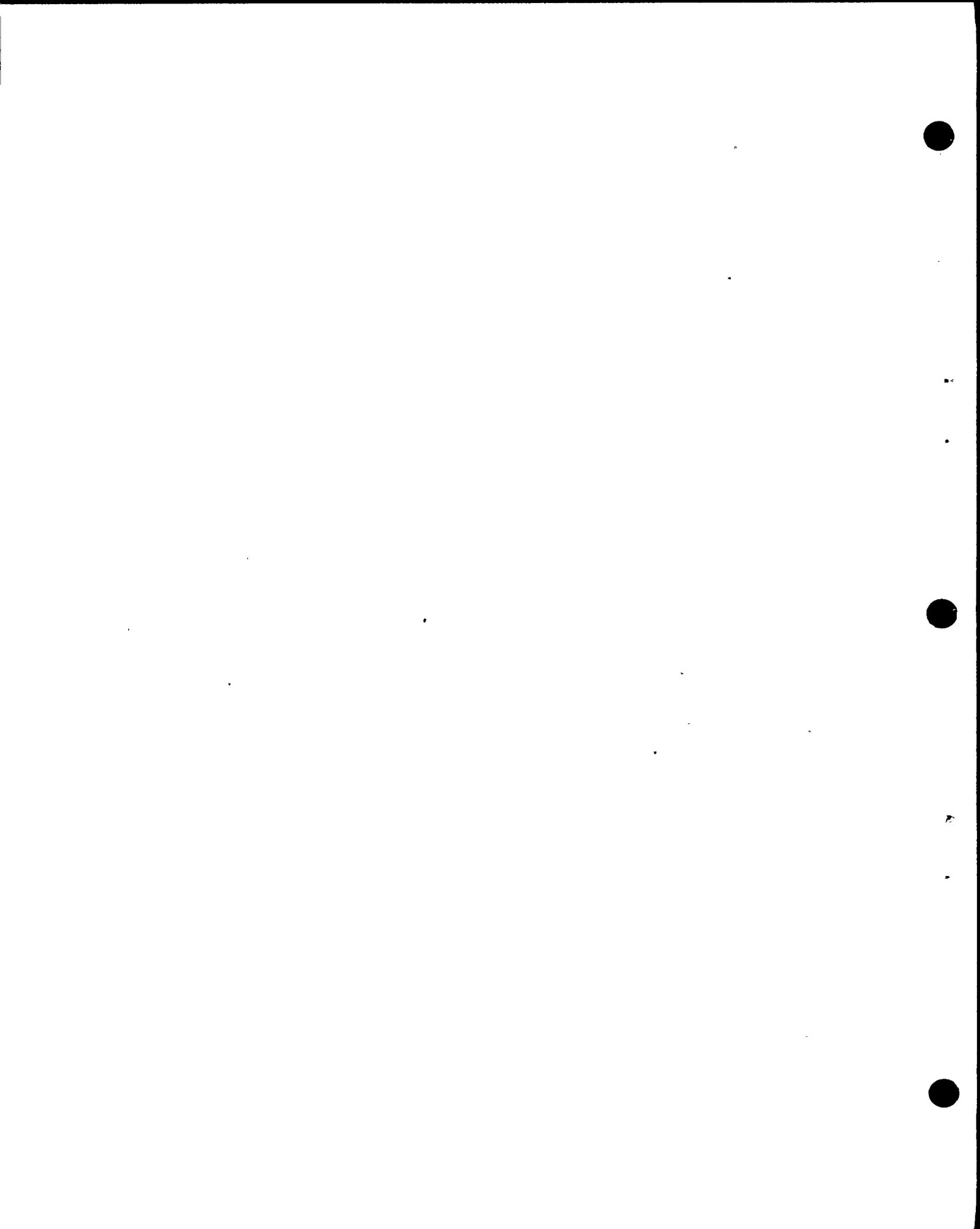
14 MR. NORTON: Well, if they have a regulatory  
15 guide in mind that hasn't been complied with, let's hear  
16 about it.

17 MR. KRISTOVICH: That was my question, which  
18 ones.

19 MRS. BOWERS: Staff, Mr. Tourtelotte?

20 MR. TOURTELLOTTE: Well, regulatory guides, as  
21 we've all heard, are not a part of the regulation. And they  
22 are simply a suggestion, actually to the Applicant, as to  
23 how the applicant can meet the requirements of the Staff  
24 most ably.

25 They are in no way a requirement on the applicant.



mpb6 1

2 I believe that the question is overly broad,  
3 because it seems to me if there is some particular reg guide  
4 that pertains specifically to the contention of the Applicant  
5 that was not complied with, then perhaps that is --

6 MR. NORTON: Is that a contention of the  
7 Intervenor?

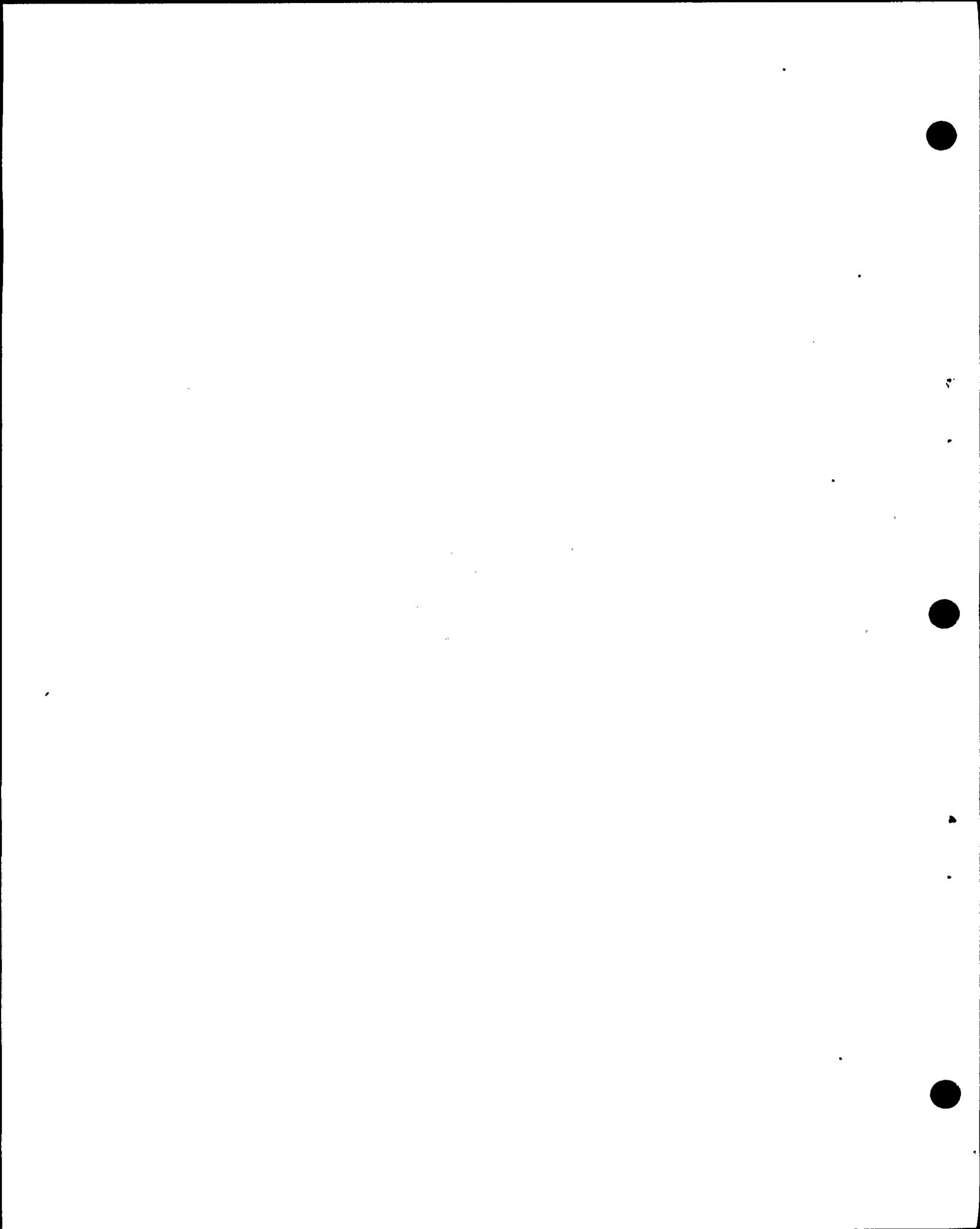
8 MR. TOURTELLOTTE: I'm sorry, contention of the  
9 Intervenor, which has not been complied with, then they  
10 perhaps have some interest or some relevancy in discovering  
11 how the reg guide was in some way supplanted by some other  
12 action.

13 But to ask a question across the board about  
14 which reg guides have been complied with and which have not  
15 surpasses what may be relevant in the case.

16 It seems to me that the question is overly broad  
17 and should be more specific.

18 MRS. BOWERS: You used the word "discover". Is  
19 this a matter that might have been raised earlier during the  
20 discovery period?

21 MR. TOURTELLOTTE: Certainly. Certainly. There  
22 is no reason why during the period of interrogatories that  
23 same question could not have been asked and answered. And  
24 in the event that had any bearing upon the contentions of the  
25 Intervenor then certainly the Intervenor could have done  
something with that.



mpb7 1 But it seems to me it's a little bit late in  
2 the ball game to engage in this kind of a fishing expedition.

3 MR. KRISTOVICH: Mrs. Bowers, could I respond  
4 to that?

5 MRS. BOWERS: Yes.

6 MR. KRISTOVICH: As I understand, we could not  
7 have learned of this information on discovery because our  
8 contentions regarding this were turned down on backfitting.

9 MR. NORTON: That was my original objection, and  
10 that was what Mr. Kristovich said he was not asking.

11 MR. KRISTOVICH: Well, Mrs. Bowers, in response  
12 to that I would just move to strike this part of the testimony,  
13 then. If they don't want it in the testimony, then that's  
14 fine. If it's in the testimony, then we'll cross-examine on  
15 it.

16 MR. NORTON: Mrs. Bowers, what's in the testi-  
17 mony is the statement that as the new reg guidas came out the  
18 Applicant made every attempt to comply with them where practi-  
19 cable. That's a simple flat statement. That is not a state-  
20 ment that they've complied with all of them, or that they've  
21 complied with this one or that one or another one. It's  
22 simply a statement that they did read them, they did work  
23 on them, and they complied with them where practicable.

24 MR. KRISTOVICH: Is Mr. Norton testifying now,  
25 or is Mr. Hoch testifying.



mpb8 1 MRS. BOWERS: We'd like all of you to give us  
2 a chance to consider this.

3 MR. TOURTELLOTTE: I would invite the Board's  
4 attention to the fact that we have now two motions:

5 We have one motion, as I recall it, Mr. Norton's,  
6 which goes to an objection to what is a vague and overly  
7 broad question, I suppose.

8 And the other one is a motion to strike by  
9 Mr. Kristovich.

10 I believe that's a fair representation of what's  
11 going on.

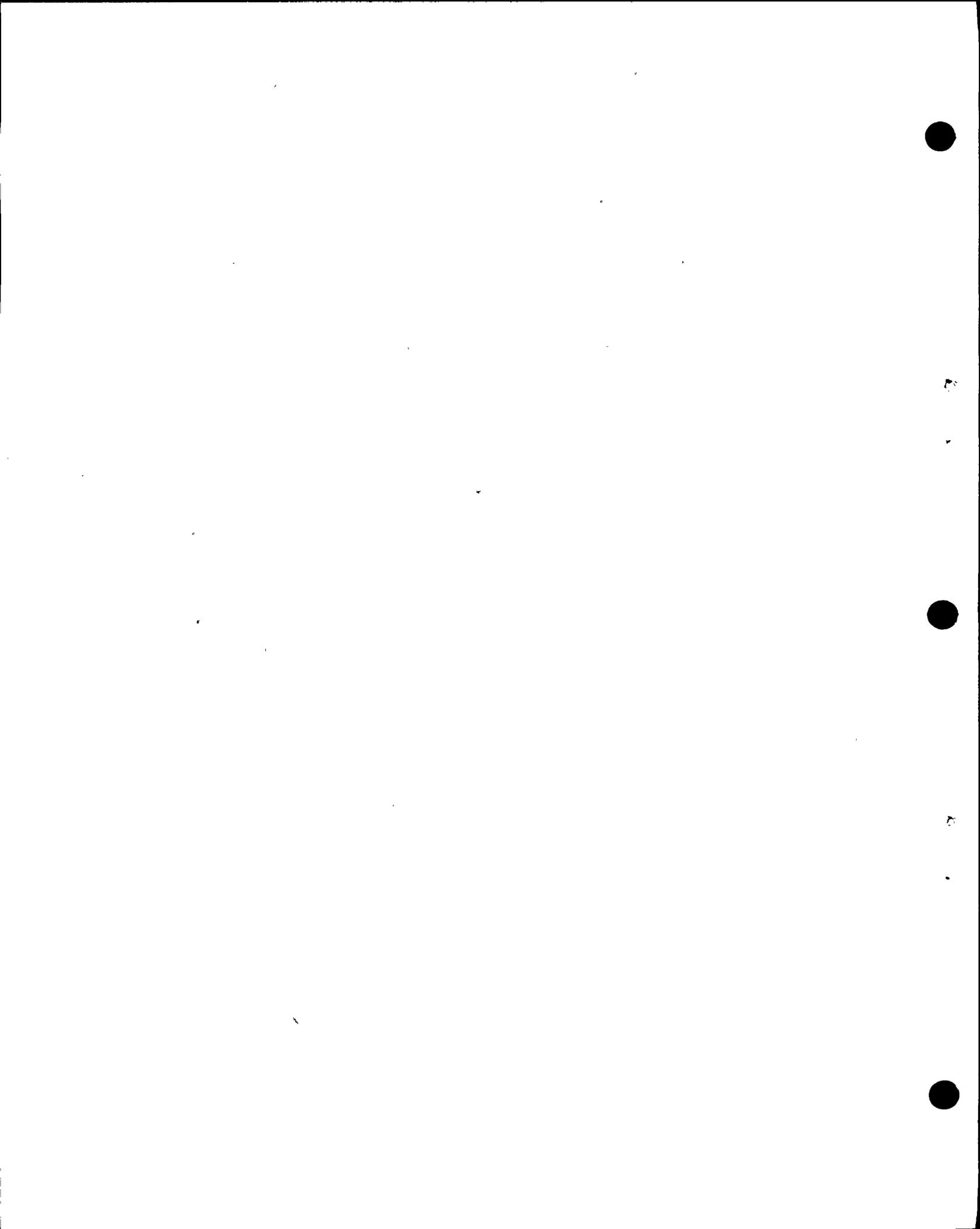
12 MR. KRISTOVICH: Mrs. Bowers, I will withdraw  
13 the motion to strike until you rule on the first one, if you  
14 like.

15 (The Board conferring.)

16 MRS. BOWERS: Well, the objection is sustained,  
17 Mr. Norton's objection. We do think that the question to the  
18 witness was overly broad.

19 And what we would prefer, which may not be  
20 possible, is that, Mr. Kristovich, you identify an area or  
21 areas where you feel there was not compliance.

22 Now another way to approach this which the Board  
23 feels comfortable with is that perhaps the witness could  
24 identify one from memory where there was not -- the regulatory  
25 guide was not applied, per se, but compliance was reached by



mpb9 1 a substitution.

2 MR. KRISTOVICH: Well, Mrs. Bowers, we're not  
3 interested in just one.

4 MRS. BOWERS: Well, but you have to identify  
5 those that you're interested in.

6 MR. KRISTOVICH: I'm asking the witness to  
7 identify which ones. He's in a better position to know which  
8 ones were not practicable to be complied with.

9 MRS. BOWERS: Well, I've heard the term 120-some  
10 regulatory guides. I know back in our office there are  
11 volumes of them.

12 MR. NORTON: Excuse me, Mrs. Bowers. Let me  
13 interject something.

14 The problem is that Mr. Kristovich keeps saying  
15 the ones they haven't complied with. There is no basis for  
16 that statement.

17 It says, and I'll read it again, is:

18 "As these Regulatory Guides were  
19 issued, the guidance they contained was  
20 incorporated, where practicable, in  
21 Diablo Canyon design and procedures or  
22 justification for using other criteria  
23 or methodology was established."

24 And he says Tell me which ones weren't complied  
25 with.



mpbl01

1 My point is that there is no evidence in the  
2 record that any of them -- quote -- weren't complied with --  
3 endquote.

4 MR. KRISTOVICH: I stand corrected.

5 The regulatory guides where it was not practic-  
6 able.

7 MR. NORTON: But you see, Mrs. Bowers, that  
8 gets down to what Mr. Tourtellotte was saying. We are not  
9 required to incorporate the guidance. We are either to  
10 incorporate the guidance -- and you're not required to even  
11 do that, but you can do that -- or you can show reasons why  
12 you don't have to.

13 So his question is just not relevant to this  
14 statement. His question is saying if you didn't comply with  
15 it, or where you didn't incorporate it. I don't understand  
16 where that goes because we're not required to.

17 In other words, it's just not relevant.

18 MRS. BOWERS: Well, but his question I thought  
19 was he wanted identification where justification was submitted  
20 to use other criteria.

21 MR. NORTON: Okay. I understand that.

22 And the problem with that is it would take  
23 hours and hours and hours for Mr. Hoch to go through and  
24 answer that. I have in front of me, for example, just the  
25 first 100 reg guides and the index goes up to 142 as of May



mpbil 1 of '78, and I'm sure there have been more since then. There  
2 is no way the witness can sit on the stand and do that. I  
3 mean, that's absurd.

4 I can start reading off the titles. For example,  
5 "Estimating Aquatic Dispersion of Effluents from Accidental  
6 and Routine Reactor Releases for the Purpose of Implementing  
7 Appendix I". That happens to be number 113.

8 We would be here forever going through these,  
9 and these things take months to do. Even just one of them  
10 might take months.

11 For him to sit here and explain how the justi-  
12 fication was given to the NRC, where does that get us? It  
13 takes forever. And how is it relevant if it's not required  
14 under the law?

15 MRS. BOWERS: Well, the objection was sustained.  
16 You withdraw your motion to strike, Mr. Kristovich.

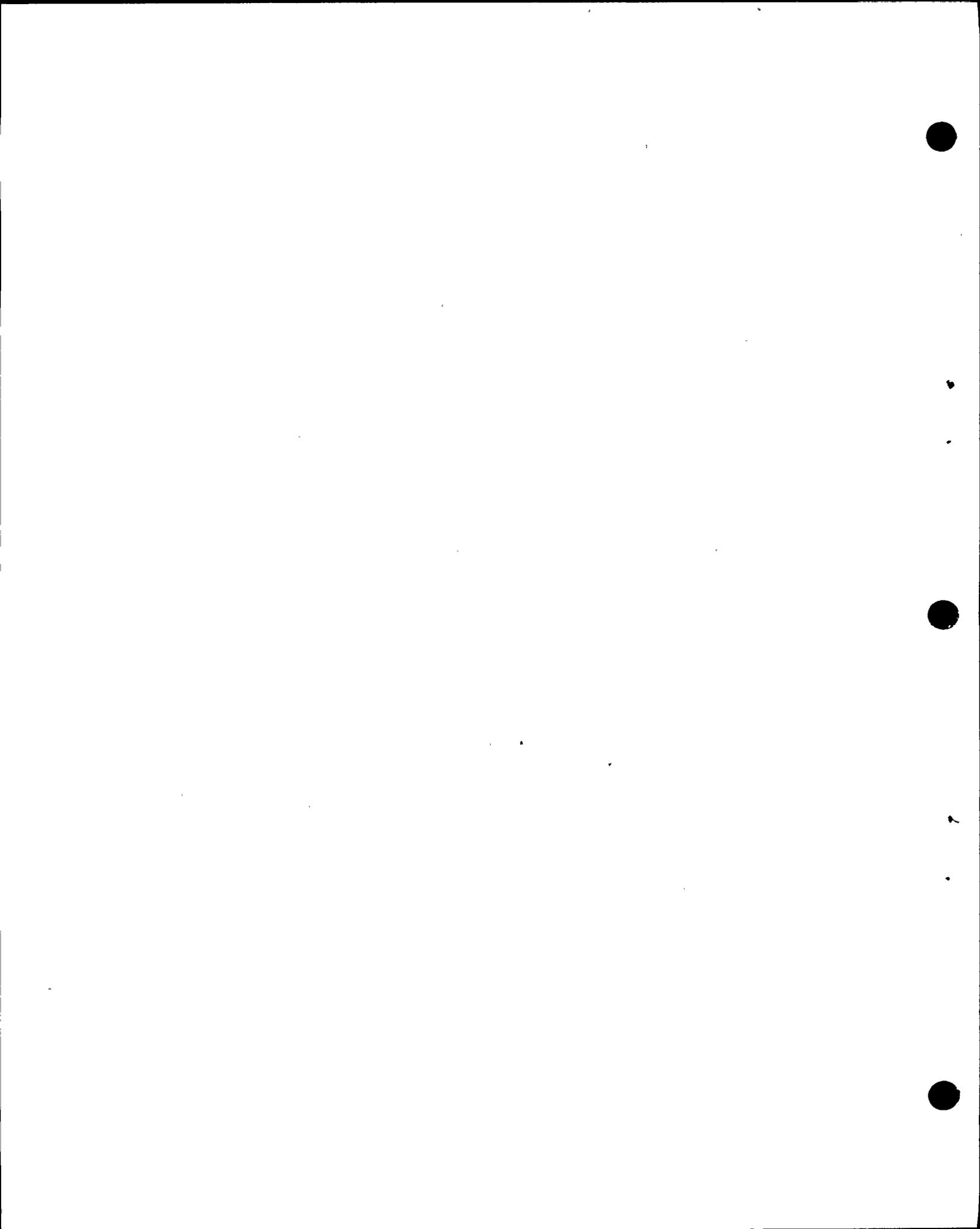
17 MR. KRISTOVICH: We'll move on.

18 BY MR. KRISTOVICH:

19 Q Mr. Hoch, directing your attention to page 6,  
20 lines 7 through 9, you state, and I quote:

21 "I believe the Hosgri seismic evaluation  
22 to be the most complete and comprehensive study  
23 ever made of the seismic capability of a nuclear  
24 power plant."

25 Do you know of any other nuclear power plant in



mpbl21 the world located within six kilometers of an active fault  
2 capable of generating an earthquake with a postulated magni-  
3 tude 7.5?

4 A No, I don't specifically, no.

5 Q Mr. Hoch, directing your attention to page 9,  
6 lines 13 to 15. This is the middle of a sentence, but you  
7 state that you conclude that Intervenor's contentions -- and  
8 I'm paraphrasing -- either have no basis in fact or are  
9 not relevant to the issues of whether the Diablo Canyon  
10 units can be operated without undue risk to the health and  
11 safety of the public.

12 Which of the contentions have no basis in fact?

13 A All of them except for IIA-4. All of them I  
14 have addressed here except for IIA-4.

15 Q And which contentions are not relevant to the  
16 health and safety of the public?

17 A Contention IIA-4.

18 Q Moving to page 10, on lines 3 and 4, you have  
19 a list of plants.

20 Do you know of the current status of those  
21 plants? Would you go through the list one by one and say  
22 which plants have a construction permit--

23 A No, I can't.

24 But I can say that I am certain that one or  
25 more of those plants has been issued a construction permit.



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mpb131

Q Which one?

2

A I'm sorry, I can't tell you that. I don't know.

3

I don't recall.

4

Q And so none of them have an operating license?

5

A Certainly none of them has an operating license.

6

Q Isn't it true that Byron and Braidwood are

7

actually the same plant?

8

A Yes, I think we have a typo there.

9

MR. NORTON: Yes, the comma should come out

10

after "Byron". It's Byron-Braidwood.

11

THE WITNESS: I'm sorry, I missed that. Although

12

there is some confusion in my mind, I think they may have been

13

originally applied for as separate sites, so that what I've

14

said here may be correct for -- as the operating basis earth-

15

quake was determined. I don't know the details of that.

16

MR. NORTON: I believe it is two sites, come to

17

think about it. The person from Westinghouse who is sitting

18

back here says it is two sites.

19

MRS. BOWERS: Well, I know in Marble Hill, that's

20

a design based on Byron, and only the Byron design was

21

incorporated in the Marble Hill.

22

MR. TOURTELLOTTE: They're two separate plants.

23

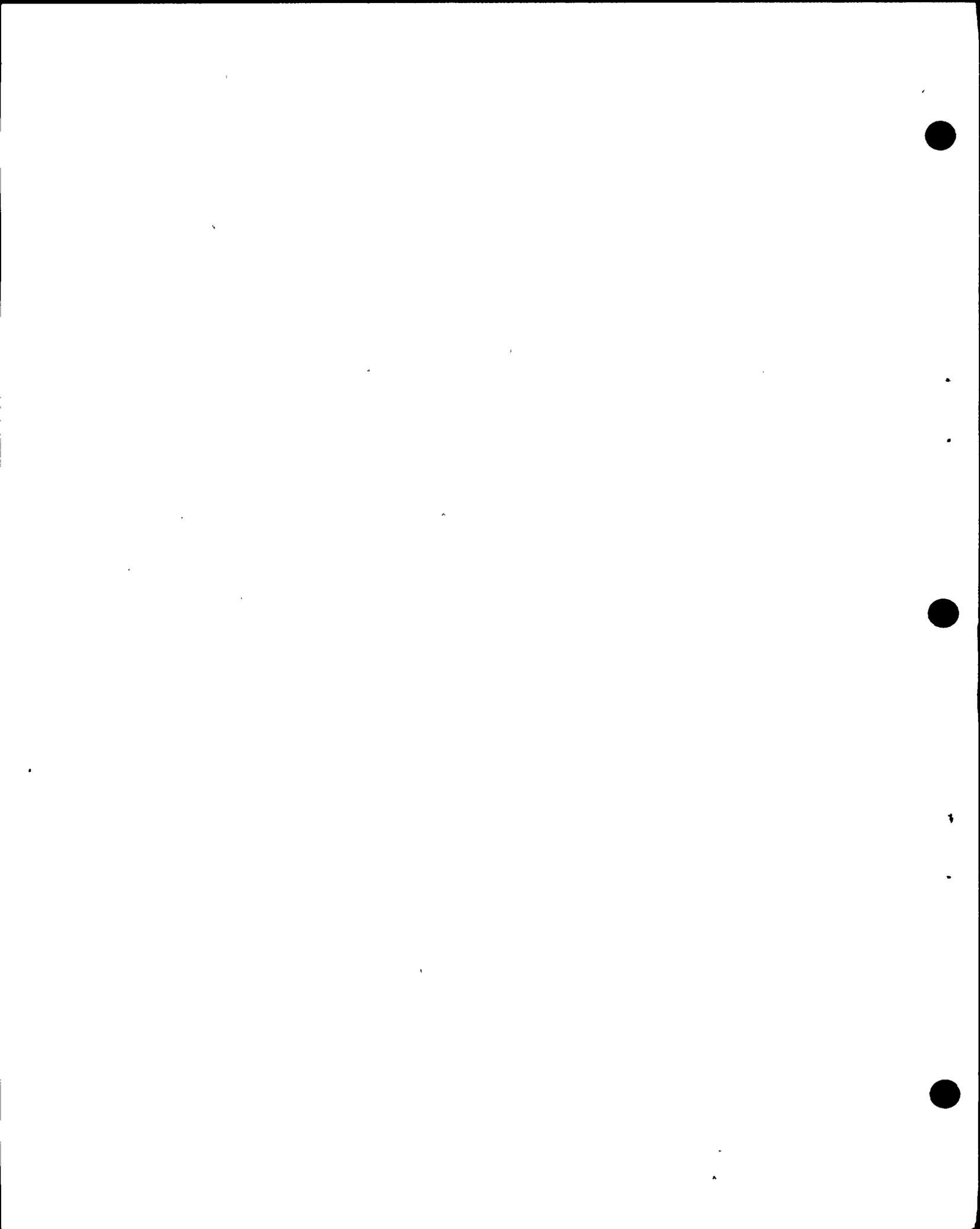
One was named after a man named Byron and the other one was

24

named after a man named Braidwood. And they are in the same

25

general location, but they are not the same plants.



mpbi41

That's not sworn testimony, and I don't want to be cross-examined on it.

(Laughter.)

MRS. BOWERS: So the comma stays in, right?

MR. NORTON: Yes.

BY MR. KRISTOVICH:

Q Well, Mr. Hoch, for each of these plants, then, do you know what the safe shutdown earthquake is?

A No, I don't have that at my fingertips.

Q Do you have it not at your fingertips?

A I'm not sure we did. If we had that information here we could find it, but I'm not sure that information is available to me now.

Q Well, I would like the information if you could get it, if it is here.

I would like to get the SSE for each of these plants and the OBE for each of these plants.

A Certainly that can be provided and given, I guess, in connection with later more detailed testimony.

Q Well, is it possible -- do you have it here right now?

A No, I don't think so. I think that this would involve a little bit of research. If you've ever done research into licensing, it might take a while.

Q All right.



mpbl5 1

2 Well, Mr. Hoch, if I understand your testimony  
3 correctly, you are saying that these six plants have an  
4 operating basis earthquake less than one-half the safe  
5 shutdown earthquake. And what is the basis for that statement  
6 if you don't know what the safe shutdown earthquake is or  
7 what the OBE is?

8 MR. NORTON: Object.

9 He is testifying -- that's argumentative. He's  
10 testifying that it is less than one-half. That doesn't mean  
11 he has to know the specific numbers. For example, someone  
12 who is on the staff of those plants or on the NRC Staff  
13 who's reviewed them could tell him they are less than one-  
14 half without telling him the detailed numbers.

15 That's argumentative. He said he doesn't have  
16 the detailed numbers.

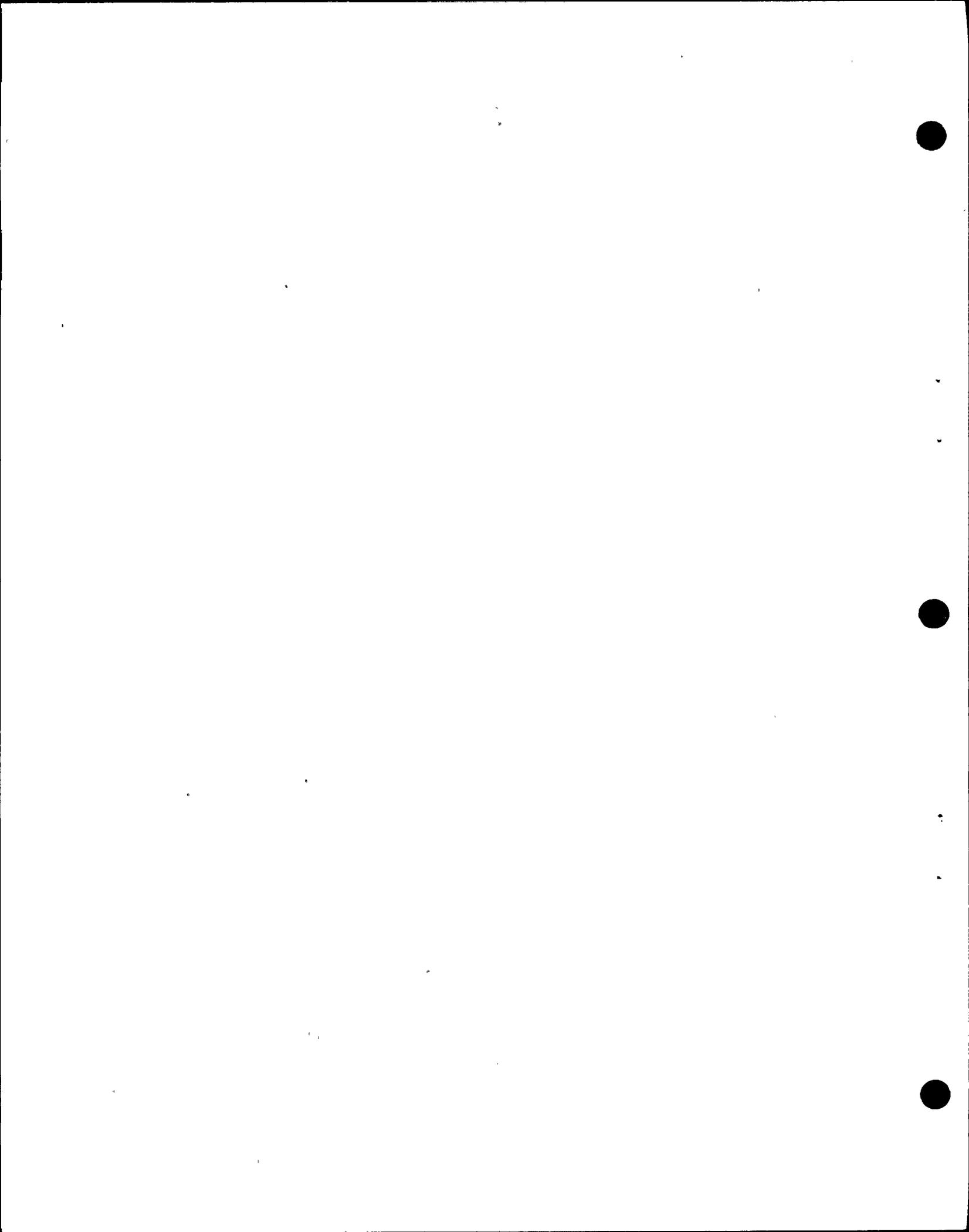
17 MR. KRISTOVICH: Mrs. Bowers, I don't think it's  
18 argumentative.

19 THE WITNESS: I've seen the detailed numbers for  
20 the plants; I just can't recall them from memory.

21 I can say, for instance, Mr. Kristovich, that  
22 you're taller than Mr. Hubbard, and I could be very sure of  
23 it without knowing how much taller.

24 MR. KRISTOVICH: Well, how much is what we're  
25 interested, precisely how much.

MRS. BOWERS: Mr. Tourtellotte?



mp0161

2 MR. TOURTELLOTT: The question I think that  
3 was originally asked was an argumentative question in its  
4 form. It could be that the question could be asked in a  
5 different way to elicit the information that Mr. Kristovich  
6 wants. But it was an argumentative question.

7 MR. NORTON: Well, Mrs. Bowers, the witness and  
8 the Intervenor's Counsel overruled my objection without a  
9 ruling from the Bench. They went ahead and talked a little  
10 more, so I don't think -- Applicant's will withdraw the objec-  
11 tion because he answered the question.

12 MR. KRISTOVICH: Well, Mrs. Bowers, we move  
13 to strike this part of the testimony.

14 MRS. BOWERS: Well, but the witness is going to  
15 furnish the information you're looking for, I thought.

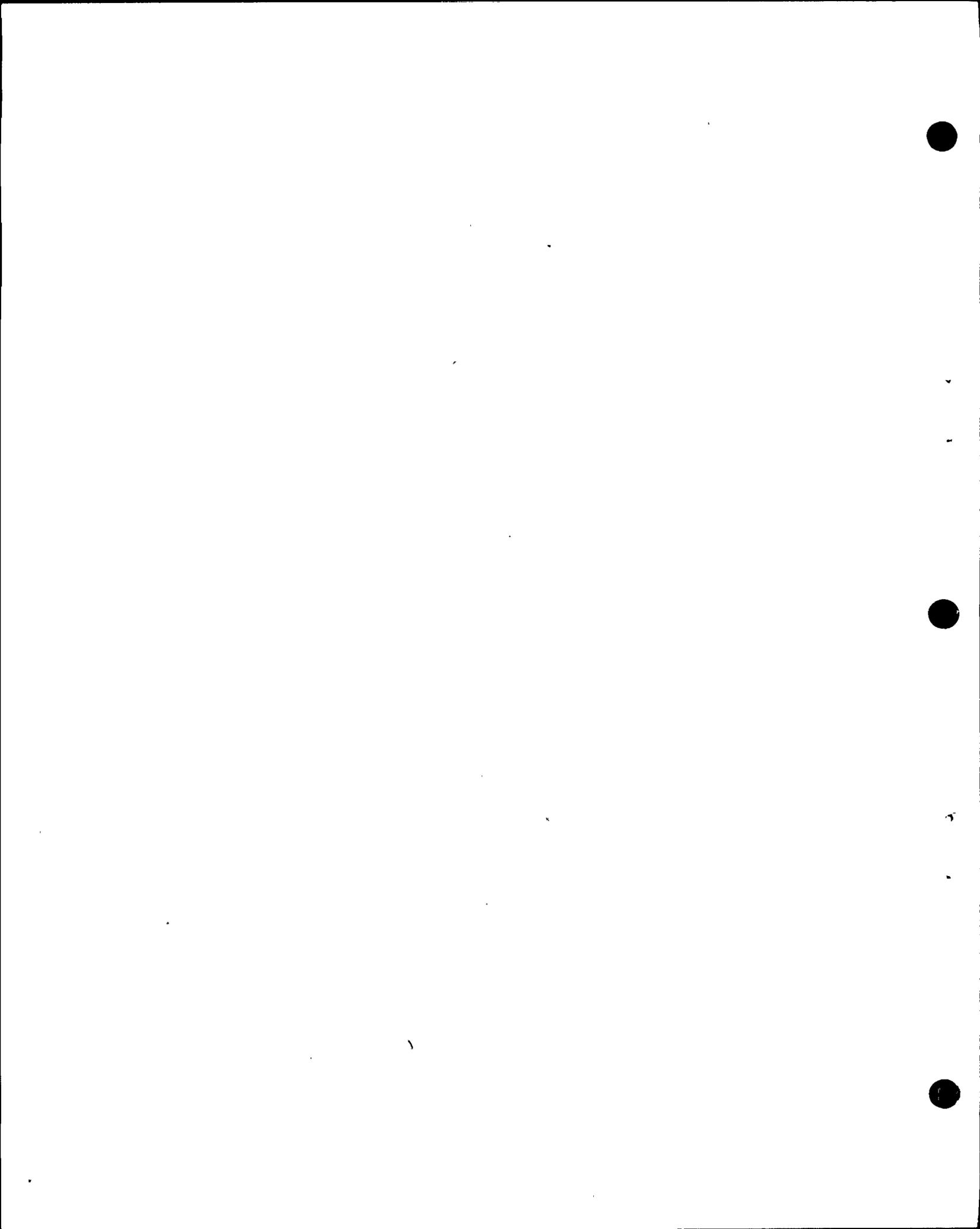
16 MR. KRISTOVICH: When?

17 THE WITNESS: Well, not instantaneously.

18 MR. KRISTOVICH: Mrs. Bowers, it's not going to  
19 do us later for cross-examination purposes.

20 MR. NORTON: Mrs. Bowers, the record stands that  
21 Mr. Hoch has testified that he's reviewed the numbers and  
22 that the OBEs are indeed less than half of the safe shutdown.

23 Now they are upset because he doesn't have the  
24 specific numbers at his fingertips. Fine. They've cross-  
25 examined him; they've got their answer. And if they think  
that that's wonderful that they don't have the specific



mpbl71

numbers, fine. He doesn't have them. That's the answer.

2

THE WITNESS: Would you like me to give you

3

one, Mr. Kristovich, that I just happened to have jotted down?

4

MRS. BOWERS: Well, how much time would it take

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Mr. Hoch to develop that information, because there's the

6

very clear statement here in his direct testimony, and the

7

Joint Interveners are simply asking the basis for that state-

8

ment.

9

MR. NORTON: Well, I believe he's answered the

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question to the best of his ability.

11

THE WITNESS: We don't have here with us a

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complete docket file on all of their plants. It would take

13

a search I think of the docket files of the other plants to

14

come up with the specific numbers, and that could take a day

15

or a week.

16

MRS. BOWERS: Mr. Tourtelotte?

17

MR. TOURTELLOTTE: Well, the question has been

18

asked and answered. I don't believe that as a matter of law

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that any witness who has an opinion based upon some facts

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that he has observed some time in the past is required to

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carry written proof of facts that he observed in the past

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with him to the hearing.

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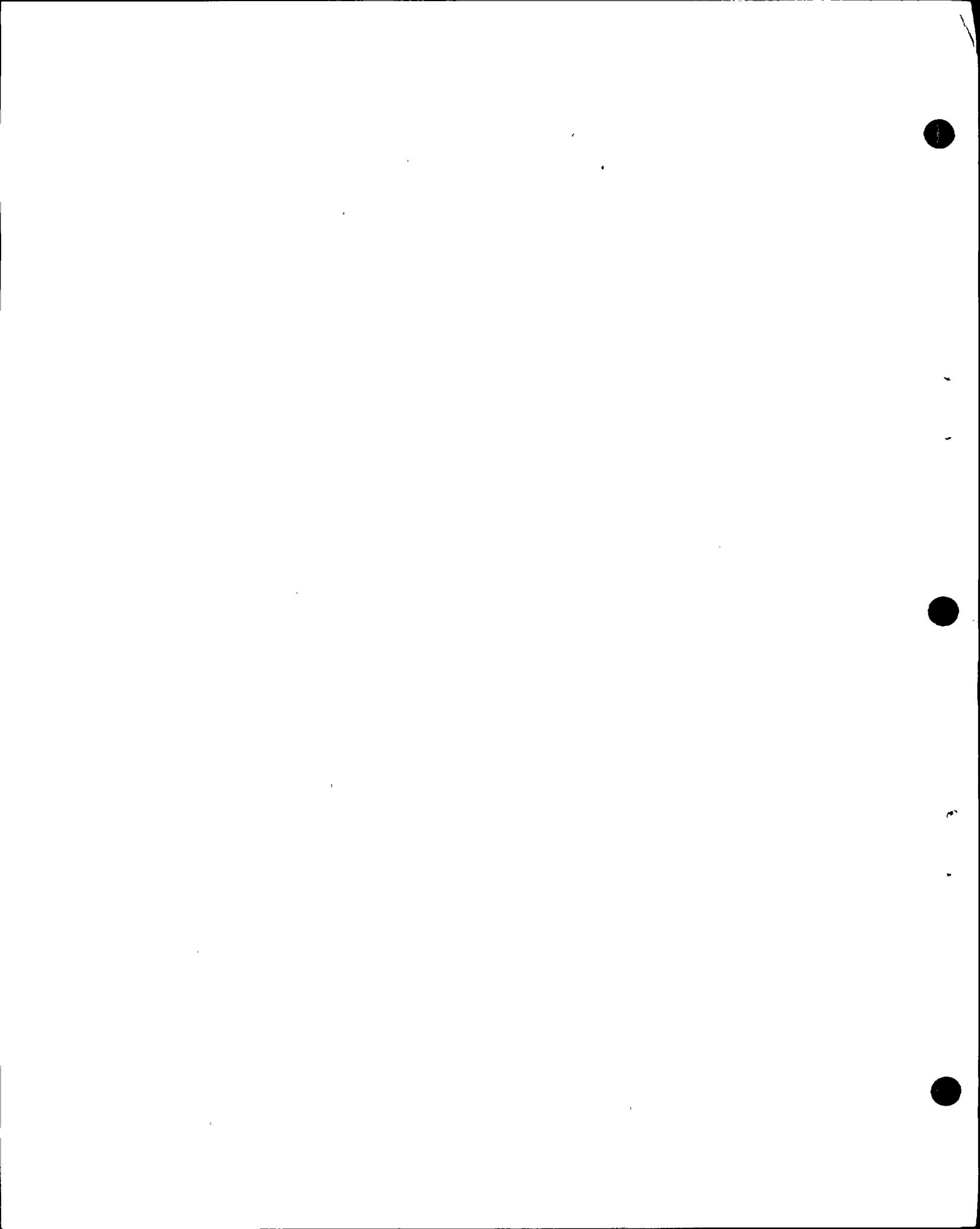
And the cross-examination is entitled to go as

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far as that witness can go, but it does not require that he

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either manufacture evidence or that he go out and bring in



mpbls1

physical evidence which he doesn't have with him.

2

And the question's been asked what's the basis for this statement. He said the basis for the statement was an observation of facts and figures which he has forgotten and which he has no record of presently. And that's as far as it can go.

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Now if there is some argument to be made about the weight of what Mr. Hoch's testimony is and the finding, that's all good and well. But he can't really be required to go out and get them unless someone wants to issue a subpoena duces tecum.

12

13

14

MR. NORTON: Mrs. Bowers, I think that's exactly what the law is. And he stated his basis for the opinion, and that goes to the weight of the opinion; that's all.

15

16

17

18

You know, we don't object to getting the figures. It's just that it's not physically possible for us to go make a phone call or to go to our rooms and come back down with the numbers. It's a much more involved process than that.

19

20

21

MRS. BOWERS: Mr. Hoch has been here during the entire time. I assume he'll be here January the 3rd.

22

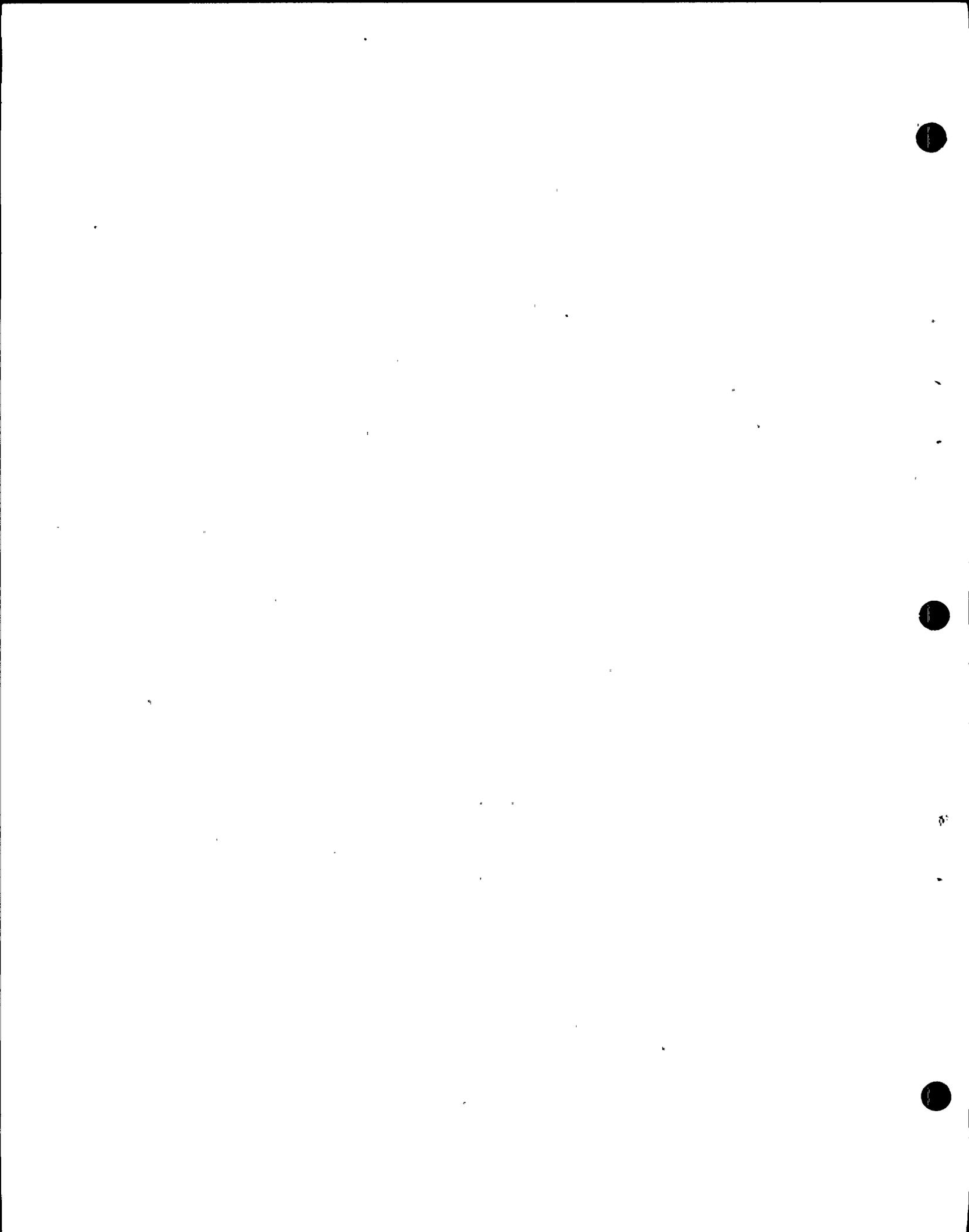
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25

MR. NORTON: He certainly will.

MR. KRISTOVICH: Well, Mrs. Bowers, if Mr. Hoch does not have the figures now -- and apparently he does not -- we will go on if he will provide us with the figures when we return.



mpbl9 1

MRS. BOWERS: Well, just a minute.

2

MR. NORTON: Mrs. Bowers, I have some problems with that, though.

3

4

Mr. Tourtellotte just stated it goes to the weight of the decision. Now if it's information that the Board wants to reach its decision, then, believe me, we'll provide the information. But the Intervenor doesn't have the right to conduct discovery during this hearing and send people home to do facts and figures for them.

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As a matter of fact, these are all part of the public record. These numbers are just as available to the Intervenor as they are to us. All they've got to do is look in the public record and find out what the SSE and the OBE of these various plants are, just as we can.

15

16

17

MR. KRISTOVICH: We have.

MR. NORTON: Fine. Then I don't know what you're so excited about.

18

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MRS. BOWERS: Well, the Board hasn't ruled.

I was simply asking a question so that we could consider what options are available.

21

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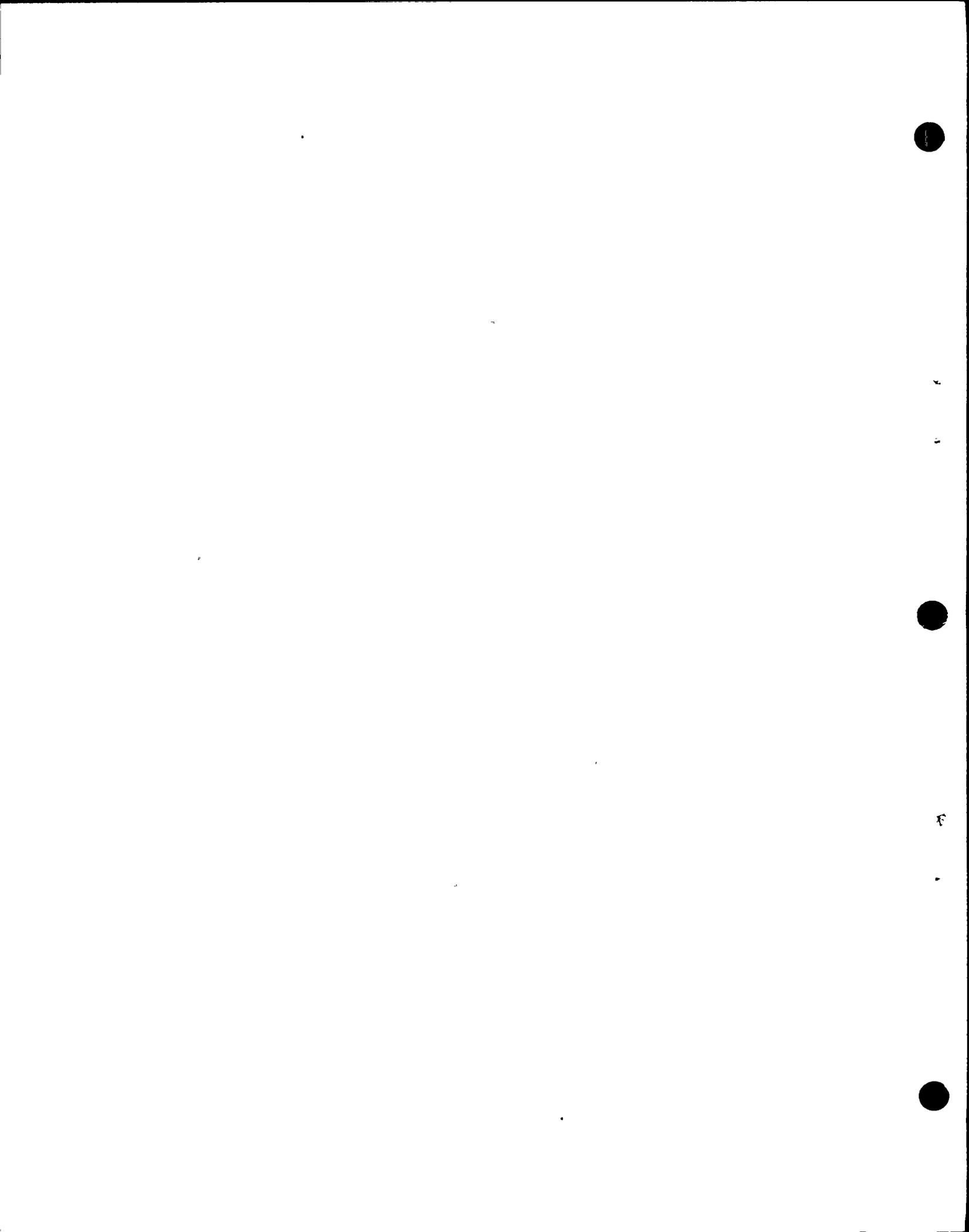
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(The Board conferring.)

MRS. BOWERS: Well, we have in front of us the motion to strike the testimony. And, of course, we've had in response to that argument from other Counsel.

25

The testimony will not be stricken. If Intervenor



mpb201

1 want to put on a witness that will testify in this area,  
2 that of course is your prerogative. But we do think that  
3 this witness has answered sufficiently to permit the testi-  
4 mony to remain in the record.

5 And, as usual, of course, we will do an evalua-  
6 tion as to what weight it should be given.

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

8 This testimony isn't subject to being stricken  
9 in any event. They've already admitted it into evidence.  
10 They've already stipulated it to be into evidence; they can't  
11 now move to strike it.

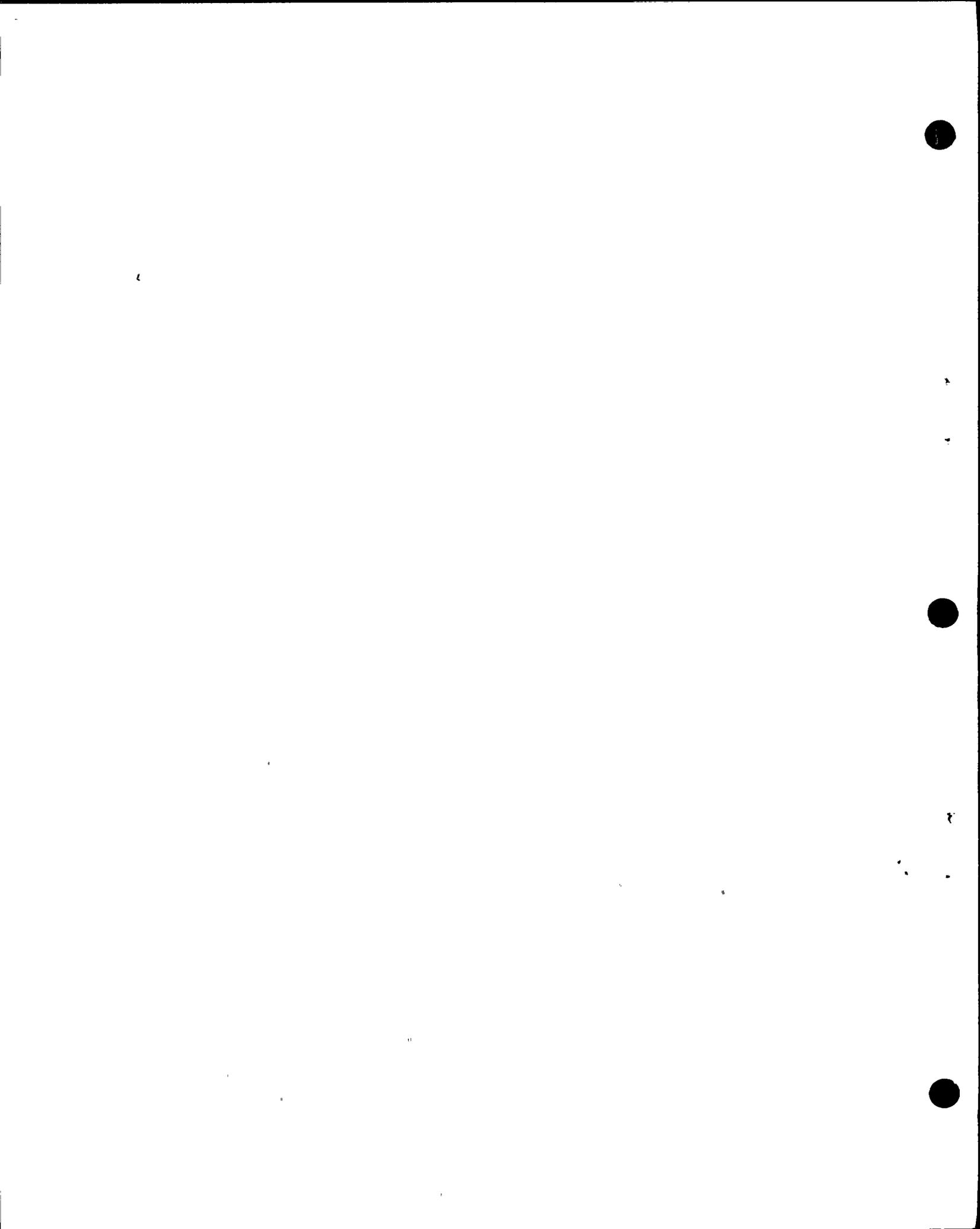
12 They didn't admit it subject to later cross-  
13 examination motions to strike. They admitted it, period.  
14 They can strike his spoken testimony or a response, they can  
15 move to do that; but they've already admitted this into evi-  
16 dence. They can't now come back and move to strike it.

17 MR. KRISTOVICH: Well, there was no basis to  
18 strike before we proceeded to cross-examination of the  
19 witness.

20 MR. NORTON: Then you shouldn't admit it into  
21 evidence. You should reserve that.

22 MR. KRISTOVICH: We'll move on.

23  
24  
25  
1D flws  
and  
M'DELON  
W. BLOOM  
flws



1  
2 BY MR. KRISTOVICH:

3 Q Still on Page Ten, Mr. Hoch, beginning on Line  
4 Ten, you state, and I'm paraphrasing: In licensing actions  
5 for at least one plant, the Regulatory Staff stated accept-  
6 ance criteria for an OBE, and then you state: "These  
7 criteria are given below," and on Lines 17 through 23, you  
8 quote these criteria.

9 Are these criteria a regulatory guide?

10 A Not to my knowledge, no.

11 Q Are these criteria part of the NRC standards --  
12 Standard Review Plan?

13 A To the best of my knowledge, no. I haven't seen  
14 a Standard Review Plan that incorporates the criteria. That  
15 doesn't mean that one couldn't have been issued but I  
16 haven't seen it.

17 Q Which plant do these criteria apply to?

18 A Phipps Bend.

19 Q Mr. Hoch, on Lines 25 to 26 on Page Ten, you  
20 state:

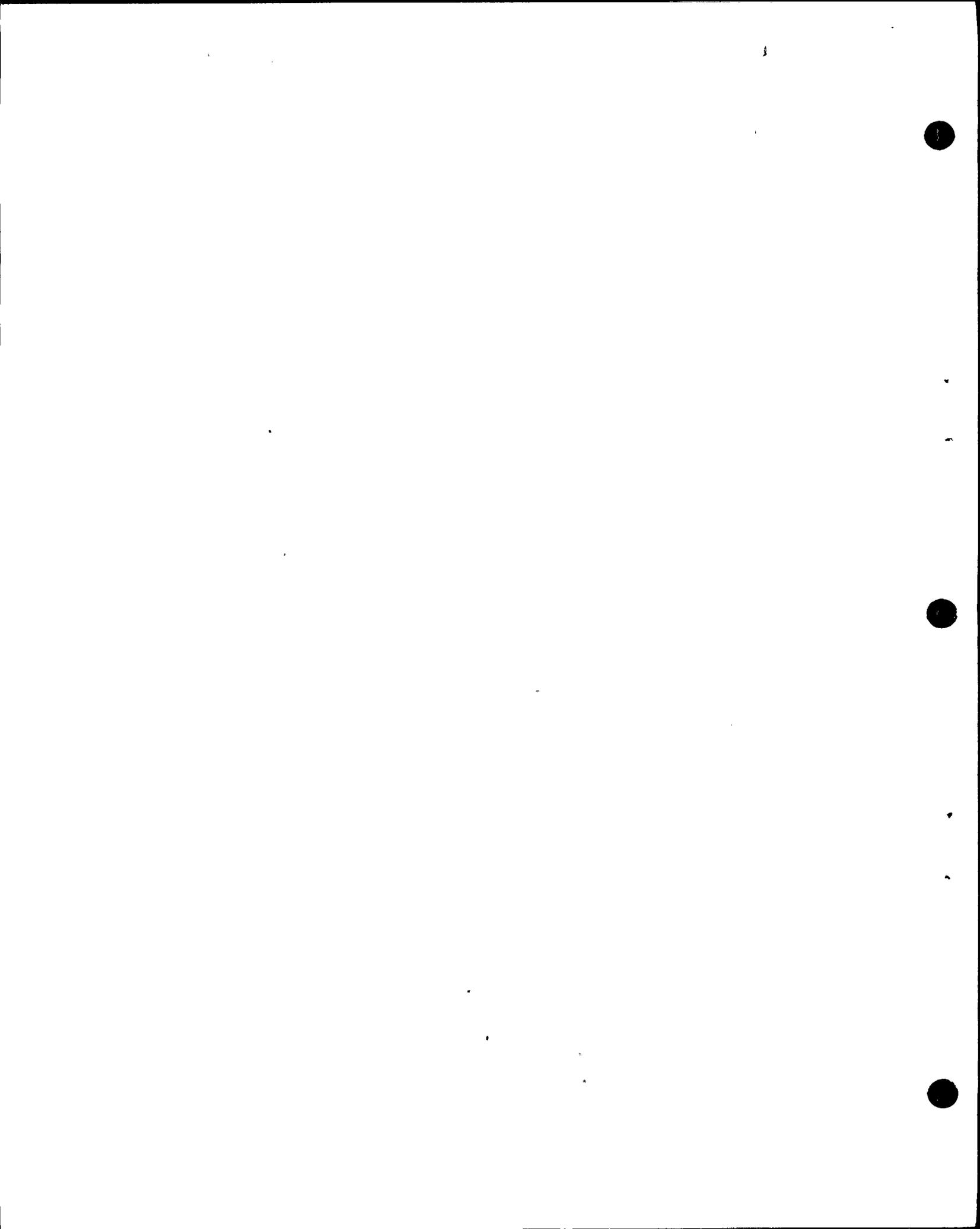
21 "Since construction permits have  
22 been issued for several of the plants named  
23 above..." -- referring to the six plants.

24 Which plants?

25 A I don't know which of those six plants con-  
struction permits have been issued for.

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Q Okay.

On Page 11, Line 18 and the subsequent lines,  
you state:

"For peak instrumental acceleration  
(maximum vibratory ground acceleration) at the  
site..." -- and then you continue.

Is your definition of peak instrumental accelera-  
tion the same as Dr. Blume's definition that he gave on  
Page Two, Lines Six through Ten, in his testimony? I don't  
know if you have that in front of you.

A I don't have it in front of me.

Q Well I can read it to you.

Reading from Page Two of Dr. Blume's written  
testimony at Lines Six through Ten:

"The maximum or peak acceleration  
whether moving in one direction or the other  
during the entire record of strong motion is  
called the absolute peak instrumental  
acceleration or often simply instrumental  
acceleration."

A I'm sorry, I've forgotten the question.

Q The question is, is that what you mean by  
peak instrumental acceleration, as you use it on Page 11  
of your testimony?

A Well since this value given here was taken from



agb3

1 a table in DLL-41 offered by Dr. Blume, and the heading of  
2 that table, if I'm not mistaken is Peak Instrumental  
3 Acceleration, I think it can be assumed that that definition  
4 means the same as Dr. Blume's definition.

5 Q Well does that mean, then, that the effective  
6 acceleration that goes with your 0.20g peak instrumental  
7 acceleration is 0.13g?

8 A Does what mean that?

9 Q Well if you're using -- Correct me if I'm wrong,  
10 if you're using the term "peak instrumental acceleration"  
11 the same way Dr. Blume is, and you say your peak instrumental  
12 acceleration is 0.20g at the site, does that mean your  
13 effective acceleration at the site will be 0.13g?

14 A I'm sorry, I still don't understand the question.  
15 I don't understand -- one thing doesn't follow from the other  
16 necessarily from what we're looking at here.

17 Q Okay. I'll back up.

18 As Dr. Blume says in his testimony peak accelera-  
19 tion is 1.15g, an effective acceleration of 0.75g. You  
20 here say that peak instrumental acceleration at the site of  
21 0.20g, does that mean your effective acceleration is in  
22 the same ratio, which would make it 0.13g?

23 MR. NORTON: Excuse me, Mr. Hoch.

24 Object. This witness is not one to testify  
25 as to what effective accelerations are. The panel that just



agb4

1 left testifies as to what effective accelerations are.

2 The statement simply says the average return  
3 period for 0.2g peak instrumental acceleration is 275  
4 years, period. This witness is not qualified to translate  
5 that to an effective acceleration. I don't think he has the  
6 foggiest idea what the effective acceleration of a 0.20g  
7 should be. And if he does, he isn't qualified to testify  
8 about it.

9 (Laughter.)

10 MRS. BOWERS: Mr. Kristovich?

11 MR. KRISTOVICH: Mrs. Bowers, we're just trying  
12 to understand what this 0.20g means to Mr. Hoch.

13 THE WITNESS: I think I can clear it up very  
14 easily.

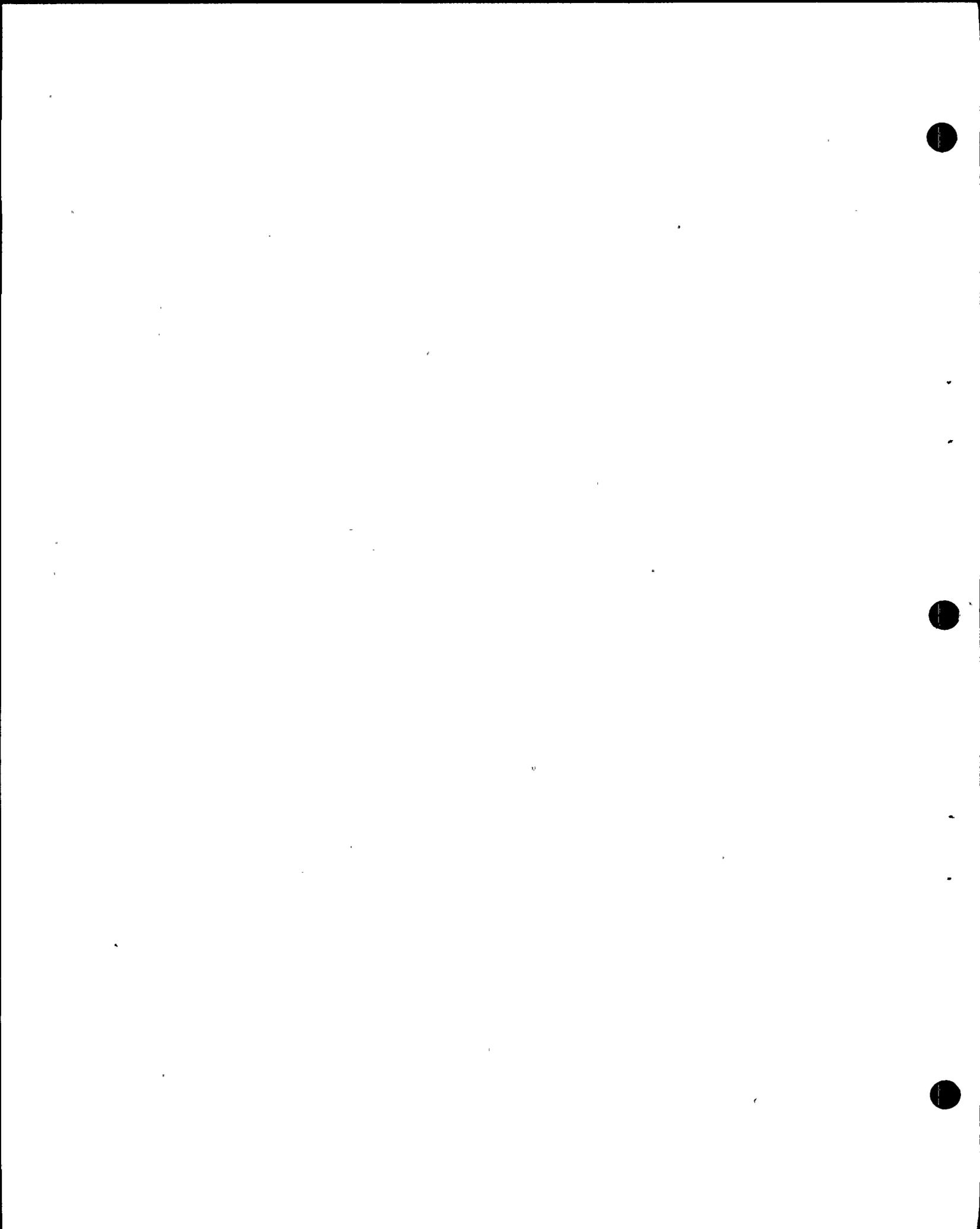
15 MRS. BOWERS: We have an objection pending.  
16 And the objection is sustained, but we'll go ahead with  
17 your question. -- Excuse me, Mr. Tourtellotte? I didn't  
18 mean to pass you.

19 MR. TOURTELLOTTE: You mean go with the next  
20 question or go with the question that you just sustained  
21 the objection to?

22 MRS. BOWERS: The next question. He restated  
23 the question before the Board ruled.

24 MR. TOURTELLOTTE: How did he restate it?

25 MR. KRISTOVICH: I'll restate it right now,



agb5

1 Mr. Tourtellotte, and you can let me know if you object.

2 MR. TOURTELLOTTE: I will.

3 MR. KRISTOVICH: I'm sure you will.

4 MR. NORTON: Indirectly, of course.

5 BY MR. KRISTOVICH:

6 Q Mr. Hoch, could you explain how you're using  
7 this 0.20g?

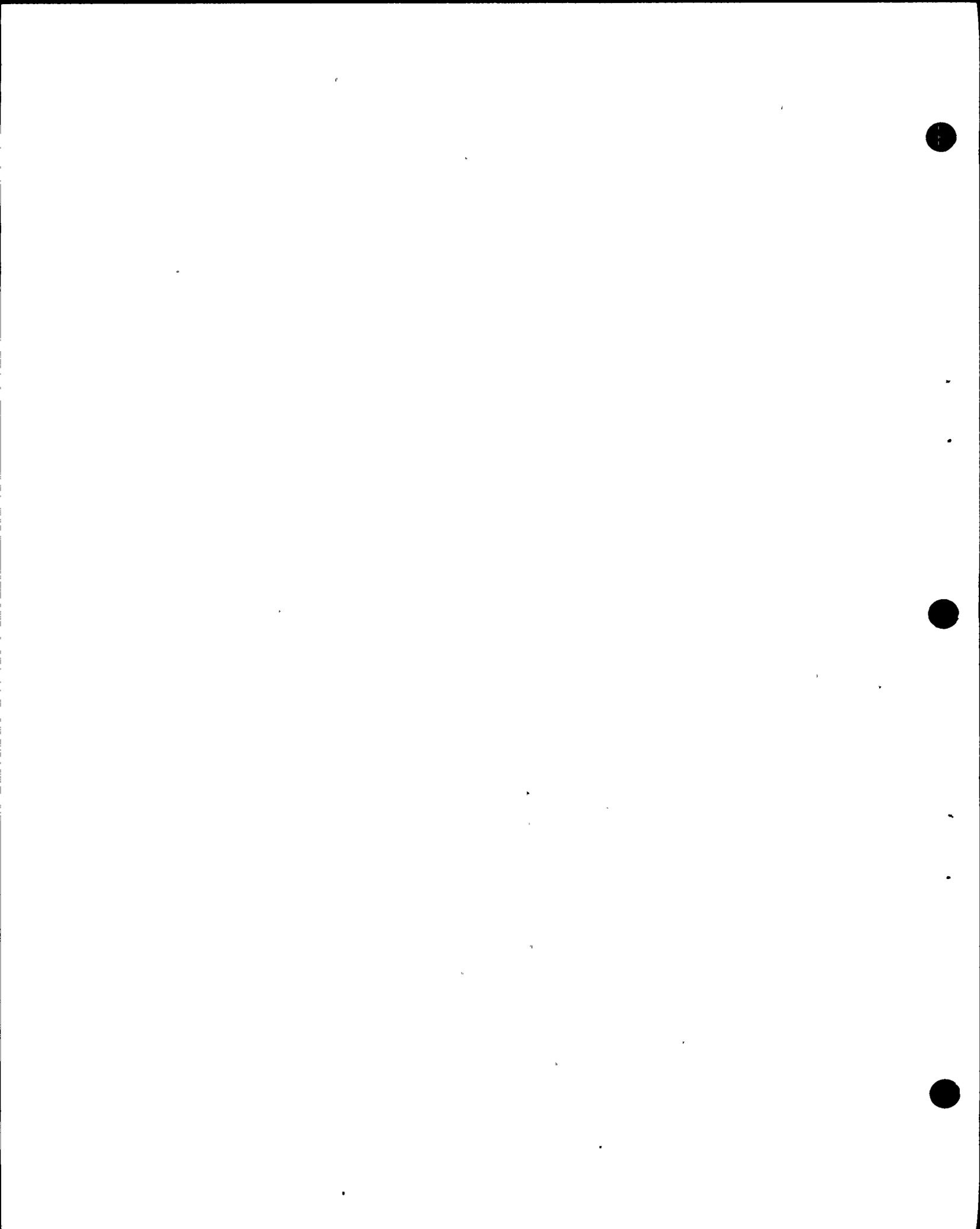
8 A Yes, certainly.

9 I think it becomes very plain if you read the  
10 words. And if you wish to, you can get your copy of D-LL  
11 41 out and look at the table that that 0.20g was taken  
12 from.

13 And you see in the table that there's a column  
14 that says Peak Instrumental Acceleration. There's another  
15 column that says Effective Acceleration. This was taken  
16 from a column that says Peak Instrumental Acceleration  
17 for two reasons: First, there was not an explicit value  
18 shown in the table for a 0.2g effective acceleration or  
19 we would have used that.

20 Secondly, by stating a return period for 0.2g  
21 peak instrumental acceleration, that return period is  
22 certainly conservative with respect to a 0.2g effective  
23 acceleration.

24 And since that return period of 275 years was  
25 well in excess of the Staff's, what I have termed the Staff's



ngb6

1 stated acceptance criteria, we didn't bother to give a return  
2 period for an effective acceleration of 0.2g, which is  
3 certainly much longer in the calculations made by Dr. Blume  
4 than this 275 years.

5 If you turn to the Table in D-LL 41, you'll  
6 see that table and we can use that number, if you'd like.

7 Q Mr. Hoch, is the OBE then based on instrumental  
8 or effective acceleration of 0.2g?

9 A The OBE?

10 Q Yes.

11 A Well the original seismic design basis for the  
12 plant was based -- the design earthquake, which was part of  
13 that original seismic design basis, was an earthquake with  
14 a maximum acceleration, that is, the response spectrum had  
15 a zero period acceleration of 0.2g that was handled in the  
16 design as an input to the plant.

17 Does that answer your question? I'm not trying  
18 to dodge your question.

19 Q So is that effective acceleration?

20 A That is the acceleration which is input to the  
21 plant structures.

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

23 We're starting to get into the area of the panel  
24 that just left again. Rather than Mr. Hoch -- I mean,  
25 that question could well have been asked of Dr. Blume,



agb7

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who is the one who did that response spectrum.

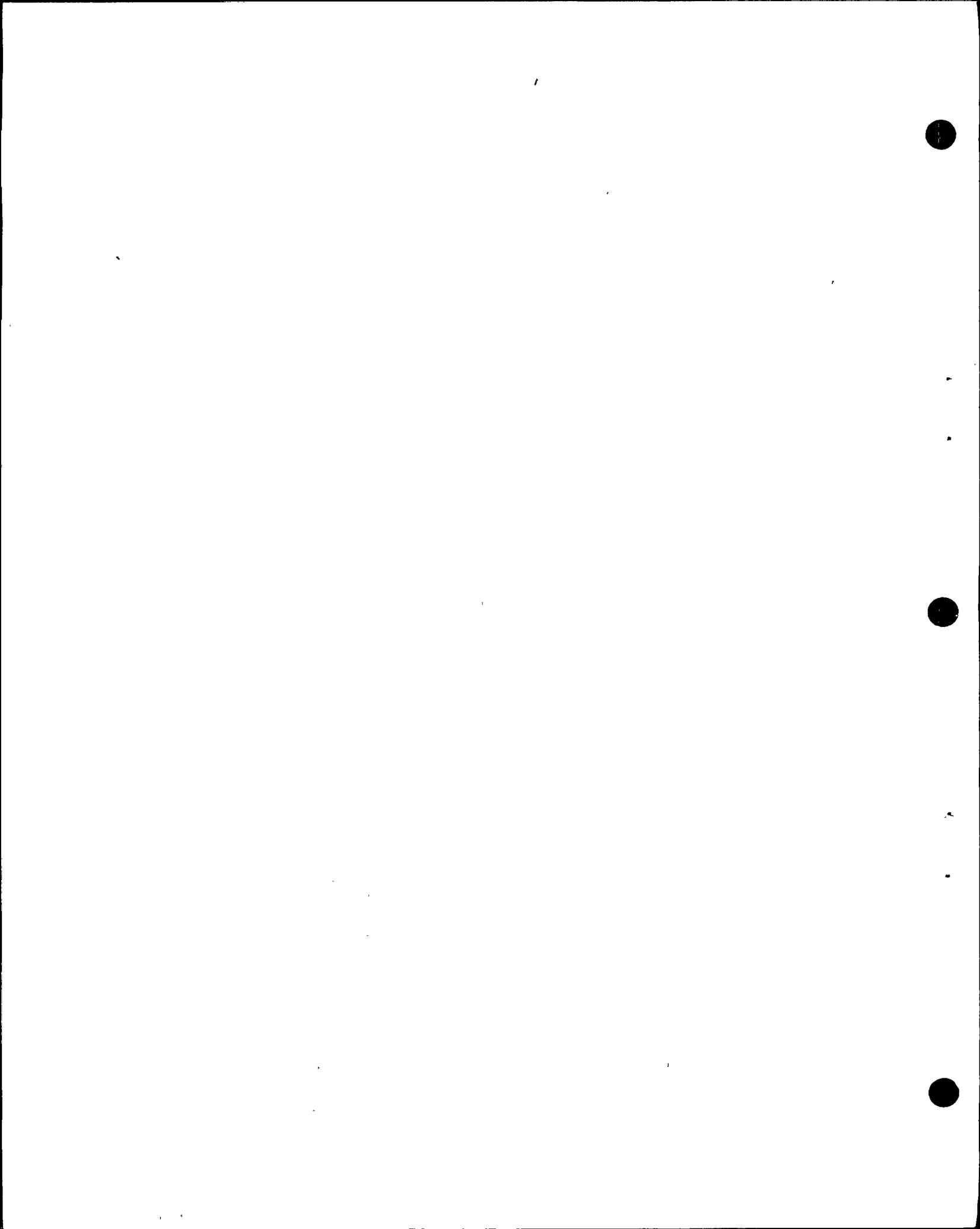
MR. KRISTOVICH: Mr. Hoch answered the question.

We'll move on.

MRS. BOWERS: The Board would like to take a brief recess. Ten minutes.

(Recess.)

endlD



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1

MRS. BOWERS: Mr. Kristovich, are you ready to

110

2

continue?

3

BY MR. KRISTOVICH:

4

Q Mr. Hoch, was a vertical dynamic analysis made for the original design earthquake?

5

6

A No, it was not, not of structures. I'll correct that.

7

8

Q Mr. Hoch, turning to page 14, beginning at the end of line 15 you state:

9

10

"Safety Guide 29 was subsequently re-issued as Regulatory Guide 1.29, Regulatory (Guide) 1.29 Rev. 1, and Regulatory Guide 1.29 Rev. 2. The Diablo Canyon classification system also meets the intent of this latest revision."

11

12

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14

15

Could you list each and every exception to the criteria, Reg. Guide 1.29 Rev. 2?

16

17

A Each and every exception to the criteria?

18

Q The classification criteria.

19

A I think that's relatively easy.

20

To the best of my knowledge there is only one exception to meeting the letter of the criteria and that involves cooling systems for the spent fuel storage pool.

21

22

23

I happen to have a copy of Reg. Guide 1.29, Revision 2, dated February 1976, which is marked "For Comment," and I'm not certain that this hasn't subsequently been

24

25



eb2

1 issued in other than a "Comment" draft, but I think the word-  
2 ing is the same.

3 In that Regulatory Guide, under "C, Regulatory  
4 Position," subitem (g), a number of things are listed which,  
5 according to the Regulatory Guide-- Well, let me just para-  
6 phrase it. It is that the following structures, systems and  
7 components should be considered as Seismic Category I, and it  
8 lists a number of those structures, systems and components.

9 And under subitem (g), one of the items listed is  
10 cooling water, component cooling, and auxiliary feedwater  
11 systems or portions of these systems, including the intake  
12 structures that are required for a number of functions, and  
13 the last function mentioned there is, under subitem (5),  
14 cooling the spent fuel storage pool.

15 And at Diablo Canyon, not all components of the  
16 spent fuel pool cooling system are classified as Design  
17 Class I using Diablo Canyon terminology, or Category I.

18 Q Okay, Mr. Hoch.

19 Now directing your attention to page 17 of your  
20 written testimony, beginning on line 3 you state:

21 "The relationship of aftershocks to  
22 the Hosgri seismic event has been described in  
23 previous testimony."

24 Could you point out where in previous testimony  
25 aftershocks have been discussed?



eb3

1 A I wasn't in the room for all the previous testi-  
2 mony, nor have I reviewed all of the transcripts of the many  
3 days that have taken place here so I can't do that.

4 Q Well, I assume you mean the written testimony.

5 A I guess I can't point out-- It was my under-  
6 standing when I wrote this written testimony that testimony,  
7 I believe of Dr. Smith, would contain such a description.

8 Q Okay.

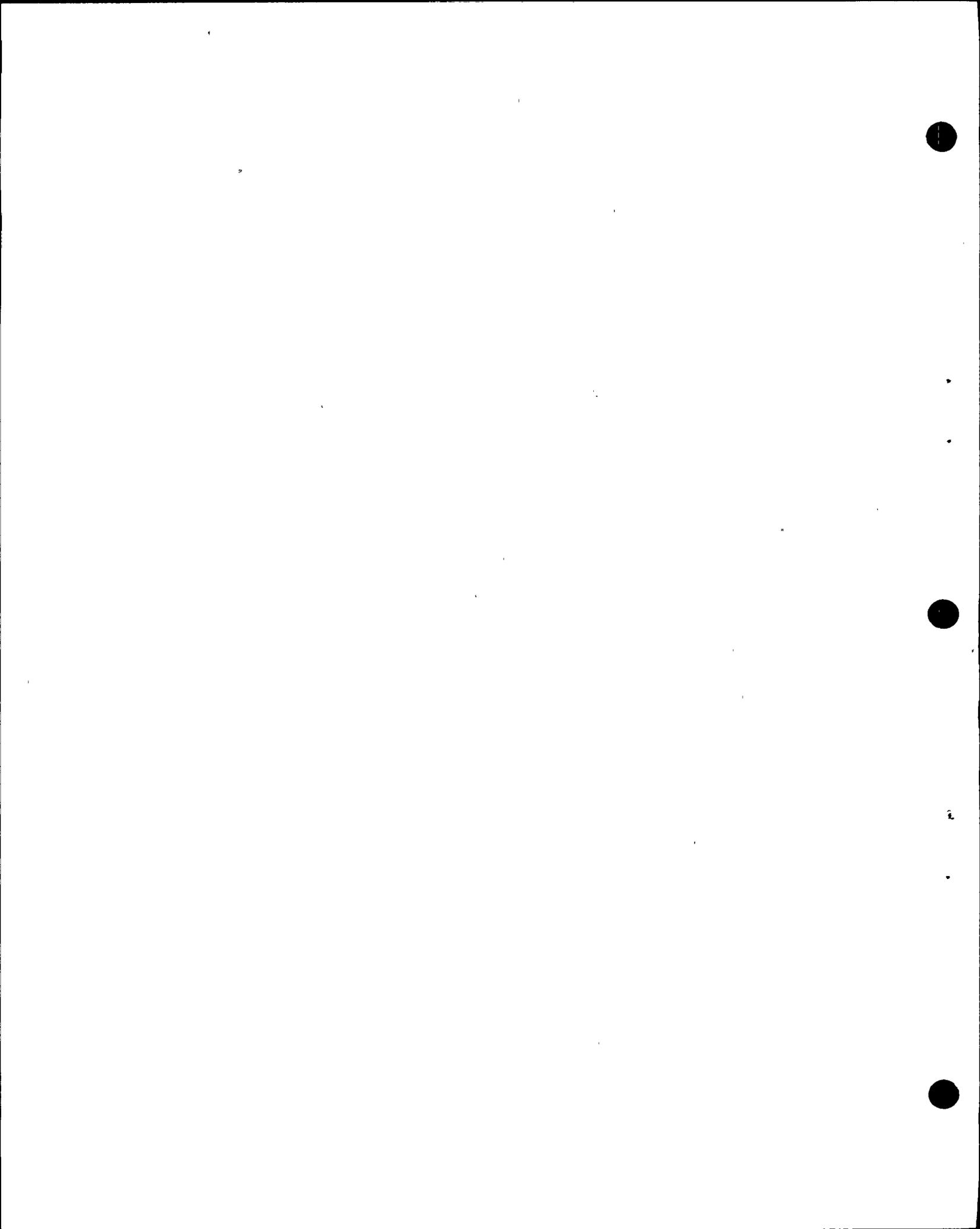
9 MR. NORTON: Excuse me. For the record I believe  
10 Dr. Smith's testimony indeed regarding the 6.75 not associated  
11 with any earthquake does cover that. That is also intended  
12 as an aftershock. I believe it is in his testimony. That is  
13 subject to check, but I remember the term "aftershock" in  
14 connection with that earthquake event. I think that was  
15 Earthquake Event D.

16 Excuse me, did I say "6.75 not associated  
17 with any earthquake"? I mean an earthquake not associated  
18 with any fault. I believe it is in that section of Dr. Smith's  
19 testimony that the word "aftershock" -- I recall seeing it.

20 BY MR. KRISTOVICH:

21 Q On page 22 of your testimony, Mr. Hoch, beginning  
22 on line 5, you state:

23 "Only in a very few locations in  
24 Diablo Canyon structures did the results of the  
25 Hosgri Seismic Evaluation indicate stresses beyond



abr

1 the yield point of the material."

2 Could you list each and every location where the  
3 structures have stresses beyond yield point?

4 A Certainly.

5 MR. NORTON: Excuse me, Mr. Hoch.

6 To shorten things, isn't that covered in the later  
7 testimony of the individual panels?

8 THE WITNESS: Yes, it is.

9 MR. NORTON: In detail, in specifics?

10 THE WITNESS: Yes, it is.

11 MR. NORTON: Mrs. Bowers, you know this is just an  
12 overview, and we would suggest that detailed discussions  
13 of these individual points be handled with the individual  
14 panels where the specific information is contained.

15 MRS. BOWERS: Mr. Kristovich?

16 MR. KRISTOVICH: Is there an --

17 MR. NORTON: Yes. We're asking that this kind of  
18 detail be reserved for the individual panels that handle  
19 those individual specific discussions, rather than with an  
20 overview witness. They are the people who did the analyses  
21 and the people who are familiar with it, you know, with the  
22 specifications of each and every one.

23 I'm sure Mr. Hoch, as Project Engineer, knows the  
24 areas but obviously, we have them on because they know the  
25 details.



eb5

1 MRS. BOWERS: Well, we have followed to some  
2 extent that procedure when we were informed that subsequent  
3 witnesses really would be testifying in that area, but  
4 Mr. Kristovich has my sympathy. He has direct testimony in  
5 front of him that is an overview that the witness doesn't  
6 have the specifics to back it up.

7 MR. NORTON: He does. He said he did. But I'm  
8 just saying rather than spend the time on it now, it would  
9 make more sense for the individual witnesses who have done  
10 the specifics to do it. He can do it. I was just suggesting  
11 that to Mr. Kristovich.

12 BY MR. KRISTOVICH:

13 Q Mr. Hoch, how long is the list?

14 A There aren't very many locations so the list isn't  
15 very long.

16 MRS. BOWERS: Go ahead then.

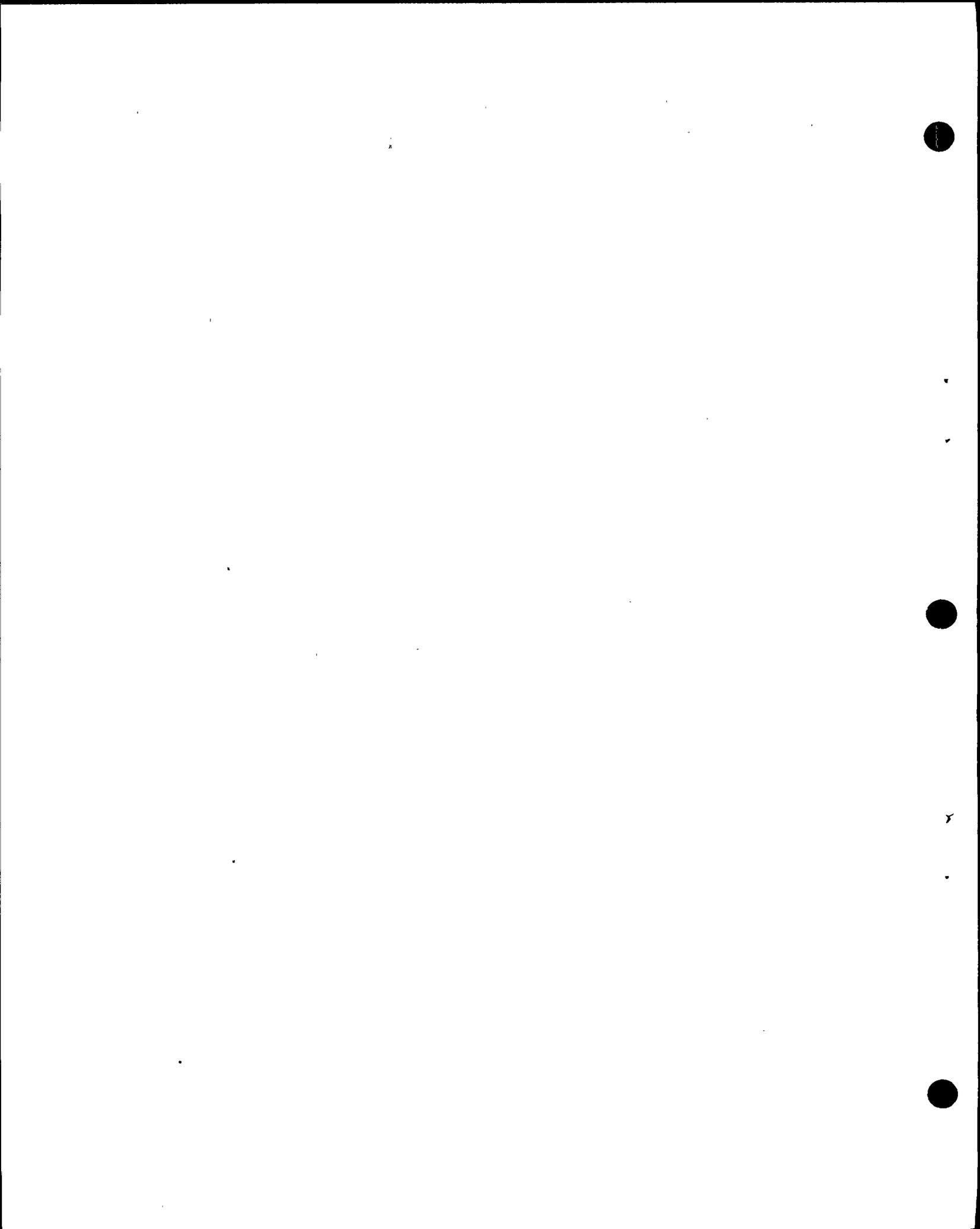
17 BY MR. KRISTOVICH:

18 Q Could you read the list?

19 A I don't have the list in front of me but there  
20 are few enough locations that I can cite them.

21 In the intake structure, a portion of the intake  
22 structure which we've called the curtain wall of the intake  
23 structure for the Hosgri Seismic Evaluation, stresses did  
24 indeed go into the -- beyond the yield point of the material.

25 However, the curtain wall is a structure that is



eb6

1 only loosely associated with the main body of the intake  
2 structure, and in the Staff's Safety Evaluation Report, a  
3 careful appraisal of that ---

4 MR. NORTON: Excuse me, Mr. Hoch. The question  
5 is simply to list.

6 THE WITNESS: Okay. I'm sorry.

7 The curtain wall of the intake structure.

8 Localized end bents in the turbine building if a  
9 turbine building crane is parked in the ends of the turbine  
10 building, either end of the turbine building.

11 And I believe, although I am not prepared to  
12 discuss it in detail, an area in the piers which are beneath  
13 the main turbine generators.

14 Q Would you also include the fuel during the  
15 combined LOCA and seismic event?

16 A I wouldn't include the fuel as a structure at all.

17 Q Mr. Hoch, could you list the equipment that has  
18 stresses beyond the yield point?

19 A No, I can't.

20 Q Okay.

21 Now on page 22, beginning at line 8, you state:

22 "The associated deformations have  
23 been carefully evaluated...."

24 A I'm sorry, I've lost the line you're looking at.

25 Q Line 8, page 22.

c6



ab7

1 A Okay.

2 Q "The associated deformations have  
3 been carefully evaluated...."

4 Could you cite where in the FSAR this careful  
5 evaluation is?

6 A We're talking now about-- I think we should be  
7 talking about the Hosgri Seismic Evaluation, that report,  
8 rather than the FSAR.

9 Q In particular the piers beneath the turbine  
10 building, is that discussed in the Hosgri seismic report?

11 A I believe it is, yes.

12 Q Do you have a specific citation?

13 A I don't have, but if you'll let me look at it I  
14 can give you one, or I can describe it to you verbally,  
15 whichever way you prefer. It's a rather simple verbal  
16 description.

17 Q I think we'd prefer if you would just tell us what  
18 it is.

19 A Chapter 4 is a nice general citation for that.  
20 That's the chapter in the Hosgri Evaluation.

21 MR. NORTON: It's 4.4, --

22 MR. KRISTOVICH: Thank you.

23 MR. NORTON: -- starting at 4-38 et seq.

24 BY MR. KRISTOVICH:

25 Q Okay, Mr. Hoch, still on page 22, beginning on



.

.



.

.



eb8

1 line 15, you state:

2 "For equipment qualified by analysis  
3 which must move, open or close, pump fluids, or  
4 otherwise perform an active safety function when  
5 subject to seismic loadings, special criteria were  
6 developed and applied to assure that deformations  
7 as a result of seismic loadings would not prevent  
8 performance of the active safety function."

9 How do special criteria preclude deformations  
10 from seismic loadings that would prevent performance of the  
11 active safety function?

12 A You may misunderstand what criteria are.

13 Q That's what I'm trying to clear up.

14 A Is your problem with the way this is worded?

15 I don't understand your question.

16 Q I don't understand the sentence.

17 A Well, let's read the sentence again and see if we  
18 can understand it.

19 Q Fine.

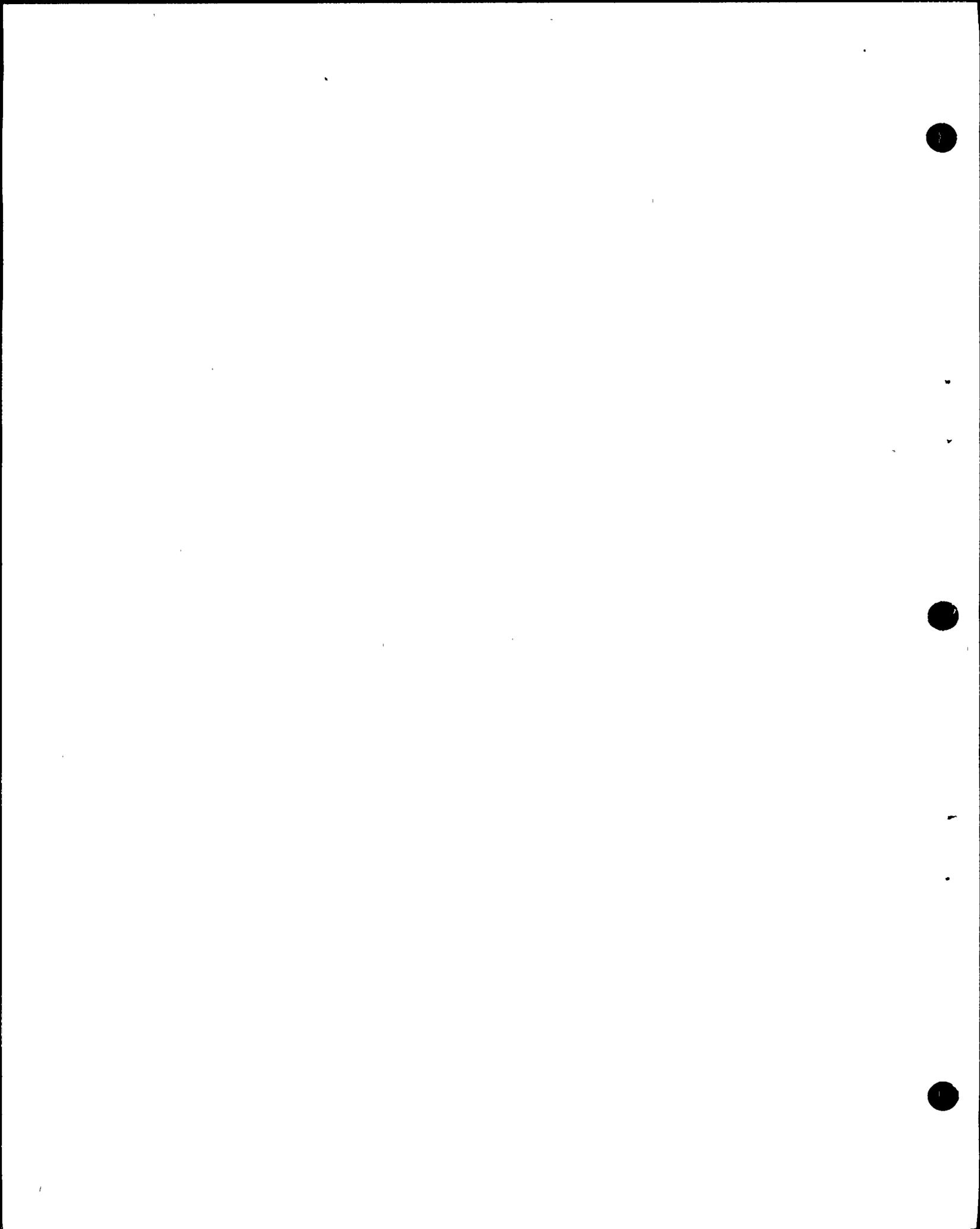
20 A It begins where now?

21 Q It begins on line 15 and runs through line 20.

22 A Okay.

23 Q What I want to know is how do criteria prevent  
24 deformations?

25 A Well, read the sentence very carefully if you would.



ab9

1 I'll just begin with the middle of line 18.

2 "....special criteria were developed  
3 and applied to assure that deformations as a  
4 result of seismic loadings would not prevent  
5 performance of the active safety function."

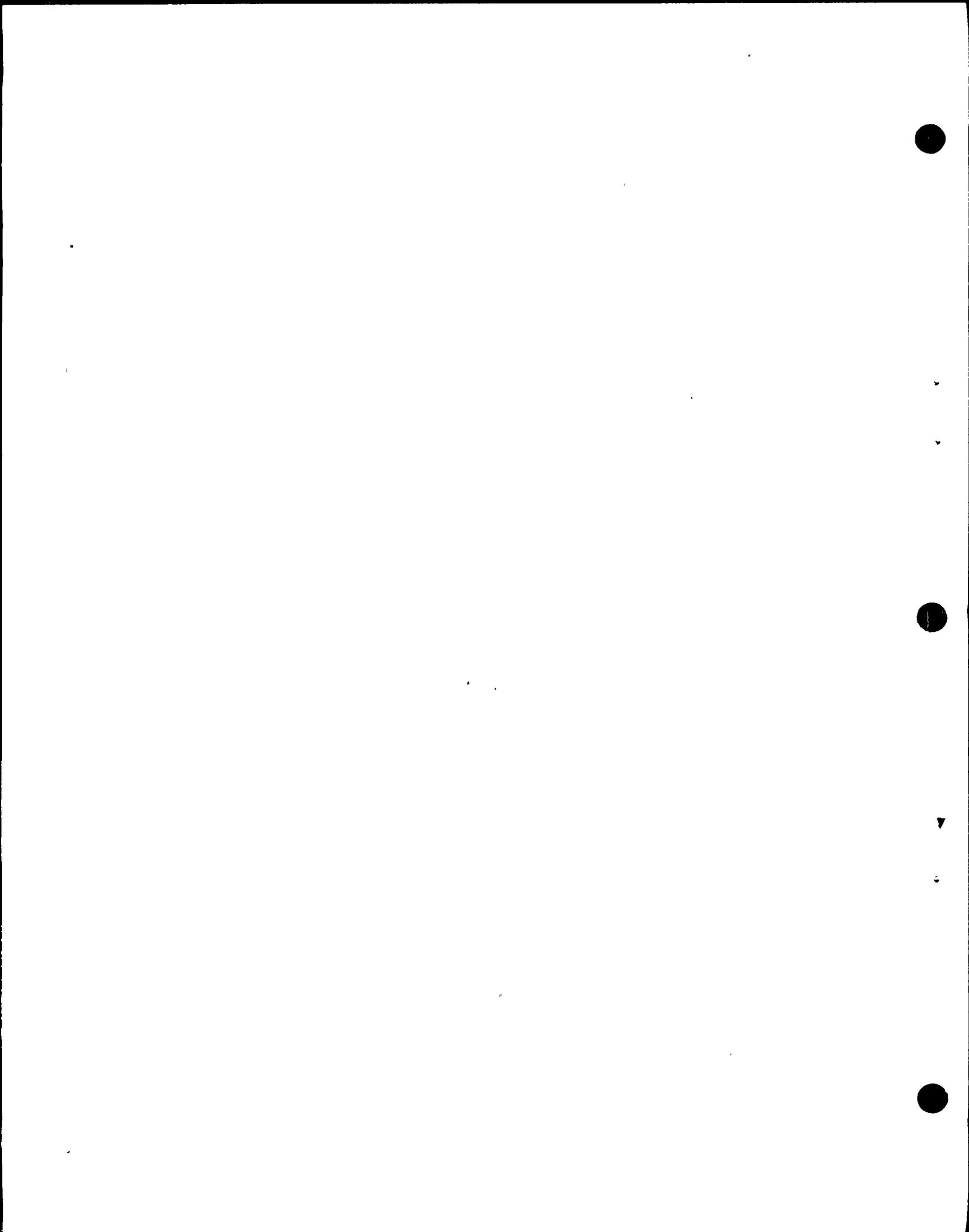
6 Now "criteria" in this sense-- Let's take a  
7 concrete example. Let's look at a pump.

8 I have a pump and I've analyzed the pump, and I  
9 know the clearances between the impeller and the stationary  
10 parts of the pump. I know the amount of deformation of the  
11 shaft that can take place without bearing problems.

12 In the analysis of the pump I subject analytically  
13 the pump to seismic loads in combination with its normal  
14 operating loads and any required accident loads, and I  
15 compute the deformations that result.

16 Now if the criteria I've applied says in no  
17 instance should these loadings result in reducing the gap  
18 between the stationary and moving parts of the pump to zero,  
19 in other words, not cause one part of the pump to rub against  
20 another, then after I complete the analysis I can show the  
21 amount of deformation and show that it doesn't -- that the  
22 parts do indeed not rub against each other, and by so apply-  
23 ing this criteria I have provided assurance that -- and I  
24 will read the sentence again:

25 "....that deformations as a result of



eb10

1 seismic loadings would not prevent performance  
2 of the active safety function."

3 So I guess I don't really understand the-- If  
4 you have a problem with the way the sentence reads, I don't  
5 understand. It reads perfectly well to me.

6 Q Do you feel that these criteria preclude loadings  
7 that would prevent performance of the active safety functions?

8 A Criteria do not preclude loadings. I think that  
9 may be the difficulty in how you're trying to read the  
10 sentence.

11 Loadings occur. Criteria are established to  
12 assure that the results of those loadings are acceptable.  
13 So we're not precluding loadings by applying criteria; we're  
14 precluding some kind of an effect from the loadings which  
15 might result in the equipment not performing its required  
16 safety function.

17 To get back a little bit, Dr. Bolt did this  
18 earlier. We can go through this sentence and diagram it and  
19 find out what the subject and the verb are, and I think it  
20 might make it more plain to you.

21 Q Okay. Well, I think I'm slowly beginning to see  
22 what you're trying to say.

23 Are you saying that criteria as applied can assure  
24 but cannot preclude?

25 A No, I'm not saying that at all.



eb11 1

MR. NORTON: Excuse me. This is becoming argumentative with the witness. The witness has said what the sentence means to him. I don't know, maybe I'm-- I understand what he's saying and if Counsel doesn't understand what he's saying, I don't know what we can do about that, but he is starting to argue with the witness about what the sentence means.

MRS. BOWERS: Mr. Kristovich, the witness answered and tried to -- and did explain the sentence. It made sense to me. There will be loadings and there have been criteria developed to adjust to that so there won't be a safety problem.

MR. KRISTOVICH: Fine.

BY MR. KRISTOVICH:

Q Still on page 22, on lines 23 and 24 you speak of acceptance criteria "in accordance with accepted industry codes and standards."

Could you list these industry codes and standards?

A I can list some of them. I won't give you an exhaustive list. But there is of course what is commonly called the ASME Code, which is contained in a number of parts.

Q Which section in the ASME?

A Well, there are a number of sections, as you know. Section 3 of the ASME Code deals with -- originally, when originally formulated, dealt with nuclear vessels. It now deals with a much wider range of components, and that Section



eb12

1 3 is certainly applicable.

2 Some of the original codes and standards that  
3 were used in the design of the plant prior to the time when  
4 Section 3 of the ASME Code did apply to anything other than  
5 vessels were originally some of the ASNI Codes and B-31-1,  
6 B-31-7.

7 Other sections of the ASME Code, ASME Section 8,  
8 which still applies and has applied for many years to pressure  
9 vessels.

10 I could proceed with the list but I'd have to  
11 sit here and recall codes, one by one, item by item.

12 I guess I'd refer you if you're interested to  
13 again look at the Hosgri Evaluation Report in each of the  
14 sections dealing with -- whether it deals with structures or  
15 equipment, in each of the sections the codes that were applied  
16 in the evaluation are set down in detail.

17 If you'd like, we can get the report and go  
18 through each item in detail.

19 MRS. BOWERS: I want to check on something for  
20 the record.

21 I think it has been said here that the Hosgri  
22 books, volumes-- Well, you've referred to Hosgri reports  
23 rather than the FSAR, but they're a part of it, aren't they?

24 MR. NORTON: I think they are amendments to the  
25 FSAR.



cb13

1 THE WITNESS: Could I explain this since  
2 Mr. Crane doesn't always understand this?

3 MR. NORTON: Okay.

4 THE WITNESS: All this material has been filed  
5 as amendments to our operating license application. We have  
6 chosen to keep the Hosgri Evaluation Report separate from the  
7 FSAR, contained in separate volumes. Certainly all have  
8 been submitted as amendments to our operating license appli-  
9 cation and in support of that application.

10 MRS. BOWERS: Well, the FSAR is in evidence. Does  
11 that mean that the Hosgri Reports are not in evidence, not  
12 part of the FSAR?

13 MR. NORTON: Well, it was certainly stipulated  
14 by Counsel, and I believe we were all operating under the  
15 assumption, mistaken as it obviously was, that it was part of  
16 the FSAR.

17 So I guess at this time we have to move that the  
18 Hosgri Evaluation, which is a part of the operating license  
19 application, be moved into evidence, although I'm sure we all  
20 thought we had it in evidence up to this point in time.

21 MRS. BOWERS: Mr. Kristovich?

22 MR. KRISTOVICH: No objection.

23 MRS. BOWERS: Mr. Tourtellotte?

24 MR. TOURTELLOTTE: No objection.

25 MRS. BOWERS: Well, the Hosgri Reports are



ebl4

1 accepted into evidence.

2 THE WITNESS: I think when you moved this material  
3 into evidence before, if I'm not mistaken, you included all  
4 the amendments that had been made to the operating license  
5 application.

6 MR. NORTON: I thought we did, too, but I'm not--  
7 As you say that, I shouldn't say "I thought," I think you're  
8 right, but I'm not positive.

9 THE WITNESS: In other words, there is a lot of  
10 material such as -- well, other material than the FSAR and  
11 the Hosgri Reports which have been submitted as part of  
12 amendments to the operating license application.

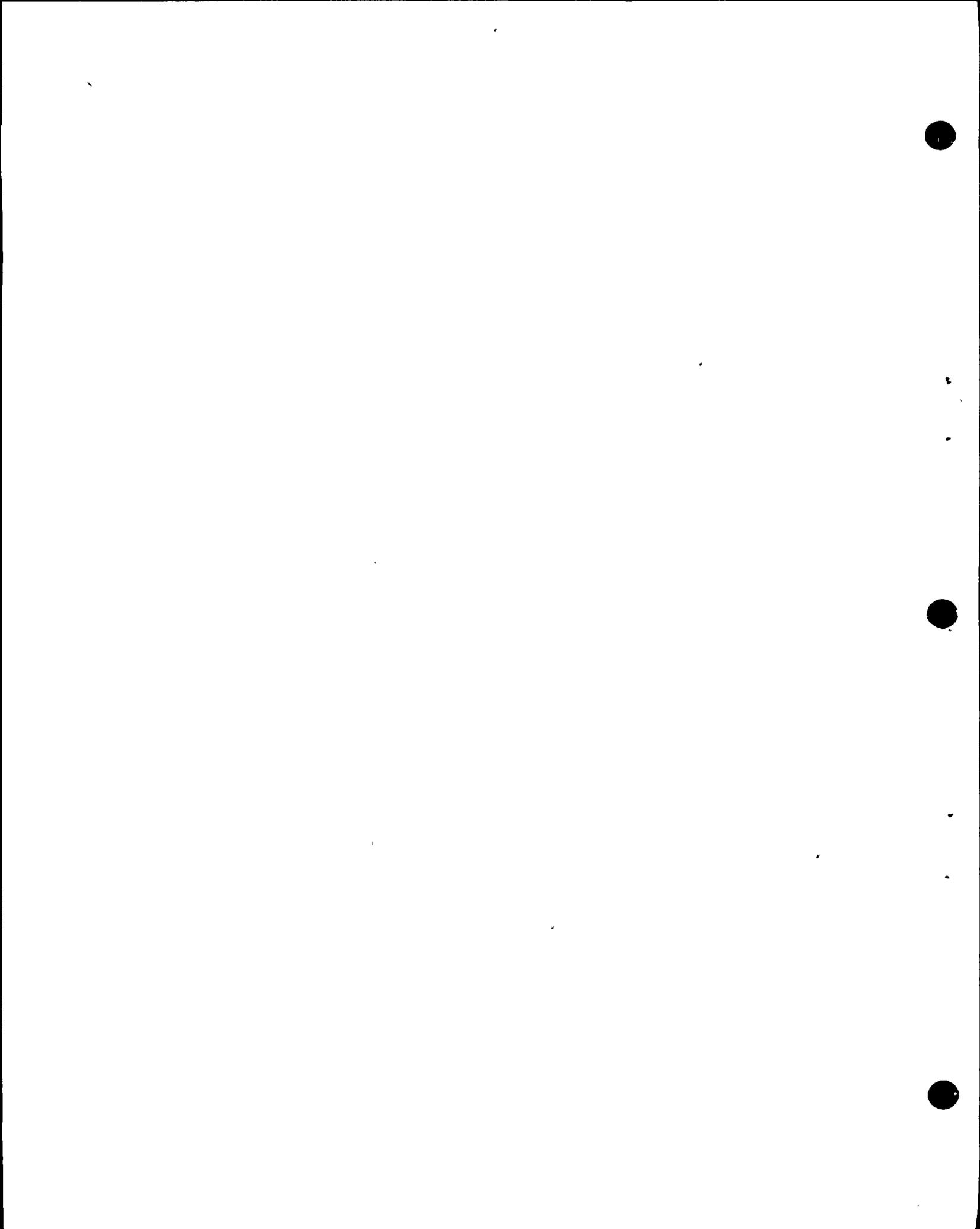
13 MR. NORTON: I believe we did, Mrs. Bowers; now  
14 that we're discussing it in more detail, I do believe that  
15 that was part of -- and we'd have to check the transcript,  
16 but all the attachments to the operating license were also  
17 in evidence. But if not, maybe we can do it at this time,  
18 just to make sure.

19 MRS. BOWERS: Rather than a complete review of the  
20 transcript on that point?

21 MR. NORTON: Yes.

22 MRS. BOWERS: Well, this changes the question a  
23 little bit.

24 Mr. Kristovich, do you have any objection to the  
25 amendments to the application for the operating license?



eb15

1 MR. KRISTOVICH: No objection.

2 MRS. BOWERS: Mr. Tourtellotte?

3 MR. TOURTELLOTTE: No objection.

4 MRS. BOWERS: Well, all amendments to the operating  
5 license are accepted into evidence.

6 MR. NORTON: Perhaps we could give the FSAR and  
7 the operating license application and the amendments thereto  
8 an exhibit number. Perhaps we could call that Exhibit A,  
9 Applicant's Exhibit A. Obviously it's a very voluminous  
10 amount of material and rather than have it given a number,  
11 maybe we could just call it Applicant's Exhibit A.

12 MRS. BOWERS: Does that mean you give three copies  
13 to Mr. Bloom?

14 MR. NORTON: Well, if he wants to carry them.  
15 I don't think he wants three copies of that. I think we have  
16 to mail those. I know we did that with the Environmental  
17 Report. I believe those were sent back to Washington by some  
18 sort of carrier.

19 MRS. BOWERS: All right, fine.

20 (Whereupon, the documents  
21 referred to were marked  
22 as Applicant's Exhibit A  
23 for identification,  
24 and received in evidence.)  
25



1G agbl

1 BY MR. KRISTOVICH:

2 Q Mr. Hoch, do the codes you mentioned, ASME  
3 Sections 3 and 8 and ANSI 331.7 allow calculated stresses  
4 beyond the yield point of the material?

5 A Other witnesses later will discuss this in a  
6 lot of detail. But in general, let me say this about the  
7 ASME code, for instance.

8 Stresses allowed in the ASME Code for this kind  
9 of condition, that is, for a faulted condition, the safe  
10 shutdown earthquake in combination with the other appropriate  
11 loads, those allowable stresses are stresses which I think,  
12 strictly speaking, are beyond the yield point of the material  
13 involved.

14 There's lots of detailed testimony to go into  
15 that, addressing and explain it later on.

16 Q Are there other codes and standards that were  
17 used that allow stresses beyond the yield point of the  
18 material?

19 A Are we talking this part of my testimony here,  
20 this part about piping, or are we talking about something  
21 else?

22 Q This part of your testimony.

23 A Well I think the three codes I mentioned -- and  
24 we can scratch ASME Six and Eight because, as I say, that  
25 refers to pressure vessels -- I think the three codes I



agb2

1 mention are the only codes to my knowledge that have been  
2 applied to the Diablo Canyon piping systems. I could be  
3 wrong, but that's my belief.

4 Q Mr. Hoch, I just have one final question that  
5 Mr. Fleischaker suggested I ask.

6 Can you state to a reasonable degree of project  
7 management certainty -- Well, strike that.

8 (Laughter.)

9 MR. KRISTOVICH: No further questions at this  
10 time.

11 MRS. BOWERS: Mr. Tourtellotte?

12 MR. TOURTELLOTTE: No questions.

13 MR. NORTON: I have no redirect.

14 MRS. BOWERS: Well the Board has no questions.

15 I think the record should show that Mr. Hoch  
16 has been in the background in his jogging clothes for several  
17 weeks, and now he's beautifully attired and we don't even  
18 have a television camera.

19 (Laughter.)

20 MR. TOURTELLOTTE: You would have thought that  
21 all that time of getting in shape, he would have had a  
22 longer and harder run today, wouldn't you?

23 MR. KRISTOVICH: Mrs. Bowers, Intervenors would  
24 like to say we saw Mr. Hoch on television the other night  
25 and he was marvelous.



agb3

1. MR. NORTON: We saw Mr. Fleischaker and he  
2. wasn't.

3. (Laughter.)

4. MR. KRISTOVICH: I'm going to tell him you  
5. said that.

6. MR. NORTON: He can read the transcript.

7. MRS. BOWERS: Do you want the witness to be  
8. excused?

9. MR. NORTON: Yes. Well, Mr. Hoch won't be  
10. excused, because he'll be on other panels, I believe, as we  
11. go through some of the detailed stuff.

12. You are aren't you, Mr. Hoch?

13. THE WITNESS: I may be.

14. MR. NORTON: He may be on some of the other  
15. panels.

16. MRS. BOWERS: Fine.

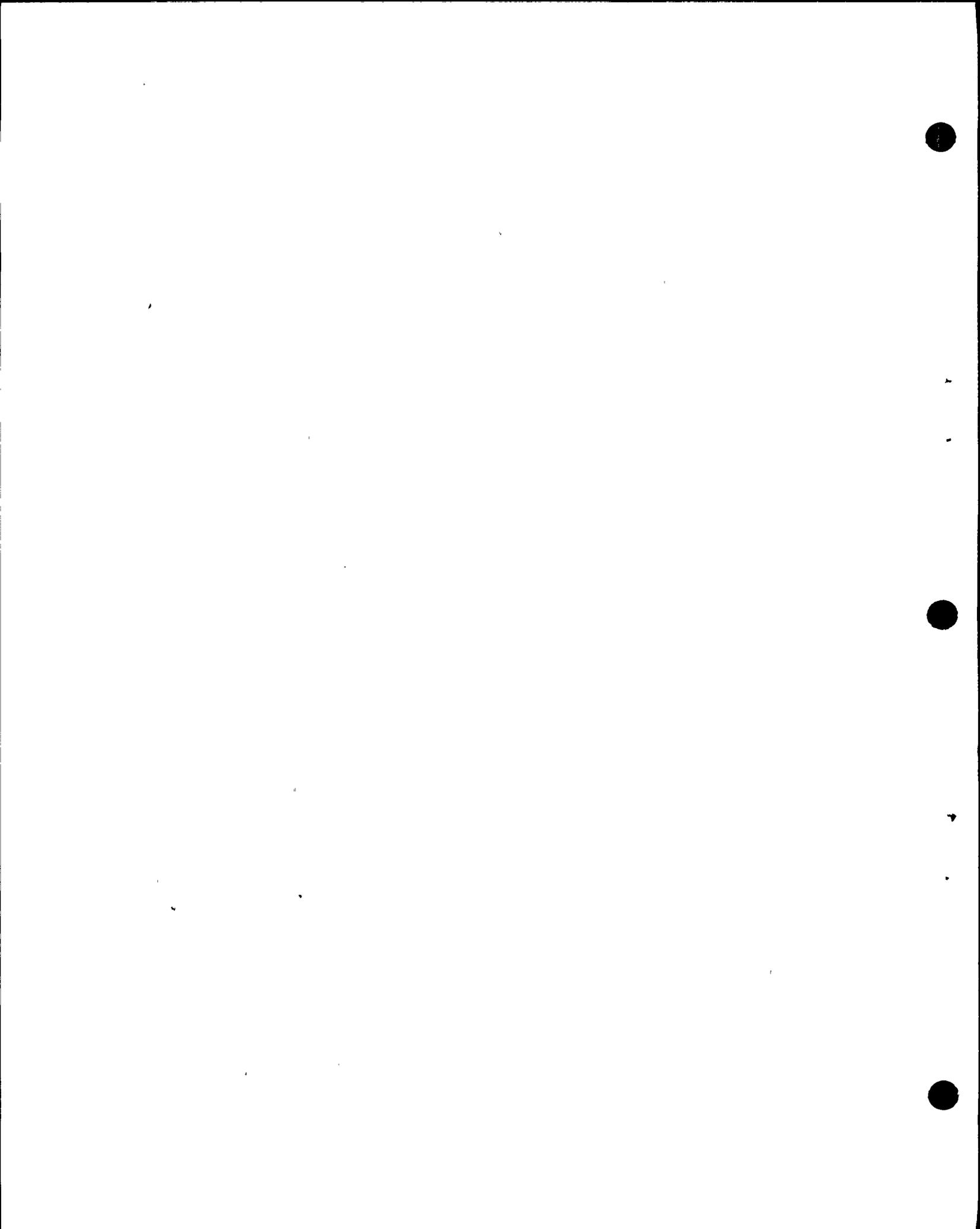
17. (The witness temporarily excused.)

18. MRS. BOWERS: Do you have another witness?

19. MR. NORTON: Yes, Mr. Gnio.

20. Mrs. Bowers, the reference we gave, incidentally,  
21. to the intervenors regarding the question of the turbine  
22. pad, I don't think that's a correct reference. We've looked  
23. through there and it isn't there. We'll see if we can get  
24. you a correct reference.

25. When we get it, we'll get it to Mr. Hubbard who,



agb4

1 I presume, would be the one who would want it.  
2 Whereupon,

3  
4 VINCENT J. GHIO

5 was called to the stand as a witness on behalf of the  
6 Applicant, and, having been first duly sworn, was examined  
7 and testified as follows:

8 DIRECT EXAMINATION

9 BY MR. NORTON:

10 Q Mr. Ghio, do you have a copy of the professional  
11 and personal qualifications and educational background that  
12 lead you to be here today?

13 A Yes, I do.

14 Q Do you have any corrections to that?

15 A No, I don't.

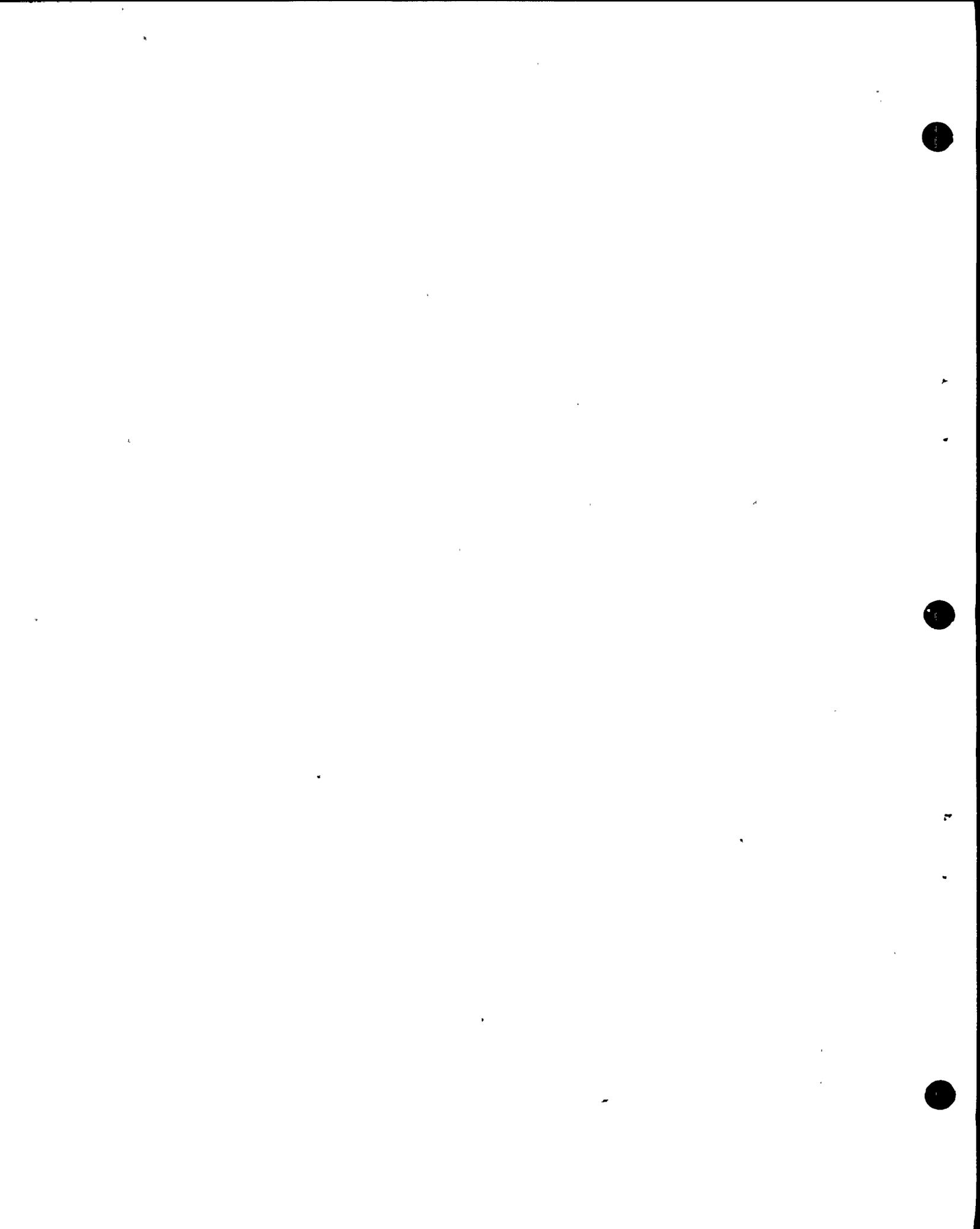
16 Q All right.

17 Could you briefly summarize those professional  
18 qualifications which lead you to be here today?

19 A Gladly.

20 I'm a senior civil engineer with Pacific Gas and  
21 Electric Company. I have a bachelor's degree in Civil  
22 Engineering from the University of California, 1959.

23 I have been continuously employed since that  
24 time in Pacific Gas and Electric Company's Engineering De-  
25 partment, with increasing levels of responsibility for  
structural design of fossil and nuclear fuel power plants.



agb5

1 I have been involved since about mid-1970  
2 with structural design coordination, supervision and review  
3 for the Diablo Canyon power plant structures.

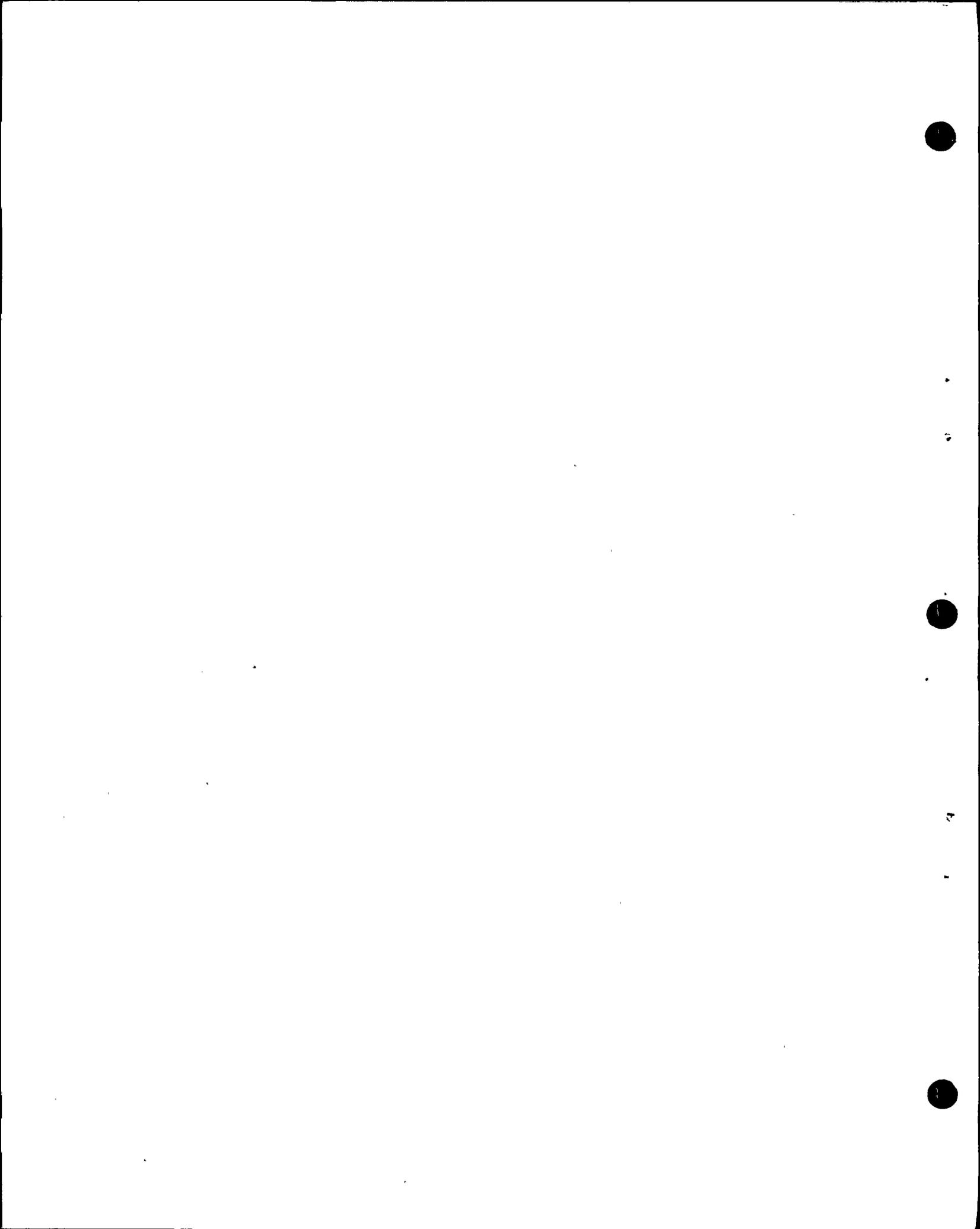
4 I'm a registered Civil Engineer in California,  
5 and I'm a member of the American Society of Civil Engineers.

6  
7 MR. NORTON: We would ask that Mr. Ghio's  
8 professional qualifications be inserted into the record as  
9 though read at this time.

10 MRS. BOWERS: The qualifications will be physi-  
11 cally inserted in the record as if read.

12 (The document follows:)

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1 UNITED STATES OF AMERICA  
2 NUCLEAR REGULATORY COMMISSION

3 BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

4 In the Matter of ) Docket Nos. 50-275  
5 PACIFIC GAS AND ELECTRIC COMPANY ) 50-323  
6 (Diablo Canyon Nuclear Power ) Applicants Ex. No. 7  
7 Plant, Units No. 1 and 2) December 1978

8 PROFESSIONAL QUALIFICATIONS  
9 OF WITNESSES FOR  
10 PACIFIC GAS AND ELECTRIC COMPANY

11 Name: Vincent J. Ghio

12 Title or Position: Senior Civil Engineer

13 Degrees: B.S. University of California 1959 - Continuing  
14 Education courses and professional conferences  
15 related to structural analysis, design and project  
16 management.

17 Professional Experience: Continuously employed since 1959  
18 in the Company's Engineering Department with  
19 increasing levels of responsibility for structural  
20 design of Fossil and Nuclear fueled power plants.  
21 Involved with structural design coordination,  
22 supervision, and review for the Diablo Canyon  
23 Nuclear Power Plant structures since 1970.  
24 Registered Civil Engineer, California. Member of  
25 American Society of Civil Engineers.  
26



3



1G cont'd  
agbl

1 BY MR. NORTON:  
2

3 Q Mr. Ghio, I understand we have some corrections  
4 to make to your testimony which include some new diagrams.  
5 And when I say new, they are pages to be substituted for  
6 other pages that are in there.

7 Could you go through and slowly -- I believe we  
8 have passed out to everyone, or are in the process of passing  
9 out to everyone, those changed pages. And could you slowly  
10 now go through and detail those changes?

11 A Yes. I believe there are some figures that are  
12 revised that are being passed out. In addition, there are  
13 some changes in the text of the testimony.

14 Q All right. Why don't you deal with the changes  
15 in the text of the testimony first and then you can describe  
16 the figures.

17 A All right.

18 Now the testimony that I'm sponsoring, or  
19 that I am a co-sponsor of, consists of six parts. And I  
20 will go through each part, starting with the first part.

21 And on Page Number Four of the first part, of  
22 the testimony of which I am listed as the only sponsor,  
23 on Line Five, insert a comma after the word "and."

24 On Page Five. Line 25, insert the word "the"  
25 between "both" and "turbine."

On Page 11, Line Seven, insert the words "of the"



agb2

1 between the words "study" and "effect."

2 On Page 13, Line Four, close parenthesis after  
3 the word "report."

4 In the second part of the testimony, of which  
5 I and Lang and Malik are sponsors, entitled "Hosgri Analysis  
6 and Evaluation of the Containment Structure," Page Two,  
7 Line 19, strike the words "and vertical." --

8 MR. KRISTOVICH: Excuse me, are we together  
9 here?

10 MR. NORTON: Let's stop, Mr. Ghio. The Court  
11 Reporter does not have those pieces of testimony. They'll  
12 be inserted in the record when those panels appear, so let's  
13 make those corrections at that time.

14 BY MR. NORTON:

15 Q Now the figures, are they for the overall  
16 testimony or for the subparts?

17 A The figures affect detailed testimony. They  
18 do not affect the overall.

19 Q Okay. Then let's not go into those now either  
20 then, because we haven't furnished the Court Reporter  
21 with the copies. However, if the parties that we have  
22 passed those three figures out to can hang on to them, we  
23 won't have to do that again.

24 Q Now Mr. Ghio, could you very briefly summarize  
25 your main testimony?



agb3

1 MR. NORTON: And Mrs. Bowers, before we do that,  
2 Mr. Ghio is joint author of a number of subparts of  
3 testimony which will consist of panels as to detailed  
4 structural analysis of such things as the turbine building  
5 and other structures, containment building, et cetera.  
6 So today his overall testimony is just an overview of that.

7 And again, there will be panels who will follow  
8 up and Mr. Ghio will be on them regarding the details of  
9 the analysis of each building.

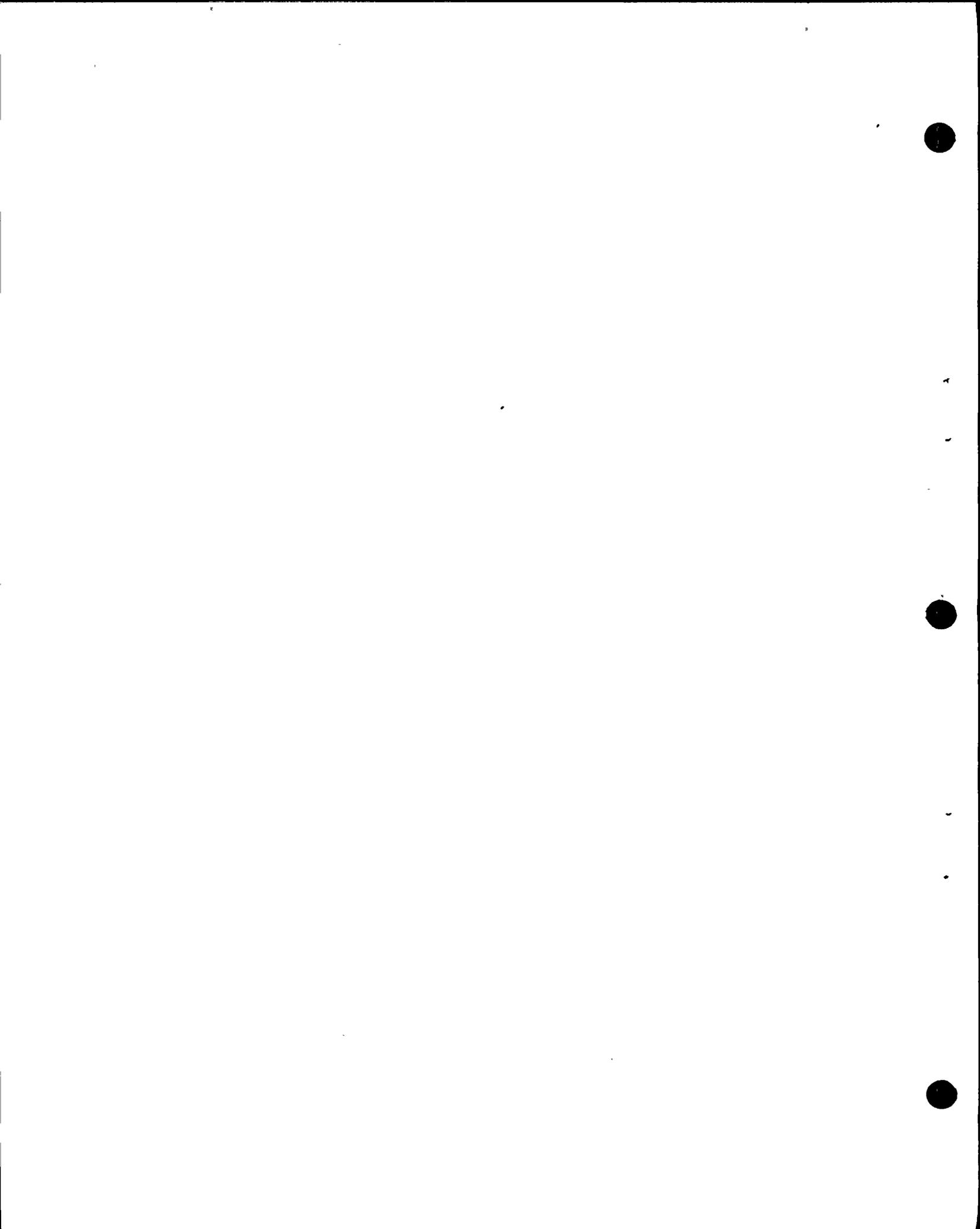
10 BY MR. NORTON:

11 Q Please now proceed to summarize your overview  
12 testimony.

13 A All right.

14 My prepared testimony provides a summary of the  
15 extensive seismic analyses which have been performed for  
16 the Diablo Canyon structures to demonstrate their capability  
17 to resist the various earthquakes which have been postulated,  
18 including the magnitude 7.5 Hosgri earthquake, together with  
19 the appropriate concurrent loads.

20 The testimony is divided into six parts. The  
21 first part defines and describes the design Class I and  
22 design Class II structures which have been seismically  
23 qualified and discusses the seismic input methodology and  
24 acceptance criteria employed in the seismic qualification  
25 for those postulated earthquakes reviewed and approved by the



agb4

1 AEC with the issuance of the construction permits. Those  
2 earthquakes were termed the design and double design earth-  
3 quakes.

4 Using current regulatory terminology, these  
5 earthquakes would be known as the operating basis and safe  
6 shutdown earthquakes respectively.

7 In addition, a brief statement regarding the  
8 extensive regulatory review both by the NRC Staff and the  
9 ACRS, including the Staff seismic audits, is provided.

10 This first part of testimony concludes with a  
11 chronological discussion and summary of the methodology  
12 and criteria employed in the seismic evaluation of the  
13 structures for the magnitude 7.5 Hosgri earthquake.

14 That would conclude a summary of the overview  
15 part of testimony.

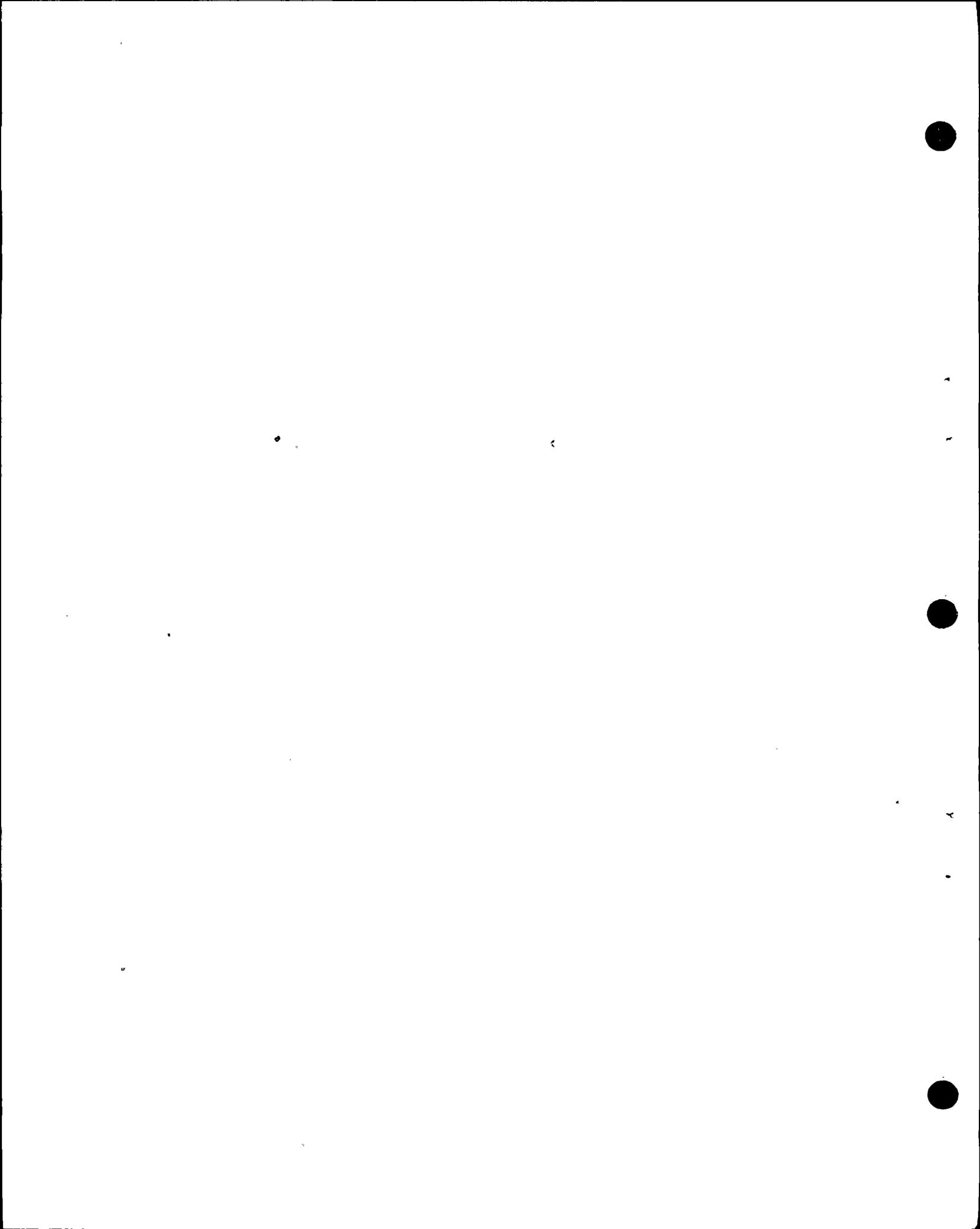
16 Q All right. And again, I think we will summarize  
17 the subparts at the time we get to them. I think in between  
18 now and when we come back January 3, people will have for-  
19 gotten what you said in any event.

20 MR. NORTON: We have no further direct.

21 We would ask that the overview testimony of  
22 Mr. Ghio be inserted in the record as though read.

23 MRS. BOWERS: Mr. Kristovich?

24 MR. KRISTOVICH: Well Mrs. Bowers, I would move  
25 to strike various portions that deal with seismology and



agb5

1 geology. More specifically, Page 8, Line Seven, through  
2 Page 9, Line 6.

3 MRS. BOWERS: Now wait a minute. Go slowly.

4 MR. KRISTOVICH: Page 8, Line Seven through  
5 Page 9, Line 6, Page 11, Line 17 --

6 DR. MARTIN: Wait a minute, I'm not keeping  
7 up with you.

8 MR. KRISTOVICH: That's the first one. Page 8,  
9 Line Seven through Page 9, Line 6.

10 MRS. BOWERS: And then Page 11, Line 17 to what?

11 MR. KRISTOVICH: Page 14, Line 5.

endlG

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1E wbl

1 MR. NORTON: Excuse me. Page 14, line 5,  
2 which says "Appendix C to Supplement No. 5 of the SER"?

3 MR. KRISTOVICH: Up to that.

4 MR. NORTON: Where did you start from?

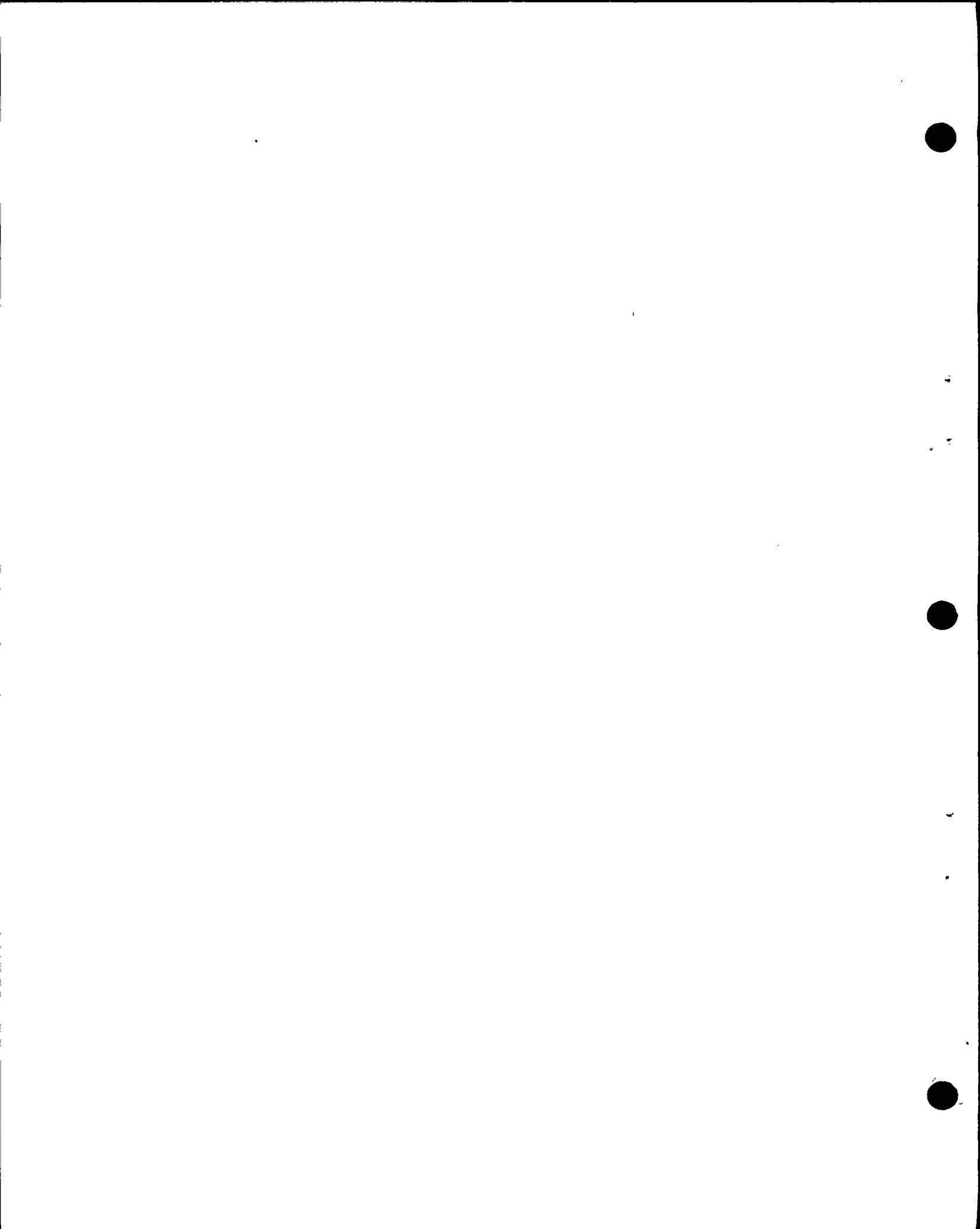
5 MR. KRISTOVICH: Page 11, line 17.

6 MR. NORTON: Excuse me, Mrs. Bowers. As I look  
7 at this testimony it's all facts in evidence. He's just  
8 reviewing the facts that have been testified to by prior  
9 witnesses which formed the basis of the analysis that was  
10 done by this engineer. I don't see any basis for that motion  
11 to strike whatsoever.

12 MRS. BOWERS: Well let's hear from Mr. Kristovich.

13 MR. KRISTOVICH: Well, moving back to page 8,  
14 specifically at line 14, Mr. Ghio talks about an earthquake  
15 six miles directly under the site. And Mr. Blume in his  
16 testimony I believe testified to an earthquake 12 miles  
17 under the site. This is a problem when you have a witness  
18 summarizing testimony that he -- well, summarizing previous  
19 testimony. Rather than cross-examining on a summary of  
20 other people's testimony we would just move to strike it.

21 MR. NORTON: Mrs. Bowers, I appreciate that six  
22 maybe should read 12, and, you know, that could be a mistake.  
23 The point is, it says "These spectra anchored at .2g and .4g  
24 ground accelerations were termed the design earthquake and  
25 the double design earthquake respectively," and so on. These



wb2

1 are engineers who did the analysis. They've got to have.  
2 data on which to do that analysis. And all he's doing is  
3 setting forth the data upon which they did their analysis.

4 It's not a discussion of seismology/geology or  
5 anything other than the data that was supplied to them.

6 Evidently there's a mistake: that six miles  
7 perhaps should be 12 miles, and I guess they can cross-  
8 examine on that, and if they think that somehow it affects  
9 the testimony. But he's not testifying here other than as  
10 to what he was given to do his analysis with.

11 MRS. BOWERS: Mr. Staenberg.

12 MR. STAENBERG: We have nothing to add beyond  
13 what Mr. Norton has just said. A quick reading of this  
14 indicates that there is nothing new here that the witness  
15 would be testifying to, but, rather, it's a recitation of  
16 what has gone before and is already in the evidence by  
17 experts and previous panels. We're not sure, therefore, what  
18 basis Mr. Kristovich has for wanting to strike this testimony.

19 MRS. BOWERS: What about this business at line  
20 14 of six miles, where Mr. Kristovich said the testimony was  
21 that it was 12 miles?

22 MR. STAENBERG: To the best of my recollection  
23 that may indeed be an error. But that can be cleared up  
24 without striking entire pieces of testimony.

25 MR. NORTON: In addition to that, I'm not so sure



22



wb3

1 that is an error. If I'm not mistaken, the focus was 12  
2 miles. But I believe in other portions of the testimony,  
3 such as the FSAR it talks about coming to within six miles,  
4 that 6.75. So I'm not sure at all that that is a mistake.

5 But it's immaterial even if it is a mistake.  
6 If it's a mistake they cross-examine and say "You made a  
7 mistake." But that's not a basis to strike testimony.

8 MR. KRISTOVICH: Well is Mr. Norton suggesting  
9 that I cross-examine Mr. Ghio on what he means by the 6.75  
10 magnitude local earthquake or aftershock at a depth of six  
11 miles directly under the site? From the listing of  
12 Mr. Ghio's qualification it doesn't sound like this is his  
13 area of expertise.

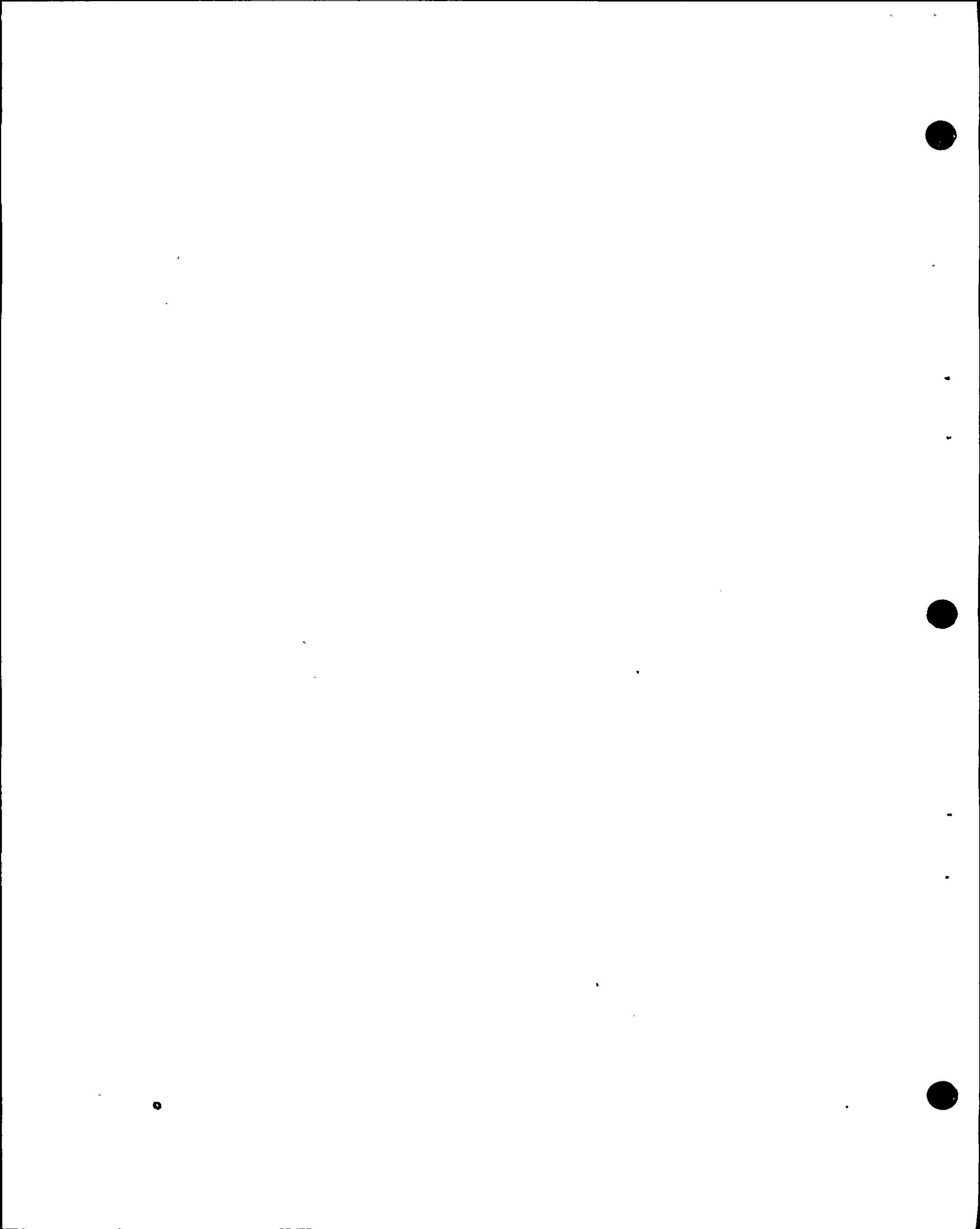
14 MR. NORTON: He's not sponsoring those; he's  
15 saying that those are the criteria that were used to develop  
16 the response spectra from which he did his analysis. I  
17 don't understand. There's no dispute about that. No one  
18 has attested that those were the bases of the analyses.  
19 Intervenors don't contest that.

20 MRS. BOWERS: Well the Board will take a minute  
21 to consider this matter.

22 (The Board conferring)

23 MRS. BOWERS: Mr. Kristovich, the motion to strike  
24 will not be granted. We think this is just reciting back-  
25 ground. And it is in evidence. Dr. Martin found the reference

F 100



wb4

1 to six miles rather than 12.

2 MR. KRISTOVICH: Well, Mrs. Bowers, I would like  
3 to point out, page 9 of Dr. Blume's testimony, line 22 is  
4 where the figure 12 miles is used.

5 MR. NORTON: That's the focus.

6 MR. KRISTOVICH: Including down.

7 MR. NORTON: That's the focus.

8 MRS. BOWERS: Well, you can proceed on cross-  
9 examination, but the matter before us was a motion to  
10 strike, and that has not been granted: that has been denied.

11 Now you had one other matter, page 11, line 17.

12 MR. KRISTOVICH: Page 11, line 17 through page 14,  
13 line 5.

14 MR. NORTON: Again, Mrs. Bowers, that's the same  
15 thing. This is just the background basis of the analysis,  
16 the .75g analysis, a recapitulation of previous testimony,  
17 "The Company's position was, and is, that a magnitude 6-1/4  
18 to 6-1/2 earthquake with an associated peak ground accelera-  
19 tion of 0.5g is the largest that can reasonably be expected  
20 to occur on the Hosgri Fault."

21 It's precisely what Dr. Blume had testified to  
22 in the last two days.

23 MR. STAENBERG: Beyond which, it appears to be  
24 simply a chronological historical recitation of the interface  
25 between the NRC Staff and their consultants and the applicant.



wb5

1 MRS. BOWERS: Mr. Kristovich, do you want to  
2 respond?

3 MR. KRISTOVICH: No.

4 MRS. BOWERS: Well the motion to strike page 11,  
5 line 17 to page 14, line 5 is denied. And it's essentially  
6 the same reason: it's an historical recap of prior testimony.

7 MR. KRISTOVICH: I have no further objection at  
8 this time, but I would like to reserve the right to renew my  
9 motion to strike following cross-examination.

10 MR. NORTON: Okay. May we still have it placed  
11 in the record as though read at this point, with Mr. Kristovich's  
12 reservation of right to renew his motion to strike any  
13 portion thereof upon completion of his cross-examination?

14 MRS. BOWERS: Mr. Kristovich?

15 MR. KRISTOVICH: Yes.

16 MRS. BOWERS: Mr. Staenberg?

17 MR. STAENBERG: The Staff has no objection.

18 MRS. BOWERS: Well the testimony of this witness  
19 will be physically inserted into the transcript as if read.

20 (Testimony of Vincent J. Ghio follows.)  
21  
22  
23  
24  
25

INSERT



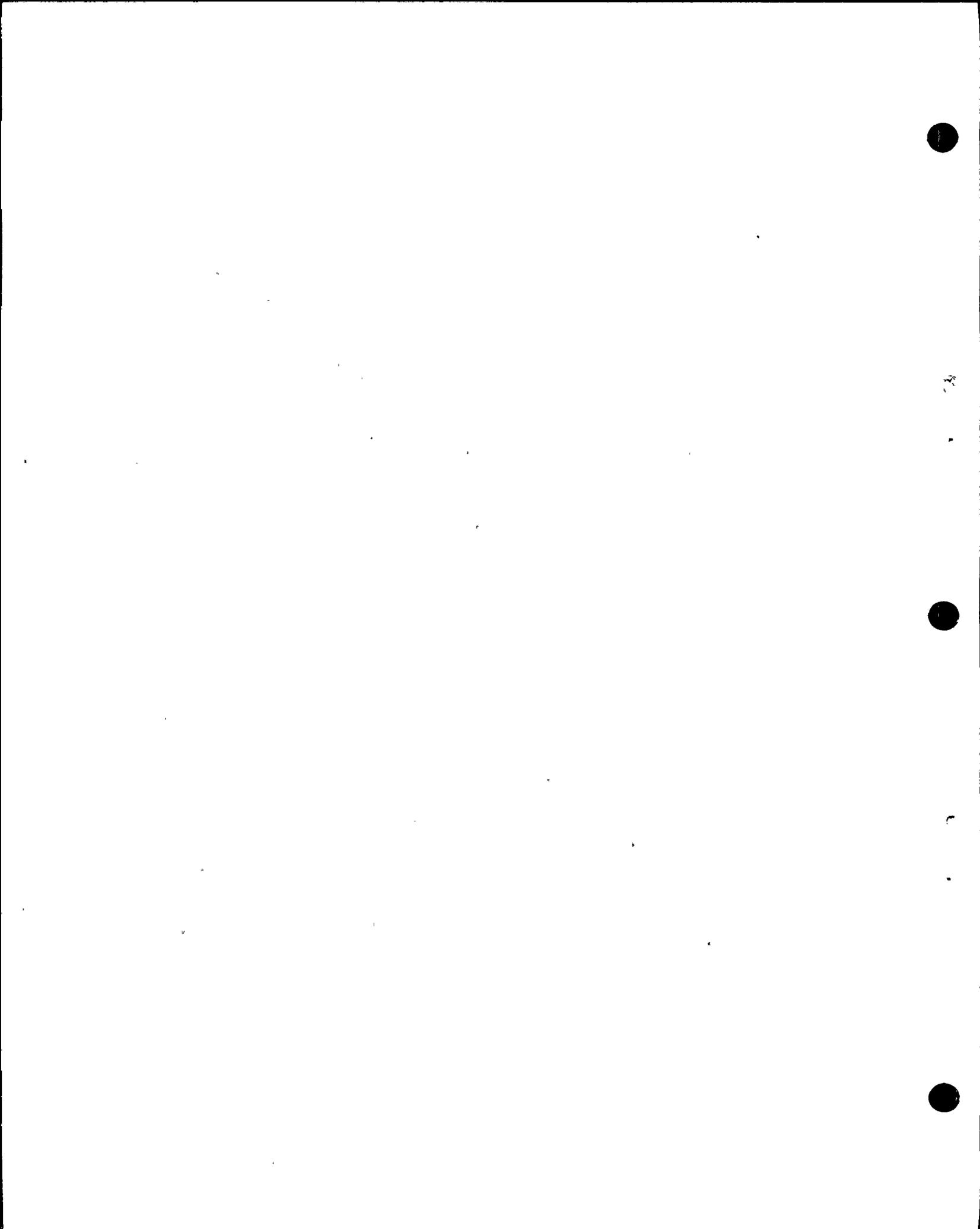
1 TESTIMONY OF  
2 VINCENT J. GHIO  
3 ON BEHALF OF  
4 PACIFIC GAS AND ELECTRIC COMPANY  
5 DECEMBER 4, 1978  
6 DOCKET NOS. 50-275, 50-323

7 My name is Vincent J. Ghio. I am a Senior Civil  
8 Engineer with responsibility for coordinating and reviewing  
9 the design of structures for the Diablo Canyon Nuclear Power  
10 Plant.

11 My testimony today deals with the capability of  
12 the Design Class I structures and the Design Class II structures  
13 containing Design Class I components to satisfactorily  
14 resist the various seismic inputs considered in the analyses,  
15 including the postulated 7.5M Hosgri earthquake, together  
16 with the appropriate concurrent loads. It is offered in  
17 response to contentions II A5, II A6 and II A7.

18 We have concluded that these structures will  
19 perform as required during the postulated earthquakes, i.e.,  
20 they will remain functional and within applicable stress and  
21 deformation limits when subjected to the effects of the  
22 vibratory motion of these earthquakes, including appropriate  
23 concurrent loads. Thus, the structures will perform their  
24 function required in order to assure:

25 1. The integrity of the reactor coolant pressure  
26 boundary.

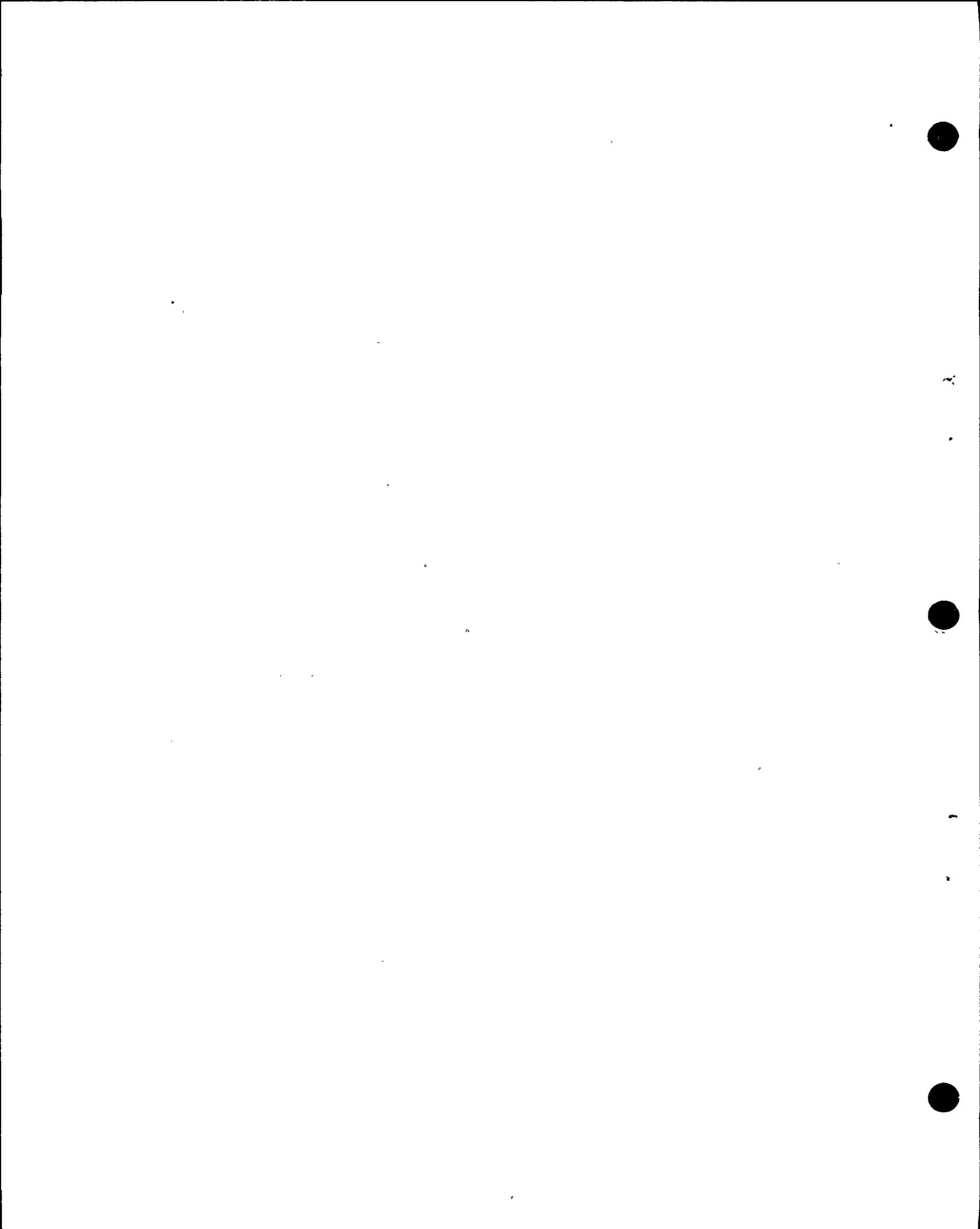


1           2.    The capability to shut down and maintain the  
2 reactor in a safe condition.

3           3.    The capability to prevent or mitigate the  
4 consequences of accidents which could result in potential  
5 offsite exposures comparable to the guideline exposures of  
6 10 CFR Part 100.

7           This conclusion is supported by the results of the  
8 extensive seismic analyses performed by PGandE and its  
9 consultants during the design and licensing of the project.  
10 These analyses are described in Sections 2.5E, 3.7 and 3.8  
11 of the Final Safety Analysis Report and Chapters 4 and 11  
12 and Appendix A of the Hosgri Report.

13           As noted in earlier testimony, the seismic criteria,  
14 analysis and design of the Diablo Canyon facility have under-  
15 gone extensive regulatory review by both the Nuclear Regulatory  
16 Commission staff and the Advisory Committee on Reactor Safe-  
17 guards. There have been a total of eleven A.C.R.S. subcommittee  
18 and six A.C.R.S. full committee meetings spanning the time  
19 period from September 1974 through July 1978. Seismic  
20 issues were discussed at the majority of these meetings.  
21 The extensive review of the criteria, procedures and results  
22 of the seismic analyses performed by the NRC staff included  
23 comprehensive audits of the documents supporting the analyses.  
24 The audits related to the original seismic design bases,  
25 i.e., the Design and Double Design Earthquakes, and to the  
26



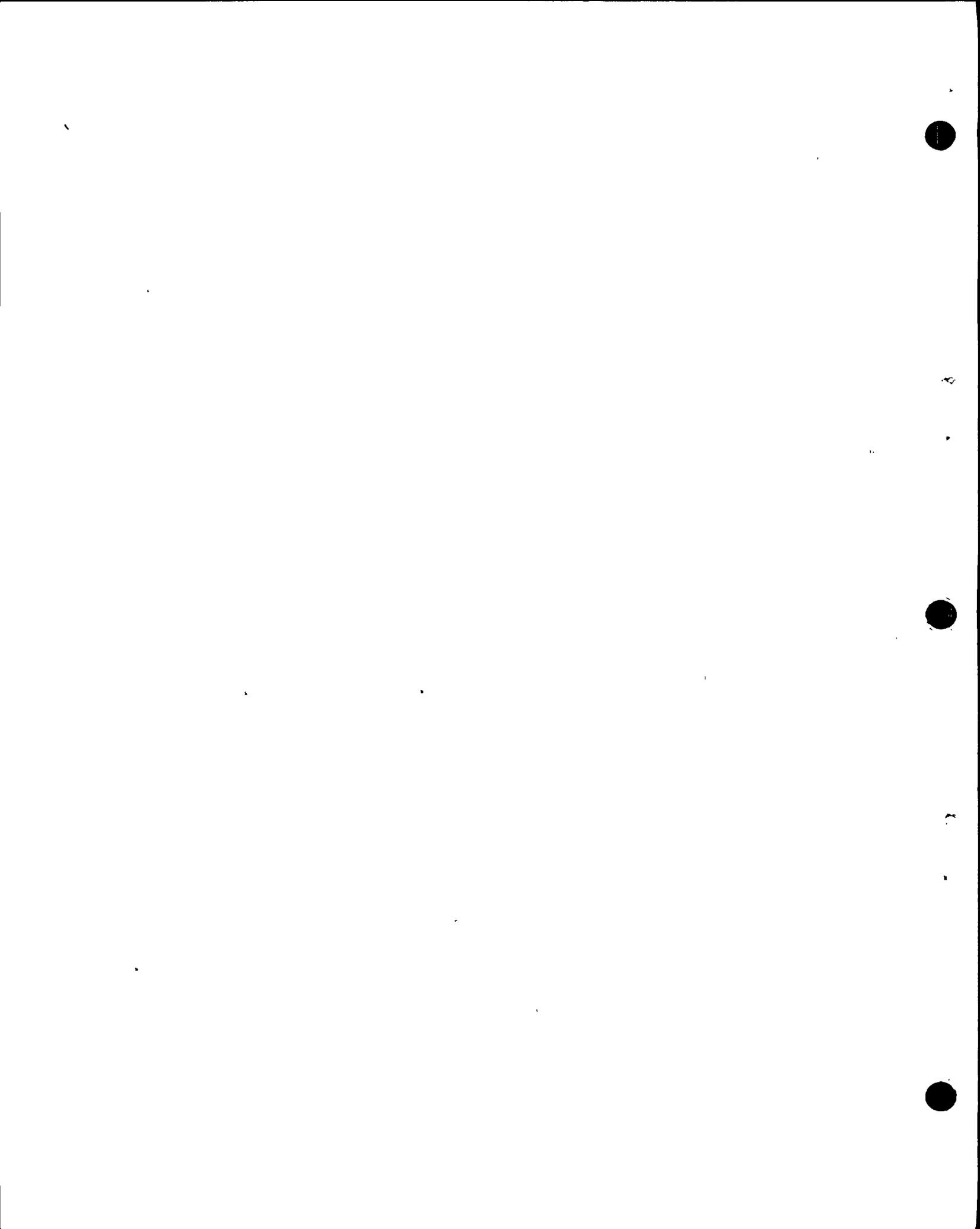
1 Hosgri Seismic Evaluation. Consultants to the A.C.R.S.  
2 participated in the Hosgri audit.

3 The Design Class I structures at Diablo Canyon and  
4 discussed in this testimony consist of the Containment  
5 Structure, Auxiliary Building, and the Outdoor Storage  
6 Tanks. The Design Class II structures consist of the Turbine  
7 Building and Intake Structure. The relative arrangement of  
8 these structures is shown in Figure 1.

9 The Containment for each unit is a cylindrical,  
10 reinforced concrete structure that completely encloses and  
11 provides support for the Reactor and Reactor Coolant System.  
12 It assures that essentially no leakage of radioactive materials  
13 to the environment would result even if a design basis  
14 accident were to occur simultaneously with an earthquake of  
15 a magnitude of the Double Design Earthquake or the Hosgri  
16 Earthquake.

17 The Containment Structures for Units 1 and 2 are  
18 essentially identical, except for orientation. The following  
19 discussion applies to either unit.

20 The exterior shell of the Containment Structure  
21 consists of a 142 foot high cylinder, topped with a hemis-  
22 pherical dome. The cylinder wall is 3 feet, 8 inches thick,  
23 and the dome is 2 feet, 6 inches thick. Both have an inside  
24 diameter of 140 feet. The base is a circular slab 153 feet  
25 in diameter and 14 feet, 6 inches thick, with the reactor  
26 cavity near the center. The inside of the dome, cylinder



1 and base slab is lined with welded steel plate which forms a  
2 leaktight membrane. The liner is 3/8-inch thick on the wall  
3 and dome and 1/4-inch thick on the base slab.

4 The Containment Structure has been qualified for  
5 the Design and Double Design Earthquake and with minor  
6 modifications which have been implemented, for the Hosgri  
7 earthquake.

8 The Auxiliary Building is located between the  
9 Unit 1 and Unit 2 Containment Structures. It is a low-rise  
10 structure with plan dimensions of approximately 500 feet by  
11 230 feet. It contains the control room for each unit and a  
12 fuel handling area for each unit. In addition, the Auxiliary  
13 Building contains equipment for the Chemical and Volume  
14 Control Systems, the Safety Injection Systems, the Residual  
15 Heat Removal Systems, the Component Cooling Water Systems,  
16 the Liquid Radwaste Systems, the Gaseous Radwaste System,  
17 and others.

18 The main floor levels in the Auxiliary Building  
19 are at elevation 60, 73, 85, 100, 115 and 140. Elevations  
20 60 and 73 are below ground level, which is at elevation 85,  
21 except for the east side of the building where ground level  
22 is at elevation 115.

23 Generally speaking, one-half of the Auxiliary  
24 Building is a mirror image of the other, with each half of  
25 the structure containing equipment for one unit. The control  
26 room is located at elevation 140. The two fuel handling

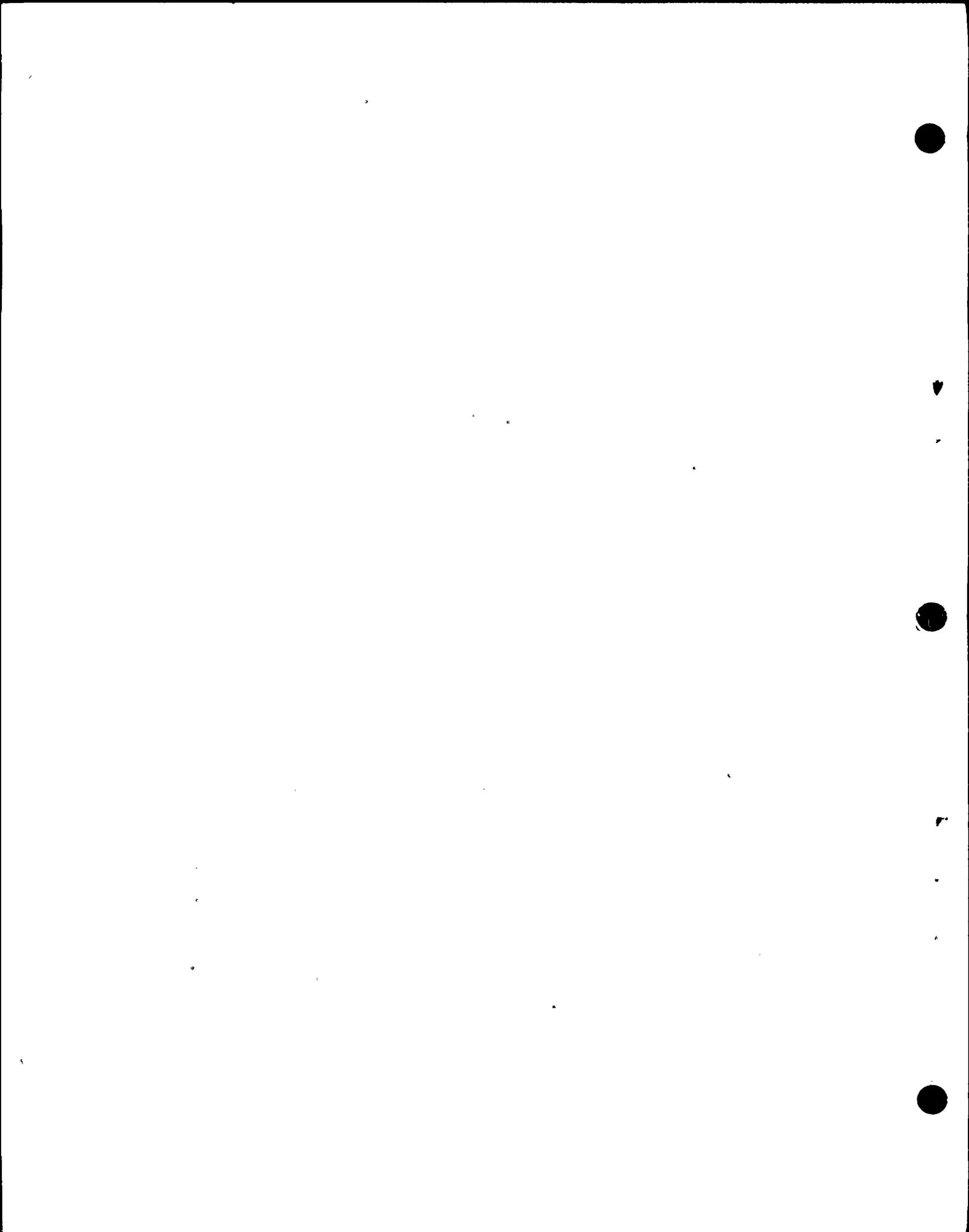


1 areas which contain the spent fuel pools, the fuel handling  
2 cranes, fuel racks, and related equipment are located on the  
3 east side of the Auxiliary Building, with the top of the  
4 spent fuel pools at elevation 140.

5 The Auxiliary Building is a reinforced concrete,  
6 shear wall structure, except for the fuel handling structure  
7 which is structural steel. The shear walls are generally  
8 3 feet thick, with a minimum thickness of 2 feet. Slabs are  
9 generally 2 feet thick. The walls of the spent fuel pools  
10 are a minimum of 6 feet thick, except for local areas around  
11 the fuel transfer tubes. The foundation slabs under the  
12 spent fuel pits have a minimum thickness of 5 feet.

13 The Auxiliary Building has been qualified for the  
14 Design and Double Design Earthquakes. Modifications to  
15 improve the seismic shear distribution in the fuel handling  
16 area were determined necessary for the Hosgri earthquake.  
17 These modifications have been implemented.

18 The Turbine Building and the Intake Structure are  
19 Design Class II structures that contain Design Class I  
20 equipment. The Turbine Building contains the Design Class I  
21 Component Cooling Water Heat Exchangers, the Emergency  
22 Diesel Generators and the 4.16 KV Vital Switchgear. The  
23 Intake Structure contains the Auxiliary Saltwater Pumps,  
24 also Design Class I. In order to assure that this Design  
25 Class I equipment would not be affected by failure of the  
26 Design Class II structures, both Turbine Building and the



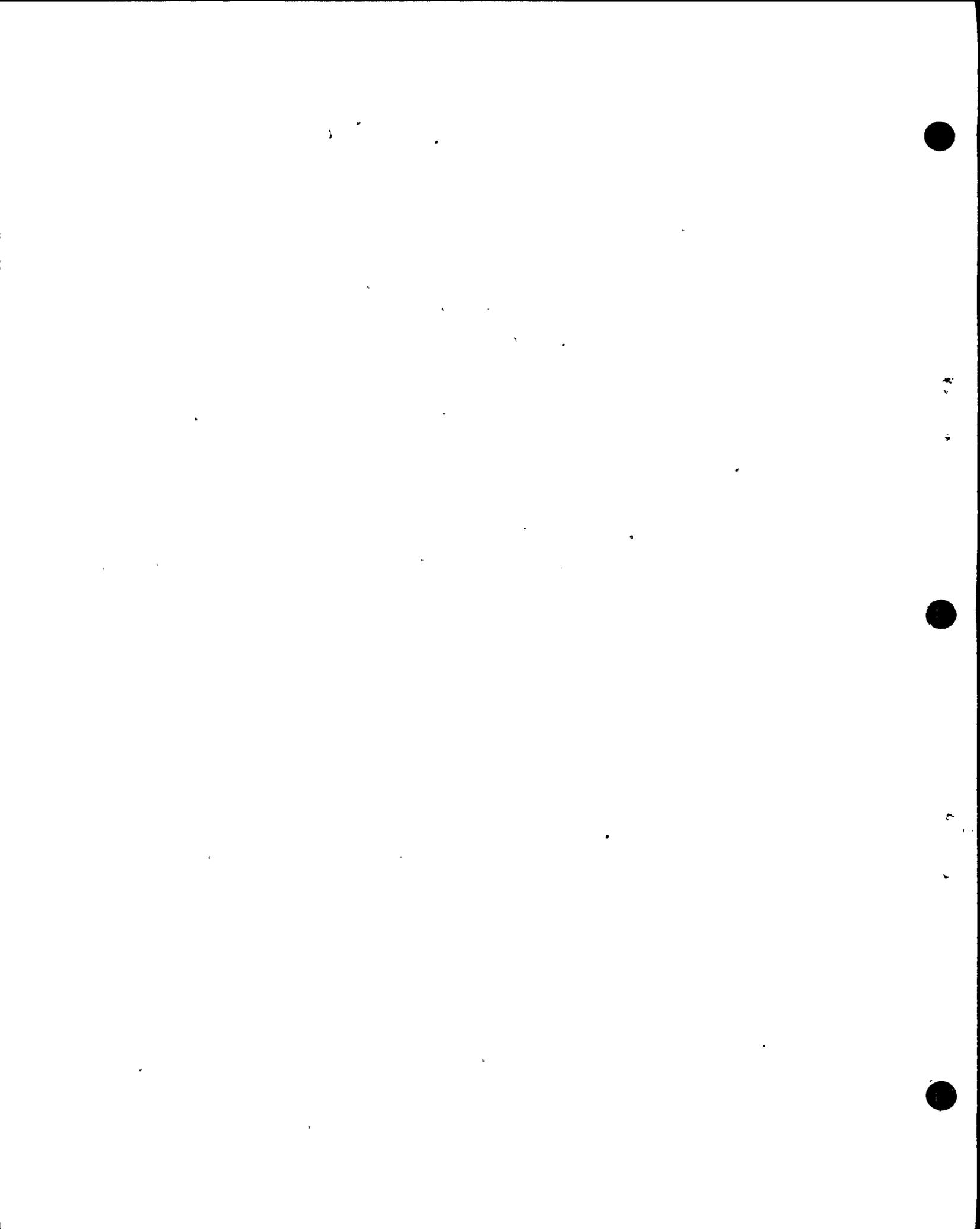
1 Intake Structure were analyzed for the Double Design Earth-  
2 quake and the Hosgri earthquake.

3           The Turbine Building, serving both Units 1 and 2,  
4 is approximately 750 feet long, 140 feet wide and 134 feet  
5 high and consists of four major floor levels at elevations  
6 140, 119, 104 and 85, with grade being located at elevation  
7 85. The Component Cooling Water Heat Exchangers and the  
8 Diesel Generators are located at elevation 85. The Vital  
9 Switchgear is located at elevation 119. The Design Class II  
10 turbine generators are located at elevation 140.

11           The Turbine Building is a steel frame structure in  
12 which a combination of steel cross-bracing and reinforced  
13 concrete shear walls and floors provide lateral force resis-  
14 tance. There is an expansion joint between the Unit 1 and  
15 Unit 2. Therefore, the Units 1 and 2 sections act as  
16 essentially separate structures in terms of lateral force  
17 resistance.

18           Massive reinforced concrete pedestals which support  
19 the turbine generators are located in the center of the two  
20 sections of the building. These pedestals have been struc-  
21 turally isolated from the floors at each elevation but do  
22 share a common foundation mat with the building.

23           The Turbine Building has been found to be capable  
24 of resisting the seismic forces associated with the Double  
25 Design Earthquake. Substantial structural modifications  
26 were determined to be necessary to resist the Hosgri earthquake.



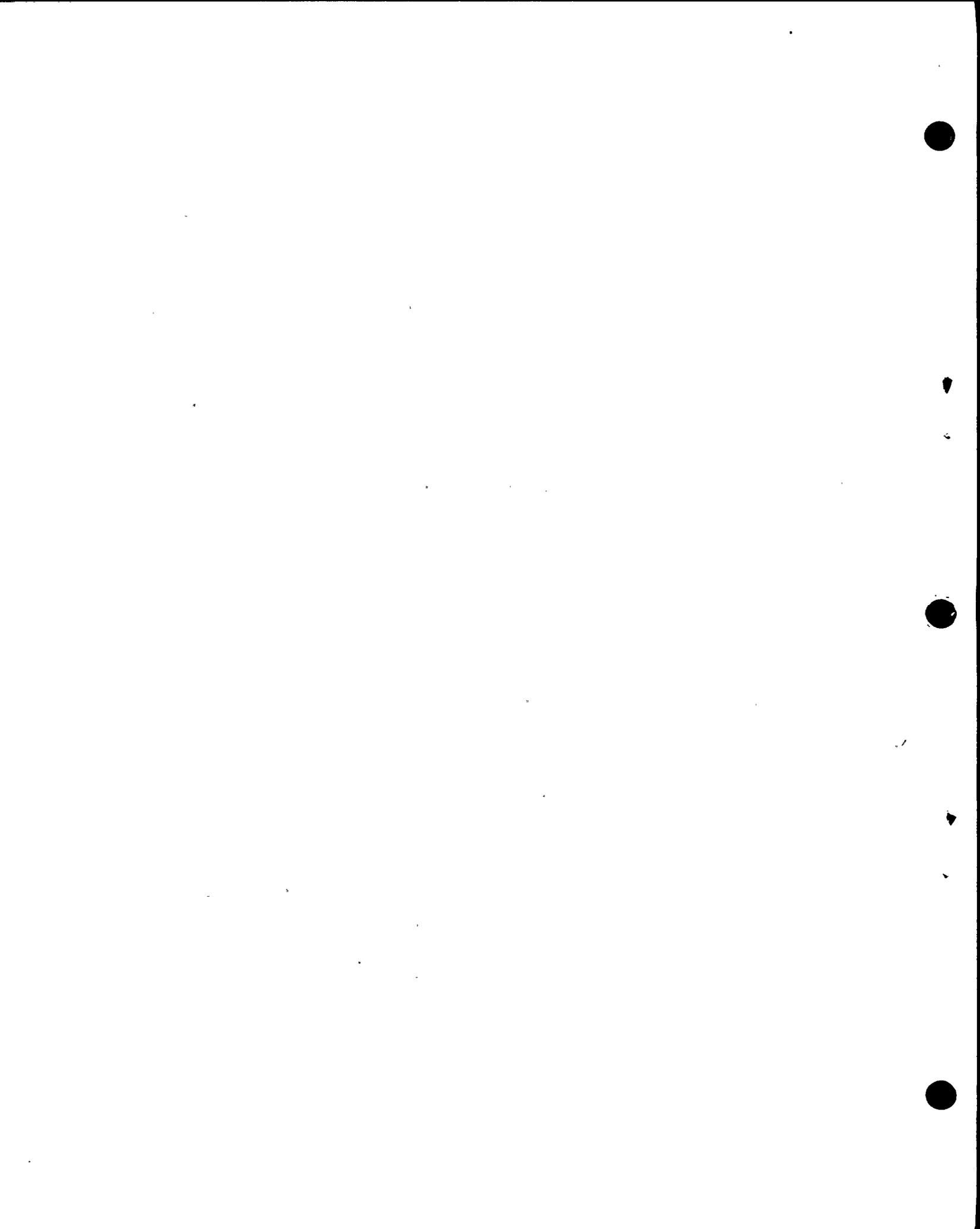
1 These modifications will be discussed in more detail in a  
2 later portion of this testimony.

3 The Intake Structure, which serves both Units 1  
4 and 2, is a Design Class II structure. Its primary function  
5 is to house the main circulating water pumps which deliver  
6 ocean water for condenser cooling. However, because it also  
7 houses the four Design Class I auxiliary saltwater pumps,  
8 two for each unit, it was reviewed for the postulated Double  
9 Design and 7.5M Hosgri earthquakes.

10 The Intake Structure is a reinforced concrete  
11 shear wall building approximately 240 feet by 100 feet in  
12 plan dimension with an overall height of 50 feet. The long  
13 dimension of the structure represents the length of the  
14 seaward face of the structure. The structure is founded on  
15 the rock at the seacoast and backfilled on all but the ocean  
16 side, resulting in a partially embedded structure.

17 The Intake Structure has been qualified for the  
18 Double Design Earthquake and has been found capable of  
19 resisting the Hosgri earthquake without sustaining any  
20 damage that would impair the functioning of the auxiliary  
21 saltwater pumps.

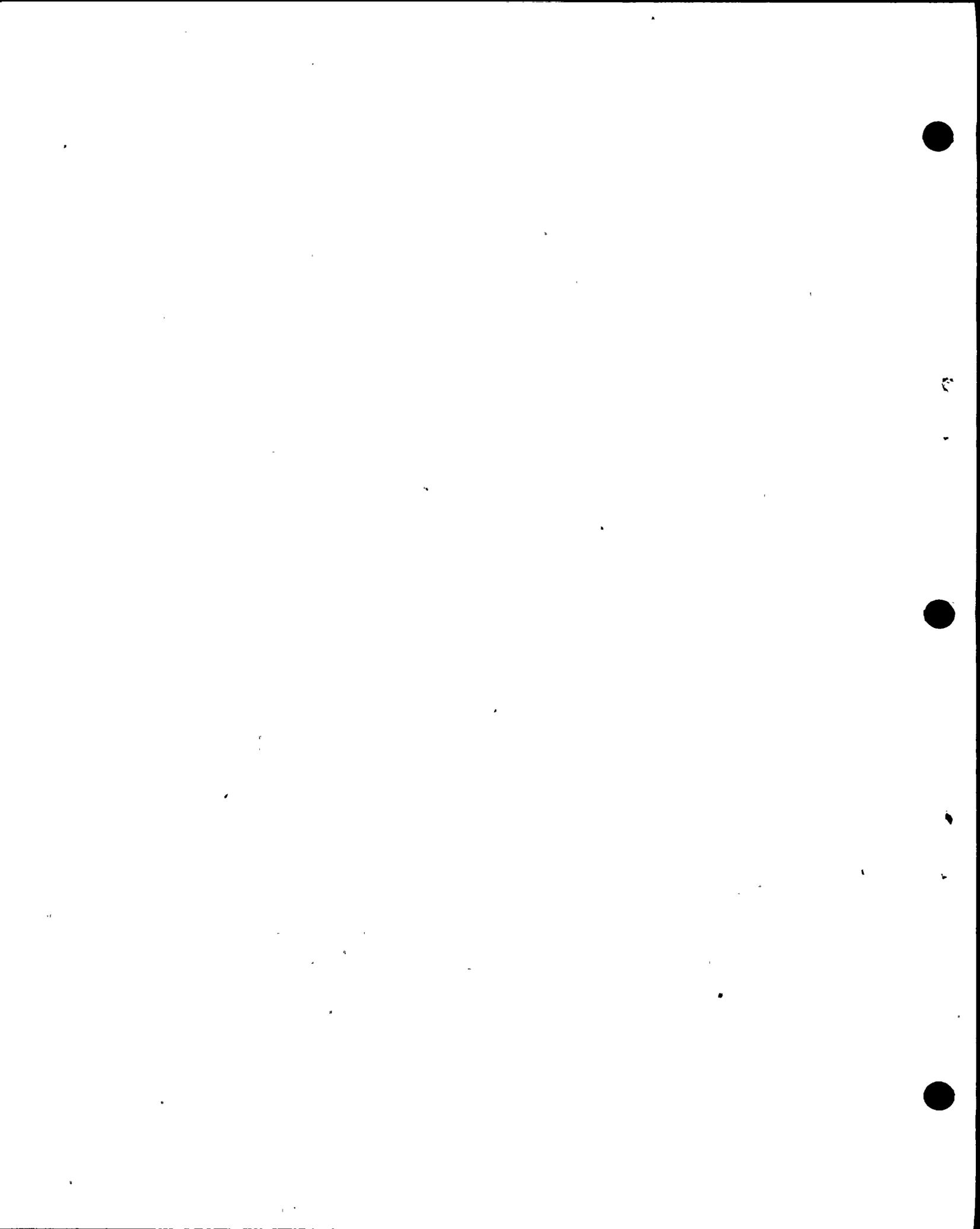
22 The Design Class I Outdoor Water Storage Tanks  
23 include the refueling water, condensate and fire water and  
24 transfer tanks. These tanks are located east of the Fuel  
25 Handling Building at grade elevation 115. The fire water  
26 and transfer tanks are concentric on the same foundation.



1 The outer tank is for transfer water. The inner tank is for  
2 fire water.

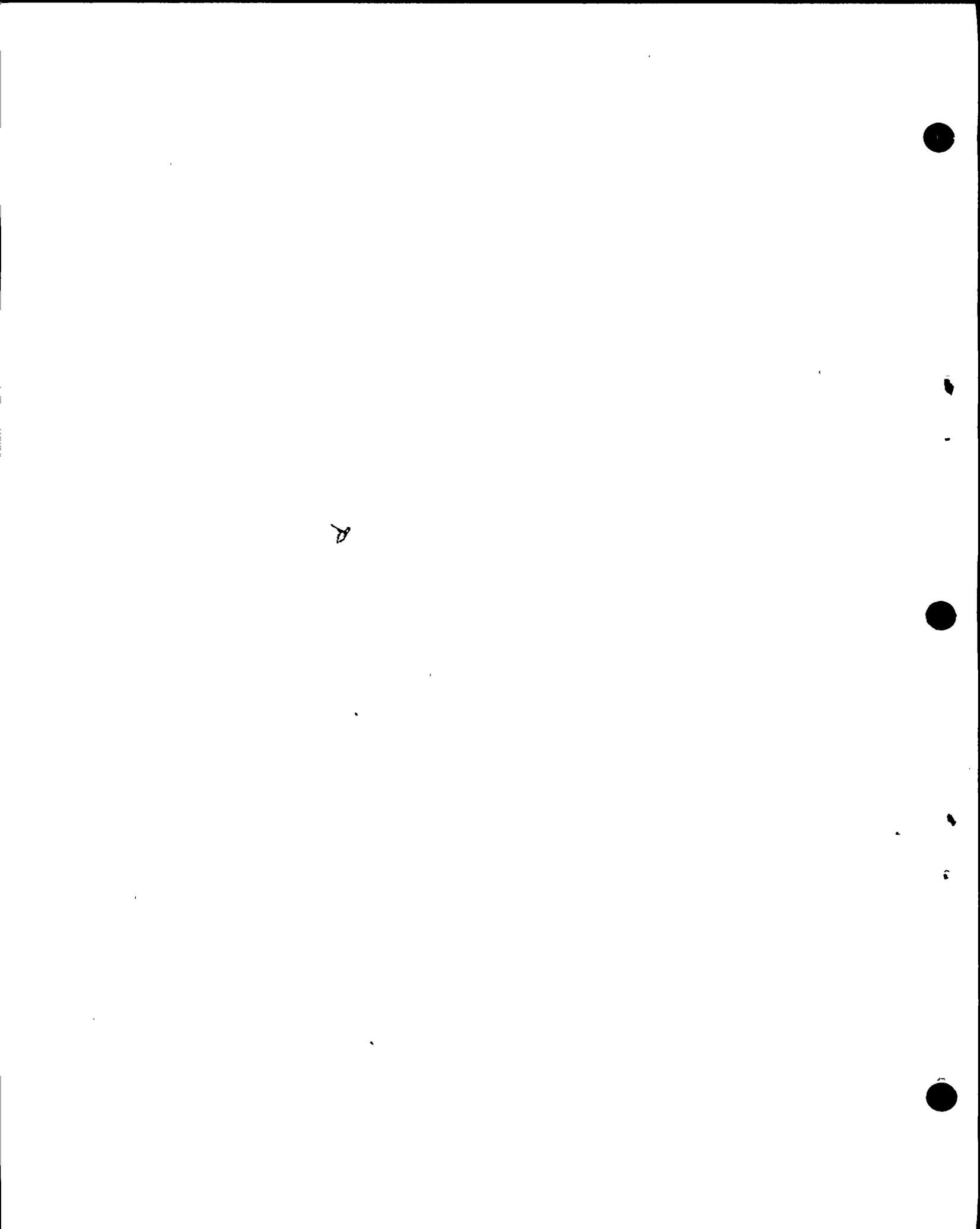
3 Although these tanks have been found adequate for  
4 the Double Design Earthquake, significant modifications were  
5 determined necessary to resist the Hosgri earthquake. These  
6 modifications will be discussed later.

7 The following portion of testimony deals with a  
8 summary of the original seismic design of the plant structures  
9 for the postulated earthquakes and criteria which were  
10 approved by the Atomic Energy Commission with the issuance  
11 of construction permits. Briefly, two of four postulated  
12 earthquakes, namely a 7.25M event on the Nacimiento fault  
13 and a 6.75M local earthquake or aftershock at a depth of  
14 6 miles directly under the site, led to the development of  
15 the controlling site specific response spectra. These  
16 spectra, anchored at 0.2g and 0.4g peak ground acceleration,  
17 were termed the Design Earthquake (Operating Basis Earthquake  
18 in current regulations) and Double Design Earthquake (Safe  
19 Shutdown Earthquake in current regulations) respectively.  
20 The damping employed in application of these spectra to the  
21 structures varied from 1 percent for welded steel to 5 percent  
22 for concrete structures. Two basic methods of dynamic  
23 seismic analysis were utilized in determining the response  
24 of the structures; namely, the time history and response  
25 spectrum methods. The structures were represented as mathe-  
26 matical models in the form of lumped masses or nodes inter-



1 connected by springs or finite elements. The interactive  
2 effects of the foundation supporting media on the response  
3 of the structure, i.e, soil-structure interaction, were  
4 considered by extending the finite element models to include  
5 the underlying foundation material or by the use of equivalent  
6 foundation springs. The mathematical model used in the  
7 seismic analysis of the containment structure is shown in  
8 Figure 2. In addition to determining seismic forces induced  
9 in the structures, these dynamic analyses developed in-  
10 structure response spectra subsequently used in the seismic  
11 qualification of safety-related equipment.

12           The seismic forces were combined with the forces  
13 due to applicable concurrent loads, such as dead, live and  
14 thermal loads and, in the case of the Containment Structure,  
15 loss-of-coolant accident loads (even though seismic loads  
16 alone are insufficient to cause a loss-of-coolant accident).  
17 The resulting combined forces were then compared with the  
18 capacity of the various structural elements to resist these  
19 forces. These capacities were determined by using the  
20 formulations contained in the applicable codes and standards.  
21 For example, the capacity of concrete structural elements  
22 were determined by the American Concrete Institute Standard  
23 Building Code Requirement for Reinforced Concrete and the  
24 capacity of structural steel members were determined by the  
25 American Institute of Steel Construction specifications for  
26 the Design Fabrication and Erection of Structural Steel for



1 Buildings. A complete listing of the codes and standards  
2 used is contained in Section 3.8 of the FSAR. One important  
3 exception to these codes should be noted, i.e., for the case  
4 of load combinations including Design Earthquake loads the  
5 required resisting capacity was determined without invoking  
6 the one-third increase in allowable stresses for load com-  
7 binations involving seismic loads that is typically allowed  
8 by the above-mentioned codes. Thus under Design Earthquake  
9 load combinations, the maximum stress levels in the structures  
10 are no higher than those that would be allowed in a conven-  
11 tional building under normal service loads without earthquake.  
12 Another way of saying this is simply that we would have at  
13 least the same margin of safety in the Design Class I  
14 structures under Design Earthquake conditions that a typical  
15 code designed structure would have under its normal load  
16 conditions.

17 In summary, the Design Class I structures and the  
18 Design Class II structures containing Design Class I equip-  
19 ment have been analyzed and qualified using the postulated  
20 earthquakes and related acceptance criteria reviewed and  
21 approved by the Atomic Energy Commission as a condition in  
22 the construction permit proceedings.

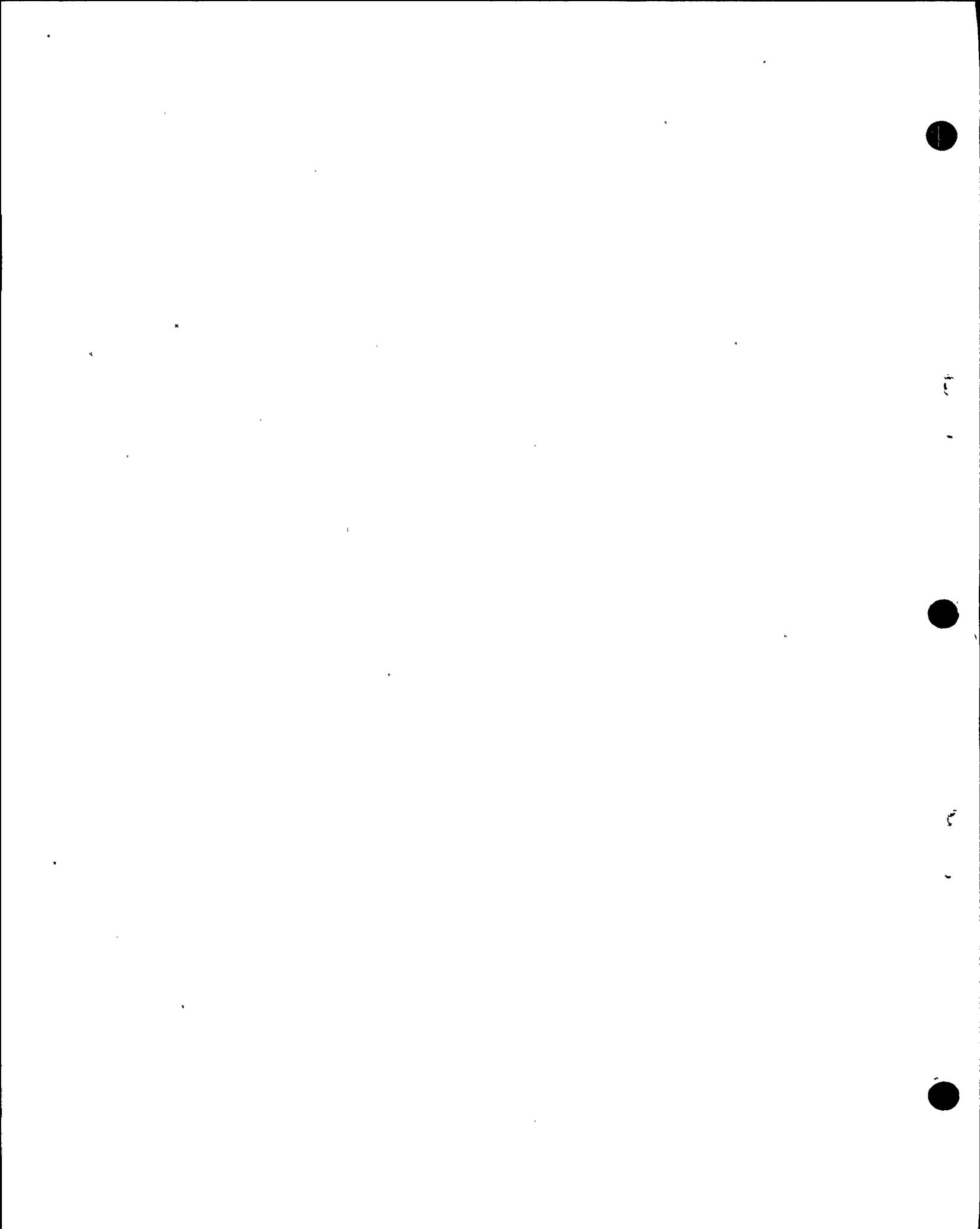
23 The following portion of testimony deals primarily  
24 with a summary of the seismic evaluation of the Diablo  
25 Canyon structures for the postulated 7.5M Hosgri earthquake.  
26 However, in order to provide a complete treatment of the



1 extensive seismic review performed for the Diablo Canyon  
2 structures, a brief background statement regarding studies  
3 which preceded the evaluation for a 7.5M event follows.

4           As part of its continuing assessment of the geology  
5 and seismology in the vicinity of the Diablo Canyon site,  
6 including the Hosgri Fault, the Company in 1974 submitted to  
7 the AEC, upon request, a study effect on the structures and  
8 selected floor response spectra of certain components of  
9 time-history for the 1966 Parkfield-5 and 1971 Castaic  
10 earthquakes scaled to 0.5g peak acceleration. This study,  
11 although not as comprehensive as subsequent analyses, con-  
12 cluded that the Design Class I structures and the Nuclear  
13 Steam Supply System components were capable of resisting  
14 this earthquake if appropriate Regulatory Guide 1.61 damping  
15 values were utilized. This study is included as Appendix A  
16 to the Hosgri Report.

17           In 1975, the Company submitted to the NRC as an  
18 amendment to the FSAR its evaluation of the maximum credible  
19 earthquake on the Hosgri Fault zone and associated response  
20 spectra comparisons. The Company's position was, and is,  
21 that a magnitude 6-1/4 to 6-1/2 earthquake with an associated  
22 peak ground acceleration of 0.5g is the largest that can  
23 reasonably be expected to occur on the Hosgri Fault. This  
24 postulation was supported by comprehensive geological and  
25 seismological studies documented in Appendices 2.5D and 2.5E  
26 of the FSAR. The plant's original seismic design has been



1 shown to be adequate for this postulated earthquake. This  
2 analysis is documented in Appendix 2.5E of the FSAR.

3 Based on a review of the above cited geological  
4 and seismological studies by the NRC and the USGS (acting as  
5 NRC's geological consultant), Supplement No. 4 to the NRC  
6 Safety Evaluation Report was issued in May 1976. This  
7 supplement included the USGS conclusion that a magnitude 7.5  
8 earthquake could occur on the Hosgri Fault at a point nearest  
9 to the Diablo Canyon site. The USGS further concluded that  
10 such an earthquake should be described in terms of near  
11 fault horizontal ground motion using techniques and conditions  
12 presented in Geological Survey Circular 672. The USGS also  
13 recommended that an effective engineering acceleration be  
14 derived for seismic analysis.

15 The NRC adopted the USGS recommendation for the  
16 seismic potential of the Hosgri Fault. In addition, based  
17 on the recommendation of Dr. N. M. Newmark, NRC's seismic  
18 design consultant, the NRC prescribed that an effective  
19 horizontal ground acceleration of 0.75g be used for the  
20 development of response spectra to be employed in a seismic  
21 evaluation of the plant. The NRC outlined procedures con-  
22 sidered appropriate for the evaluation, including an adjust-  
23 ment of the response spectra to account for the filtering  
24 effect of the large building foundations. An appropriate  
25 allowance for torsion was to be included in the analysis. A  
26



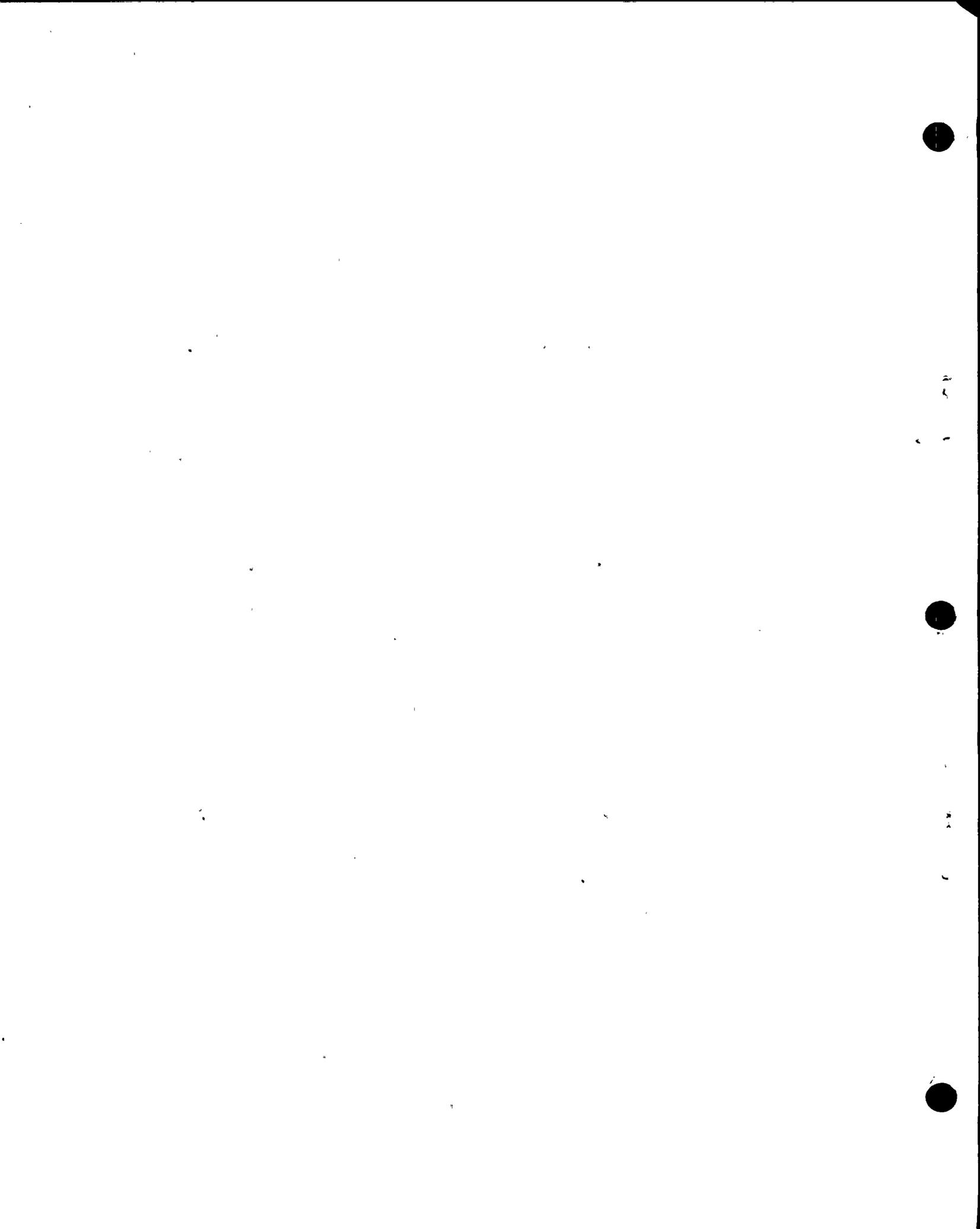
1 guideline for the consideration of inelastic behavior, with  
2 an associated ductility ratio, was also established.

3 Appendix 3.7A of the Diablo Canyon FSAR (subse-  
4 quently superseded by the Hosgri Report filed in July 1976,  
5 presented a program for the seismic Hosgri evaluation using  
6 the bases described above. It included the proposed ground  
7 response spectra applicable to the various structures as  
8 determined by the Company's seismic consultant, URS/Blume &  
9 Associates. Based on review of this submittal, the NRC  
10 issued Supplement No. 5 to the SER in September 1976. This  
11 supplement included response spectra independently derived  
12 by Dr. Newmark and the rationale for their development as  
13 well as parameters to be used in the foundation filtering  
14 calculations for each major structure. The supplement  
15 prescribed that either the spectra developed by Blume or  
16 Newmark would be acceptable for use in the evaluation with  
17 the following conditions:

18 1. In the case of the Newmark spectra, no reduc-  
19 tion for non-linear effects would be taken except in certain  
20 specific areas on an individual case basis.

21 2. In the case of the Blume spectra, a reduction  
22 for non-linear behavior using a conservative ductility ratio  
23 may be employed.

24 3. The results determined by use of the Blume  
25 spectra would be adjusted so as not to fall below the results  
26 determined by use of the Newmark spectra at any frequency.

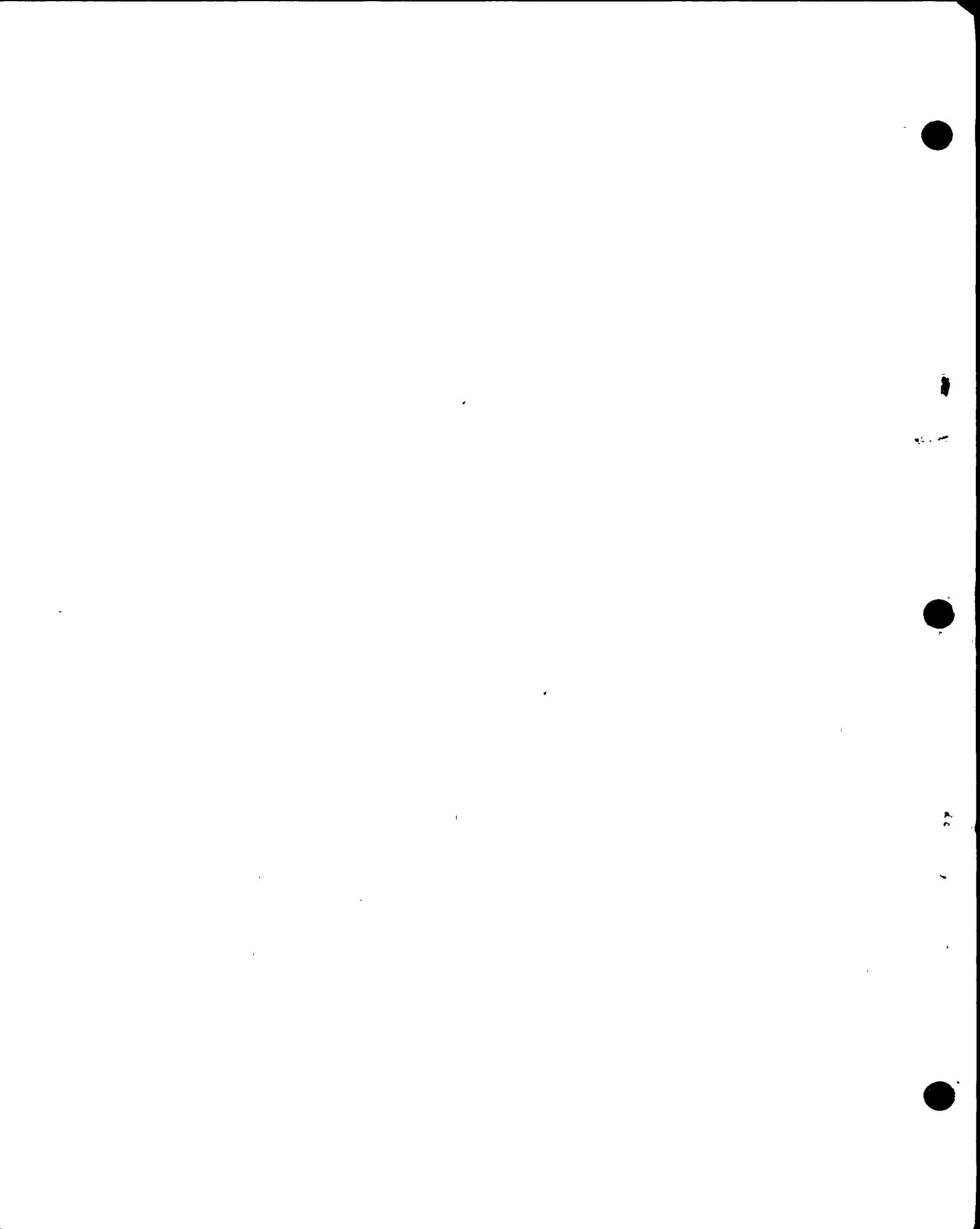


1           The development of the Blume ground response  
2 spectra, including the effect of foundation filtering, is  
3 discussed in the Hosgri Report. The rationale and derivation  
4 of the Newmark ground response spectra is discussed in  
5 Appendix C to Supplement No. 5 of the SER.

6           The basic approach used in the Hosgri evaluation  
7 of structures adopted the same analyses procedures and  
8 criteria which were employed for the original seismic  
9 analyses as summarized in earlier portions of this testimony  
10 and as discussed in detail in the FSAR, but with certain  
11 specific changes. These changes are as follows:

- 12           1. Use of the new 7.5M Hosgri seismic inputs
- 13           2. Use of Regulatory Guide 1.61 damping
- 14           3. Use of actual material properties
- 15           4. Allowance for ductility in certain cases
- 16           5. Use of fixed base mathematical models
- 17           6. Use of accidental torsion or equivalent (in  
18           addition to geometric torsion)
- 19           7. Vertical response dynamic analysis (or  
20           equivalent)
- 21           8. Modified procedure for smoothing of the floor  
22           spectra
- 23           9. Combination of horizontal and vertical responses  
24           on 3-component square-root of the sum of the  
25           squares basis (or equivalent).

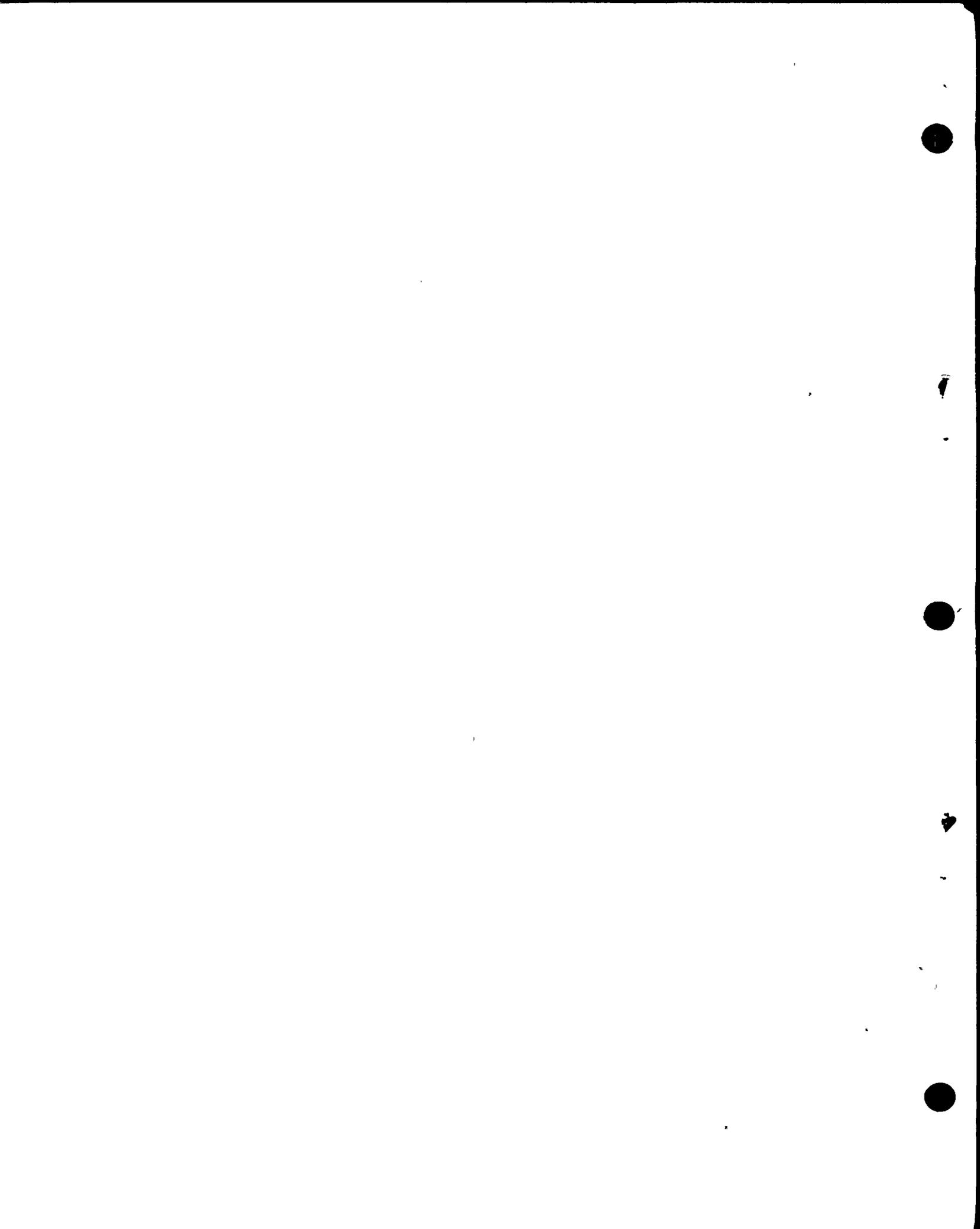
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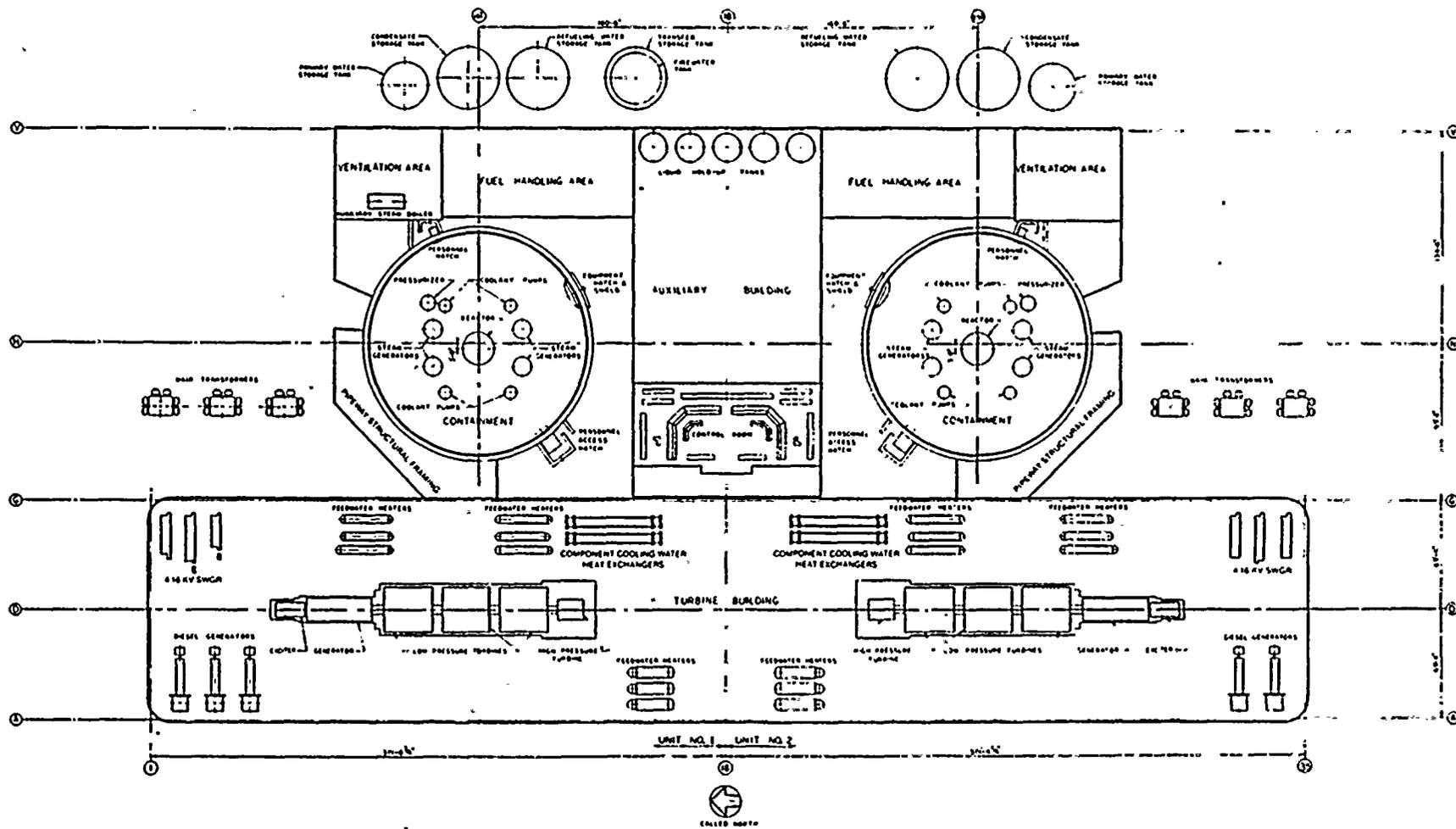


1                   These changes have been reviewed with and were  
2 accepted by the NRC staff as documented in SER Supplement  
3 No. 7.

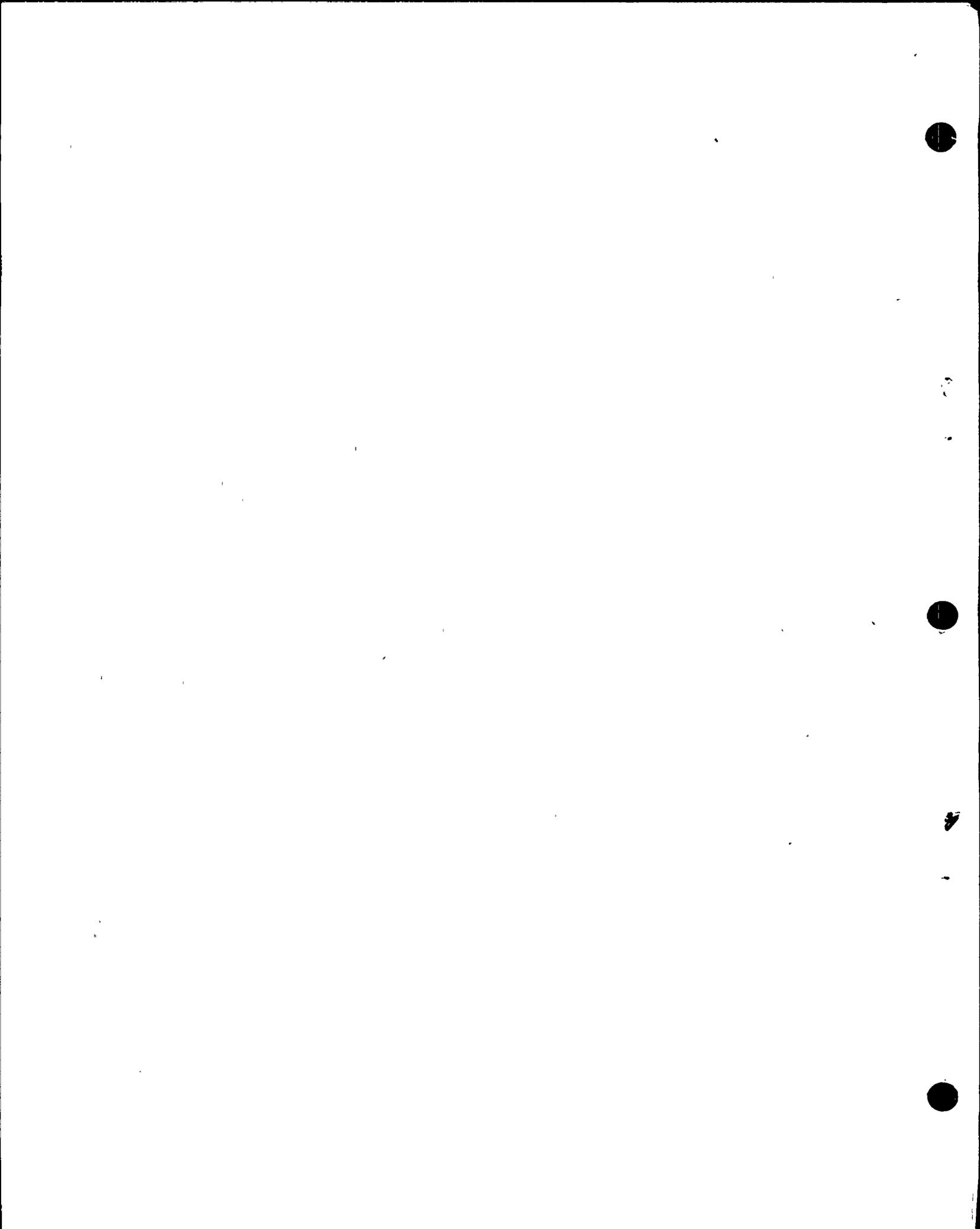
4                   With this background, more detailed testimony  
5 regarding the Hosgri analysis and evaluation of specific  
6 structures is presented in the following sections.

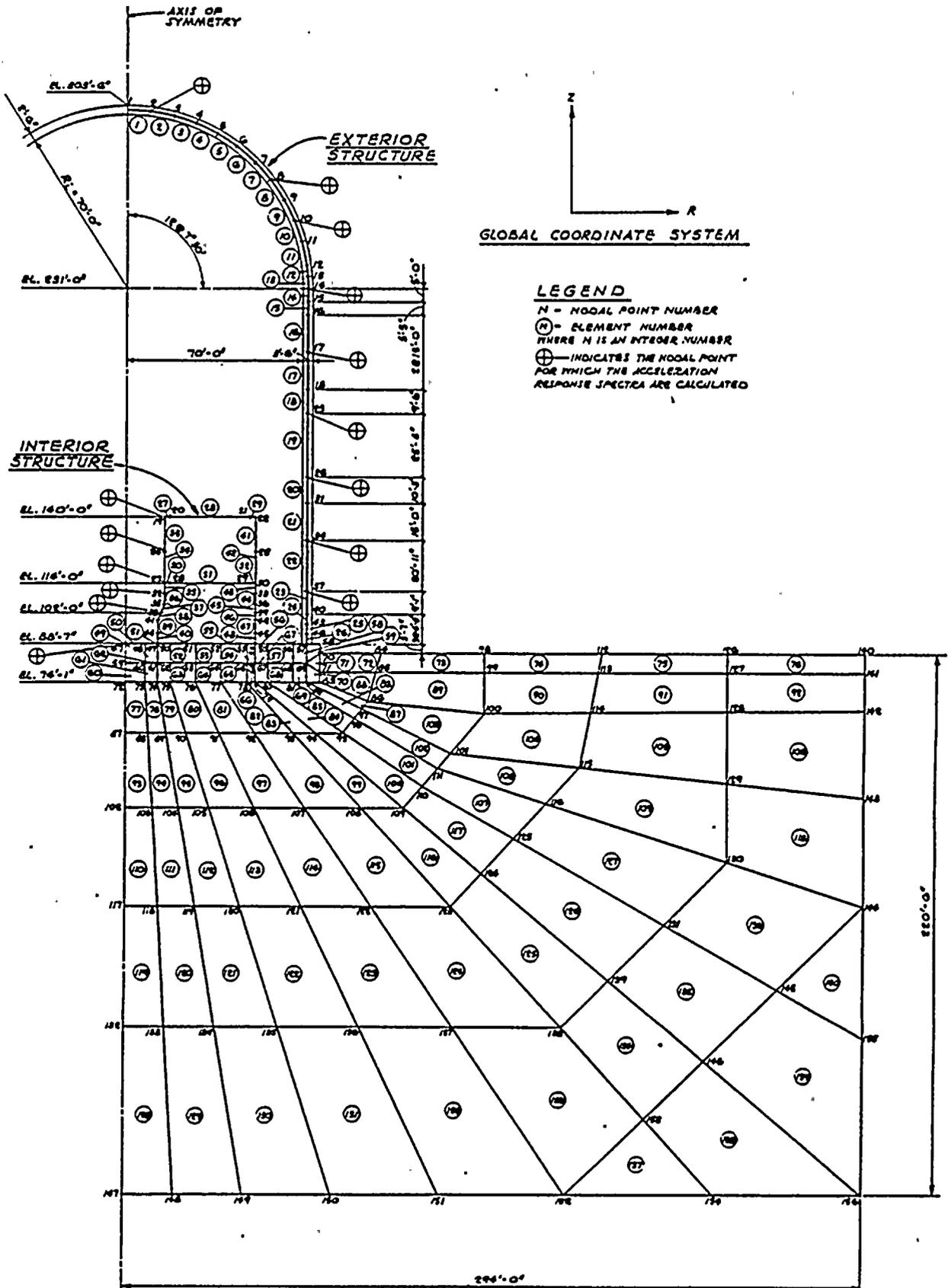
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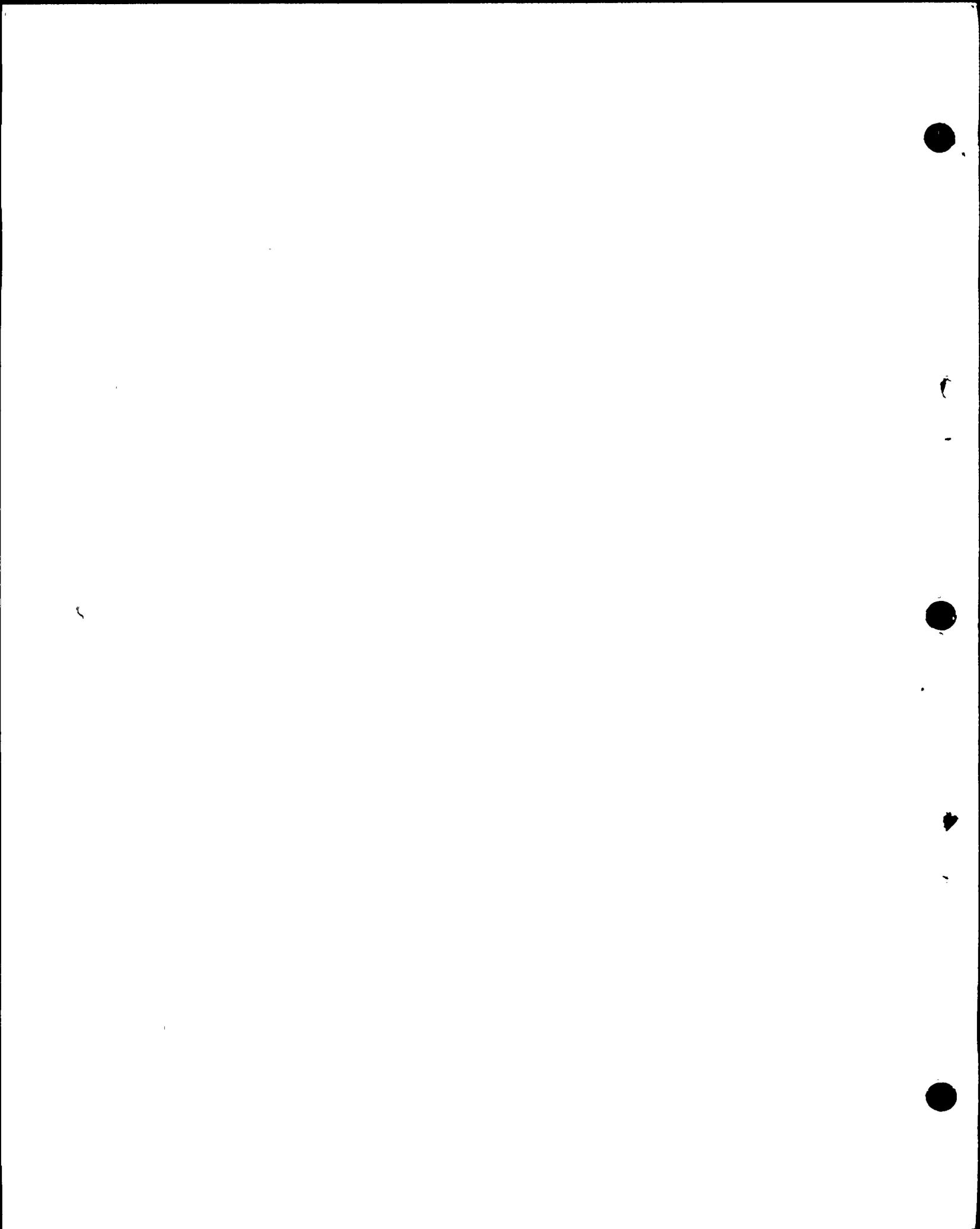


**Diablo Canyon Units 1 & 2  
PLANT LAYOUT  
Figure 1**





**DIABLO CANYON UNITS 1 & 2  
CONTAINMENT STRUCTURE  
FINITE ELEMENT MODEL USED IN  
ORIGINAL ANALYSIS  
FIGURE 2**



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MRS. BOWERS: Have you concluded your direct,

Mr. Norton?

MR. NORTON: I believe I have.

MRS. BOWERS: Mr. Kristovich.

End LH



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11 WRB/mpbl 1

## CROSS-EXAMINATION

2

BY MR. KRISTOVICH:

3

Q Mr. Ghic, turning to page 7 of your testimony, on line 17 you refer to the intake structure.

5

What damage would the intake structure sustain during the postulated Hosgri earthquake?

7

A It is my view that it would not sustain any damage that would cause any difficulty with the functioning of the design Class I equipment contained within that structure.

10

11

The area of highest stress in the intake structure for the postulated Hosgri earthquake involves an area at the ocean-front of the structure where there are some walls inserted below the curtain wall parallel to the incoming water flow that essentially serve as directional elements for splitting up the water flow. These walls have relatively little to do with the seismic integrity of the structure.

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In fact, we have performed an analysis with these walls taken out of the seismic resisting model of the structure and have found that the structure with those elements removed meets the -- can sustain the Hosgri earthquake within the acceptance criteria that has been prescribed.

20

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23

24

Q Well, what happens to the intake structure physically during the postulated Hosgri event?

25



mpb2 1 A The walls that I just alluded to may experience  
2 some very minor cracking and minor spalling of concrete that  
3 would conceivably deposit itself on the invert, and that's  
4 the extent of the damage.

5 Q What do you mean by "spalling of the concrete"?

6 A Spalling of concrete means small pieces of  
7 concrete located outside of the reinforcing bar curtain,  
8 that would become loose and fall to the invert of structure.  
9 So we're talking of a thickness of a few inches.

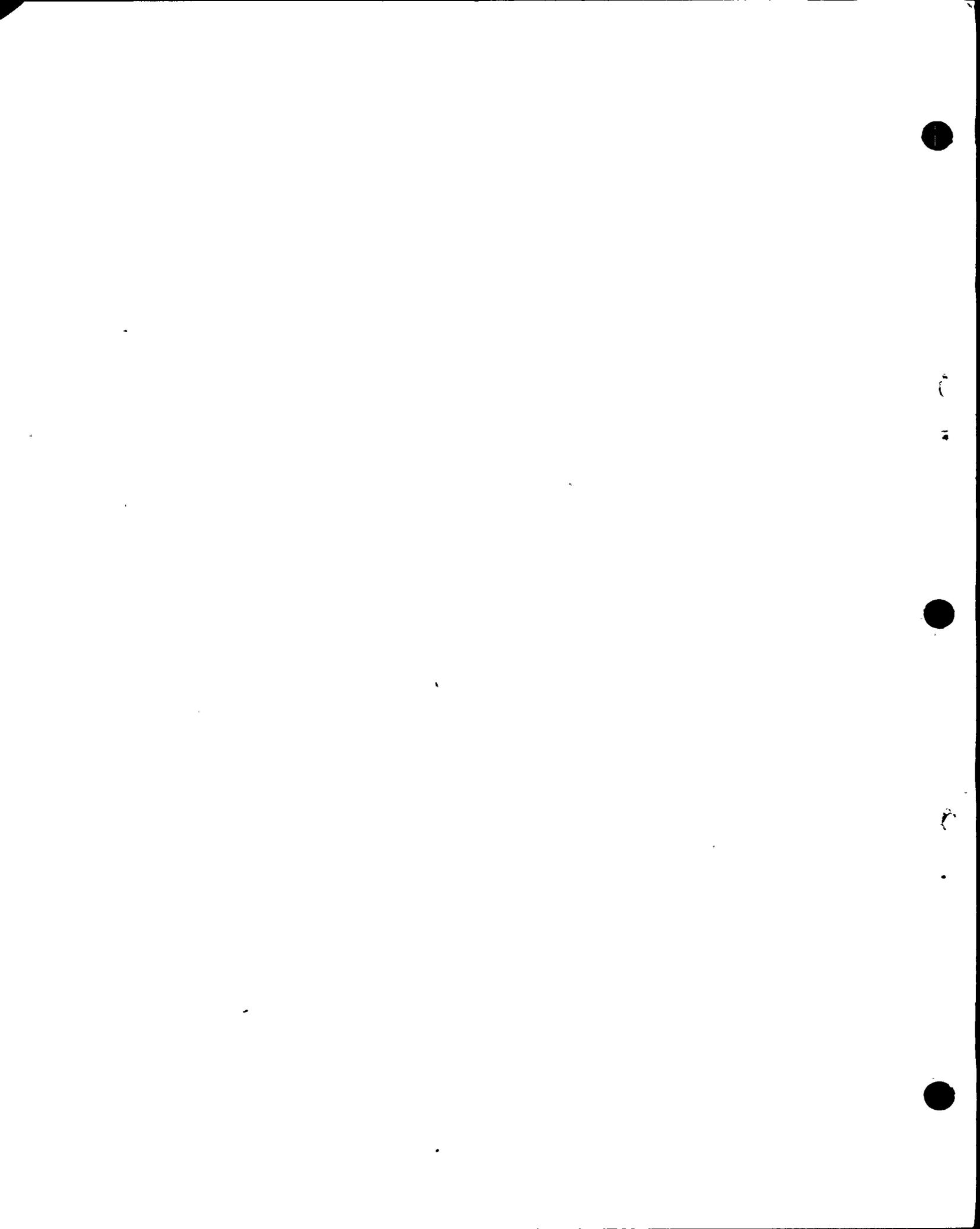
10 Q Turning to page 9 of your written testimony, at  
11 lines 22 and 23, you refer to the American Concrete  
12 Institute Standard Building Code Requirement for reinforced  
13 concrete.

14 Does this code allow the use of actual material  
15 properties?

16 A That code is formulated as a basis for doing a  
17 design of the facility. It contemplates the use of material  
18 properties that would be prescribed at the time of your  
19 completing a design rather than those that would exist  
20 after construction of the facility.

21 So in that sense, no, it would not contemplate  
22 actual material properties, the use of actual material pro-  
23 perties.

24 However, in an evaluation of a completed facility  
25 it is my view, and I think it would be shared by many others,



mpb3 1 that it is appropriate to use properties that represent  
2 the situation that then exists.

3 Q On line 25 on page 9 you refer to the  
4 American Institute of Steel Construction, specifications  
5 for the design, fabrication, and erection of structural steel.  
6 And continuing on page 10, for buildings.

7 Does this code allow the use of actual material  
8 properties?

9 A My response to your question with respect to  
10 this code would be the same as my response to the question  
11 relevant to the concrete code.

12 Q I'd like to direct your attention to page 14,  
13 lines 19 and 20. In this section you're listing various  
14 changes that were made, and you state on lines 19 and 20,  
15 "a vertical response dynamic analysis (or equivalent)".

16 What do you mean by "or equivalent"?

17 A I believe that this listing of changes was taken  
18 from the document that was used when we were -- that document  
19 of the criteria to be employed in the Hcsgr1 evaluation,  
20 and the words "or equivalent" were meant to cover cases where  
21 an engineering equivalent to a vertical response dynamic  
22 analysis would be employed.

23 And in fact the words are essentially moot at  
24 this point because we did perform vertical response dynamic  
25 analyses for all the structures for the postulated Hcsgr1

*[Faint, illegible markings in the top-left corner]*



mpb4

1 earthquake.

2 You see, this was a specification that preceded  
3 the actual work. And it was structured in this way because  
4 we felt at that time we may be able to justify an equivalent  
5 type of analysis; however we didn't do that.

6 Q You didn't do any equivalence?

7 A No, not that I'm aware of.

8 Q Okay.

9 I have a similar question on line 25 of that  
10 page regarding your -- regarding the vertical and horizontal  
11 responses.

12 You state on line 25, "or equivalent". I'm  
13 just wondering what you mean by "or equivalent" there.

14 A I think it was the same intent as the use of the  
15 words "or equivalent" in item number seven, and the same  
16 consequences flow from that.

17 We did do horizontal and vertical responses on  
18 a three component square root of the sum of the squares basis.

19 Q In all cases?

20 A In all cases.

21 Q On line 14 you state "use of actual material  
22 properties".

23 Do you mean the average value of actual material  
24 properties --

25 A Yes.

11



11



11



mpb5 1

Q -- or actual material properties?

2

Do you mean the average value of actual material properties or the actual material properties?

3

4

A The average value of the actual material properties.

5

6

MR. KRISTOVICH: No further questions.

7

MRS. BOWERS: Mr. Staenberg?

8

MR. STAENBERG: The Staff has no questions.

9

MRS. BOWERS: Well, the Board has no questions of this witness. But we realize that this is an overview testimony and there will be panels later that will be offering testimony in some of the areas that have been covered here.

10

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MR. NORTON: I believe all the areas, yes.

15

MRS. BOWERS: Do you have redirect?

16

MR. NORTON: I just want to wish everyone a Merry Christmas.

17

18

MRS. BOWERS: May this witness be excused?

19

MR. NORTON: He'll be back.

20

MR. KRISTOVICH: We have no objection to his testimony going in, but I guess it already went in.

21

22

MR. NORTON: Yes.

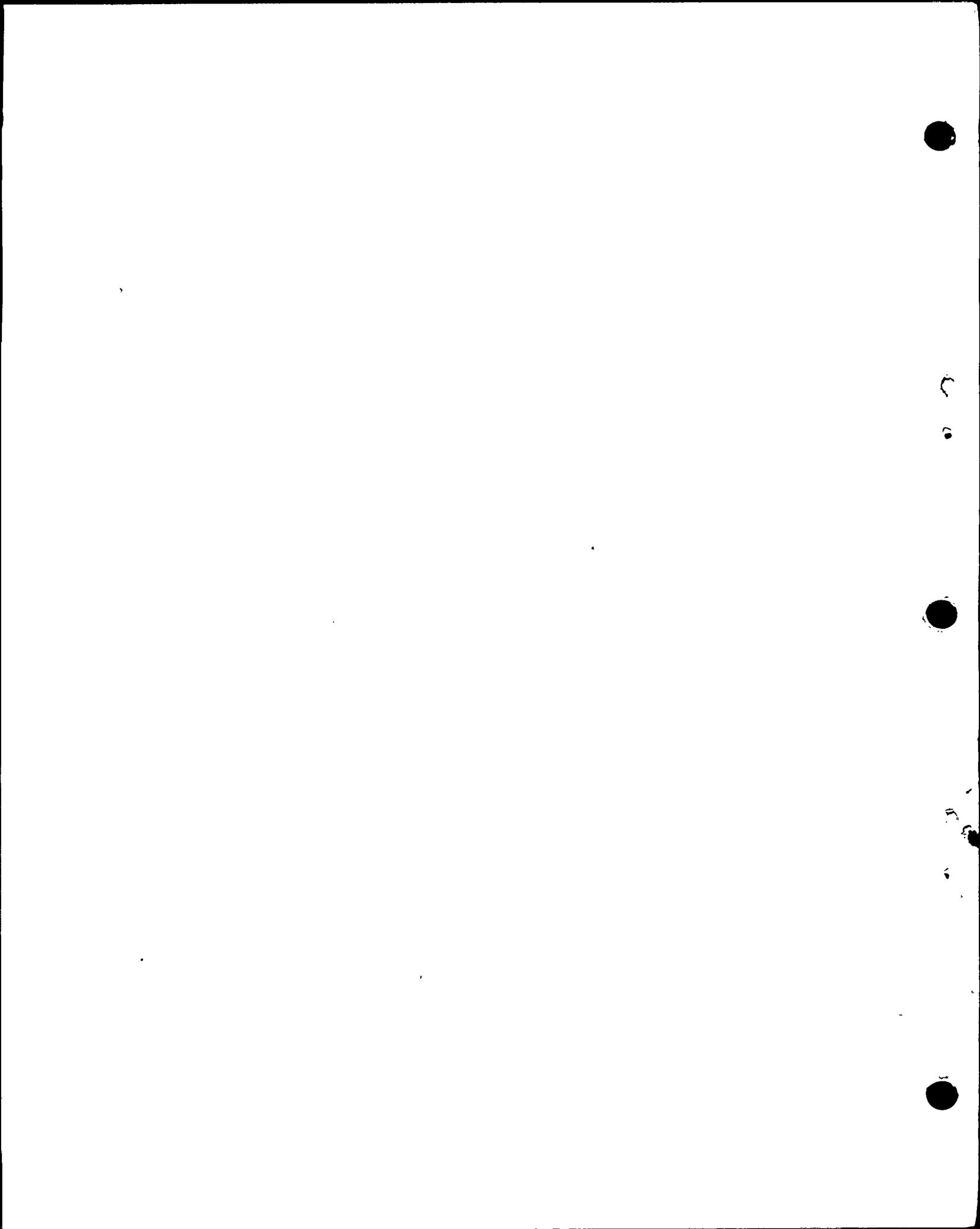
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This is the last witness we have today.

24

MRS. BOWERS: Can any other testimony be offered from any the party at this time?

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mpb6 1

MR. KRISTOVICH: No.

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MR. STAENBERG: No.

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(The witness temporarily excused.)

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MRS. BOWERS: The question was raised yesterday, Mr. Norton, about the secrets of your witnesses. Now when we reconvene at 8:30 January 3rd --

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MR. NORTON: I think we probably -- Mr. Steinhardt who was scheduled to precede these witnesses, his testimony really can go in any time. It's not a -- it doesn't matter whether it goes in at the beginning, the middle, or the end. It doesn't follow in a logical sequence with the other testimony.

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So we probably will keep him much in the respect we did Mr. Bettinger, as a filler for some day when we're caught between witnesses or something. So we'll probably just start with Mr. Ghio's panel and just go right through.

17

MRS. BOWERS: In the way you've listed them?

18

19

MR. NORTON: In the way they're listed in the testimony.

20

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MRS. BOWERS: Well, let me check before we recess today.

22

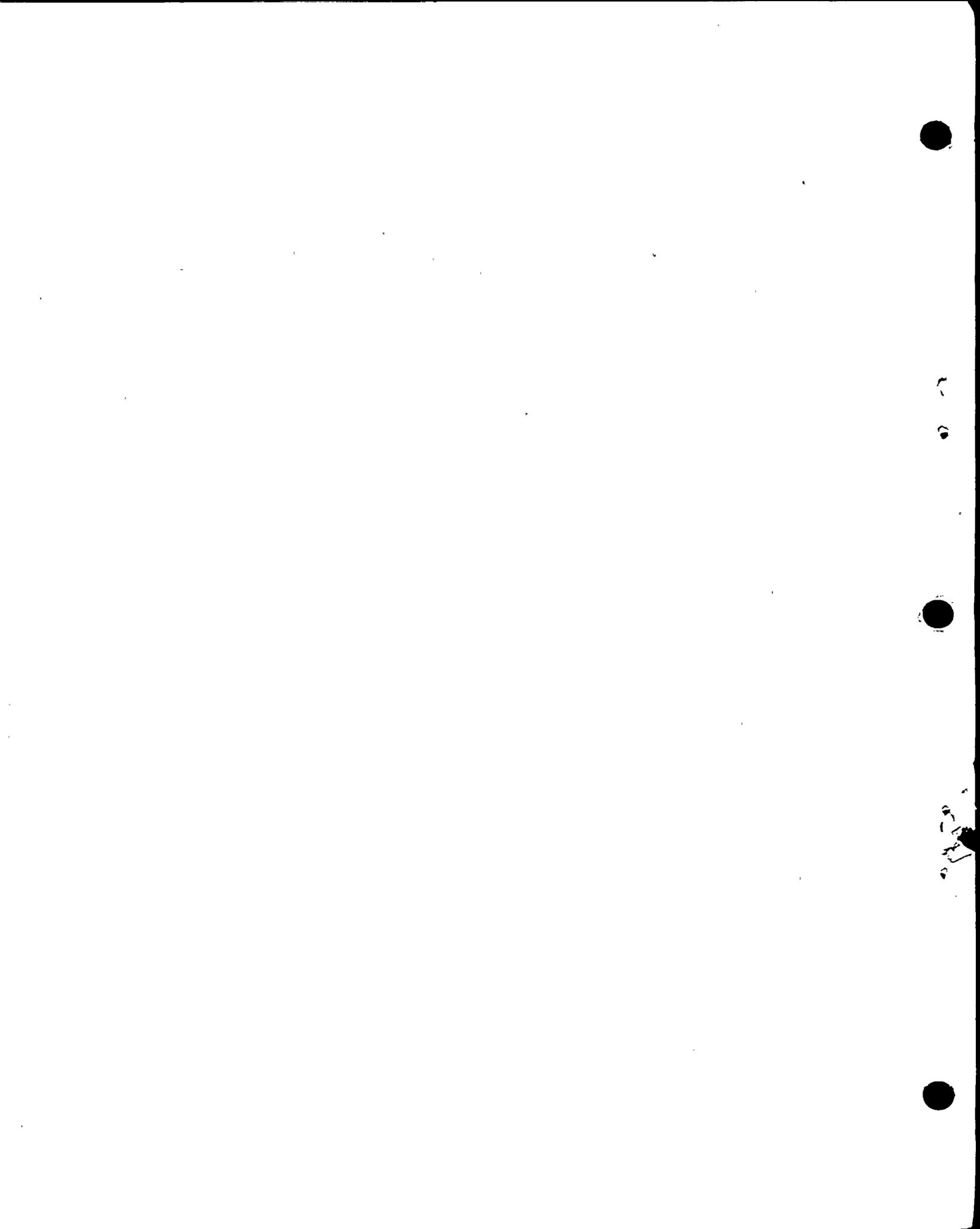
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Mr. Norton, is there any other matter that should be considered?

24

25

MR. NORTON: No, there isn't, not that I can think of at the moment.



mpb7

MRS. BOWERS: Mr. Kristovich?

MR. KRISTOVICH: No.

MRS. BOWERS: Mr. Staenberg?

MR. STAENBERG: No.

MRS. BOWERS: Well, we will recess today and plan to reconvene at 3:30 on January 3rd, 1979.

(Whereupon, at 11:10 a.m., the hearing in the above-entitled matter was adjourned, to reconvene at 8:30 a.m., January 3, 1979.)

