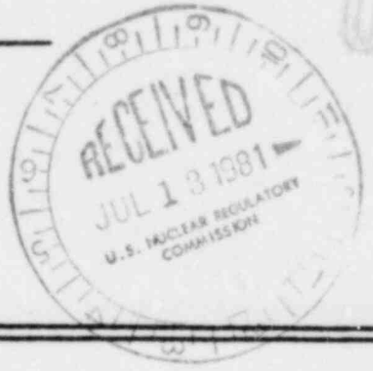
NUCLEAR REGULATORY COMMISSION



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In the Matter of:

SOUTHERN CALIFORNIA EDISON COMPANY, ET AL., (SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 & 3	)	DOCKET NOS. 50-361, OL and 50-~~236~~ 362, OL

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:	:	
SOUTHERN CALIFORNIA EDISON COMPANY, ET AL.	:	Docket Numbers:
	:	50-361 OL
(San Onofre Nuclear Generation Station, Units 2 and 3)	:	50-362 OL

Stardust Room
Stardust Hotel and Country Club
950 Hotel Circle North
San Diego, California

Wednesday,
July 1, 1981

Evidentiary hearing in the above-entitled matter was reconvened, pursuant to recess, at 9:00 a.m.

BEFORE:

JAMES L. KELLEY, Esq., Chairman
Atomic Safety and Licensing Board

DR. CADET H. HAND, JR., Member

MRS. ELIZABETH B. JOHNSON, Member

APPEARANCES:

ON BEHALF OF THE APPLICANTS, SOUTHERN CALIFORNIA EDISON COMPANY, ET AL.:

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APPEARANCES (Continued):

ON BEHALF OF THE REGULATORY STAFF:

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Deputy Assistant Chief Hearing Counsel
Office of Executive Legal Director
Nuclear Regulatory Commission
Washington, D.C.

I N D E X

P R O C E E D I N G S

(9:00 a.m.)

JUDGE KELLEY: On the record. As the first order of business we are going over our rather voluminous filings in the area of emergency planning to insure the completeness of our respective files. I am going to ask Mr. Chandler first to simply list the various filings the Staff has in this area and then we will do the same across the room and also look at what we had from the Intervenor GUARD to see that we all have everything that we need to have.

Off the record.

(Brief discussion off the record.)

JUDGE KELLEY: Back on the record.

Mr. Chandler, why don't you go ahead with the Staff's papers.

MR. CHANDLER: Mr. Chairman, in going through our files and checking with our office, I believe the Staff has made three filings since the prehearing conference regarding emergency planning.

The first is dated June 22nd, 1981. It is entitled, "NRC Staff Use With Respect to Questions Posed by the Atomic Safety and Licensing Board for the Area of Emergency Planning."

JUDGE KELLEY: Yes.

MR. CHANDLER: The second document is a letter dated June 23rd, 1981 to the Board from Richard K. Hoefling, copies

to the parties, which attaches the affadavit of Robert T. Jasky which had been omitted from the previously mentioned filing.

JUDGE KELLEY: Yes.

MR. CHANDLER: The third document is dated June 26, 1981 and is entitled, "NRC Staff Use With Respect to Issuance of a Low Power License for San Onofre Units 2 and 3."

JUDGE KELLEY: Yes, we have that.

MR. CHANDLER: I believe those are the only three filings made since the prehearing conference by the Staff, Mr. Chairman.

JUDGE KELLEY: For the sake of maintenance, I think there are some additional filings which, although filed before the preharing, still bear directly on issues that we have before us. Let me just mention what they are, at least from my file.

I have the NRC Staff's answer to the motion to consolidate which is pending.

MR. CHANDLER: Yes.

JUDGE KELLEY: I have a memorandum to the Board from Daryl Eisenhut (ph.) dated June 11, 1981 entitled, "Board Notification of Emergency Planning" and this is a document which speaks in a rather general way to the way in which the Staff considers earthquake hazards in this context of emergency planning.

MR. CHANDLER: Correct. I believe that document was previously provided to the Board by Mr. Hoefling. I may be

mistaken but I do know a Board notification confirmed that.

JUDGE KELLEY: In any event it would appear to have a bearing on a question we raised and sought memoranda on certain aspects of earthquake effects and emergency planning.

MR. CHANDLER: Yes.

JUDGE KELLEY: Then of course Mr. Hoefling gave us all the interim findings of FEMA.

MR. CHANDLER: Right.

JUDGE KELLEY: Did you include the -- yes, I am sure you did. The June 22nd filing speaks to, I take it, the size of the EPZ and earthquakes?

MR. CHANDLER: That is right. Both of those issues were addressed by the Staff in a single filing.

JUDGE KELLEY: Low Power License was distributed just a couple of days ago?

MR. CHANDLER: Yes, sir, I distributed that document on Monday.

JUDGE KELLEY: Maybe the simplest way is, if one or more of us find it, and I think we very well may, and we are missing one or more of these pieces of paper, we might just go to the individual party individually and see if we can't arrange for a xerox. It might be the simplest way to do it.

MR. CHANDLER: That would be fine.

JUDGE KELLEY: Mr. Wharton, do you want to go over what we should have from you?

MR. WHARTON: We have points and authorities regarding the size of the EPZ dated June 17, 1981.

I have the addendum to that dated June 22nd.

JUDGE KELLEY: That is correct.

MR. WHARTON: A revised Intervenor's posed contention RE emergency planning revised contention dated June 22nd with an addendum attached to it.

JUDGE KELLEY: Yes.

MR. WHARTON: The Intervenors Carstens et Al. position regarding consideration of a major earthquake and emergency planning at SONGS 2 and 3 dated June 22, 1981.

JUDGE KELLEY: Yes.

MR. WHARTON: Intervenors Carstens et Al. memorandum of points and authority RE issuance of low power license dated June 29th, 1981.

JUDGE KELLEY: That was distributed just the other day; right?

MR. WHARTON: Yes, it was distributed Monday, I believe it was. I have other copies if you need them right now.

JUDGE KELLEY: Fine, that would be helpful; thank you. Okay, I think we have all those.

MR. WHARTON: You are not referring to the comments on res judicata collateral estoppal?

JUDGE KELLEY: No.

MR. WHARTON: This is a June 17th filing also.

This is answer to Applicant's motion to order consolidation of Intervenors and designated lead Intervenor.

JUDGE KELLEY: Yes, I have that.

MR. WHARTON: And there is an accompanying declaration of A. S. Carstens.

JUDGE KELLEY: Yes.

MR. WHARTON: That is all that I have as far as emergency planning.

JUDGE KELLEY: Let me just ask you, your revised contention which I know at least added citations to the FEMA report and citations to 50.47, I think it is, does that entirely supercede the earlier?

MR. WHARTON: Yes.

JUDGE KELLEY: So we can just focus on the latter?

MR. WHARTON: Right.

MR. CHANDLER: Can I get some clarification of that, Mr. Chairman? The contentions of 6-22 entirely supercede the contentions of 6-15?

MR. WHARTON: I am talking about the emergency planning contention. I am trying to remember if there were other contentions at that time. This revised contention is a revision of the previous contention that we had submitted regarding FEMA review. That is what it supercedes, the previous contention regarding FEMA.

MR. CHANDLER: When you refer to the previous

contention, Mr. Wharton, is that the contention that you submitted at the prehearing conference?

MR. WHARTON: Yes, that is correct.

JUDGE KELLEY: That reminds me, though, and I don't seem to have it here right now but I know that I probably have it in my room, you had a special, if you will, separate contention regarding the size of the EPZ.

MR. WHARTON: That is correct.

JUDGE KELLEY: Is that in your memo on size?

MR. WHARTON: The contention restated, you mean? I don't believe that it is.

JUDGE KELLEY: Then we are to have in hand a separate sheet of paper concerning a contention about the size of the EPZ.

MR. WHARTON: Yes, I believe so. I don't believe that I brought that with me. I can get it at lunch time.

MR. CHANDLER: I can provide a copy to the Board.

JUDGE KELLEY: Thank you. Does that cover your filings, Mr. Wharton?

MR. WHARTON: Yes, it does.

JUDGE KELLEY: Mr. Casey?

MR. CASEY: Thank you, Mr. Chairman. Applicants have filed counterparts to all the briefs mentioned. They are as follows:

We filed our brief on the earthquake emergency

planning issue, without reading the title, on June 22nd.

JUDGE KELLEY: Yes, and that is a document -- I won't read the whole thing -- but it imposes exercise of sui sponte authority in the area of earthquakes and emergency planning; is that correct?

MR. CASEY: That is correct.

That same day, June 22nd, Applicants also filed their memorandum in reply to Intervenor's memoranda in opposition to motion for consolidation of Intervenors.

JUDGE KELLEY: I am sorry.

MR. CASEY: That was June 22nd, Mr. Chairman.

JUDGE KELLEY: Back-dating, I have got your motion for order to consolidate and that is much earlier.

MR. CASEY: Yes, that is June 9.

JUDGE KELLEY: Okay, and then tell me again what you just did?

MR. CASEY: Then on June 22nd we served and filed with the Board Applicant's memorandum in reply to Intervenor's memoranda in opposition to motion for consolidation of Intervenor's.

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JUDGE KELLEY: I for one am going to ask for another copy of that. I don't seem to see it --

MR. CASEY: We lodged it with the Board on the 22nd or -- I believe the 22nd.

JUDGE KELLEY: I am sure you did. I am just asking you to lodge it again if you could.

MR. CASEY: Yeah. Get a copy to you right away.

JUDGE KELLEY: Thank you.

MR. CASEY: Then on June 22nd, Applicants filed their -- and served on the Board Applicants' memorandum of law, on appropriate means for determining size of the plume exposure and ingestion pathway emergency planning zones for SONGS 2 and 3?

JUDGE KELLEY: We have that.

MR. CASEY: And then finally the last brief on June 29, we filed --

JUDGE KELLEY: Low power license?

MR. CASEY: Our low power license brief.

JUDGE KELLEY: We have that.

MR. CASEY: Without going into the title.

JUDGE KELLEY: Right.

MR. CASEY: But it might be helpful to the Board to give just a little chronology of how the Board might piece together what contentions, so to speak, are on the table, and where we are.

JUDGE KELLEY: Yeah, I was just going to ask you about -- maybe you remember this package at the meeting, and so on.

Probably the trickiest thing thing to get one's hand around and get resolved is this whole area of contentions, and if you could give us a chrono without -- we don't want to -- are obviously not arguing contentions at this point, but just what is before us and where things stand, and I think that might be useful at this point.

MR. CASEY: I will take a shot at it, and appreciate hearing from the parties if --

JUDGE KELLEY: If they want to, if either party-- of the other parties -- wants to comment, they will be free to.

MR. CASEY: The best place to start, Mr. Chairman, is going to the chronological listing of the development of the contentions as we had them just prior to that last pre-hearing conference, which is contained as an attachment to our motion for consolidation, and it is also found attached to our letter, which was the agenda.

JUDGE KELLEY: The June 15 letter, as to the background and contentions?

MR. CASEY: Yeah. I would like to take this time to bring to the Board's attention a typographical error in that listing.

JUDGE KELLEY: All right.

MR. CASEY: There is a typographical error in GUARD's admitted second contention. We omitted the following language, purely by oversight, which stated including -- I will just give you the quote of the phrase: "Including if necessary, evacuation, particularly considering the unique geographic constraints in these areas." It is a matter of Board record that that is what the contention under memorandum of order, January 27, 1977, said; when we did this chronology, we just had a typographical error there.

JUDGE KELLEY: I am sorry, I am not sure I located that. I am looking at your letter of June 15, and you were referring to GUARD's second contention?

MR. CASEY: Yes, the contentions that were GUARD's admitted contentions --

JUDGE KELLEY: Yes.

MR. CASEY: If you go down to their second admitted contention.

JUDGE KELLEY: Beginning with "as a consequence of?"

MR. CASEY: Yes.

JUDGE KELLEY: That is where I was looking, but I didn't see what you were saying, I --

MR. CASEY: And go down approximately five lines, you begin, probability protective measures could be taken on behalf of individuals, do you see that section in there?

JUDGE KELLEY: "Reasonable probability protective measures could be taken," and so on?

MR. CASEY: Yeah. "In these areas," and then when you read ours, we had excluded by oversight the words "including, if necessary, evacuation, particularly considering the unique geographic constraints in these areas."

JUDGE KELLEY: All right.

MR. CASEY: I just want to --

JUDGE KELLEY: All right.

MR. CASEY: -- put that on the record.

Moving along from that chronological listing, we then come to the chronology of FOE's revision to its admitted contentions, and we have the sheet of paper that I will provide to the Board on their EPZ contention, dated 6-17-81.

JUDGE KELLEY: Yes.

MR. CASEY: Then they had their first revision, which has now been superseded, which was 6-15-81, and then we have their current revised emergency planning contentions, which are 6-22-81.

JUDGE KELLEY: Yes.

MR. CASEY: Then we came to the pre-hearing conference, and presented to the Board as the afternoon session began, as you recall, Applicants' proposed -- I guess we would call them consolidated contentions, which you have in front of you, I just saw you hold them up.

JUDGE KELLEY: Yeah, that is where I hadn't studied these papers since the 18th of June. I am sure if I went back to the transcript and then read the papers, it would all come back to me, but could you perhaps briefly summarize -- well, I am not sure we want to get into this.

MR. CASEY: The chronology goes a little further, just for the record.

JUDGE KELLEY: And this is something we will just have to do anyway, so chronology and papers are one thing, and getting into where these stand is something else, and Mrs. Gallagher and Mr. McClung aren't here, so let us keep this to sort of indexing type of stuff this morning.

MR. CASEY: Continuing with the chronology since the pre-hearing conference --

JUDGE KELLEY: Yes.

MR. CASEY: -- in terms of papers that have been filed --

JUDGE KELLEY: Yes.

MR. CASEY: -- there is a document which I believe was attached to GUARD's earthquake memorandum, dated 6-23-81, which presents to the Board GUARD's proposed contentions on earthquake emergency planning, emergency planning generally, and evacuation planning. Those are all on the same page, and they are dated 6-23-81.

JUDGE KELLEY: Yes.

MR. CASEY: Okay?

JUDGE KELLEY: Yes.

MR. CASEY: Finally, since GUARD proposed its contentions, we have been in ongoing negotiation to refine those, and to report to the Board as we are sitting here, we have two forms of stipulated contentions which we are going to try to boil down to one before the end of the day, so that is where we stand right now, and we will be prepared this afternoon at our session to present the Board with the next iteration of this process.

JUDGE KELLEY: Well, that sounds useful. Just for the record, we don't have here a representative of GUARD, and for that reason we are just keeping this to a sort of an inventory process. Let me just say for the record, though, that I have three filings of theirs. One is their filing of June 23, concerning the earthquake question, which has attached to it, as Mr. Casey has just said, some new contentions or some revised contentions.

I also have their comments on the size of the EPZ, which is the other legal issue we asked for comment on. I do not believe I have anything on low licensing from them.

MR. CASEY: We have not received any memorandum on that subject.

JUDGE KELLEY: You might ask Mr. McClung or Mrs. Gallagher about that later today, and then I also have their

opposition to the motion to consolidate.

Well, I think this has been helpful for us. We know what we have or need copies of. We had talked informally, not on the record, about spending a little time later on today talking about where we are in the area of emergency planning, and particularly with regard to contentions, and that seemed to be a useful idea. I am advised that it will be Mr. McClung representing GUARD this evening, and that he cannot be here before about seven o'clock. We had thought to have a session from 4:30 to 5:30 on this.

I suppose, depending on what we attempt to cover, that might still be possible. Let me ask -- perhaps I could just go left to right -- for some brief statement of what Counsel thinks we should try to get done in an hour this afternoon on emergency planning. I think it was Mr. Pigott's suggestion in the first place, but I will let you bat cleanup.

Mr. Chandler -- now, Mr. Chandler, you have not been Counsel upon this subject, so to speak, right?

MR. CHANDLER: I am generally familiar with what has transpired in recent weeks on emergency planning, but no, you are correct, I am not intimately familiar with the contents of all these documents, and for that matter, I don't have most of them with me. I will have to try to obtain some during the day from the various parties.

I do think it would be useful, though, if we did

sometime today spend some time discussing the status of contentions. I think that certainly with GUARD, as Mr. Casey indicated, we perhaps can come to some resolution of contentions rather quickly. Only because I don't have Mr. Wharton's papers, I can't make the same representation regarding his contentions, but assuming I am able to obtain them, and go through them at least briefly, I think it would also be useful to discuss what he has proposed.

JUDGE KELLEY: Well, I don't see why we can't certainly work with Mr. Wharton's contentions, as -- well, any differences you may have with either Staff or the Applicant without GUARD being here. The broader questions we could hold, if we need to talk about them at all, until later on.

Okay, thank you. Mr. Wharton?

MR. WHARTON: Yes, since Mr. Pigott asked for the meeting, I had some -- I suppose had some things in mind as to what he wanted to do, I would like to find out what he had in mind for the meeting and now he wants to conduct it, and if I could respond to that.

JUDGE KELLEY: Okay.

MR. CASEY: I will respond to that, Mr. Chairman. Having taken a look at this chronology which we have just gone through, it appears to Applicants now that the issues are pretty well briefed, and we are ready to submit it, you know, on the papers, with the understanding that we will probably be

able to get something in as regards a stipulation with GUARD today, but we are ready to submit it on the papers, and we want to move this along. We are looking for a final pre-hearing conference order, as you know, and I think the parties views are well-ventilated, so we would just like to submit it on that basis.

JUDGE KELLEY: I would want to be awfully sure, this is the package I have, that was sort of glued and pasted together, I think, at the conference. Well, I guess I can come back to you if there is any -- or all of us can, if there is any doubt in my mind about what this all represents. I believe I understand Mr. Wharton's contentions. He has got his revised version of June 22, plus the EPZ contention, and that is what you would like to have.

MR. WHARTON: That is correct, yes. That is what I have submitted. I believe, as I agree, we have briefed everything. I don't know if you are contemplating extensive oral argument this afternoon regarding that. I don't know that that is something that I am going to be terribly prepared to do, but if we can get into it, I can do some, because of what I am working on --

JUDGE KELLEY: It is not easy to shift gears from where we have been, I think for any of us who have been involved in seismic. Okay?

MR. CASEY: Mr. Chairman?

JUDGE KELLEY: Yes?

MR. CASEY: Perhaps it would be best if we just set a date, let us say Monday, for submission of all additional views to the Board, and put it at issue in that way. If there are any additional views, Applicants as we sit here don't anticipate any additional papers, but may want to respond to anything that comes up before that time.

MR. WHARTON: Mr. Chairman, there is one thing along there, that Mr. Casey had presented, and that is there was a question regarding the difference between the contention that we proposed regarding FEMA, and the contention as proposed by Mr. Pigott, and I have -- I had prepared a memo for this, not in final form, and I do think -- it is a memo that I have of the research memo, that I would like to be able to present in final form as our final statement, and I would think with this, there is really nothing more for us to say. We have said everything we can say about the issues, and if I could just -- if I could file those, if we are talking about a Monday date, or sometime, if I could file that with the Board, I think that would end anything that we have to argue further and leave the decision up to you.

JUDGE KELLEY: Well, now we are adjourning tomorrow and reconvening next Wednesday the 8th, I believe. As a practical matter, the Board wouldn't see such papers until they got back here the night of the 7th at the earliest. If you

have something further you want to say, and it is -- this is a fairly what, brief single point sort of thing that you are filing?

MR. WHARTON: What I am proposing is, there was a question as far as the difference, and I am just proposing -- I have a short brief regarding which ones are different, and why we want the wording the way it is, rather than the way Mr. Pigott has proposed it, that is all.

JUDGE KELLEY: I believe I recall that.

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JUDGE KELLEY: You mean the introductory wording?

MR. WHARTON: There was introductory wording, but introductory wording and which ones of the subsections were the same as Mr. Pigott's and which ones were different.

JUDGE KELLEY: Okay. Why don't you go ahead and file that in final form with the Applicants.

Are the Applicants going to be in this neighborhood come next Monday?

MR. CASEY: Yes, we will be in the neighborhood.

JUDGE KELLEY: So that it would be possible for Mr. Wharton not merely to file in the mail but to have it in your hands by next Monday?

MR. CASEY: I would suggest that Mr. Wharton deliver it to the Sheraton Harbor Island Hotel.

JUDGE KELLEY: That is here in town?

MR. CASEY: Yes.

JUDGE KELLEY. All right. And then, any response you would want to make, and I am assuming this is pretty short and to the point, by Wednesday?

MR. CASEY: Fine. The only response we would like to make is that we really desire an Order, so that we can get on with witness preparation and get this thing to hearing.

JUDGE KELLEY: Well, I think it is in everybody's interest to get an Order here. We did take some time on the low-power issue, partly at the request of the Applicants. But

I think the Board now, with all these filings in hand, is prepared to turn to them and issue an Order.

Let me ask a question. I don't have in front of me the Commission's recent rule changes empowering Boards to issue oral rulings. What I have been thinking about, if I can do it, is giving a ruling on the record post pre-hearing conference, and I think, if I did that, I would want the understanding that I could look at it the next day and make a few changes or additions, the fallibilities of oral expression being what they are.

But I can assure you that you will get an Order a lot faster, if that is what everybody wants, than you will get through the drafting and revision and revision process that would otherwise go into such a document.

If I have to write a formal Order, I will do it, but I don't know whether this recent amendment extends to a post pre-hearing conference Order; I just don't know.

MR. CHANDLER: Mr. Chairman, this is not directly responsive to your question at the moment, but I would indicate that I will also be available in this area, and I would like to obtain a copy of Mr. Wharton's memorandum, and would ask if we could also, if we had any comments, file by Wednesday.

JUDGE KELLEY: Yes.

MR. CHANDLER: Thank you.

JUDGE KELLEY: Do you think you have got someplace

that oral ruling rule? We don't need to hold up the proceedings now.

MR. CHANDLER: No, I think I do. I am not going to hold it up. I am just thumbing through it.

JUDGE KELLEY: Fine. But it would be my fault if it were held up. You could maybe show it to me later, and I will take a look at it.

MR. CHANDLER: I believe I have a copy of it, Mr. Chairman, here.

JUDGE KELLEY: Okay.

MR. CHANDLER: I will have a copy of this made for the Board.

JUDGE KELLEY: Thank you.

Before calling our first witness this morning, reference has been made earlier to the request by the Carstens Intervenors for a subpoena to Dr. Henrique Luco, who is with the University of California at San Diego, Scripps Institution. Dr. Luco, among other things, has served as a consultant to the Advisory Committee on Reactor Safeguards of the NRC and, by virtue of that fact, he falls within Section 720, Subsection H2, of the Commission's rules on subpoenas, which say, in effect, that employees or consultants of the NRC may not be subpoenaed by name, in the absence of a showing of "exceptional circumstances."

The NRC Staff has opposed the Carstens' application

for a subpoena, arguing that there has been no showing of exceptional circumstances in this case. In addition to paper filings, we did hear oral argument from Counsel for the Staff and Mr. Wharton last Friday. Carstens Intervenors referenced several areas of Dr. Luco's expertise. However, the only real particularization is with regard to his past experience and familiarity with a Tera Delta Study concerning modeling of ground motion at Unit 1 of San Onofre, and also, I believe, some supplements to that Study.

We understand, from the Carstens statement, that Dr. Luco has done a considerable amount of work in the area of modeling strong ground motion. That is a very important area in this case.

We have had testimony from Dr. Frazier, and we a study and several supplements relating to predicted ground motion at San Onofre. It is our understanding that predicting strong ground motion is still a relatively new discipline. It is certainly a developing area. One would assume there are not a lot of people who know a great deal about it. It is also an area in which there appear to be significant areas of uncertainty.

The Board believes that Dr. Luco's apparent knowledge and experience in this area, while perhaps not unique, could add a significant dimension to the record on this important issue.

While the rule, when speaking of "exceptional circumstances" gives the example of unique knowledge, that is not the only thing that can qualify; that is merely one, and perhaps the most obvious example.

In considering whether the facts before us here amount to "exceptional circumstances," we think it is appropriate to consider the underlying purpose of the Rule and also conditions that might be attached in calling Dr. Luco as a witness, if, indeed, he is to be called.

While the Rule does cover both Staff members and people like ACRS consultants, the rationale for the Rule is a good bit different for these two classes of people.

In the case of a Staff member, it is essentially a rationale of administrative control, controlling your own workload, and who is going to do what, and that is a very important consideration if you are the Branch Chief of the NRC, but it hasn't got very much to do with an academic who consults to the ACRS. There, it seems to us, it really comes down to the potential inconvenience that testifying can represent for ACRS consultants and, in that regard, there is background on this very narrow question.

We referred earlier to the Diablo Canyon decision, involving the testimony of Drs. Luco and Trifunac (phon.), and although the Commission never wrote an opinion on this, I think I can not improperly comment on what seemed to be the motivating

considerations at the time.

Subpoenas were sought. The ACRS was strongly opposed to their issuance, and they took their case to the Commission. This was a couple of years ago. And I happened to participate in that discussion at the time as the Acting General Counsel of the NRC, and the whole argument was, if they have to go, the word will get around, and we won't be able to get good consultants, because it will take up all their time, and they won't be able to do their other academic things, and that would injure the ACRS.

After a good deal of discussion, the upshot was that those two people, Luco and Trifunac, were called as Board witnesses in Diablo Canyon.

So that, notwithstanding the possibility of some inconvenience, there is no absolute bar to the appearance of an ACRS consultant, if other circumstances suggest such an appearance is appropriate. But there is a strong underlying concern about unduly inconveniencing people and having what lawyers call a "chilling" effect on the willingness of people to be consultants to the ACRS.

Turning back to the facts of this case, apart from the subject matter that has been mentioned, it seems to us that we should evaluate the request in terms of the likely, necessary burden on Dr. Luco and see where that leads us.

I might say that I have talked to Dr. Luco about his appearing as a witness, and his general feeling is that he has many other projects, and he is over-extended as it is, and he is simply very reluctant to become involved, and that is a perfectly understandable attitude on his part, and it is not merely the number of hours he may come down here; it would also be, in his view, a matter of preparation, and it all looks like a burden, from his perspective.

Nevertheless, he said, if he has to come, he will come. You couldn't characterize him as a "willing" witness but, on the other hand, certainly not one who is going to really resist a conclusion that his presence would be helpful.

One factor that has a bearing is the wholly fortuitous circumstance that Dr. Luco is in San Diego, California. He is not in Chicago or in New York. So he doesn't have to spend a couple of days coming out here and getting back, and that is an obvious factor here that is fortuitous, but it seems to me it bears on inconvenience.

In addition, we would not envision calling him without certain conditions being attached, and I have certain conditions here, and Mr. Wharton, I would like you to focus on conditions, because when I get through telling you what the conditions are, my question will then be, do you want him on those conditions, and then it is either "yes" or "no."

In the first place, he would be a Board witness.

he would not be subpoenaed by any party. This is the way it was done in Diablo.

There is a possible problem, a conflict of interest here, that Mr. Chandler has pointed out in his filing, and I think, as a practical matter, it really wouldn't affect what you would be able to accomplish.

Secondly, there would be no probing of the collegial process of the ACRS. What he may have said or not said to the ACRS is irrelevant in this case, because their letter is in evidence in the case.

Thirdly, we would impose very specific time limits on an appearance, and to spell that out, I would not initially call Dr. Luco for more than four hours of his time, two of which would be allotted to the Carstens Intervenors, and one each to the Staff and the Applicants, and as a possibility, more time for anybody, on a good-cause showing, but basically, those would be the parameters that we would have in mind.

Beyond that, we would look to you to submit specific questions to the Board several days in advance, and I mean the actual questions you would ask him, not just areas of interest. This is aimed really at preparation, from his standpoint. There is an awful lot of paper he might have to read, unless he knows in advance exactly what he is going to be asked, and he doesn't have to read anything, but as a professional, he would want to, so I think it is only fair to

give him as much of an indication as possible of what he is going to be asked.

You could ask follow-up questions, related questions; I am not barring that. But I am saying that the examination, itself, should be written out.

Since you are in a very technical area, you would need your best qualified person to conduct cross-examination, from a technical standpoint, which, from what I have seen, would be Dr. Brune.

MR. WHARTON: That is correct.

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JUDGE KELLEY: With those understandings in mind, do you want to call Dr. Luco? I say call, but I don't know whether a subpoena is necessary or not, but would you want to have that kind of an opportunity to question?

MR. WHARTON: Yes, I would. Mr. Chairman, in fact I think it is probably the best way to handle it.

JUDGE KELLEY: Mr. Chandler, any comment?

MR. CHANDLER: Just a point of clarification. I was busy copying down notes and with my head cold, my hearing is not what it should be. Were the Chairman's comments also responsive, or did they include the fact, that he is a consultant to the Staff as well?

JUDGE KELLEY: I already focused on the ACRS. It struck me as the more sensitive consideration here. I understand he also worked for the Staff. I am not sure how that would effect where we come out. If you want to comment on that, go ahead.

MR. CHANDLER: I don't believe any further comment is necessary, Mr. Chairman. I believe I laid it out the other day.

JUDGE KELLEY: Yes, you did, and I am aware of it and simply in terms of giving a rationale I thought the focus or emphasis ought to be on the ACRS connection.

So Mr. Pigott, any comment?

MR. PIGOTT: Yes, I guess the two comments that

come to mind, first of all with respect to the time limitation on cross examination, hopefully an hour is reasonable and perhaps it is, but obviously we are going to have to reserve our rights to cross examine in the degree we think necessary to protect our case.

Secondly, with the idea of expediting that, if the questions are to be presented in writing in advance, I would suspect that they should also be circulated to the parties because that certainly aids the cross examination.

JUDGE KELLEY: Yes, I should have said that and I would expect that to be done.

Now in terms of -- well, go ahead, Mr. Wharton.

MR. WHARTON: Yes, I just wanted to clarify whether you are asking us to submit specific questions that we want the Board to ask?

JUDGE KELLEY: No, let me clarify. Here is what I want you to do. I would envision that Dr. Brune and the other parties would conduct the examination of Dr. Luco. The Board probably will have some questions and we won't take that out of anybody's time.

My timing is a little bit dependent on Dr. Luco. It now looks as though we will certainly get into your case the latter part of next week, the way this is going, I think. Everybody knows where we are and where we are going.

I think that both from the parties' standpoint and

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Dr. Luco's standpoint we would need -- certainly Dr. Luco would have the questions several days in advance so he could do whatever reviewing he wants to do.

With that in mind, if you could have your questions submitted to the Board and the parties by next Wednesday then we would look them over and then transmit them to Dr. Luco and I will talk to him and we will work out the most mutually beneficial convenient time for everybody for him to come.

It would probably be sometime in the following week, I would think.

MR. CHANDLER: Mr. Chairman, would the Board undertake to advise the Office of General Counsel? I believe that they traditionally represent the ACRS and it will be a little confusing because of his other relationship to the Staff and, to that extent, I guess I am involved.

JUDGE KELLEY: Yes, I will do that.

MR. CHANDLER: Thank you.

MR. PIGOTT: Has the Board considered a limitation on the area of inquiry, i.e., specifically to modelling studies, or is this a wide-ranging --

JUDGE KELLEY: I suspect I wasn't nearly as clear as I meant to be. I am glad you raised that. I was talking about the background here. It seemed to me that the original particularization that we got in the request was in the area of strong ground motion modelling studies and let me make it

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explicit that since that was the basis -- the factual basis -- the subject matter basis -- for granting this request, that the questioning itself will be limited to that area.

You mentioned the terrace studies. Obviously that is something that you may want to get into, but I think the guideline of modelling of strong ground motion studies is sufficient for this purpose, but not other areas.

Size of earthquakes, slip rates, I don't see Dr. Luco having been established as exceptional for those purposes.

MR. CHANDLER: I would then just note, Mr. Chairman, that I do believe that his functioning as a consultant to the Staff with respect to Unit 1, in certain respects, is probably the more sensitive consideration because that is, indeed, precisely what his activity has been as a consultant to the Staff.

MR. PIGOTT: I would also submit that that is the only true modelling before this Board. There are other studies but I am not so sure that you would call, for instance, the testimony of either Dr. Idgress or Mr. Wight as models.

JUDGE KELLEY: I distinguish in my own mind rather roughly between empirical studies in ground motion and modelling studies. Is that, in your mind, a reasonable distinction?

MR. PIGOTT: That is the distinction I am trying to make sure is on the record. There is only one modelling witness, candidly, from the Applicant's side and that is Frazier.

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JUDGE KELLEY: That is the area that the Carstens Intervenors have cited. They have referred to a couple of others but that is the one they have elaborated on and that is what the Board -- it is the Board's understanding that Dr. Luco will be called to address himself to that area.

MR. WHARTON: Do I understand, Mr. Chairman -- we do have reference in points and authorities regarding Dr. Luco reviewing and criticizing the slip rate methodology and that is one of the basis on which we did want to call him.

MR. PIGOTT: You are certainly not unique there.

JUDGE KELLEY: Two answers. One, it is not our understanding, based on what we have heard, that that is nearly as unique an area, and, two, you didn't particularlize that in any degree whereas you did with regard to the modelling study, so we are granting this request restricted to the area of the modelling study.

MR. CHANDLER: I would also note, Mr. Chairman, the Staff is presenting its own witness on that issue.

JUDGE KELLEY: Yes.

MR. CHANDLER: Mr. Chairman, before we get into the resumption of the evidentiary presentation, I do have two documents I would like to distribute to the Board. The first is attached to a letter dated June 11, 1981 from David B. Slemmons to Dr. Robert E. Jackson, Chief, and Mr. Tom Cardone, Geoscience Branch of the Division of Site Safety Environmental Analysis of

the NRC.

This letter, Mr. Chairman, contains a copy of Dr. Slemmons' report which is bound into Supplement No. 1 to the Staff Safety Evaluation Report as Appendix E and is referred to in the SER.

This document is substantively different. All that it reflects -- and the cover letter is self-explanatory -- is that it now has included the minor corrections reflected on the errata, so it is merely a re-typed and updated version.

I think it may make the use of Appendix E a little easier and it is my intention to then provide an additional copy to the reporter when Dr. Slemmons appears.

I will provide that to the Board and parties in a moment.

The next document I will preface by reading a letter which I received yesterday from Robert H. Moll, Staff Attorney, Division of General Law, U.S. Department of Interior, a letter dated June 29th.

Dear Mr. Chandler:

"Enclosed for appropriate filing and service are the original and ten copies of the Department's motion to quash subpoenas issued to Department of Interior employees Dr. William B. Joyner and David M. Boor (ph.) in this matter. Please make personal service upon the parties and Intervenors

as necessary.

"Though we hope that oral argument is not necessary, should the Atomic Safety and Licensing Board require oral argument, we will assign a staff member from a Field Solicitor's Office in California to make the argument.

"Thank you for your assistance in this matter," etcetera.

I would like the record to reflect that I have provided the Chairman with the original of the document as well as a copy.

JUDGE KELLEY: Well, the quashing paragraph does not refer to a response that, it seems to me, to be reasonable. If Mr. Wharton wants an opportunity to respond -- well, it is a motion like any other motion, if you want to read the Rules that way.

If you would like to file a response, I think you should do it pretty quickly in view of the fact that your own case is coming up pretty soon and these people are going to come. We had better resolve this as fast as we can.

Again, the Board is going to be out of town a few days. Could you have these ready for us next Wednesday morning?

MR. WHARTON: Wednesday morning, yes.

JUDGE KELLEY: Why don't we have a coffee break here before we get back to our litigation.

(Brief recess.)

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JUDGE KELLEY: Back on the record.

Mr. Pigott?

MR. PIGOTT: Yes, I recall for redirect Mr. Lawrence Wight. I have spoken to Mr. Wharton who has no objection to his recall at this time in the absence of Dr. Brune.

Mr. Wight, it is not unfair to say, is a significant consultant to the Applicants. It is possible, and in fact likely, that Mr. Wight will be involved in these proceedings backstage or whereve as a technical consultant and aid in our putting on the Applicant's case, so it is possible that if there is cross examination with respect to this additional direct, that we may be able to make Mr. Wight available at some other time for cross examination.

I would also say the same of Dr. McNeill, who I will be calling for further redirect. I can't guarantee that they will be here at any particular time, but they probably will be here off and on for the balance of the proceeding.

JUDGE KELLEY: Very well.

MR. WHARTON: Before we start, I did contact Dr. Brune. He is not available this morning. I have reviewed it with him and based on what was suggested about convenience for Mr. Wight, it is okay to go ahead, and I appreciate Mr. Pigott stating that Dr. Wight will be available at some other time and possibly at that point, if Dr. Brune wants to question him further, he can.

JUDGE KELLEY: Very good.

MR. CHANDLER: Yesterday the Applicant's provided a new exhibit, I believe, for Dr. Wight which was retrieved when Dr. Wight stepped out.

MR. PIGOTT: And will be redistributed when Dr. Wight steps back up.

Whereupon,

LAWRENCE H. WIGHT

was recalled as a witness herein, and having been previously duly sworn, was examined and testified further as follows:

REDIRECT EXAMINATION

BY MR. PIGOTT:

Q Would you restate your name for the record please?

A My name is Lawrence H. Wight.

Q Mr. Wight, during the course of your cross examination, and in fact in particular with some follow-up questions from Dr. Hand of the Board, there was some question of an instrument located in a flower box outside the Imperial County Services Building. Do you recall that examination?

A Yes, I do.

Q With respect to the further comments that you want to make on that subject, have you prepared an exhibit?

A Yes, I have.

MR. PIGOTT: May I have marked as Applicant's Exhibit No. 35 LHW-3 entitled "High Frequency Spectral

Amplitudes, Imperial Valley 1979 Free Field Stations."

(The document referred to was marked for identification as Applicant's Exhibit No. 35.)

MR. PIGOTT: That has been circulated to the parties. Upon its admission, assuming its admission, Mr. Chairman, we would undertake to serve the service list from our regular office in San Francisco.

JUDGE KELLEY: Very well.

BY MR. PIGOTT:

Q Mr. Wight, was this exhibit prepared either by you or under your supervision and direction?

A Yes, it was.

MR. PIGOTT: I would move the exhibit into evidence.

MR. WHARTON: Mr. Chairman, due to the technical nature of the particular document and inability to be able to thoroughly review the document, I would like to have it as an exhibit at this time and be able to confer with Dr. Brune after the basis for this not being admitted into evidence, but it to be used as an exhibit at this time and can be referred to so that further, for the record, it can be explained exactly what it means.

MR. PIGOTT: Mr. Chairman, if I may comment. I will withdraw my motion to move this into evidence at this time and reserve that until after the further direct examination.

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I would, however, indicate that I will oppose withholding it from evidence if every other requirement has been met other than Dr. Brune's review. I do not think that that is an appropriate reason for keeping something in or out.

It could be cross examined and motions to strike and a number of procedural motions could be made, but I would say that that is not one of the appropriate ones at this time.

BY MR. PIGOTT:

Q Mr. Wight, I think I have set the subject matter and that is the discussion of the instrument located in the flower box outside the Imperial Services Building. Are there any other comments you would like to make with respect to that?

A Yes, there are, thank you.

I reviewed the transcript regarding my answer to Dr. Hand's question concerning the instrument outside the Imperial County Services Building and I can see my answer in response to the question placed more emphasis than appropriate on the wetness of the soil. In that sense my answer was incomplete and perhaps misleading.

MR. WHARTON: May I get a reference on the transcript as to which part that is?

WITNESS WIGHT: Sure. I believe the question starts on line 20 of page 1690.

As I was saying, my answer placed inappropriate emphasis on the wetness of the soil and in that sense I might

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have been misleading in my answer so I would like to take this opportunity to elaborate a little bit on that instrument and the record recorded on that instrument during the Imperial Valley earthquake in 1979.

Now by way of introduction to this clarification, I have prepared this figure. In fact, the figure was prepared about nine months ago as part of a report that we did. It is shown on the viewgraph as a black-and-white version of a color copy that has been distributed.

What the viewgraph shows are some seven or so response spectra calculated from seven components of acceleration recorded during the Imperial Valley earthquake.

They are keyed on the top in the legend and what is termed -- the first entry on the legend -- what is termed the El Centro Free Field Station is, in fact, the free field recording outside the Imperial County Services Building and all the other records are recorded within one to ten kilometers of the Imperial fault.

I should note that the free field instrument was some seven kilometers from the fault and therefore all the other recordings span distances around that which the Imperial County Services free field instrument was at.

These response spectra are calculated for five percent damping.

Now again, the black-and-white version won't show

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it but hopefully the color one will. The bottom response spectra -- the lowest response spectra -- is the Imperial County Services free field and all the others -- the remaining six or so -- are about a factor of two above that instrument.

There are a number of hypotheses that one can advance in trying to explain this but I think this is a most dramatic presentation as to the possible anomalous recording in that free field instrument.

One explanation might simply be scatter in data. We do see a scatter in the data of plus-or-minus some 50-or-so percent. You might attribute some of this difference to that fact, but it is certainly more suggestive of some other underlying physical mechanism that caused a filtering of the ground motion outside the Imperial County Services Building.

I might remind you that the high frequency portion of the response spectra corresponds to the low period plots on this viewgraph and you can see that the difference between the Imperial County Services free field and all the other free field recordings seems to decrease with decreasing frequency suggesting in particular some sort of frequency filtering.

MR. WHARTON: I am sorry, I didn't hear the last sentence you said. I wasn't sure whether you said increase or decrease. Could you repeat that?

WITNESS WIGHT: Yes, that the difference between the free field instrument -- that the response spectra

calculated from the free field instrument outside the Imperial County Services Building and the remaining six free field components plotted on this viewgraph seems to decrease with decreasing frequency or increasing period, as plotted here.

Now just to resummarize what I said thus far, one explanation could be scatter, but there appears to be some other underlying phenomena taking place and therefore many people have gone out and looked at the instrument and tried to ascertain whether there is something unique about its placement.

It has been characterized as sitting in a flower pot and I think I ought to better define that. It is actually in a planter bed of dimensions, I recall, approximately 10 by four feet in plan view.

MR. WHARTON: I would object, Mr. Chairman, unless we get some foundation as to what his basis for this knowledge is, whether it is something that somebody told him or whether it is something that he knows of his own knowledge.

JUDGE KELLEY: Have you seen the actual site yourself?

WITNESS WIGHT: I have seen photographs of the site.

JUDGE HAND: What were the dimensions?

WITNESS WIGHT: Approximately four feet by ten feet.

JUDGE HAND: It is a wooden box?

WITNESS WIGHT: No, I would like to go on and

explain this.

JUDGE KELLEY: Were these photographs within studies or could you elaborate on that a little bit?

WITNESS WIGHT. Yes, they were within studies and there were several studies performed in this area and many of them directed at the building and response itself; peripheral to that, an examination of the free field instrument.

MR. WHARTON: Mr. Chairman, I still don't know the basis of his understanding, whether this was something that someone told him, what the situation was, whether it was a published study that went into detail that he would refer to.

What we are having now is he is trying to explain away a feature -- a very important feature -- by statements that we do not know who to attribute these statements to, as far as what the box was like and where it was.

JUDGE KELLEY: I am not sure that he wasn't in the process of doing so, but if you could elaborate to the extent you can on your knowledge of this matter bearing in mind Mr. Wharton's comments.

WITNESS WIGHT: The source of my knowledge or the knowledge itself?

JUDGE KELLEY: Both.

WITNESS WIGHT: The source of my knowledge is discussions with several people who actually visited the site during those discussions, viewing photographs they had taken,

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maps they had drawn of the area.

MR. WHARTON: Mr. Chairman, I would submit that any testimony regarding that would be hearsay and is inadmissible.

MR. PIGOTT: If I might respond, Mr. Chairman, I believe that when we are dealing with experts there is a level of hearsay that is offensive and I think we got to some of that yesterday.

There is hearsay, however, which is admissible and that is a hearsay objection not only in administrative proceedings but in any court proceeding, and that being if it is the type of knowledge on which experts used to rely in coming to their opinions, the way they go about gathering the various input to their opinions.

I would submit that this is, in fact, that kind of hearsay and if the Board so desires, I will go into an examination of Mr. Wight as to who the people were that he went to, whether it was done as part of a formal study, whether or not it is his usual custom to gather information in putting together his reports in this manner.

I believe all the answers would be, perhaps, useful but I would say that this is the kind of hearsay -- and it is hearsay that we are dealing with -- and I believe it is the appropriate kind of hearsay.

Now if the Board wants more foundation, we are certainly willing to give it.

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JUDGE KELLEY: Well, technically we can admit just about any kind of hearsay and then say that, to the extent that it lacks circumstantial indications of reliability, that goes to the weight to be accorded to it rather than whether it comes in.

Having said that, though, it is a matter of degree. It does seem to me that you are talking about a fairly important data point. I wouldn't say that you couldn't get into it via hearsay in some fashion but I think we can take the time for some foundation here, the circumstances under which the witness found out about this and the detail of his knowledge and so forth, so why don't you go ahead and lay a little more foundation along those lines.

BY MR. PIGOTT:

Q Mr. Wight, first of all let me ask, the information that you have relied on, was that information gained by other people in the course of officially studying the earthquake and its effects in the Imperial Valley in 1979?

A Yes.

Q First of all, who were these people that you have talked to?

A My discussions have been largely with Mr. Douglas Hamilton of Earth Science Associates in Palo Alto.

Q Do you know whether, in fact, Mr. Hamilton was -- what was Mr. Hamilton studying at the time he observed this

planter area, if you know?

A He was doing various geophysical studies analyzing the mechanical properties of the earth underneath these recording stations, visiting virtually all of the stations listed on this viewgraph.

Q Is it correct to say, Mr. Wight, that in preparing reports and rendering opinions, that conversations with persons such as Mr. Hamilton in this context would be something that you might find useful ani use in your analyses?

A Most certainly and I would emphasize again that in particular, given that we had photographs and maps prepared by Mr. Hamilton to review --

Q Mr. Hamilton took the photographs?

A I believe.

Q Did Mr. Hamilton describe to you this flower box?

A I am sorry?

Q This planter area?

A This planter, yes.

MR. PIGOTT: Mr. Chairman, I would submit that foundation has been laid for appropriate expert discussion of the relevance of this particular small structure.

JUDGE KELLEY: I think it is adequate for some furtner discussion. It is hearsay. It may not be the best of all possible bases, but I think it is good enough for our purposes. Again, it goes to weight, so if you want to pursue it,

go ahead.

BY MR. PIGOTT:

Q Would you like to continue with your discussion?

A Thank you. I was to describe the characteristics of this planter. The planter was some 100 yards away to the east, as I recall, of the Imperial County Services Building. Between the planter and the building was a parking lot and on the other side -- the far side of the planter -- was a sidewalk.

The planter was surrounded by a concrete retaining wall, as I recall some foot tall. To my knowledge nobody has dug down to see how deep these retaining walls are, but I believe standard practice would be that they are buried maybe another foot or so.

The instrument was inside the planter surrounded by the retaining wall on a pad of dimensions, as I recall, two feet square approximately and the retaining walls butted up against the sidewalk on one side and the parking lot on the other.

This is a most unusual location for an instrument and I believe that this has to be taken into account in trying to interpret the apparent anomalous character of the response factor and the peak ground acceleration recorded on that instrument.

Now another parameter much less important -- and this is why I say there is under-emphasis in my answer -- is

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the fact that that planter is sprinkled intermittently and, in particular, during the summer and while the water table is at some 100-foot depth underneath the instrument, there is an increased level of saturation in the near surface around the instrument pad itself and this would increase the deformability of the soil in response to shaking from earthquakes and tend to, in a sense, damp out motions.

These are two possible processes or circumstances that could have explained the anomalous character of these response spectra.

MR. PIGOTT: I don't believ I have any further questions.

RECROSS EXAMINATION

BY MR. WHARTON:

Q You say you gained this information from Douglas Hamilton. When was that?

A Approximately early August 1980.

Q And where did that occur? Where were you with Mr. Hamilton at the time he gave you this information?

A As I recall we were in a technical conference being held at Pacific Gas and Electric offices.

Q And is Mr. Hamilton in any way a consultant to Southern California Edison?

A Not to my knowledge.

Q Have you ever gone to the site where this flower

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box or whatever-it-is is located?

A I have not.

Q You have never been there?

A No.

Q And what kind of instrument was there?

A It was the standard strong motion instrument, I believe. I believe it is termed SMA-1.

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BY MR. WHARTON:

Q Do you know who placed it there?

A I believe it was California Division of Mines and Geology. It could have been the geological survey, but I am more certain of the CDMG placement.

Q You are not certain, though.

A Not absolutely.

Q Did you contact anyone that you believed placed it there?

A I did not.

Q You never asked anyone why that particular instrument was placed at that location?

A Certainly Douglass Hamilton and I discussed this. It was a convenient place. The objective was to match the recording in the free field with records that might be taken inside the Imperial County Services Building in the event of an earthquake.

Q Well, you said that the location was an unusual location. I would think that if it is an unusual location, you would contact the person that put it there and find out what his reasons were for putting it there.

MR. PIGOTT: Do we have to argue with the witness? Just -- it is argumentative. Could we have questions?

MR. WHARTON: Yes.

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BY MR. WHARTON:

Q You state that it was an unusual location, is that correct?

A In my judgment, yes.

Q The fact that it was an unusual location, did it raise questions as to why the particular -- it was placed at that particular location?

A Yes, it did.

Q Did you ever resolve those questions by going to whoever it was that placed the instrument there?

A No, we did not. It seemed to be a rather useless exercise at that point.

Q Did Douglass Hamilton have any knowledge of why the instrument was placed at that location?

A Again, he and I speculated as to reasons. I don't think he had discussions with anybody else regarding the logic for that placement.

Q You stated that you -- that the planter was water -- often watered. How do you know that?

A Knowing the meteorological environment in the valley there, summer season ends, late October. It was a planter box in which there were plants, as I recall the photo.

Q You don't have any direct knowledge of how often it was watered?

A No, I don't.

Q So -- and aren't you really assuming that it was watered?

A The plants were alive in the photograph, which was taken right after the earthquake, so I am certain it was watered.

Q Okay, you are talking about from -- you are certain it was watered from looking at a photograph?

A Yes.

Q That is the basis of your knowledge about watering?

A Yes.

Q Now, you commented something else about the water table being saturated?

A I did say that the water table was approximately at a 100-foot depth.

Q Okay, are you then stating that from -- are you trying to say that because of watering, the ground was saturated and that decreased the ground motion?

A No. The ground was not saturated in a technical sense. It would be saturated beneath the water table, and any water poured on the surface or sprinkled on the surface would drain downwards. The saturation would be less than 100 percent at any point above the water table, but the water content would be highest at the surface where irrigation is taking place.

Q Again, you are assuming that irrigation took place. You don't have any personal knowledge of that.

A If you can say that it is an assumption based on seeing plants alive in the planter box.

Q How big were these plants?

A I can't recall their sizes. There seemed to be, as I recall, quite a variety, ivy.

Q Do you have any knowledge of how much water it would take to keep these kinds of plants alive?

A No.

Q Okay, the chart that you have drawn up here, you stated this shows the accelerations, free fields, and I believe the spectrum at seven kilometers, is that correct?

A What I said was that the Imperial County Services free field instrument was approximately seven kilometers, and that is the lowest -- that corresponds to the lowest curve on this plot.

Q Do you have any other -- okay, what was the magnitude, M_S, of this particular earthquake?

A 6.9.

Q Do you have any comparable data that you could draw a chart of such as this, showing the difference as you show on this chart, of another earthquake in the area of seven kilometers or less with an earthquake of around M_S 6.9 or 7.0?

A No.

Q So this is the only data that you have showing this particular information?

MR. PIGOTT: I am going to object. The -- I think the purpose of this redirect was to discuss this data at this location, for this earthquake, at this time of the year, in El Centro. I think we are expanding it into far more than at least Applicants intended by way of clarification and amplification.

MR. WHARTON: Mr. Chairman, he submitted a new chart here. I think that I am entitled to go into this chart for whatever purpose, and --

MR. PIGOTT: I think we have left the chart. That is my point.

JUDGE KELLEY: Within reason, yes. I do think that you are -- this was redirect for a pretty narrow purpose and your recross should be correspondingly narrow. I will allow that particular question, but just keep that in mind.

MR. PIGOTT: Especially since I have quasi-volunteered that Mr. Wight would be back, and would very likely be available for their technical cross-examiner.

MR. WHARTON: I think the last question will do in this area.

JUDGE KELLEY: Excuse me?

MR. WHARTON: The last question that I asked would

be the only answer that I would require and I wouldn't go any further.

JUDGE KELLEY: Very well. Do you want to repeat it?

BY MR. WHARTON:

Q Do you recall the last question?

A I would appreciate it if you would repeat it.

Q Okay. Could we have it read back, just so I have it straight?

(Whereupon, the question of the previous transcript page, lines 2 and 3, was played back)

JUDGE KELLEY: Okay, go ahead.

WITNESS WIGHT: Your question refers to this particular kind of data. In terms of characterizing variability of ground motion at a given distance, which this portrays, there is a lot of data.

BY MR. WHARTON:

Q I am talking about at this particular distance.

MR. PIGOTT: Could he finish the answer, please? I don't believe the witness finished the answer.

JUDGE KELLEY: Yes, go ahead.

WITNESS WIGHT: There is a lot of data, not from one single earthquake, certainly this data being from one single earthquake, it more specificially addresses the variation around the Imperial fault, but there are -- there is

an opportunity, of course, to do a regression analysis on data from a variety of earthquakes, and there are many magnitudes, 6.5 to 7.7, in our data base, for example.

BY.MR. WHARTON:

Q I am speaking of measurements, say, less than eight kilometers only.

A And there are data represented for the magnitude range six and a half to 7.7 and less than ten or eight kilometers in our data base, from which one can derive a statistical representation of the scatter. This level of variation is -- is not unusual compared to the scatter in the data base.

MR. WHARTON: Okay, I have nothing further at this time.

JUDGE KELLEY: Mr. Chandler?

MR. CHANDLER: Thank you.

RECROSS EXAMINATION

BY MR. CHANDLER:

Q Now, Mr. Wight, I believe on -- with respect to this figure 3-1, did you indicate that this was based on five percent damping?

A I did.

Q Do you recall the testimony of Dr. Idriss?

A Yes.

Q Do you know what damping value has used in his

testimony and the Exhibits he has offered?

A As I recall, two percent.

Q Could you explain why you have used five percent as opposed to two percent?

A I cannot explain why Dr.Idriss used two percent, but we have taken as a matter of standard practice in our office, to plot response spectra, for purposes of comparison, at five percent.

Q Do you know what effect the use of five percent rather than two percent has, on the spectra that are depicted?

MR. PIGOTT: I am going to object as to not going to -- well, I am going to object as beyond the scope of this particular limited redirect, and also the relevance with respect to this chart, which I believe shows relative levels of motion, and not going to any absolute prediction or any absolute numerical values, but rather the comparison of what was recorded in this particular planter area vis-a-vis what was recorded in other free-field instruments during this earthquake, and I thin perhaps we are losing sight of that -- of that limited objective.

MR. CHANDLER: Mr. Chairman, I recognize that there was a limited objective intended by this particular figure. At the same time, we have spectra on the record which are based on two percent values. I think if we are to

understand a relationship, even in a relative sense, internally in this document, we ought to be able to talk on a common ground, at least understand what effect or what difference there may be in talking five percent or two percent.

We have some witnesses talking two and some talking five. I don't intend to probe this very deeply, by the way, Mr. Chairman?

JUDGE KELLEY: What is your technical view of the issue?

JUDGE HAND: I am curious, too. I had made a note, five percent damping, and I -- what does it do to the curve, I mean, to the line? Does it shift them somewnere? Does it change their relative position?

WITNESS WIGHT: In my opinion, it does not change their relative positions, but it does change their absolute level. There would be a detailed difference in the peaks and the valleys, how they would be represented on plots like this, but the overall character of this plot would, in terms of relative differences, would be unchanged.

BY MR. CHANDLER:

Q Is it just a straight linear or three percent difference across the board, or --

A It is not that simple, but it is a straight difference.

Q Does this -- does the use of a five percent damping factor tend to reduce the spectra?

A Yes.

Q Bear with me, having had little time to prepare, I am trying to see what Dr. Idriss's Exhibits might suggest.

MR. CHANDLER: I have no further questions of the witness.

JUDGE KELLEY: Cadet?

JUDGE HAND: That viewgraph says velocity in centimeters per second on the left-hand side, and mine -- my copy in front of me says velocity in centimeters per second times ten to the minus three, and --

THE WITNESS: That is correct.

JUDGE HAND: Which is correct?

THE WITNESS: Ten to the minus three. In other words, the ordinates should be multiplied by a thousand to get unit centimeters per second.

JUDGE HAND: And does this have something to do with peak acceleration, some of this in front of us?

THE WITNESS: Yes. Recall that the high frequency asymptote of the response spectra approaches the peak ground acceleration, on a --

JUDGE HAND: And that is the data on the lower left of that figure?

THE WITNESS: Yes, and more specifically, if you

could compare the asymptote of these spectra against the diagonal line, with an angle of 45 degrees, recall acceleration is plotted on that diagonal access, going from your lower left to your upper right.

JUDGE HAND: Well, then is the acceleration at the County Service Building in that planter bed in fact higher than the rest of the data, is that --

THE WITNESS: Lower.

JUDGE HAND: It is lower than the rest of the data.

THE WITNESS: Exactly. Acceleration on this plot would increase in that direction with the axis of acceleration 90 degrees rotated.

JUDGE HAND: So the instrument in the planter recorded lower acceleration. Well, why did that concern people? Have I lost the thread here? I mean, what --

MR. WHARTON: Yes.

THE WITNESS: I think it is a matter of emphasis again. There was another instrument inside the building, and my testimony on Friday discussed the general phenomena of building reduction, that when we have records recorded in buildings, and records recorded outside buildings, both on a statistical and, say, a deterministic basis, one can say on the average that the building tends to reduce the ground motion. Now, the Imperial County Services building record

pair, between the building and the free field, was anomalous. The different --

JUDGE HAND: I am back with you again. I have it back in my head.

THE WITNESS: Okay.

JUDGE HAND: I had lost it and I have --

THE WITNESS: And all of this discussion is with regard to the free field instrument alone.

JUDGE HAND: Yes.

THE WITNESS: There were other points, explanations that I offered regarding the record in the building.

JUDGE HAND: And one other thing, when you were talking about the location of this instrument in the flower bed, or box, or whatever it is to be called, you either said it was anomalous or unusual or something, you have got half a dozen other free instruments, free field stations. What -- how do they differ? I mean, what are they, just put out in somebody's back yard, or --

THE WITNESS: Highly variable. Highly variable. I think we have to consider the manner in which CDMG or the USGS deploys instrumentation. They go out and find a location that is secure and available to them.

JUDGE HAND: Secure in the sense of being safe from --

THE WITNESS: Vandalism.

JUDGE HAND: -- pilferers and vandals.

THE WITNESS: Exactly, exactly. And where the land would be available for their use. Even though it is a small piece of real estate, it is important, so frequently, they will place these instruments on governmental property, whether it be local, state or federal. Another instrument, for example, to give you a feel for the variability here, another instrument, I can't recall which one it is offhand, but one of them is recorded -- it is placed inside a school building, a two-story school building that previously was used to house a turbine and a pump for the irrigation district there.

They removed the turbine and the pump, and they used -- they refurbished the structure to be a schoolhouse. It is kind of interesting that that -- that the basement or the foundation of this schoolhouse is some, as I recall, 20 feet thick poured concrete, and the fact that it recorded --

JUDGE KELLEY: Twenty feet thick?

THE WITNESS: Yes, to support the turbine. The turbine and the pump together weighed some tens of tons, and back in nineteen -- I believe the late '30s when it was installed, it was the largest turbine-pump combination in the world.

JUDGE HAND: But that is not on this chart, is it?

THE WITNESS: Well, the instrument that is now in the school building, sitting on top of that foundation, is, and it recorded a higher acceleration. Again, to further emphasize first, the variability, and second of all, the anomalous character of whatever was in the planter bed.

JUDGE HAND: Can that instrument be calibrated somehow, can it be taken into the laboratory and shaken so that you can -- with some determined force, so that you can find out whether or not it works properly?

THE WITNESS: And that is standard practice, in fact, after earthquakes, to go out and check the calibration level of instruments.

JUDGE HAND: And this was done with this instrument?

THE WITNESS: To my knowledge. The question, I don't think, is really the instrument, but rather the setting.

MR. WHARTON: Mr. Chairman, I believe there might be a clarification on him stating "to my knowledge," on whether or not the instrument was checked. Is he saying that he -- is he saying that he knows the instrument was checked afterwards, or not?

JUDGE KELLEY: Can you just repeat what you said?

THE WITNESS: I do -- what I did say is to my knowledge, the instrument was checked, and the basis for that is that it is standard practice within the organizations that operate these arrays, to go out and check them.

JUDGE KELLEY: So you in effect recalibrate them after an earthquake?

THE WITNESS: Yes.

JUDGE JOHNSON: Is there any sort of periodic calibration between earthquakes?

THE WITNESS: Yes.

JUDGE JOHNSON: Like once every six months or once every year?

THE WITNESS: I don't know the frequency, but they certainly maintain calibration levels periodically.

JUDGE KELLEY: Can you get variations in readings depending upon different intensities in the earthquake at different places on the fault? You know, you refer, for example, to a -- say a 6.9. As I understand it, let us say that involves a rupture of 30 kilometers. It isn't 6.9 along all 30 of those kilometers, or isn't necessarily, is it? It could be 7.2 or 6.4 at different places on the fault?

THE WITNESS: Well --

JUDGE KELLEY: I am not stating that. I am asking it. But it is my impression that it isn't -- intensities aren't uniform all the way up and down the fault and therefore with respect to buildings that may be in the near field.

THE WITNESS: There are a couple of points here. With regard to magnitude, earthquakes have a given

magnitude determined by organizations that have responsibilities to calculate that magnitude, and there is a -- so the magnitude for IV '79 is reported by the U.S. Government to be 6.9, and --

JUDGE KELLEY: Okay, but doesn't that -- doesn't that involve some kind of averaging?

THE WITNESS: Yes, it does, certainly. Now, you use the word "intensity," implied intensity of ground motion, and it is true, the intensity of ground motion for a given earthquake does vary along the fault, and away from the fault, and that is -- that mechanism -- that results in some degree of scatter in the data.

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Q I think maybe I was a little careless in my choice of words. The earthquake measurement is really usually referred to as a magnitude measurement; right?

A Yes.

Q And there is one number of 6.5 or whatever in any given earthquake, and I am repeating myself and I know that, but it is my impression that typically in a long fault the magnitude of the earthquake, if you will, will vary.

A Yes.

Q And this, then, would produce different strong motion measurements and depending upon whether you were on a certain angle of a fault or whatever; isn't that possible?

A That is quite true. A physical explanation for this has to do with the earthquake rupture process; that we envision the earthquake rupture rather chattering along, going through the earth where the earth contains different levels of local stress, for example, and when that local stress if relieved it results in variation of ground motion at that point.

You might imagine that if you have got a station looking at the fault in front of it, that the likelihood of a random occurrance of a high stress drop is going to be greatest at some point within an azimuthal arc in front of that station.

If there were a high stress drop at some point further away outside that azimuthal window of, say, 45 degrees resulting in a high frequency acceleration, that that

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acceleration pulse would have to travel through a greater distance of earth medium and attenuate greater. So it is a trade-off there and probablisticly one might hypothesize that the peak accelerations -- high frequency accelerations -- are coming from some nearby window on the fault.

Now there is no consensus on this matter but we have looked at it rather statistically ourselves trying to get a better feel for where that energy is coming from, and with respect to our data base that I have described last Friday, we find that the best statistical representation of distance is the closest distance to the rupture surface, not at the central or hypocentral corresponding to points related to the first energy release, but rather the point on the fault closest to the station.

I say on a statistical basis. By that I mean our standard error is reduced and the fit is improved.

I could say that when we calculate regression based on epicentral distance the scatter, the uncertainty in our fit, increases by, as I recall, 50 percent, which is very large.

JUDGE KELLEY: Are we through with Mr. Wight, at least, for this morning?

MR. PIGOTT: I would move the admission of Applicant's Exhibit No. 35, LHW-3 into evidence.

MR. WHARTON: I have no objection.

MR. CHANDLER: No objections.

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JUDGE KELLEY: So ordered.

(The document identified as Applicant's Exhibit No. 35 was received into evidence.)

MR. PIGOTT: Thank you, and I have no further questions for Mr. Wight.

JUDGE KELLEY: Thank you, Mr. Wight.

(Mr. Wight leaves stand.)

MR. PIGOTT: I would next call redirect for Dr. McNeill from yesterday. We have no redirect of Dr. Edress who was on Friday.

Whereupon,

ROBERT L. MC NEILL

was recalled as a witness herein, and having been previously duly sworn, was examined and testified further as follows:

REDIRECT EXAMINATION

BY MR. PIGOTT:

Q Dr. McNeill, you have had a chance over the evening recess and this morning to review the transcript of your testimony yesterday, have you not?

A Yes.

Q And I believe that there was some general questioning concerning the purpose of your testimony in this proceeding. I wonder if you would expand on that, if you would describe for us the position of your testimony in the overall

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scheme of Issue No. 4.

A Yes. To do that, let me describe the normal process of deriving site-specific spectra, that involves four steps. The first one is by the geologist who studies the area and identifies the various faults involved and also identifies their size, their sense of motion and their degree of activity.

The second step involves the geologist, quite often with a seismologist, in assessing the characteristics of those faults to determine the maximum magnitude that might occur on those particular features.

The third step is by the seismologist, usually in consultation with the earthquake engineer, to take those magnitudes and their appropriate distances and derive the instrumental site-specific motions. Usually those are expressed in the form of a spectrum.

The fourth step is by the earthquake engineer, who takes those instrumental site-specific motions and, from those, derives a design spectrum which he furnishes to the designer.

Notice that up to this point no attention to details of any particular structure have been considered.

Now my function as an earthquake engineer is to serve to bridge the gap between the seismologist with an instrumental acceleration and a designer who needs a design spectrum and that is my purpose in being here, is to bridge that gap.

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Q I believe also in your cross examination there was some question as to whether or not you were here to testify on providing assurance for public health and safety. I wonder if you could address the purpose of your testimony in that context?

A Yes, I view the purpose of my testimony in that context to be to quantify the level of conservatism but not to make judgements regarding public health and safety.

MR. PIGOTT: I have no further questions of Dr. McNeill.

JUDGE KELLEY: Mr. Wharton?

MR. WHARTON: I have nothing.

MR. CHANDLER: No questions, Mr. Chairman.

JUDGE KELLEY: Thank you, Dr. McNeill.

(Witness leaves stand.)

MR. PIGOTT: Mr. Chairman, subject to a few little nits that may have to be provided for the record, I think that actually concludes our presentation on the first of the four issues before us and we would move to call as Applicant's next witness Mr. Jay Smith, who will be addressing Issue No. 3 as they have been ordered.

JUDGE KELLEY: Fine.

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Whereupon,

JAY SMITH

was recalled as a witness herein, and having been previously duly sworn, was examined and testified further as follows:

MR. PIGOTT: For the record Mr. Smith was previously sworn and his qualifications are set forth in his testimony on the earlier issues.

DIRECT EXAMINATION

BY MR. PIGOTT:

Q Do you now have before you, Mr. Smith, 19 pages of questions and answers and Figures JLS-N through JLS-Z?

A Yes, I do.

Q And if you were asked those questions today, would your answers be the same?

A Yes.

Q And the figures that accompanied that testimony, do you incorporate that as a part of your testimony?

A Yes, I do.

Q Do you have any corrections to make to the text of your testimony?

A Yes, I have two.

Q Okay, if you would give them to us?

A On page 2, line 18, within the quotes is the caption for Figure JLS-O. That should be changed slightly. Instead of reading, "photograph of an A feature," it should read,

"photograph of A and B features." So the correction would be to delete the word A and insert the words A and B and add an "s" to feature.

Q And I assume that the same correction should be made to the caption of JLS-O?

A Yes, following the text of the testimony; that is correct.

Q What is your second correction, or did I steal it?

A Those are the two.

MR. PIGOTT: I would ask that the testimony and the accompanying figures be placed into the record as evidence at this point.

JUDGE KELLEY: Without objection, so ordered.

BY MR. PIGOTT:

Q Are you also sponsoring the exhibits with respect to this portion of your testimony?

A Yes, I am.

MR. PIGOTT: Mr. Chairman, I believe those exhibits were previously identified as Applicant's Exhibits No. 25, No. 26, No. 27, also bearing the designation JLS-1 through JLS-3.

BY MR. PIGOTT:

Q Mr. Smith, were those exhibits either prepared by you or under your supervision and direction?

A Yes, they were.

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MR. PIGOTT: I would ask that Applicant's Exhibits No. 25, No. 26 and No. 27 be introduced into evidence.

MR. WHARTON: No objection.

JUDGE KELLEY: So ordered.

(The documents identified as Applicant's Exhibits No. 25, No. 26 and No. 27 were received into evidence.)

BY MR. PIGOTT:

Q Mr. Smith, have you prepared a general introductory discussion of your testimony?

A Yes, I have.

MR. PIGOTT: If the Board has no introductory questions, I would suggest that Mr. Smith go ahead with his discussion.

JUDGE KELLEY: Go ahead.

WITNESS SMITH: I believe I can be very brief in presenting my synopsis by quickly going through some of the figures in my testimony. This first slide is of Figure JLS-N. It is simply a plan view of the excavated SONG site showing the locations of features that have been referred to as A, B, C and D.

The A, B features are the intersecting lines we see in the vicinity of the pointer here. The C feature is difficult to distinguish on this slide but it occurs at about

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the upper tip of the pointer on the southeast side of the site. The D feature is that very irregular line traversing from southeast to northwest across the site.

My testimony describes the features as they were encountered, also the history of their discovery. It identifies their characteristics and draws conclusions on their age and origin. This figure, JLS-Q, is a log of a vertical trench exposure within the excavated site area.

It shows one of the A features at this point rising up through the San Mateo formation to the stage 5-E marine terrace platform at that point, clearing indicating that these features have formed prior to the development of the Stage 5-E terrace and are therefore older than about 125,000 years.

This viewgraph is of Figure JLS-S. It is simply a location map showing two areas referred to as Trail 6 and Dead Dog and Horno Canyons. These are at distances from three to five miles respectively south of the site.

They are areas where offsets had been encountered in the Stage 5-E marine terrace platform. Initially to some observers it suggested as posisbly being fault offsets.

This slide is Figure JLS-U. It is one of many illustrations from many reports that clearly indicate that the displacements observed in that marine terrace platform are clearly within the boundary of a large old landslide on the sea cliff and are related to landslide motion in the sea cliff,

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rather than faulting.

That slide that I just showed was of the Trail 6 area.

This slide is from Figure JLS-W. It shows the Horno Canyon area where similar offsets were found and also shown to be part of a very large landslide, one of many common along this part of the coast.

This viewgraph is of Figure JLS-X. It is a location map of the Target Canyon area about six-and-a-half to seven miles down-coast from the SONG site. It is an area where some sheer surfaces in the bedrock of the Monterey formation were found to extend short distances up into the overlying marine and non-marine terrace deposit.

The displacements and the sheers across which they occurred are shown in this Figure JLS-Z which is a plan view of the Target Canyon area. These were found to be discontinuous sheers. They have various orientations that are described in some detail in the testimony.

The weight of the evidence, in my opinion, favors a non-tectonic origin for these features. However, the investigation and the available data was not sufficient to conclusively rule out some tectonic role in here.

Clearly these features, even if projected along their north trend some distance, would barely lie tangent to a circle of five-mile-radius centered on the SONG site.

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In view of their discontinuity, their short length, their great age at last movement of at least several 10's of thousands of years, their distance from the site, my conclusion has been that they are not significant to SONG.

I think that is a fair summary of my testimony.

MR. PIGOTT: Thank you, Mr. Smith. Unless there are Board questions, I would tender the witness for cross examination.

JUDGE KELLEY: Just out of curiosity, where do some of these names come from; do you know? Dead Dog Canyon, I believe, is my favorite.

WITNESS SMITH: The Target Canyon was probably named for its use by the Marine Corps in gunnery practice. I really don't know where Horno Canyon comes from but I suspect one of my geologists who did the mapping in the canyon south of Horno was responsible for naming it Dead Dog for perhaps obvious reasons.

JUDGE KELLEY: Or for reasons that will become obvious.

WITNESS SMITH: Perhaps.

JUDGE KELLEY: Thank you for that little aside

MR. WHARTON: Mr. Chairman, I had my Voir Dire portion of cross examination with Mr. Smith before. We will go directly to Mr. Barlow for the technical part.

JUDGE KELLEY: Fine.

BY MR. BARLOW:

Q Mr. Smith, on page 5 of your testimony you state that the A features strike nearly north/south and dip vertically. Is this strike of Feature A parallel to the strike of the Cristianitos fault?

A Would you point the line to me?

Q I am sorry, on page 5, line 20 and 21.

A And your question again, please?

Q The question is, is the strike of Feature A parallel to the strike of the Cristianitos fault?

A I would say in general it is not.

Q Could you explain that answer?

A Yes, the Cristianitos fault has been mapped to have a generally north to slightly northwest trend overall averaging something on the order of north 15 degrees west. There very well may be places along the Cristianitos where it has a north strike, but in general overall plan, it is viewed by maps in the exhibits and by Dr. Heilig as having a west of north trend.

Q Does the Cristianitos fault bend in certain areas and take different strikes?

A I think I just indicated that it may have some variable strike from place to place. The extent to which it bends would depend on the place you are examining it and also the nature of the map that one was inspecting.

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Q. Are you aware of reports by Applicants and consultants to Applicants which describe the Cristianitos fault zone as north/south trending?

A. I'm not aware of reports that describe that as a dominant prevailing strike. As I've indicated from the mapping that I've done and observed of others, it has a variable strike which lies something west of due north. But I would not preclude there being some north strike to parts of the fault plane.

Q. Okay. Thank you.

Are you aware of the strike of the so-called Cristianitos Zone of Deformation?

A. I'm not aware that anyone has described a strike on the Cristianitos Zone of Deformation.

Q. Are you aware of any description of it being north/south trending?

MR. PIGOTT: I think the witness has answered that question.

MR. WHARTON: I believe he answered as to the Cristianitos fault not the Cristianitos Zone of Deformation.

JUDGE KELLEY: I think that it's a fair question. The first one was asked about a strike and the witness said it doesn't have a strike.

So north/south trending I think is a somewhat different notion.

THE WITNESS: The Chairman is correct in that.

There is in the geologic terminology a distinct difference between strike and trend.

Strike is the direction of a horizontal line in a plane. Clearly the CZD is not a plane. It doesn't represent a fault and there's no single element from which one can measure a strike.

But as a zone comprising a number of structural elements, both folds and faults, one could generally describe that there is a trend of these individual features that is generally north -- north/south.

BY MR. BARLOW:

Q. Is the strike of feature A parallel to the trend of the Cristianitos Zone of Deformation?

A. Well you're talking about two different things here because strike -- let me think about that a moment.

Is the strike of feature A parallel to the trend of the CZD?

Q. Correct.

A. Well in more or less terms, yes.

Q. Okay. On Page 6 of your testimony, Line 5, you state that the B feature strike about north 45 to 55 west and they dip nearly vertically also.

Is the strike of feature B parallel to the strike of the Offshore Zone of Deformation?

MR. BARLOW: Excuse me. Let me modify that question.

BY MR. BARLOW:

Q. Is the strike of feature B parallel or sub-parallel to the strike of the OZD?

A. Well I think, insofar as there is a high degree of variability of the strike of any single fault along the OZD, it would be not possible without your being more specific for me to answer that.

The OZD is a broad, sinuous zone of folds and faults and, again, such a zone would be impossible to characterize as having a strike or a single strike.

Q. Okay. Let me rephrase the question.

Is the trend of the OZD north/west?

A. It is generally north/west. There are deviations from that and I wouldn't want to get more specific unless you would like to say within how many degrees you want to define north/west.

Q. Well let's just discuss it in terms of north/west without degrees.

Therefore, is the strike of feature B parallel to the general trend of the OZD?

A. I would say only in those areas where the general trend of the OZD is north/west. As I indicated, there are some significant deviations from that.

Q In general, in Southern California, are there several fault zones, including the San Andreas fault zone, the San Jacinto fault zone, the Whittier-Elsinore fault zone and the Newport-Inglewood, Rose Canyon or OZD fault zone, which are, in general, trending northwest?

A Well, that was a pretty complex question. I am not sure there was only one question.

Q Okay, we could break it down.

Is the San Andreas plate boundary, in general, trending northwest in Southern California?

MR. PIGOTT: Could we have a definition of how "plate boundary" is being used in this particular instance?

JUDGE KELLEY: We have been talking about faults. Are you really asking the trend of the San Andreas fault?

MR. BARLOW: Yes, sir.

THE WITNESS: Is your question, does the San Andreas fault in Southern California trend northwest?

MR. BARLOW: I will make it even more specific.

BY MR. BARLOW:

Q Does the San Andreas fault, in the area opposite the San Onofre site to the east, trend northwest?

A Well, that would be in Southern California, and I would say south of the transverse ranges, at the latitude of San Onofre, yes, it has a general northwest trend.

Q Do other faults which are parallel to the San

Andreas fault, including the Whittier-Elsinore and the OZD, in general, trend northwest?

A Well, I want to take exception to your identification of the OZD as a "fault." It is not a fault. I have not described it as such, nor have any of Applicant's witnesses, and I am not sure any of the other witnesses I have heard.

But, with that caveat, I would say that there are other zones that have faults in Southern California that trend generally northwest.

JUDGE KELLEY: Let me interrupt and ask. You have had a series of questions about the parallel strike of various faults and zones, trends of zones. I am not real clear where you are taking us with the questions.

Could you give us an indication of the significance? Let's assume that you establish that a lot of faults and zones are more or less parallel. What will that tell us?

MR. BARLOW: Well, it is analyzing the ABCD features in the context of being between parallel northwest trending faults with north/south trending branches in this region.

JUDGE KELLEY: Would that lead one to -- what kind of a conclusion would that lead one to, assuming you establish it?

MR. BARLOW: It could lead to a conclusion that the A and B features were formed as a part of the regional tectonics that have formed these other faults, which are

parallel to the A and B features.

JUDGE KELLEY: Go ahead.

BY MR. BARLOW:

Q I am not sure if we got an answer to the question that those other questions were attempting to lay a foundation for, so if I could go back and ask you this:

Is the strike of Feature B parallel to the trend of the OZD?

A I believe I answered that. I said, it is generally parallel to those parts of the OZD, and those elements of the OZD, that trend northwest.

I qualified my earlier answer by saying there are places where it deviates far enough from northwest that various people might say it is not northwest.

Q Does the Newport-Inglewood fault trend northwest?

A I have said in earlier testimony, in fact on the first day here, that I don't recognize the existence of a Newport-Inglewood fault, per se, crossing the Los Angeles Basin, but if you mean by that terminology the Newport-Inglewood zone of deformation, then I would say that it does have a general northwest trend.

Q Okay. Do you know what is the width of the Cristianitos fault zone at the portion where it has the Forrester Branch?

JUDGE KELLEY: Could you identify that a little

clearer for the record?

MR. BARLOW: Yes, sir. I believe there is a map in the exhibits of Mr. Smith that shows this.

JUDGE KELLEY: Well, let's find it if we can.

MR. BARLOW: It is Drawing Number 1 in Exhibit 25, Applicant's Exhibit 25, Drawing Number 1, and Appendix C.

JUDGE KELLEY: And is that JLS, which number?

MR. WHARTON: JLS-1.

MR. PIGOTT: May I ask for a clarification of what the Interrogator is referring to as the "Cristianitos fault zone?" Applicant's have referred to a "Cristianitos fault onshore," and whether this is an attempt to make a "zone" out of a "fault," rather than a "fault" out of a "zone," I would like some clarification on that.

JUDGE KELLEY: Clarifying the term would be useful. I am still looking for the map.

Is there any page reference?

MR. BARLOW: Well, it doesn't have a page number on it. It immediately follows Page C-7 in JLS-1.

JUDGE KELLEY: That helps.

MR. BARLOW: In general, in California, faults occur not just as one single line on a map, but occur as zones, with various branches, and the faults, with its branches, are referred to as "zones," "fault zones."

JUDGE KELLEY: I am not disagreeing with you. That

is just in terms of my own mind. I have heard of "faults" and I have heard of "zones of deformation."

Perhaps between you and the witness, we could reach agreement on proper terminology. Mr. Barlow's explanation of "fault zone" -- was that the term? Maybe you could restate that and see what your reaction would be.

BY MR. BARLOW:

Q In general, faults are not just simple lines on a map, but often include branches or splays, which, taken together, are called "fault zones." Do you agree with that definition?

A I think, in a strinct, general sense, that is correct, but I think in the relevant matters that are important here, it is very important to look at the context in which a zone is being defined, and if you are talking specifically about the Cristianitos fault, then we need to look specifically at that fault at various places to see how the zone might be defined.

Q Okay. Looking specifically at the Cristianitos fault and the Forrester fault on your map, following Page C7, would you say that the Forrester fault is a branch of the Cristianitos fault?

A I don't have an opinion on that. This figure was shown for location purposes. The mapping that I have been involved with has not extended that far north on the Cristianitos fault, so I have no personal knowledge of the Forrester fault

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or any postulated relationship to the Cristianitos. I believe Dr. Ehling has included that area in his study, and perhaps would be the better one to ask.

Q Why did you include this map in your --

MR. PIGOTT: I am going to object to the line of questions. It seems we are now reaching -- I think I have been rather patient with these questions, but it would appear that the examiner is more interested in the Cristianitos fault than the ABCD features, which are properly a part of the issue. The issue does not call for an examination of the Cristianitos fault, and although I can understand, as we have, some general discussion of it, I think we are beyond setting the stage, and we are now into an interrogation concerning that fault itself, and I object on the grounds it's beyond the scope of the issues.

JUDGE KELLEY: The issue itself now before us is Issue Number 3, which had to do with discoveries, meaning, really, geologic discoveries subsequent to issuance of the CP, and it enumerates several, including ABCD. While I think it is fairly within that issue to establish -- to attempt to establish if there be one some relationship between ABCD and the Cristianitos, I think the focus should be on ABCD.

It looks like a good time to eat lunch. Why don't we come back to this matter, in one hour, and not one-and-one-half hours, but at 1:00, and further to explore

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the ABCD features of this site.

(Whereupon, at 11:56 a.m., a luncheon recess was taken, and the hearing was scheduled to resume at 12:00 p.m. of the same day.)

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AFTERNOON SESSION

(1:06 p.m.)

JUDGE KELLEY: Back on the record. Let me interject quickly just one short matter before we resume with Dr. Smith. I mentioned this morning the possibility of giving an oral on-the-record post-pre-hearing conference order under Section 752-C and there was some question in my mind, at least, about whether I had the authority to do that.

There has been a recent change to the NRC Rules authorizing Board's to rule orally on motions. 730(e) is now revised.

It does seem that, reading that section along with 752-C, it leaves one with some ambiguity as to the answer to the question. 752-C talks about entering an order and arguably that means some sort of a written order.

On the other hand, it does seem that the objections to this order may be accomplished by an order dictated into the record just about as well. Again, I would propose this procedure. What I am leading up to is whether anybody would object to doing it that way.

What I would propose to do is state on the record the functional equivalent of a 752-C order regarding such matters as contentions, consolidations and whatever else we have got before us with reference to emergency planning.

This, of course, would be Board's rulings which

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would come from our deliberations, but which I would just state on the record.

I would then, the following day, take the transcript and undoubtedly have some additions and possibly some corrections, but as so amended and amplified upon, that would comprise the order contemplated by 752-C and upon which parties would have the right to comment within the specified number of days.

So I want to simply ask you to consider, and not answer now, but advise me perhaps by the close of the hearing tomorrow when we could raise this again, whether any party would have any objection to this procedure.

Do you understand what I am referring to, what I am describing?

MR. WHARTON: You are talking about using this procedure further down the road after all submissions and to determine the emergency planning issues and you are not proposing to make those rulings tomorrow.

JUDGE KELLEY: Oh, no. It is just that now the Board has all this paper and we are going to go our separate ways to read it and we are going to come back here and confer and deliberate and then do the parties want me to go back and start writing draft orders or do you want to find out what the result is.

You will get the same in substance, it seems to me, with maybe a little less elegance but in the interest of moving

ghp 3

things along, that is what I am proposing to do.

We had, just at the break, a question by Mr. Barlow and an objection by Mr. Pigott, and I gave it a little thought and decided that we should go to lunch and come back here.

Could you restate your question, Mr. Barlow?

MR. BARLOW: To be honest --

JUDGE KELLEY: Or you could start fresh, approximately where you were.

MR. BARLOW: I would appreciate it if we could have it read back.

JUDGE KELLEY: Do you remember about where you were? It takes time to find it and it isn't here anyway, so why don't you pick up about where you were.

MR. BARLOW: Your Honor, if I might explain the context and where this is leading to, the Intervenors have contended in the discovery process and in the list of contentions that was presented in the prehearing conference which we were told were being subsumed under this Contention 3, that we contend that the A, B, C, D features are related to the Cristianitos fault and the Cristianitos Zone of Deformation so that might explain the context that these questions are being offered.

JUDGE KELLEY: Very well, go ahead, bearing in mind -- let me say this. Of course the whole concept of subsuming contentions was something that we discussed at length.

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I don't have them in front of me. Perhaps I should but I don't remember exactly what was subsumed under what. I would make the observation that we are basically here to cross examine this witness' testimony.

He has not testified, as far as I recall, to any such relationship and even under the argument that the relationship of these features to the Cristianitos is subsumable, do you have a witness to testify to that?

MR. WHARTON: Mr. Chairman, if I am not answering the question directly, what we are looking at is this whole area is regarding the A, B, C, D features. What are they? What could they be? What implications do they have?

I think that is one of the open questions that is being submitted by this testimony to try to explain away the A, B, C, D features as not having significance. I think, since you opened up the area of what they are, I think we should be able to go into determining whether or not there is any relationship to other features, and if so, if the relationships have any implications.

So rather than treat it as being subsumed by an issue, I think it is covered simply by the direct testimony. What are the A, B, C, D features. What do they mean. What implications do they have, and that is the area that we want to get into.

JUDGE KELLEY: Even with that understanding I

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expect you to stay within reasonable distance of what this witness testified today.

MR. BARLOW: I will try to move along.

Whereupon,

JAY SMITH

the witness on the stand at the time of the recess, resumed the stand, and having been previously duly sworn, was examined and testified further as follows:

CROSS EXAMINATION (Resumed)

BY MR. BARLOW:

Q Mr. Smith, on page 6 of your testimony, line 21, you state that the A and B features are found in several locations within about a five-square-mile area including that area well outside the center of the site. You say that they occur both near and far from the coast and without any particular pattern and displayed no zonal distribution nor maintained any close proximity to any known fault including the Cristianitos fault.

I would like to ask you a series of questions about this paragraph. First of all, I believe that in another portion of your testimony -- in fact the next sentence on page 7 -- that the C and D features are relatively rare in contrast and they have not been found outside the site.

Going back to your line 21 on page 6, you noted that A and B type features are found in several locations

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within about a five-square-mile area. Could you tell us where these other several locations are in relation to the San Onofre site and in relation to the Cristianitos fault?

A You are asking here specifically about the other locations of the A and B features?

Q Yes, sir, where you have observed, or the people working with you have observed, the A and B type features that were found in several locations within about a five-square-mile area.

A As I understand it, now, those locations are identified in my Exhibit JLS-1 which is Applicant's Exhibit No. 25. If you will give me a moment I will try to locate that specifically.

Appendix C of that description is entitled, "Description of Type A and B Features in Off-site Areas."

JUDGE KELLEY: We are having a little trouble finding this.

MR. WHARTON: We have an extra copy.

MR. PIGOTT: He is looking at the title which is at C-1. It is that index. There are seven pages to Appendix C and they are numbered C-1 through C-7, which is a description.

JUDGE KELLEY: A description of Type A and B?

MR. PIGOTT: Yes.

JUDGE KELLEY: C-1?

MR. PIGOTT: Yes.

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WITNESS SMITH: And part of that Appendix includes some figures at the end of that exhibit, two figures identified as Drawing No. 25 and Drawing No. 26.

JUDGE KELLEY: Okay, thank you.

WITNESS SMITH: There is one more drawing that accompanies Appendix C and that is Drawing No. 27. They are the last three drawings of Appendix C.

Now to answer your question, Mr. Barlow, as to the location, Drawing No. 25, if you have it there, shows a square box that is hashered (ph.) to the northwest of the SONG site and identified as Area 1. That is along Bazalone (ph.) Road which lies along the north side of San Onofre Creek.

Area 2 is to the southwest of that and is in a rectangular hashered box at the mouth of San Onofre Creek just north of the Santa Fe Railroad tracks.

These are the two initial areas that were described in Appendix C. A and B features have been observed elsewhere outside the site. They have been observed on the ridge that lies in between San Mateo Creek to the northwest and San Onofre Creek to the southwest.

Area 1 is just sort of off the nose of that ridge. Specifically there is a pair of diagonal lines crossing that ridge just north of the number 13 above Bazelon Road. That represents the location of the power transmission lines.

There are a number of roads excavated along there

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that are unpaved and accompanied by cut clopes and these rather abundantly display the occurrance of A and B features.

A and B features have been found in one or two of the minor gulleys just southeast of the SONG site within perhaps a few hundreds or thousands of feet south of the southeast margin of the site. I don't recall which.

BY MR. BARLOW:

Q Excuse me, that last location that you were discussing, is that between the reactors and the Cristianitos fault?

A I don't know if it is correct to characterize it as between. The gulleys on the sea cliff lie southeast of the site and they generally are between the Cristianitos and the site but I can't say that the features have an ex ent that would put them truly between the site and the fault.

And those are the areas that have been specifically identified and I observed. There may be others that I am not aware of or that have not been documented.

Q So you have discussed here four different areas where the A and B type features were found. If I could ask you about these A and B type features in these four sites, for example, in Area 1 which you discuss here in Appendix C of your exhibit -- Applicant's Exhibit No. 25 -- you say on page C-1, second paragraph from the bottom, that a total of 1.5 days were spent in field observation and mapping at the

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selected locations. Does this 1.5 days represent your personal geologic research or does it include a group of people that you worked with or could you tell us who spent the 1,5 days?

A Well, the 1.5 days simply refers to the specific time spent plotting the observations of the features on the map. This was the result of mary more days of observation and consideration of these features.

The geologists including myself that had mapped the vicinity prior to 1974 when these features at the site were found, had observed features and had also observed areas of extensive exposure of the San Mateo formation where they were not existing.

So as a consequence of recalling where good exposures of the features existed and where we knew they did not exist, the conclusion was drawn to direct the documentation at these two areas.

Q I am sorry, did I interrupt you?

A So I was involved in that. The geologists who were involved in the original mapping plus the geologists who did the field observations at Area 1 and 2 were all involved, as well as a number of others who I cannot specifically remember who have made observations.

So I wouldn't want you to be misled in thinking that only one-and-a-half days were spent in addressing the nature of the A and B features.

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Q Is it correct to interpret this to mean that there was other time spent analyzing these features, but one-and-a-half days were spent in the field observing the features and mapping them?

A Well, I guess I haven't made that clear yet. No, there were many days spent in the field observing and considering these features. The individual who prepared the map that accompanies C-1 spent one-and-a-half days in preparing that map.

Q Oh, I see.

A But many other people spent many other days.

Q And this map and this study just looks at Area 1 and Area 2? That is what this person is referring to, since on the map that is what is put in boxes?

A No, that wouldn't be entirely correct because the geologist who mapped these was intimately involved in the mapping of the A and B and other features at the SONGS site and I believe there are some parts of the report that make some comparisons between what is observed at Areas 1 and 2 and what is observed at the site.

So I think it would not be a correct characterization to say that he only looked at those areas.

Q Thank you for explaining that. On this map I noticed that the map shows the Cristianitos fault zone and this morning we were discussing the Cristianitos fault zone and we were told that it is referred to Cristianitos fault, yet here

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in Applicant's Exhibit No. 25 it is referred to as the Cristianitos fault zone.

Could you explain to us, is the Cristianitos fault a fault zone, as indicated on map sheet 25?

A What I indicated earlier was that the use of these terms has to be considered in the context in which it is being used. I am sure we have seen in this hearing that geologists have many terms for the same feature or the same term for many features but which are different so I think that the context is important.

The identification of the Cristianitos fault here is drawn from earlier mapping by geologists under my supervision which attempted to bound the fault between two lines, not always observable in the field but inferred by a number of observations based on topography and geology.

The application for this map here was only in general to serve as a location map of the features and the site to the general location of the Cristianitos fault.

If you wanted to get into the specific characterization at some scale other than the general location map like this, I could proceed to do that. We would have to start at the coastal exposure and go various places up along the north using another map.

Q In the context of this map, is it called a fault zone because it has more than one trace on the surface?

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A I don't recall exactly why it was referred to as a zone here. I don't think it is significant for this purpose, that it is a zone or a fault.

You will notice that the lines that bound the fault there are solid lines with the exception of some sections that have dots.

On the geologic map that was prepared much earlier -- in 1969 or '70 -- from which this map is taken, there are no such solid lines. Therefore, this map is simply a diagrammatic representation of the approximate location of the fault and there really is no intended implication about the nature of the fault or trying to define it as a zone or a sharp plane or anything else.

Q Getting back to Area 1 and Area 2 on this map sheet 25 in your exhibit, Area 1 is a sand quarry; is that correct; and on page C-3 at the bottom of the page, the last paragraph, you note that about 50 sheers were found in the geologic traverse along the quarry roads.

On the average one sheer zone can be found per 100-foot length of the road. The sheers are mostly vertical and northwesterly oriented and fewer are north/south aligned. The length of most sheers could be traceable along the strike for at least a few hundred feet.

Could you, first of all, define for us sheers and sheer zones as you use them in the context of describing the

A and B features?

A Yes. I think that before I address that, since you are describing the orientation and the length along which these were traced, it would be appropriate to read the sentence that follows the one you quoted, which is as follows:

However, the disappearance of sheers within 50 feet from the road was also noted

There are other sentences that are also important that refer to the relationship of one to another, but I don't think I need to read that into the record here.

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BY MR. BARLOW:

Q Okay, could you define shears and shear zone for us, in the context of the A and B features?

A Well, a shear would be in general context, as well as here --

Q That is fine.

A -- a surface --

JUDGE KELLEY: Are you through? Go ahead.

WITNESS SMITH: Would be a surface along which there has been displacement parallel to the surface. Using the term shear or shear zone here is a matter of scale. If one can identify a discrete planar surface, something that is a millimeter or a fraction of an inch wide, that appears to be a single plane, there would be a tendency to call it a shear. If it had greater dimension in terms of width, and I can't give you a specific width, but some of these shears cumulatively or collectively lying subparallel to each other form a zone a few inches wide, and one would refer to that sort of a characteristic, whether it is width, as a shear zone.

These features, not only in the site and in the offsite areas, are jointlike, because of their orientation and planar nature, and their relationship to each other. They do exhibit some small amount of displacement parallel to the surface.

Q Now, are these approximately 50 shears discovered

in the quarry 1.7 miles northwest of the reactors, are they similar to the A and B features found beneath unit 2?

A In most respects. The report does decribe, or the appendix, here, C, does describe the ways in which they are similar.

Q And the northwest oriented shears, are they parallel, or oriented in the same direction as feature A at the site?

A The northwest trending, is that what you are asking?

Q Yes. Wait, I may have them switched around. Are they oriented in the same way as feature A or feature B at the site?

A In this quarry at area 1, there are two orientations, one, essentially north-south, and another essentially northwest. The features A and B at the site have similar strike, essentially north-south for the A, and roughly northwest for the B features.

Q So in general, the 50 shears observed at the quarry site have the same strike or orientation as the A and B features at the site, that is correct?

A Yes, and they have other comparable characteristics.

Q Okay. Is this also true for area 2, where similar shears were observed?

A A fewer number of shears were found in area 2. All of them according to the description on page C-5, the first paragraph, are nearly vertical and strike about north-south, and the strike is indicated in parentheses as north eight east to north ten east, so that at area 2, only the -- apparently only the strike that is similar to the A feature was found.

Q Okay, what about the other two areas? Would you identify it on this map as being near -- first of all, if we could call that area 3 near the number 13, that you described as containing a number of shears or shear zones, with A and B type features, would their orientation in this area 3 be the same or similar as the features A and B at the site?

A Yes, at that area 3 under the transmission line, they are -- they are the same orientation as the A and B features at the site.

Q Do you have any -- well, first of all, did you personally go on a field trip to area 3 as we are calling it?

A Well, I have participated in the mapping of this area on a number of occasions, and have made a number of examinations of various outcrops as a general process of understanding the geology here. If you want to call those field trips, I guess that is appropriate, but we often refer to a field trip as sort of a guided trip to go see any number of items, and --

Q Excuse my characterization of it. If you want to call it field observation, or field work, that is fine, as you described it. In your field work in area 3, did you make an estimate of the number of shears or shear zones which were similar to features A and B?

A No, I didn't make any specific estimate. There were -- there were several of both orientations.

Q Was the number of shear features there similar to the number in the quarry in area 1?

A Well, there could have been. I didn't specifically count them.

Q I see. Were the orientations similar with north-south and north-west orientations? Or strikes?

A I believe I answered that; yes.

Q In the fourth area which you described, southeast of the reactors, does the same hold true in terms of the nature and orientation of the features observed there?

JUDGE KELLEY: Could you tie down that location a little better?

BY MR. BARLOW:

Q Perhaps the witness could describe once again the location of what we might call area 4.

A I don't have a specific location that I can identify on this map as 4, but my estimate would be that it is approximately on the coast right at the line below where it

says BM-122.

JUDGE KELLEY: Thank you.

BY MR. BARLOW:

Q Do you remember the question --

A Yes.

Q -- about area 4?

A Only a couple of features were found there, I think one of each, 1(a) feature observable on the seacliff adjacent to the gully, and a B feature observed in the gully wall itself, which cuts transverse to the cliff.

Q Could you estimate approximately how far from the reactor site that is?

A No, I can't. It would be hundreds of feet, rather than thousands.

Q Was any trenching or other digging done at the area 4 site?

A No, the seacliff and the gully wall provide excellent exposures, there, comparable if not better than a trench.

Q Was any trenching or digging done at areas in each of areas 1, 2, or 3?

A Well, area 1 was excellently exposed, because it was a quarry site which was the result of extensive excavation, far more than any trenching or simple road-cut could produce. Area number 2 is an excellent exposure, and

in a cliff produced by some excavation. I am not certain whether it is an artificial slope or an excavated slope, but an excellent exposure in any case, equal to or superior to that produced by a trench.

The features that we found broadly distributed around area 3 occur in a variety of excavations, mostly the graded roads, and the cuts that lie adjacent to them. These excavations were not specifically to investigate the A and B features.

Of course, you know that at the site, we excavated a number of trenches and drill holes to investigate the features, but in all, they are very well-exposed, at all areas.

Q In area 3, was -- could you estimate the dimensions of area 3, in which you observed these type of features, the width of it?

A No, I don't think I could in any meaningful way. The features were not specifically plotted on a map, and certainly not on drawing number 25 here, but it would occur, these features were observed to occur in an area at least having dimensions on the order of a quarter to a half a mile, on the ridge crest there.

Q A quarter to a half a mile wide, the zone was -- I mean the --

A Wide radius. I didn't specify any particular

shape.

Q Okay. Are there any reports or documents or maps in the record by the Applicant that reflect the field work done, or the observations of features in area 3?

A Not that I know of, no.

Q There is no record of these observations?

A Just my recollection, that is right, from observations. No plotting or mapping was done by anyone under my supervision.

Q What about in area 4, is there any record of the analysis of those features?

MR. PIGOTT: Are you talking only about Applicants' records?

BY.MR. BARLOW:

Q Applicants' analysis of those features, yes.

A The one or two features, the two features found in area 4 may have been documented in a report that was part of the mapping done of the site area by Converse Davis and Associates back in, I think it was 1970, but I don't recall specifically. The reason I am speculating that the feature may exist there in that document is that a very careful log of the sea cliff was made from the Cristianitos fault to the SONGS site. This was done in great detail, and it is possible that the feature that was exposed on the sea cliff was identified on that document, but I don't recall it.

Q Okay.

A I just might point out, to indicate some relevance of that, these -- these features when viewed in a vertical exposure, rather than planned view, are very innocuous looking, especially in area 4. They represent essentially a single white line within a tan sandstone, and it wouldn't surprise me at all that very little note was taken of these during the early mapping.

Q Thank you. Could you estimate the distance between the Cristianitos fault and area 3 and area 4?

MR. PIGOTT: I am going to object. I think that can probably be taken off the maps.

MR. BARLOW: Well, it would be hard for us to do it, since there is no record, I mean, areas 1 and area 2 we could do that with, Your Honor, because they are boxed in and their exact location is shown, but there is no written record or map of area 3 and area 4, and only the witness knows.

JUDGE KELLEY: The objection is overruled. I understand it will be an estimate, but if you could try one?

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THE WITNESS: Well, the approximate distance from the Cristianitos fault to the features found in Area 3 would be about one mile; just a shade under a mile, and that would be measured in a southwesterly direction from the fault.

In Area 4, the distance would be about 4/10ths of a mile; just under half a mile, and that would be measured almost due west.

JUDGE KELLEY: Thank you.

BY MR. BARLOW:

Q On your measurement of the distance between the Cristianitos fault and Area 3, were you measuring the closest distance or a distance oriented parallel to the bottom of the page?

A I gave the direction as being southwest from the Cristianitos fault, so that would be as nearly normal to the trend as mapped here in this drawing. So that would be approximately the closest approach.

Q Okay. Going back to your testimony on Page 6, where we got into this Appendix C, you said that these A and B-type features are found in several locations within a five square mile area, including the area well outside the site, and you mentioned that there were these four areas that you were not clear about.

Are there other geologists or other consultants to the Staff or people who have worked for you at Fugro who

are aware of these other locations where A and B-type features occur within five square miles?

A Are you referring to the four areas that I have identified?

Q I am referring to the other areas, besides these four, where you said there were other places where these features occurred that you did not specifically recall, yourself.

A Oh, I see.

MR. PIGOTT: And you are asking who else knows about them, or if anybody else knows about them?

MR. BARLOW: Yes, I am asking if there were other geologists or employees at Fugro who went to these other sites and observed A and B-type features.

MR. PIGOTT: I question the relevancy.

MR. BARLOW: Well, Your Honor, since there is no record of these sites, and we are interested in these type features because of their apparent relationship with the Cristianitos fault zone, we would like to know where they are and how we could find out about them.

JUDGE KELLEY: The objection is overruled.

THE WITNESS: I don't know who else knows about them. I certainly don't recall them.

BY MR. BARLOW.

Q Were they discussed in meetings or mentioned in reports at any time during the work on the San Onofre area?

A No, not specifically. I think my intent was simply to indicate that there may have been other features observed in other areas than have been specifically and generally identified here, but these two areas on Drawing Number 25 are the only ones that were specifically mapped and documented.

I have identified two other areas where I personally have identified the same features, and in making those observations, I have been accompanied by other people. For example, Area 3, Dr. Perry Ehlig has observed the features in that area along the power line.

But aside from the geologists that did the mapping in the general area back in 1970, and the geologist who did the specific mapping of Areas 1 and 2, it would only be gross speculation on my part to try to identify individuals.

Q On your Map Drawing Number 25 in Appendix C of your Exhibit 25, there is an initial of a person's name, where it says, "Checked by R.R.S." Is that Robert Strand?

A I don't know.

Q Was a Robert Strand working for you at the time?

A Yes, he was.

Q Is he currently a geologist with the California Energy Commission?

A I don't know for certain, but I think he is.

Q Do you know if Robert Strand analyzed the A and B-

type features in the unmapped areas, Areas 3 and 4?

A I don't know if he observed them. He may have been involved in the analysis, but I don't recall. He was not the geologist who was mapping Areas 1 and 2. That was Dr. Shingi Kunioshi.

Q What was the function of Robert Strand in this project at this time?

A He was one of several geologists who were carefully observing the progress of excavation at the SONGS site to identify the features, to document them, to photograph them, prepare maps and figures about them. It is very likely that he participated in the analysis, and perhaps even parts of the report that are represented by one or more of these exhibits, but I don't recall, and I don't believe he specifically is identified as an author.

Q Just one last question on that line before we go to something else.

Do you recall what year Robert Strand left Fugro and went to the State Government?

A No, I don't.

Q Okay, thank you.

On Page 4 of your testimony, Line 12, you say, "At several locations, trenches and 24-inch diameter borings were excavated across the features to allow in-place observation of the features below site grade and to determine the three-

dimensional nature and distribution of the features."

Can you tell us to what depth these trenches were dug?

A I think those depths are given in the exhibits. I don't recall, offhand.

Q Can you estimate or approximate the depth?

A The trenches are probably on the order of 5 to 10 feet deep. The borings are probably something on the order of 15 to perhaps 25 feet or more.

Q Can you tell us approximately how many trenches were dug in the analysis of the ABCD features?

A I don't recall, but I believe the number is stated in one of these exhibits, and I think there are also maps that show their location at various stages of the investigation. There were several.

Q More than 10, or less than 10?

A I don't recall. I think probably more than 10. But I would have to go through these to get the right number.

Q Well, I would appreciate knowing how many there were. I don't want to take a lot of time on this, but --

JUDGE KELLEY: It seems to me, if it is in the exhibit, you can find it. The witness can find it, and let's just go ahead.

MR. BARLOW: Okay.

BY MR. BARLOW:

Q Could you tell us whether or not, in these trenches and in the trench logs, did you find the bottom of the A and B features, or did they continue through the bottom of the trench? Did they go to the bottom of the trench?

A You mean, did we find the end of them in a vertical sense with depth?

Q Yes.

A No.

Q Did you make any effort to dig trenches deeper to find the vertical depth of features A and B?

A No, we did not attempt to find the base of these. There are many of them. It is our anticipation that they extend to considerable depth within the San Mateo formation. There was no particular reason to search for their full depth. These are very minor features.

While they have some characteristics different from a myriad of similar joints and fractures in the area, they are just one minor element here. We had very good exposure in both plan and vertical at the site and in the vicinity, and it didn't seem to us necessary to carry them to great depths.

Q You said that they extend to considerable depth. Can you characterize or specify more what the range is when you use the word "considerable" depth?

A I would say, more than 100 feet. They occur on the ridge in Area 3, which is some 200 to 300 feet above sea level. They occur at the top of the Stage 5-E platform at the site, which is around 55 feet above sea level, and they extend at least to sea level and beyond.

So, in vertical and stratigraphic extent, I would expect we are talking about something on the order of at least 200 or 300 feet, but I don't know that for certain.

Q When you say that you had no reason or no justification for exploring the depth of these features, can you explain why you did not consider it reasonable to look for the depth of the features?

JUDGE KELLEY: I believe he did when he said that. He said that he considered it a minor feature, and he said two or three other things.

MR. BARLOW: Okay.

BY MR. BARLOW:

Q Could the A and B-type features be surface expression of a deep-seated shear zone?

MR. PIGOTT: I am going to ask for a clarification of what we mean by "shear zone" in this context.

JUDGE KELLEY: Yes. Could you give us a clarification?

MR. BARLOW: Yes.

BY MR. BARLOW:

Q In your definition of "shearing," you say that "shearing" is an area in which there is displacement of the sediments or rocks, and a "zone" is where these displacements occur over a width of a few inches or more.

Using your definitions, is it possible that the A and B-type features are surface expressions of a deep-seated shear zone?

A Do you have some scale in mind when you say "deep-seated?"

Q Yes. Would they extend to the wave-cut platform?

MR. PIGOTT: Which wave-cut platform, please?

MR. BARLOW: The wave-cut platform or terrace, which is the area in which the CZD comes up to the surface of offshore.

MR. PIGOTT: I am going to object. This whole question is assuming facts not in evidence. It is completely speculative, without any basis.

MR. BARLOW: Your Honor, we have a crucial discussion regarding the terraces that the Cristianitos zone of deformation cuts through, up to a certain level in the stratigraphy. We are trying to find out if these A and B features go to that depth that the CZD comes up to.

JUDGE KELLEY: So that they meet, in effect?

MR. PIGOTT: If I might be heard further?

JUDGE KELLEY: I have a question.

A few minutes ago, you were asking about -- paraphrasing now -- how far down vertically these features went, and the witness said, I believe, 200 to 300 feet. And now your question about the shear zone and its being deep-seated, is that different than how deep do these go?

MR. BARLOW: Yes, sir. We were asking if there could be a deep-seated shear zone beneath 200 to 300 feet that would meet with the level at which the Cristianitos zone of deformation comes up to.

MR. PIGOTT: The offensive part, Mr. Chairman, is in the mixing of terraces somehow associated with the question in the questioner's mind, at least with the CZD, being significantly offshore and in a different direction. I am having trouble with the connection of unstated depths with something being alluded to literally several miles away.

Now, I am not saying you can't go into this area or that it isn't something you might not want to explore; I just do not like this very hazy and ambiguous phrasing of the question.

JUDGE KELLEY: Well, the ABCD, let's just stick to A and B for the moment; we have been talking about strictly as onshore features, and we have identified where, on this map, they have been found, and they go down more or less vertically. I believe we also have testimony to that effect.

You are exploring a possible link to the CZD, correct?

MR. BARLOW: Yes, sir, and I think, if you look at the area described by the witness as within about a five-square mile area, in which he identified these Areas 1 through 4, and you measured the distance between the reactors in Area 3 and between the reactors in the CZD at its closest point to the shore, you would see that is very similar, and they could extend offshore. They could be beneath the water there.

JUDGE KELLEY: Well, taking into account that I think there are some factual or logical gaps here, I think the thrust of your question has been put, and why don't you then rephrase it, and I will allow the question.

BY MR. BARLOW:

Q Mr. Smith, could the A and B features be surface expressions of a deep-seated shear zone?

A My answer would be no, but I would like to explain that by saying that they are only the surface expression of themselves. They exist within the San Mateo formation because of the characteristics of the San Mateo formation. They do not, as I have described in my testimony, have any zonal distribution that would relate them to some master shear zone, or any particular shear zone, at depth.

They have no characteristics or -- yes, no characteristics that would permit me to relate them, associate

them, to known faults or other types of shears in the vicinity. They are not parallel to the Cristianitos fault or to other faults that we know. They do not maintain a constant proximity to the Cristianitos or any other fault in the area.

They have senses of motion along them that are not compatible with motion on the Cristianitos fault, or other faults in the immediate area, that we know of.

JUDGE KELLEY: You are including offshore faults when you say "other" faults?

THE WITNESS: Yes. As you know in the testimony, the evidence is strong that the sense of slip on the A and B features is entirely horizontal, with no vertical, and without going through an explanation of the mechanics of that, that is one of the reasons that I say we can't relate them to any shear zone, other than the shear zones that are the A-features, themselves, which we see expressed at the surface of the San Mateo formation.

So if your concern is, is there a fault or some zone of deformation within or beneath the San Mateo formation that these A and B features may be a surface manifestation of, then I would have to say no.

BY MR. BARLOW:

Q How deep is the San Mateo formation?

A Well, it varies in depth, as Dr. Ehlig has described, filling a basin or the embayment of the Capistrano

Embayment, as it were. At the site, the San Mateo formation is about 900 feet thick. It becomes thicker to the west, maybe somewhat thicker to the northwest, and in one of the exhibits, I think we made an estimate of the maximum thickness being on the order of about 2,000 feet, maximum stratigraphic thickness, but that was based on early mapping, and Dr. Ehlig would have a much more authoritative and updated view on that maximum thickness.

Q But you say, at the site, it is approximately 900 feet deep?

A Yes.

Q And you said that the A and B features went to considerable depth, which you further clarified to be at least 200 or 300 feet, is it possible that the A and B features extend up to 900 feet?

JUDGE KELLEY: I don't recall the "at least," but perhaps it was during part of your earlier testimony.

You started out by saying 100, and I think you ended up maybe 200 to 300.

MR. BARLOW: Your Honor, I took notes of his exact words.

JUDGE KELLEY: Well, you may be right and maybe I am wrong.

MR. BARLOW: We can look back at the transcript, but I took notes of his exact words at the time.

THE WITNESS: Well, I think I answered both ways, Mr. Chairman. One would make an estimate based on data at various places, and across the region where there is topographic relief in the San Mateo formation, we can find them topographically higher at some places than we do at others, and without seeing the lower extremities of these features, one could assume that they have a vertical dimension that is on the order of the vertical relief in the topography.

Where we see them in the sea cliff, we know they are at least 55 feet in vertical dimension. So that a range of somewhere from 55 to 200 to 300 feet in vertical dimension would be my estimate.

And I think, in answer to your question, Mr. Barlow, could they extend the full depth at the site of the San Mateo formation, I don't know, but I think they could; they might.

BY MR. BARLOW:

Q Thank you.

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Q On page 5 of your testimony, line 20 -- excuse me, actually, I will read that part too. I am interested in the length of the A features and you say here that the A features strike nearly north/south and vertically. The longest feature is about 800 feet.

On line 25 and 26 you say, suggesting that they are dying out as they reach the northern and southern margins of the site.

Now I would like you to explain to us about the northern and southern extent of the A features. Say the longest feature is about 800 feet. That is the longest single strand within the A-type features at the site?

A No, that is misleading. I can see that now as you read it, but I wonder if, before we leave this vertical extent, I would like to just add to my previous answer so I don't leave something unclear.

As to the vertical extent within the San Mateo formation at the site, I think it is likely that they extend down below the site a few hundred feet. If they go to the base of the San Mateo formation, which is speculation, but if they do, I would not expect them to continue beyond the base and extent into the Monterey formation.

I think that would be most unlikely, so I think there is a bottom limit, if you will, on the vertical extent of those features at the site.

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As to the length, I would like to refer you to Figure JLS-N which is a location map of those features at the site. There is a bar scale indicated there just to the upper left of the title of the figure.

The A and B features are found on the left-hand side of that figure. The A features are the ones that are approximately north/south and form an acute angle with the B features that are roughly parallel to the bottom of the page.

The reason that that 800-foot maximum dimension is misleading is because the A features everywhere we have found them are offset and interfered with or are interrupted by the B features.

The longest length of any A feature, of which there are several that you can see here, would be approximately the dimension between any two B features.

There may be a few B features that do not interrupt the A's but in almost every case where there is a B feature crossing an A feature, there is an interruption.

So to be quite correct, there first of all is no single feature that is 800-feet long. There is really no single feature which collectively would be 800-feet long, but when you add up the number of offset segments together, then you can trace a series of A features across the site from south to north that are at least some 700 or 800 feet long.

The other part of your question was they are dying

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out, I believe.

Q Well, actually I would like you to explain how you determined the northern extent and southern extent of the A features. For example, at the southern extent, do the A features do into beach sand?

A The absolute end of the A features could not be found because of the thickness of saturated beach sand which precluded trenching but the decreasing progression of width to the A features as we approached the sea cliff from the central part of the site, indicated that there was a dying out.

Each individual feature or zone goes from about four to six inches wide in the central part of the site to something on the order of a quarter-of-an-inch to three-eighths of an inch when you reach the sea cliff.

It is just fortuitous that we ran out of exposure and were unable to excavate beyond that to find the absolute ends.

The B features, of course, which commonly offset the A features, we can, in most cases, find the absolute termination of them. Most of them -- in fact all of them as far as we can tell -- die out within the site to the southeast and the nor'..west.

Q Now you are talking about the B features. I am interested in the A features. Am I correct in understanding what you have just explained as saying you could not actually

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determine the southern end of the A features because they run into saturated beach sand?

A That is right. We could not observe the absolute end but our deduction based on the very clear thinning of each feature led us to conclude that they must die out within a very short distance to the south of the sea cliff and that is partly based on our observation of the B features which are identical in physical characteristics, where we can see them much more broadly exposed.

So taking the nature of the B features and the way they terminate, knowing their relationship and comparability to A's, I think it is reasonable to conclude that the A's are dying out shortly to the south and our conclusion is similar to the north.

Q Is it not also reasonable to postulate that the A features continue to the south into the ocean?

A There may be A features that continue. There may be new A features that start up. As you can see on this map, there are A features that do have terminations. For example, just north of the Unit 2 excavation at the base of the cut slope adjacent to that bench which has the short vertical lines on it, there are two A features which trend south from there that die out within about 80 or 100 feet and they do absolutely terminate there.

So those we know terminate within the site. Other

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A features take up and continue southward to the left and they show a progressive and distinct narrowing to the south very much as the others do and so we just come to the logical conclusion that they are going to follow suit and die out very shortly.

Q Looking at your Figure JLS-N at the southern extent of the mapped portion of the A features, I notice that -- well, first of all, to the north of the reactor foundation the A features are of a certain width and then as they progress through the Unit 2 foundation they seem to widen and as they leave the foundation area they seem to be at their widest extent there.

A No, I think you are misconstruing that. The features are not becoming wider. Other features are being picked up. These are additional A features.

Q Could you refer to these features as a sheer zone?

A I wouldn't refer to them as a sheer zone at this scale, no. They are not a sheer zone in that sense. At the scale of this drawing they are the traces of joints with very little amount of offset. I think it would be misleading to call them that.

Q Perhaps you missed the point I was trying to make. Could we call it a zone of features?

MR. PIGOTT: I believe that has been asked and answered. I think the witness put it into the context and this

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becomes argumentative.

MR. BARLOW: I think he is misunderstanding the point.

JUDGE KELLEY: I think Mr. Barlow is driving at something somewhat different, so I would ask you to restate the question.

BY MR. BARLOW:

Q If you looked at the width of the A features as they crossed the Unit 2 foundation, would you agree that as they progress from north to south the width on your map widens?

A There is a zone of individual sheers and small sheer zones a few inches wide which collectively could be described as a zone and is wider to the south, but when you have a mass of rock that is jointed, especially with a conjugate intersecting sets of joints as we have here, there are many different ways that you could define zones.

Indeed one could take a pair of A and B features and refer to that as a zone. It depends a lot on the scale with which you observe them, but I don't think you should read into the increasing number of A features to the south as indicating a greater magnitude of sheering because individually they do not indicate that.

JUDGE KELLEY: Let's take a 15-minute coffee break at this point.

(Brief recess.)

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JUDGE KELLEY: Back on. So we are back on the record, and Mr. Barlow, you can resume.

BY MR. BARLOW:

Q Okay, we were discussing the links of the features labeled A type features, and I believe you said, Mr. Smith, that the -- at the southern end of the A features, they disappear into saturated beach sand.

A I would like to correct that implication. I may have incorrectly given you that impression, Mr. Barlow. I didn't mean to say that they died out into the beach sand. I merely meant to indicate that we were prevented by the beach sand from observing the features. The features do not exist in the beach sand. Were they to do that, it would carry an implication of recent age of formation, and of course as I have testified, and the documents clearly indicate, these features do not disturb the overlying stage 5E marine platform or its deposits, which are 125,000 years, so I don't wish to indicate that they in any way affect the beach sand.

Q Thank you for that explanation. I appreciate it. One thing I am having a hard time understanding, though, is you have said that previously, you said that the type -- A type features narrowed to the south, and yet when I look at your figure JLS-N, they seem -- the zone of features seems to widen as it goes from north to south. Could you explain how they could be both narrowing and widening at the same

time?

A Well, you wish to characterize them as a zone, and I allowed as how you could. The features themselves do not widen. The features themselves become narrower. What you are seeing as you go southward is the addition of additional features lying sub-parallel to other A features. In defining a zone for some purpose, you have to look at the area as well as the scale at which you are talking, and for example, when you look to the north end of the A features, we have three A features there in a row that span a distance of, judging from the scale, some 60 feet, but I wouldn't define that as a zone. Certainly there are at least three parallel features over that width, but I wouldn't say there is a zone 60 feet wide, because indeed we know that two of those features to the east, of the longer A, die out, and don't continue to the south, and we are back to one, and on two, and then three and four, and probably as many as five six as we go to the south.

Q By die out, you mean they go into the beach sand?

A No, the features I am talking about that die out, they stop and can no longer be found. They do not exist any farther south in the San Mateo formation than we map them, and these are the two that are to the east of the longer series of features, and indeed a series might have a less prejudicial implication than the term "zone."

Q Okay. I believe I understand what you are saying. The two that you say die out are at the top of the -- your diagram?

A That is right.

Q Is that correct? And the two that I misunderstood you to be talking about are at the bottom of the diagram. And -- okay, I would like to ask you, how did you determine the northern end of the A type features? You show them in your diagram as ending at a line that seems to truncate them, which is perhaps a structure there. Were there any trenches to the north of the area on your map labeled 84 and 85? At the northern end -- the northern extent of the A features on your diagram, Figure JLS-N, where the numbers 84 and 85 occur, were there -- you seemed to indicate in this map that the A features end around that area.

Did you or your assistants investigate with trenches and borings or anything else to the north of there?

A Well, to answer that, I would like to refer you to my exhibit JLS-1, Applicant's 25, drawing number 3. That drawing is a long fold-out. This drawing reflects the location of the features at a time earlier than figure JLS-N in my testimony, and depicts a little more clearly the nature of the geology, at the site. The A features and the B features are shown in less detail here because the excavation was in progress at the time drawing 3 was prepared, had not

reached the level either of excavation or detailed scrutiny that figure JLS-N represents, but on drawing number 3, you will see that at the north end of the series of A features, there is a line that runs parallel to the long dimension of the map that has above it a stippled pattern that is labeled QT-1B. This stippled pattern above that line, which goes across the A features, represents the extent of combined marine and non-marine terrace deposits across the site, that lie directly upon the erosional platform of the stage 5E terrace, and that platform and its immediately overlying deposits are the ones that have been dated at about 125,000 years.

Those terrace deposits are quite thick there. They are well-exposed, not only in a cut slope, but in a couple of shallow trenches that we dug at this early stage, and while they demonstrated that the A features did not in any way affect the platform or the overlying deposits, they also prevented us from observing the A features farther to the north, so the feature as mapped here to the north does not stop at that line, but our ability to observe it stops.

The feature A at that point is a single feature. It occurs in a small, in a narrow zone about two to three inches wide, at the northern extremity immediately below the terrace deposit.

Q Now, are these terrace deposits, which you said

were dated at approximately 125,000 years, are these the same terrace deposits that are alleged to cap the Cristianitos fault in this area?

A Well, they definitely do cap the Cristianitos fault farther down the coast, and they are the same -- same deposits here at the site.

Q So the same deposits that cap the Cristianitos fault are capping feature A here?

A Yes. And feature B, all the A and B, C and D features are capped without disturbance by those deposits and the platform.

Q Do the features, the A type features, extend up to that terrace?

A Yes, they extend up to the marine platform erosional surface. They do not extend beyond it into the marine deposits, nor do they disturb the platform.

Q Therefore, would it be reasonable to deduce that the A type features are approximately the same age as the Cristianitos fault?

A No, that would not be correct. They are obviously older because of that relationship.

Q They are both capped by the same marine terrace, and come up to the same surface.

A Well, was your question, are the A features older than that surface?

Q No, my question is, if the A type features come up to the same marine terrace as the Cristianitos fault does, and both are approximately 125,000 years old, then are they not approximately the same age?

A No.

MR. PIGOTT: The terrace is the same terrace, and is the same age. Are you trying to ask whether or not the underlying fault is the same age? I think he has answered that about three times the same way.

BY MR. BARLOW:

Q Is the terrace the same age?

A The terrace is the same age. The features are not necessarily the same age as the Cristianitos, based on that relationship, and for other reasons that are described in the testimony, the A-B features are suggested to be -- to be hundreds of thousands of years old, whereas we know the Cristianitos was initiated some millions of years ago, and has not moved, most likely for several million years. The point to be made here, just for clarification, is that the lack of disturbance of the marine platform, and the overlying deposits puts an absolute minimum age, minimum age, on the formation of the A and B features.

It does the same thing for the Cristianitos fault, puts an absolute minimum age of last movement, and from that relationship alone, we can say that the A features, as well as

the Cristianitos fault, and the B features, C and D, formed prior to the development of the stage 5E platform, which means prior to 125,000 years ago. It doesn't mean they formed at 125,000. It means prior to.

Q If the Cristianitos fault comes up to the Marine terrace, does that mean that -- and you say that the minimum age of the Cristianitos fault is 125,000 years --

A That is not --

MR. PIGOTT: I am going to object to this line of questioning. I think we are now attempting to go into an investigation of the Cristianitos and not the A-B-C-D features. I can understand the clarification with respect to the use of terraces, but to now go into an examination of the Cristianitos is beyond the scope of this issue.

MR. BARLOW: It is merely to compare the A type features to the Cristianitos fault, Your Honor.

JUDGE KELLEY: I am sustaining the objection. It seems to me that you have crossed over into another area that is not before us today, at least not from this witness.

BY MR. BARLOW:

Q Mr. Smith, would it have been possible for you and your assistants to further examine the northern extent or length of the A type features, if you had dug trenches to the north of this area on your map and on your drawing number three?

A Well, I think the answer to that is a function of how practical it becomes to dig a trench very deeply. The terrace deposits that overly the features everywhere we find them adjacent to the features, in this area north of the site are very thick. They are -- they approach 60 feet or more, in thickness, and it -- that is very impractical to excavate a trench that deep, and I won't say it is impossible. I suppose it can, but that would be extraordinary. I have never been involved with an exploratory trench like that.

Q In your work over the past ten years on the San Onofre site, can you estimate how much trenching has been done within five miles of the San Onofre reactor site?

MR. PIGOTT: I am going to question the relevance of that particular question.

MR. WHARTON: Mr. Chairman, one of the issues assumes adequacy of investigation. We are looking at some features here that have some implications and we are wanting to find out how much research they did, how much work they did to determine the full implications and the full --

MR. PIGOTT: Objection. There is -- if I might comment further, there is no issue here on adequacy of investigation. That is a mischaracterization of the issue.

MR. WHARTON: Mr. Chairman, they were -- if I can get the letter out, if we want to refer to that at this point, on the order, but certain issues such as this were

subsumed in other issues, and I believe this is one of them.

JUDGE KELLEY: There was earlier discussion. Certainly the Intervenors at an earlier stage wanted specific contentions on adequacy of investigation. There were pleadings from both the Applicant and the Staff addressed to various of those contentions. I seem to recall at least the Staff saying that the adequacy at least of their investigations could be looked into within the context of the contentions we ultimately admitted.

I don't recall your position, Mr. Pigott, in this regard. It does seem to me that the concept of adequacy of investigation has a place in a hearing of this kind. It is the kind of a thing that if you pursue it very long, you can very quickly put more into it than what it is going to get you will warrant, so that I approach the whole subject with a certain amount of caution.

There was an interrogatory on trenching, which I believe I allowed over objection, involving trenching here, as opposed to trenching at the Vallecitos fault, my recollection serves me. But that was much more specific. Your question now, of how much trenching has been done at the San Onofre site, over the last five years, was that the question?

MR. BARLOW: Since the construction permit was issued.

JUDGE KELLEY: Okay. Over the last --

MR. PIGOTT: I would question the relevancy of trenching since the construction permit. If -- what are they driving at? The level of investigation with respect to the A-B-C-D feature? That is fine, I have no objection to that. I mean, the A-B-C-D features are clearly an issue. The question of general adequacy of investigations, I objected to that previously. I think it was sustained. There was no basis, no showing that that should be an issue in this proceeding.

JUDGE KELLEY: Oh, I certainly meant to say nothing to the contrary to that.

MR. PIGOTT: Okay.

JUDGE KELLEY: When one talks of inadequacy, one has to say inadequacy with respect to what, and for what reason, and so on, and get pretty specific. Otherwise, it is just a morass. I do think your question as phrased, and maybe you want to restate it, but I think it is too broad, but restate it.

MR. CHANDLER: Mr. Chairman, before Mr. Barlow does that, just for the record, I am not sure I would agree with the Chairman's characterization of the staff's position on the contentions on adequacy. We need not get into that, I think.

JUDGE KELLEY: I don't think we do, because it

wasn't crucial to what we are --

MR. CHANDLER: Exactly.

JUDGE KELLEY: That was just background. Go ahead. Could you restate that question?

MR. BARLOW: Yes, sir, and just to put it in context, we are discussing contention number 3, which involves discoveries, geologic discoveries subsequent to the issuance of the construction permit --

JUDGE KELLEY: Yes.

MR. BARLOW: -- of a list of geologic features, perhaps the question was -- well, the question was rather broad, but I was addressing it to all of these features, rather than just the A-B-C-D features. I could break it down into --

JUDGE KELLEY: I don't think that is a useful question. It seems to me that one feature may require one certain amount of trenching, and some other feature may require none at all, and some sort of aggregate number of X hundreds or thousands of feet of trenching, I think is irrelevant, and we have talked about trenching to some extent with respect to A-B-C-D already, and perhaps enough, but that broad question about total trenching in the past, since the CP, I think is too broad, and not meaningful anyway, so I am going to sustain the objection to that.

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BY MR. BARLOW:

Q. Mr. Smith, were vibro site studies conducted in relation to the ABCD features?

A. Vibro sites being a land-based seismic reflection profiling type of investigation? No.

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Q. Were any seismic reflection and refraction studies conducted by the Applicants' consultants onshore within a five-mile radius of the site?

MR. PIGOTT: Is this just another general question or is this going to the ABCD features?

MR. BARLOW: Well we've discussed on Page 6 of the witness' testimony -- he discusses several locations within a five-square-mile area where there are A and B type features, and I'm asking --

JUDGE KELLEY: Could you repeat your question, please?

MR. BARLOW: Yes.

Were seismic reflection and refraction studies conducted by the Applicants' consultants onshore within the five-mile radius of the site?

JUDGE KELLEY: Do you mean with respect to ABCD?

MR. BARLOW: Well I would like to know if they were conducted with respect to any of these features that we're looking at.

JUDGE KELLEY: You have to tie it down.

MR. BARLOW: Okay.

BY MR. BARLOW:

Q. Were any of these type studies conducted with respect to ABCD type features?

A. No, they were not and there really would be no purpose in doing so. These are such minor features, there would be no way of observing them on those types of seismic reflection profiles.

On the other hand, some limited amount of seismic reflection work has been done in the region of the Capistrano Embayment. The exact location and nature of the lines I'm not very familiar with, but it has been done for petroleum exploration purposes in the region and some of that data has been reviewed by consultants to the Applicant, but certainly not for any evaluation of these small ABCD features.

Q. Were any of these type of seismic studies conducted by the Applicants or their consultants in regard to the Cristianitos fault zone?

MR. PIGOTT: I'm going to object.

First of all, it's again going back to try to get into a question of Cristianitos fault without any kind of a showing, with any kind of an issue.

I'm also objecting to the form of the question, "these kinds of seismic studies".

I don't think we have any showing as to whether or not we're talking about something relevant or, for that matter, not much of a showing on the record as to precisely what these studies are, what they might accomplish or

whether there is something that should be concerned. They're extremely undefined.

JUDGE KELLEY: Can I step back and ask Mr. Smith a question.

You mentioned some studies of this kind to look for oil in a certain area near the site.

Now, apart from that, do you know of any onshore seismic studies, if you will, with respect to SONGS 2 and 3 et al.?

THE WITNESS: I know of none that were conducted onshore specifically for the Applicant. There may have been some but certainly not to look for these kind of features or --

JUDGE KELLEY: Right. I understood it why you said that you couldn't find the small feature on one of these --

THE WITNESS: Right. But those that did exist in the area is part of a comprehensive investigation where there were attempts to obtain that, to observe them, to correlate that with surface mapping and drill a hole data, both shallow and deep, in order to come up with a comprehensive understanding of the three dimensional geology and evolution of the site and time.

JUDGE KELLEY: Mr. Barlow, your last question to which objection was made, was that, to refresh my memory,

a question about seismic type research or broader?

MR. BARLOW: Seismic research, seismic reflection or refraction studies.

JUDGE KELLEY: I think he's pretty well covered the waterfront as to what he knows about that kind of research.

MR. BARLOW: Okay. Just one last question in that area.

BY MR. BARLOW:

Q. The Capistrano Embayment seismic research that you mentioned, that was done for an oil company or petroleum research; is that what you said?

A. It's my understanding that the seismic reflection profiles done in the vicinity of the Capistrano Embayment were done for or by one or more oil companies for purposes of petroleum exploration.

MR. BARLOW: If I may ask one more question along this line.

BY MR. BARLOW:

Q. Are you aware of information or data from recent wildcat oil well drilling being conducted by a major oil company inland from the SONG site?

MR. PIGOTT: I'd like to know what the relationship is of this to the ABCD features or any of the other features? We're on a witch hunt.

MR. BARLOW: It's my understanding that this drilling is being done along the Cristianitos fault zone near the SONG site. I'm wondering if the Applicants' consultants have analyzed the data from the drilling.

JUDGE KELLEY. What does that have to do with the ABCD features?

MR. BARLOW: Well, on Page 7 of the witness' testimony, he discusses -- well he states, beginning on Page 6, that, even those these A and B type features are found in several locations within a five-square-mile area, that, in his opinion, they are not in any zonal distribution or any constant proximity to the Cristianitos fault, and he has referenced the Cristianitos fault quite a few places. In fact, in Exhibit 25 --

JUDGE KELLEY: Okay. Are you aware of any such exploration?

THE WITNESS: No, I'm not.

MR. BARLOW: Okay.

BY MR. BARLOW:

Q On Page 13 of your exhibit JLS-1 -- well, beginning on Page 12, you begin to discuss the Cristianitos fault, and, on Page 13, you say at the top of the page, "The maximum displacement is estimated to be 5,000 feet at its mid-point," and, in the next sentence, you say that the Cristianitos fault zone contains two main branches which

are nearly parallel and range from 200 to 800 feet apart.

When you're discussing branches here, are you discussing the branches in the sense that -- on your Map Sheet 25 in Appendix C to this exhibit, you have a map of the Cristianitos fault zone with two lines representing the zone. Are these the two branches that you're discussing here that are nearly parallel and range from 200 to 800 feet apart?

A. The lines that are drawn on Drawing 25 to depict the Cristianitos fault were drawn so to represent generally the location of the fault, not for the purposes of specifically depicting the characteristics of the fault.

The Figure 25 was based on a generalization of drawing number 2 of that exhibit, which is a reproduction of an earlier geologic map prepared in 1970 which shows the fault in somewhat different manner.

Subsequent mapping in more detail with a greater regional knowledge of not only the stratigraphy and structure but the evolution of the Capistrano Embayment which was done by Dr. Ehlig has added further detail to our knowledge of the Cristianitos fault.

The text on Page 12 and 13 attempts merely to summarize in a general way the Cristianitos fault as it was known at that time and as it was taken from the earlier report prepared by Converse, Davis & Associates back in

1970. So its purpose here was simply to describe in general the fault as background for further discussion of the ABCD features. It was not purported to be the definitive characterization of the Cristianitos.

At any rate, it was a description of the Cristianitos as we knew it at that time and I think it's significant to note that Dr. Ehlig's portrayal of it is the current and updated version.

Q. Thank you. Before we leave that Page 13 in your exhibit, the seventh line from the bottom of the page --

A. Which page? I'm sorry.

Q. Page 13 in Exhibit 1. It's your Exhibit 1, Applicants' Exhibit No. 25.

You state on that line that -- well that line says the Cristianitos is older than 33,000 years. The context above it says that carbon 14 dating of shell fragments taken from correlative terrace deposits about four and a half miles south of the site and 17 miles northwest of the site indicates that the terrace overlaying the Cristianitos is older than 33,000 years.

And then you go on to say that, "Another dating technique of shell materials indicates the terrace is at least 70,000 to 130,000 years old.

Now is this terrace the same one that you're now saying is 125,000 years old?

MR. PIGOTT: I'm going to object to this as --

MR. BARLOW: As capping the ABCD features.

MR. PIGOTT: -- an absolute refusal, apparently, to listen to the rulings of this Board with respect to staying out of the Cristianitos fault an issue per se. I submit Intervenors are just attempting once again to make a new issue and I object.

MR. BARLOW: Your Honor, the witness testified that there is a terrace capping the ABCD features which is the same terrace capping the Cristianitos fault.

JUDGE KELLEY: Yes, I understand that.

This statement of 33,000 is exactly where?

MR. BARLOW: Page 13, the seventh line from the bottom.

MR. WHARTON: Mr. Chairman, again I would like to point out that the exhibit is part of his testimony. It's being presented for the truth of it here.

The Cristianitos is referred to all through this exhibit. He's tying it together and I think we should be able to pursue what he says in this exhibit regarding the Cristianitos.

JUDGE KELLEY: Well I'm not so sure about that, so let's talk about it for a minute.

This exhibit was put in, as I recall it, the other day in connection with Mr. Smith's initial appearance and

Mr. Smith, at that time, spoke very generally to the geography of the entire area. I believe that this exhibit was primarily in connection with that.

Now, let me just go on.

In connection with ABCD --

MR. PIGOTT: Mr. Chairman --

JUDGE KELLEY: Yes.

MR. PIGOTT: -- a correction before we go any further.

I believe that this exhibit did come in with today's --

JUDGE KELLEY: Then I'm wrong.

MR. PIGOTT: Yes. It came in with today's testimony not the previous one.

JUDGE KELLEY: Very well.

MR. WHARTON: It says Analysis of Geologic Features at San Onofre --

JUDGE KELLEY: Then I'm simply wrong about that.

MR. PIGOTT: I don't think it changes the context, but I did want the record --

JUDGE KELLEY: Well I appreciate your correcting me. I was simply wrong.

Were there any exhibits the other day in connection with your opening presentation, Mr. Smith?

MR. PIGOTT: Exhibits, not figures.

THE WITNESS: No, I don't believe there were.

JUDGE KELLEY: Okay.

MR. WHARTON: Mr. Chairman, if you would turn to the exhibit, there's a whole section on the Cristianitos fault, Page 12, 13, end of 14. This is part of thier testimony.

JUDGE KELLEY: After 12, 13 and 14, we get on into A and B.

MR. WHARTON: That's correct.

MR. CHANDLER: Mr. Chairman, may I be heard?

JUDGE KELLEY: Yes.

MR. CHANDLER: Thank you.

I think when one looks at the references that Mr. Wharton just made, Pages 12 and 13 for example, it suggests strongly to us that this discussion of the Cristianitos fault appears to be here for purposes of context rather than an evaluation of the Cristianitos fault.

It certainly does provide a geologic context and I certainly would agree, for example with Mr. Pigott, that this is not the appropriate time for consideration of something th seems more appropriately reserved for other parts of t case, if at all.

At the same time, I think the way in which Mr. Barlow's question was phrased is appropriate. I happen to agree with what he's raising -- it's here for purposes of

dating, not so much the Cristianitos fault, but with reference to the ABCD features at the site as --

JUDGE KELLEY: Well, in a narrower question itself, given the fact that we've heard 125,000 times and again in various contexts and now we've got a statement of 33, just for clarity of the record, we can find out what that means.

What I find a little more troublesome is the extent to which we're going to get into the Cristianitos fault again in the context of what at least started out to be a discussion of the ABCD features given some earlier questions about their comparative alignments and the like, but I think --

I also agree with you, Mr. Chandler that, at least on the basis of counting pages, three pages double spaced is not exactly an in-depth exploration of the Cristianitos fault.

The thrust of this is the ABCD and what they're all about.

MR. PIGOTT: I would like to point out one additional thing and that is, just to put it in context, the exhibit was done -- well the ABCD features were discovered subsequent to the CP at the time of excavation. That was back in 1974. This report was done in 1974.

One of the issues with respect to the

investigation at that time was, of course, extremely comprehensive. It had a tremendous impact on the construction of the site.

You would expect that, in reports generated at that time for that purpose there is going to be a very wide-ranging and general discussion of the terrain in order to be able to focus on what has actually occurred at the site. This is a 1974 report prepared for that purpose and now we have an issue in front of us purely and simply with respect to the ABCD features and I think it's an improper use of the document to use it as a launching pad for a new issue.

With respect to the 33,000 year old -- it'd take less time to answer it than to argue about it.

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ghp 1

JUDGE KELLEY: I am in general agreement with that, too. So why don't you put your question about clarifying the 33,000 and what that means. I don't think it is appropriate, in this context at least, to get into the Cristianitos and I don't think it is at all necessitated by the fact that there are some references in this exhibit to it.

By the way I might add that I find nothing to this effect in your cross examination plan which I would expect to find there if you were going to go off in that direction, so go ahead with the 33,000 question.

BY MR. BARLOW:

Q Mr. Smith, could you explain the discrepency between the numbers 33,000, 70,000, 130,000 and 125,000 in the context of this discussion on page 13 of your exhibit and on previous references to the age of the terrace?

A There is no discrepency but I can put into the correct context the different ages that are given. I think ultimately it will become clear when Dr. Shlemon testifies because he has done the really definitive work on correlating and dating the terraces and it is his work. In that regard it should be relied upon.

In part because of the reference at the end of that paragraph on page 13 to the PSAR, the implication that this information was taken from what had been presented in the PSAR. It does reflect what we knew about the age of the terraces or

ghp 2

of the terrace at that time.

The terrace that is being examined and its overlying deposit here is what is now known as the 5-E terrace from Dr. Shlemon's studies. Prior to 1974 fossils had been collected four-and-a-half miles south of the site and some 17 miles northwest of the site.

As you probably realize, it takes a great deal of searching to find fossils in terrace deposits. The searching that had been accomplished to that date was able to locate two areas where dating could be done.

Carbon 14 dating of shell fragments, of course, is limited effectively to some 30 to 40 thousand years and the statement that the terrace overlying Cristianitos is older than 33,000 years simply means that the age dating capability of the carbon 14 method was exceeded at that location and that the deposits containing the shells were older than that.

Using another system of dating -- lythorium protactinium (ph.) dating which Dr. Shlemon, I believe, goes into in some detail -- was able to extend the age range for those sediments overlaying the terrace platform to a period of 70 thousands to 130 thousand years old.

Subsequent studies in, I think, 1976 or 1977 by Fugro in response to some NRC questions about this very subject of correlating the terraces provided a tighter time range on the age of that terrace platform at about 120 thousand years.

ghp 3

The current date, which should be relied upon, as I said, is 125 thousand years.

So the different dates that are obtained are simply a function of the age-dating methods. They are all consistent with one another and the cumulative result now is that we very firmly have a very important time line through the site and in the region that allows us to say what the minimum age of last movement on faults and other features are for 125 thousand years.

Q Earlier in the discussion you pointed to a place where the A-type features contact the marine terrace and are capped by the marine terrace. Could you tell us to what extent geologic research methodologies are used to search for the A-type features inland from that point to ascertain their length?

Excuse me, could you tell us what sort of geologic research methodologies were conducted inland from the A-type features to ascertain their length?

A Well, I presume you mean geologic activities. The geologic activities included those observations made generally in the mapped area of Drawing No. 2 of my Exhibit No. JLS-1 plus specific observations at a number of localities since 1970 to ascertain the nature of the San Mateo formation and any discontinuities that might exist within it.

Since 1974 there have been a number of observations

gbp 4

in the vicinity mapped on Drawing No. 2 that have been for the purpose of locating A, B, C and D features outside of the site and I have already described the areas where they were found.

I haven't pointed out all the areas where they are not found, but I certainly could do that, because there are extensive areas where the San Mateo formation is excellently exposed.

MR. PIGOTT: I will object to my witness' answer if he tries to do that.

WITNESS SMITH: Okay, I will curtail that.

JUDGE KELLEY: Overruled.

WITNESS SMITH: The San Mateo formation is really remarkable in terms of its lack of fracturing and jointing so we have made many observations outside of the site. We have done no specific excavation or drilling to search for any of these features because largely we have had sufficient exposure to judge their orientation and their geometry and their relationships to each other.

BY MR. BARLOW:

Q What level of confidence would you ascribe to your conclusion that the A-type features die out at the place where they are capped by that terrace?

A I can't give you any quantitative level, if that is what you are seeking. I don't know how to do that.

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Q Let me rephrase the question. Is it reasonable to deduce that the A-type features could extend further to the north than you have mapped, beneath the terrace?

A I think it would seem to me that the features that we see at the site do not extend very far beyond the extremities where we have mapped them.

We do know that there are other A features in the region and I already discussed those too long, I think. So we know that they exist elsewhere at least northwest of the site.

Q Did you make any attempt to see if the projected strike of the A-type features at the site lined up with the projected strike of the A-type features in Area 3?

A No, I didn't. That would be impossible for them to line up. If they are both north/south striking, as I indicated, and if you are talking about the A features, and they lie at the positions I have indicated on the map, there is really no way that they could align with each other with the Area 3 lying to the northwest.

Q Do any of the A-type features have northwest trends?

A No.

Q Has any research been conducted by the Applicants or their consultants regarding the A, B, C, D-type features since the discovery of the Cristianitos Zone of Deformation in 1980?

MR. PIGOTT: I think I will object as going beyond

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the scope of this gentleman's direct. As a matter of fact, that question is answered by Dr. Shlemon in his work.

MR. WHARTON: Your Honor, the Applicants here would like us to consider A, B, C, D features by themselves as just little marks on the ground that have no significance. What we are saying here is that there has been a new discovery of Cristianitos Zone of Deformation which trends toward the shore and we are asking here to put the A, B, C, D features in the context of the CZD that projects on shore to see whether there is any possible connection, or if there is any relationship, between the two. I think it is an area that needs to be pursued.

MR. PIGOTT: And it is pursued and it is not pursued by this witness.

MR. WHARTON: He knows the features.

JUDGE KELLEY: I will allow the question.

MR. PIGOTT: Objection; he does not know the CZD features. He is not a CZD witness. He knows the A, B, C, D features.

JUDGE KELLEY: Isn't he your researcher on A,B,C,D?

MR. PIGOTT: On A, B, C, D, but the question goes to whether or not there is connection with the CZD at the shoreline and what I am saying is, there is another researcher who looked at that, whether or not there is any expression of the CZD in the sea cliffs and that is Dr. Shlemon.

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MR. WHARTON: That is not the same question.

JUDGE KELLEY: Your question, if I heard it correctly, was whether any research had been done on A, B, C, D since the discovery -- I will put discovery in quotes -- characterization of the CZD as such in 1980; is that the question?

MR. BARLOW: Yes, Your Honor.

JUDGE KELLEY: Bearing in mind your point, Mr. Pigott, I will allow the witness to answer.

MR. WHARTON: Mr. Chairman, I am wondering whether you could expect an objection when we start talking to Mr. Shlemon about whether the CZD has anything to do with the A, B, C, D features because he doesn't know anything about the A, B, C, D features.

I think it is very unfair to have it segmented as to people we can talk to when it is a big picture we have to look at.

JUDGE KELLEY: I said you could ask the question. We will cross that bridge when we come to it.

BY MR. BARLOW:

Q Did you get the question, Dr. Smith?

A I think so. I think the question was, has there been an analysis of the A B, C, D features since discovery, to use your terms, of the CZD, meaning Cristianitos Zone of Deformation.

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Insofar as I am aware of the Cristianitos Zone of Deformation, so called, and where it exists and what some of its general characteristics are, I can say, first of all, I think it has been indicated, the CZD was not discovered in 1980. It was named in 1980.

The features that that zone constitutes have been known since the earliest off-shore geophysical studies by Marine Advisors. They named it something else.

Subsequent studies in the few years following the Marine Advisors by the Board of Technical Review, of which I was a part, identify the features that lie along it and it was not referred to as the Zone of Deformation.

So I think to make it clear here, that discovery, as you mentioned it, is misleading. However, I have considered -- I have not made an in-depth analysis because I don't think it requires it -- I have considered whether or not there is anything about the A, B, C, D features that might relate them to any of the features we see off-shore in the vicinity of the so-called CZD and my conclusion is no, there is nothing.

There may be some features off-shore that have an orientation that is similar to some of the features, but that by itself is not a strong indication of anything except their geographic orientation and I can give you a number of reasons why there would be no relationship but it is true. I have not studied in depth the CZD.

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That is not only Dr. Moore's area but specifically looking on-shore for evidence of CZD-type features, that has been the pervue of Dr. Shlemon.

What observations I have made over some 10 or 12 years would conclude that I see no evidence of CZD on shore.

Q Mr. Smith, as a geologist, if you projected the strike of the A-type features off-shore, would they intersect with the CZD?

MR. PIGOTT: Sir, could we make sure that the witness has a frame of reference what you are talking about, A-type features?

BY MR. BARLOW:

Q The A features that you have mapped in the A, B, C, D features at the site.

MR. PIGOTT: I thought you used the word off-shore.

MR. BARLOW: Yes.

BY MR. BARLOW:

Q If you projected the strike of the A-type features at the site into the off-shore region.

MR. PIGOTT: Not to be mixed with something called an A feature all day yesterday.

MR. BARLOW: Correct.

JUDGE KELLEY: Yes, that was a fault on the map; right?

MR. PIGOTT: Right.

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JUDGE KELLEY: Fine.

WITNESS SMITH: I can't answer that, Mr. Barlow. One can project the orientation of a feature that has a north/south strike to the north or the south in this case and I can't say how far those features go, but you can make a geometrical projection on a piece of paper or on a map to infinity to see what they intersect with but I don't know the meaning of that intersection and I could not make a projection that would imply there is an intersection. There is just not enough information.

BY MR. BARLOW:

Q Let me ask you this. If you took the map prepared by Dr. Greene and Dr. Kennedy and looked at the trend of the Cristianitos Zone of Deformation, which has been described as trending north/south and you looked at your maps of the A, B, C, D features beneath Unit 2, and you looked at the strike of the A-type features and you drew a straight line on a map from the A-type features to the CZD, would they line up?

MR. PIGOTT: I am going to object. I believe the witness just answered and not only just answered, he has answered why it has no significance.

One could search for features in Nevada, Nebraska and New York that all pointed toward San Onofre and line them up with a ruler and that has no probative value and we have gone through this over and over and over again. I object.

MR. BARLOW: Your Honor, this is probably the most

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probative question of the day. Do the CZD features and the A, B, C, D features line up and connect.

MR. CHANDLER: I think we have had an answer to that question a couple of times, though, Mr. Chairman.

MR. WHARTON: Mr. Chairman, I believe also the question was asked in the form of a hypothetical. That is, given that they go off-shore, where do they go. We are not saying that that is the case, but where would they go. Given all these things that we do know, where would they go. I think it is an appropriate question and it is one that you are going to have to consider.

JUDGE KELLEY: Will that conclude your questioning on the A, B, C, D features provided I allow this question?

MR. BARLOW: On the outline I have two or three other questions, but I could restrict it to that.

JUDGE KELLEY: The outline of points frequently represented a lot more questions than that. They are more like subjects. Finish up A, B, C, D in the next five minutes and you can ask that question you just asked.

BY MR. BARLOW:

Q Can you answer the question?

A I don't see that they line up. I don't think that it would be a reasonable projection.

Q Have you attempted to make that projection on a map?

A I have now. I have only generally made the

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observation in the past and I don't see any alignment.

Q Have you ever taken your map of the A-type features and projected the strike of the A features off-shore as far as the CZD?

A No, I haven't done that and I don't see the relevance in doing so. I didn't go into all the reasons why the two features are not relevant but I could clearly do that.

Q When the A, B, C, D type features were discovered and mapped, did the Applicant's consultants make a recommendation to the Applicants that the reactors be designed for surface faulting beneath the reactors on the A, B, C, D features?

MR. PIGOTT: I am going to object. I think this goes far beyond the scope of this witness' examination or direct examination and is not relevant.

JUDGE KELLEY: Apart from scope, I think it is an understandable -- I think it is a relevant question and I think it is allowable.

MR. PIGOTT: May I have it read back? I would like to have it f lly in mind.

(Tape is played back for requested portion.)

BY M . BARLOW:

Q Just a yes or no please.

A I definitely did not make the recommendation in that direction. I don't think any of the other consultants did but you would have to ask them.

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Q On page 8 of your testimony you described the D features as having a displacement in a reverse sense with the northerr part being left --

JUDGE KELLEY: I am sorry, I didn't get the page.

MR. BARLOW: Page 8.

BY MR. BARLOW:

Q You say the displacement on the D features is in a reverse sense with the northern part being left. Is this the same sort of displacement that one would observe on a reverse fault?

A Well, I don't understand your putting it into the context of a reverse fault. Reverse sense means exactly what it means, that the hanging wall is up over the fault. That is simply a generic description of the sense of motion and that is the only manner in which it is intended here in that sentence. The D feature is not a fault.

Q If the D features were a fault and the displacement was in a reverse sense, could it be a reverse fault?

MR. PIGOTT: Calling for speculation.

JUDGE KELLEY: Overruled.

WITNESS SMITH: I think essentially what you are saying is, if it is a reverse fault, is it a reverse fault, and I think the answer is a little absurd, but yes.

BY MR. BARLOW:

Q One final question. If the Cristianitos is a

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normal fault as described by Dr. Ehlig, is it possible that the A, B, C, D features could have formed as surface expression of this listric normal fault at depth?

A No, I don't see how they could.

MR. BARLOW: I think that is it on A, B, C, D.

JUDGE KELLEY: Okay, let's just see where we are in terms of timing and subject matters and the like. I think we might as well take another coffee break here but wait just a minute until we establish a couple of things.

After the break you have got the subjects of Target Canyon and Horno Canyon. Now Target Canyon and Horno Canyon, you only list a couple or three points of interest. How long do you think that might take?

MR. BARLOW: Well, actually there are other questions to do with that. This outline was prepared last week before the field trip with David Phifer.

JUDGE KELLEY: That is a good point. Should we get into that at all? I am not sure that we should. Everybody knows what that involved in a general way. It is up in this neck of the woods. We were going to get some preliminary assessment from the Applicants and the Staff.

MR. PIGOTT: Mr. Chairman, if I might address that, we do not consider that what Mr. Phifer brought to the attention of the Board in his limited appearance impacts this issue as phrased, and that is as addressed by our witnesses and we

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would request that we proceed on the issues as defined and as stated and without -- well, obviously they can try and cross examine based on whatever knowledge they may have at the time they asked the question, but with respect to expanding the issue to include anything that Mr. Phifer might have indicated, I would think that in the absence of either a threshhold showing by the Intervenors or a determination by the Board that there has been a threshhold showing, that that kind of consideration is inappropriate at this time.

MR. CHANDLER: I think, Mr. Chairman, we would share that point of view. I think that we ought to go forward. There was, as the Board indicated in its order, the opportunity to the Intervenors to make such a threshhold showing and if, in fact, they somehow succeed then certainly it may be appropriate to expand this contention.

We do, of course, intend to advise the Board of at least the status of our review as time goes on. At this time it is certainly premature to suggest when that might be. As soon as we have some further information from the Applicants we will be in a better position to advise you on that.

MR. WHARTON: We would just like to comment that we would like to reserve our rights as far as the issues raised by Mr. Phifer. We should, at least, have the report from the NRC Staff regarding Mr. Phifer's findings and then raise the issues ourselves.

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So I would think at this time, too, going into Mr. Phifer may not be appropriate but I would like to reserve it as a possible issue and to recall this witness regarding these issues since he is their expert in this area.

MR. PIGOTT: Applicants have no problem with that.

JUDGE KELLEY: It seems sensible and counsel, I think, are in essential agreement. We will go ahead and try this issue for now on the basis of the submissions that are now before us.

It may be that Mr. Phifer's information would lead to, or itself constitute, evidence that -- I would think that the best way to -- the Board itself, needless to say, we are here to look into safety issues that are within our jurisdiction and we will look into what Mr. Phifer said and what this all develops, whether any party wants to raise it or not.

But in addition, if a party wants to pursue it and wants to call him as a witness, I think the vehicle would be under this contention 3 whereby some new feature comes out and then you make some sort of showing justifying its being brought into the case.

MR. WHARTON: That is correct. That is how we anticipate doing it.

JUDGE KELLEY: It seems to me that it would be simpler and neater also not to, in terms of cross examination, to not get into those matters at this time.

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MR. WHARTON: I agree.

MR. BARLOW: Your Honor, for clarification, on the Section 3 in the outline and one of the questions in Section 2 are for the next witness, Perry Ehlig.

JUDGE KELLEY: I was going to ask you about the Elmo Dana fault. Is that Ehlig?

MR. BARLOW: I think he would be the one to ask about that, yes.

JUDGE KELLEY: All right, I think that is helpful. Let's take a 15-minute break and then take up again.

(Brief recess.)

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JUDGE KELLEY: Back on. We are back on the record. Mr. Barlow will resume with cross.

BY MR. BARLOW:

Q Mr. Smith, the next section of your testimony after A-B-C-D deals with geologic features found at trail 6. You say that these features on page 13 of your testimony, you say that these features, starting on -- let us start on line 1, page 13, you say they were noted during 1977 by one of the geologists for the California Energy Commission, although the offsets were small, one or two feet, they occurred across planar fractures trending north-northwest, comparable with the attitude of the Cristianitos fault, and they were therefore suspected of being faults of tectonic origin.

Could you tell us how far these features are from the Cristianitos fault? Approximately?

A They are about two and a half to perhaps three miles, closer to two and a half miles, I think, downcoast from the coastal exposure of the Cristianitos fault.

Q And they trend north-northwest?

A Yes.

Q On page 14, the last paragraph, you say, while there are some planar fractures that trend north-northwest, the dominant strike is northwest, with some fractures striking --

A I am sorry, what line are you on?

Q Oh, line 20, is where it began. Dominant strike is northwest, then I am more interested in the next sentence, the trace of a link to the fractures responsible for the offsets is about 80 feet, and a northwest projection of them intersects the back scarp of the main landslide.

Now, if the northwest projection of these trail 6 features intersects the back scarp of the main landslide, and if these fractures were caused by faulting or had tectonic origin, how would you be able to tell whether or not there is a fault beneath the back scarp of the main landslide?

MR. PIGOTT: The question of course is compound and complex, but I won't object if the witness has it in mind and thinks he can give a sensible answer, at least check with the witness's perception of the question.

JUDGE KELLEY: Do you think you can understand and respond to the question?

THE WITNESS: No, I am afraid it is not clear to me.

JUDGE KELLEY: Could you break it down, then, a little?

MR. BARLOW: Okay, certainly. Perhaps the next sentence would help put it in context. You say, beginning bottom of page 14, going to page 15, the bedrock marine terrace deposit contact is not exposed at the back scarp. Now, what I am interested in is how you analyze the back scarp of

this main landslide and the northwest projection of the fractures, to distinguish whether or not there was faulting, whether the trail 6 fractures were of faulting origin or landslide origin.

A Okay, the question is how did we analyze them to determine what is stated on pages 14 and 15. We analyzed them by a combination of geologic mapping in considerable detail on the ground surface, by the excavation of a number of backhoe trenches and hand-excavated trenches at critical points, and by examination of aerial photographs that were flown specifically for this study.

You repeated the directions a sufficient number of times that I think it implies some significance, and I would like to perhaps clarify that.

When those fractures were identified at the sea cliff, they indeed at the sea cliff trend north-northwest. However, the geologic mapping that was done showed that they are arcuate in plan, and curve farther to the west as they are traced away and into the cliff area, and landward, so that the strike is changing.

This curvilinear trend in plan coincides with the surface and the subsurface observations that we were able to make, to indicate that they lay along the shear zone of a large landslide, large landslide that is arcuate in plan, and also arcuate in profile.

The marine terrace platform, which is 5E, here is not exposed in the scarp of the landslide. It comes very close to being exposed, however. So as a result we cannot see the marine platform, but we can see the overlying non-marine terrace deposits which are many tens of thousands of years old, and certainly give us some -- some indication as to whether there are any planar features that cut those deposits as they are moderately well-exposed in the scarp itself, and the statements that you are reading from page 14 and 15 was intended to describe that no offsets were found in the terrace deposits overlying the platform, and that farther away from the margin of the landslide, as was obvious from the mapping, and the aerial photo observation, no similar fractures or offsets could be found, either in type or in orientation, which led us to the conclusion that they were not faults, but landslide features.

Q Would you agree that in California, faulting along fault zones often results in landsliding?

A Well, if you are talking about the dynamic movement of faults causing landslides, it certainly has been known to occur. I think if you wish to imply here, perhaps, that movement along the fault, and the dynamics of that motion, caused this landslide, then I would have to say that is not applicable here, and would be entirely out of context.

The other element about the occurrence --

MR. WHARTON: Mr. Chairman, I don't believe the is answering the question as posed to him. There was a --

MR. PIGOTT: How do we know until he finishes it?

MR. WHARTON: -- as to whether he agreed or disagreed with a particular statement.

JUDGE KELLEY: The question was whether landslides go with faults, that perhaps oversimplifies it.

MR. BARLOW: The question was,does he agree that in California, faulting along fault zones often results in landslides.

JUDGE KELLEY: All right, and he was in the process of answering, and I think he should be allowed to complete his answer.

THE WITNESS: Well, it is a grossly simplified statement. There are many landslides along faults because of the weakened condition of the rock. There are orders of magnitude more landslides where there are not faults, because of the inherent weakness of the rock, combined with undermining by streams or ocean waves, which -- the latter of which is clear to the case here, and if you are talking just hypothetically, generally anyplace in the world, do you see landslides along faults, and of course that is true, but I would like to point out there are many places where faults do not have landslides, and more places where landslides are not associated in any way with faults.

BY MR. BARLOW:

Q Is it possible for landslides to cover a fault?

A Again, if you are talking about anyplace hypothetically in the world, of course, that is possible. That is certainly not the case here.

Q Does this occur in California, where landslides cover faults?

MR. PIGOTT: I question the probative value of these questions unless they are tied in to the features in question.

MR. BARLOW: Your Honor, in -- on page 15, and in several of these features, the witness concludes that although the features could either be of tectonic origin or of landslide origin, he in all cases concludes that they are of landslide origin.

JUDGE KELLEY: When you say, Mr. Barlow, cover, do you mean -- I am not sure what you mean, the dirt just covers up the rupture in the surface, is that what you are asking?

MR. BARLOW: Yes, sir.

JUDGE KELLEY: And could you restate the last question, please?

BY MR. BARLOW:

Q Is it common in California that landslides cover faults?

MR. PIGOTT: I am going to object unless there is

some connection to what we are talking about here. These are just questions without any relevance.

MR. BARLOW: Okay, I will relate it to a page in the testimony, then.

JUDGE KELLEY: All right.

BY MR. BARLOW:

Q On page 15 of your testimony, you state, beginning on line 11, quote, "My conclusion from the investigation is that the displacements at trail 6 are of landslide origin, and are not faults of tectonic origin. Consequently, they are of no significance to the SONGS site." End quote.

Mr. Smith, is it possible that there could be a fault that was covered by a landslide, and you would not see the fault?

A You mean here at trail 6? Because if that is what you mean, I would have to say no.

Q Well, to lay a foundation for this, I asked the question, does this occur anywhere in California, to your knowledge?

MR. PIGOTT: My same objection. I don't think it is of any value of any relevance to talk about covering up --

JUDGE KELLEY: Well, aren't you -- isn't your question whether these landslides at these points that are being talked about, isn't your question whether they might have

been covered up, whether they might have covered up a fault?

MR. BARLOW: Well, yes, sir, but he has already expressed his opinion that in his opinion it is a landslide and not a fault, and the question is going to the possibility that it is a fault covered by a landslide, and to lay a foundation for that, I asked if -- does this occur in California, where faults are covered by landslides?

JUDGE KELLEY: Well --

MR. PIGOTT: He answered that.

JUDGE KELLEY: I realize that he has expressed his opinion that these landslides were landslides, and not of seismic tectonic origin. I think, nevertheless, a fair question for you to ask, whether they might not -- these particular landslides might not have covered up a fault, and one can guess where the answer would be, but the question is fair enough, I think, if that is what you are trying to ask, and if you are not trying to ask that, then I don't know what you are trying to ask, and you had better move on.

MR. BARLOW: I am not sure if I understand which question you are ruling on, because I believe that the question that was objected to was, does this occur in California where a fault is covered by a landslide, and every time I asked --

JUDGE KELLEY: Right, and I will sustain that objection because we are not in the whole State of California.

We are at these particular points, but I am indicating, if you want to ask this witness whether or not it is possible ... these particular points may have involved landslides that covered up a fault that that is an allowable question.

BY MR. BARLOW:

Q Mr. Smith, is it possible that the northwest-trending fracture zones observed at trail 6 could be caused by faulting that was covered by a landslide?

A No.

Q Why do you say it is not possible?

A Well, on the basis of all the observations we have made, from the surface mapping, the excellent exposure in the seacliff that was augmented by our trenching, all of my obselvations lead me to conclude that these fractures and these offsets are definitely part of a landslide. They are not part of a fault. It is not a matter of the landslide being -- covering up something. The mapping in this area is very detailed, at very large scale, and shows no evidence of faulting. In most places it shows demonstrable positive evidence of no faulting, particularly at the location of the fractures.

Everything we see is consistent.

Q You have investigated these features at trail 6. Have you also investigated the features at trail 5?

A I don't recall whether I have or not.

Q Are you aware of a letter from the California Divisions ofmines and geology --

MR. PIGOTT: I am going to object at this stage to going beyond the scope of the issue. I don't know of any issue with respect to trail 5. I haven't heard any kind of a showing that we should be expanding this issue to trail 5. The objection is: going beyond the scope of the issue.

JUDGE KELLEY: The objection I will sustain. However, subject to your making some indication of where is trail 5 and how does it bear on trail 6, we are litigating trail 6. If trail 5 is in some -- is some possibly relevant in relationship to trail 6, then that might be a different matter, so with that, could you tell us something about trail 5?

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MR. BARLOW: There's a letter from the California Division of Mines and Geology to the NRC Geosciences Branch regarding observation of possible faulting or landsliding. There's a debate whether it's landsliding or faulting at Trail 5, and there were field trips made there. I want to know if this witness was one of the people who investigated that.

MR. CHANDLER: Mr. Chairman, I do object to the characterization of that letter. I don't have a copy before me. My recollection of the substance of it is somewhat different apparently than Mr. Barlow's.

JUDGE KELLEY: Is Trail 5 nearby? Can you give us some idea of where it's located?

MR. BARLOW: Yes, Your Honor. It is nearby. It's the next trail in the San Onofre State Park. But I've been advised that we don't have any evidence of it being directly linked to the features at Trail 6 and it may come under the Section 3 of Additional Features.

MR. CHANDLER: Mr. Chairman, I have a copy now.

I'd be happy if the Board wants to look at it -- we can even make it an exhibit.

"In conclusion, it appears that the offset feature is the result of the intersection of a slip plane with the wall at the arroyo and is not a fault feature of tectonic significance." And it continues.

MR. WHARTON: Mr. Chairman, I believe it would be best if we leave this particular area of Trail 5, what the connection is, not because of the letter. I was already going to state that. It doesn't appear to be covered by the Trail 6 issue at this time.

JUDGE KELLEY: Okay.

MR. PIGOTT: I'd like to be on record as agreeing with Mr. Wharton.

MR. WHARTON: Let us note that for the record.

(Laughter)

MR. CHANDLER: In view of the opposition of the Applicants and the Intervenors, I withdraw my suggestion.

JUDGE KELLEY: Let the reporter type that in solid caps.

Okay. Go ahead.

BY MR. BARLOW:

Q. The next section of your testimony, Mr. Smith, deals with the Horno/Dead Dog Canyon offsets beginning on Page 15. You were asked in Question 25, beginning Line 16, "Would you describe the features known as Horno/Dead Dog Canyon offsets." You say, "Offsets of the 125,000-year-old bedrock marine terrace contact exists near the mouth of Horno and Dead Dog Canyons approximately five miles southeast of the site."

First of all --

MR. PIGOTT: I'm sorry. Did you say Line 16? Were you reading from Line 16?

MR. BARLOW: Page 15 beginning Line 16.

MR. PIGOTT: Oh, I'm sorry. Okay.

MR. BARLOW: Question and answer.

THE WITNESS: If you give me just a moment, I'd like to read it.

BY MR. BARLOW:

Q. Sure.

A. Yes, I've read it.

Q. First of all, could you tell us approximately how far apart Horno and Dead Dog Canyons are?

A. I would say about two miles.

Q. Okay. Could you describe for us the offsets of the terrace and tell us why you reached the conclusion that these are results of landslides rather than faulting?

A. The conclusion was the result of the combined investigations of the Horno/Dead Dog Canyon area and the coastal seacliff that included detailed geologic mapping and examination of aerial photographs and included in the detailed mapping is very careful examination of the seacliffs and the canyon walls where offsets at various places can be observed as though they were exposed in trench walls.

Figure JLS-W is an aerial photograph -- and oblique aerial photograph of the mouth of Horno Canyon.

Dead Dog Canyon is not observable here. It's just off the photograph to the right, but we see again the generally arcuate topography, hummocky expression of the ground surface accompanied by down-dropped and backward rotated surfaces typical of landslides. Geologic mapping was able to correlate offsets of the terraces with fractures that are curvilinear both in plan and in section coincide with the margins or internal parts of various landslide blocks.

The exposures revealed no evidence of faulting. The mapping of terrace and bedrock units revealed an absence of faulting. The topography and all of the observations together was consistent with sliding.

And, for that reason, the conclusion was reached that the offsets are the result of landsliding.

Q. How far inland was Horno Canyon explored for faulting?

A. Horno Canyon was investigated relative to the disturbance by the landsliding and any other features that we could examine for -- well I don't have a dimension specifically and I don't have a map of adequate scale to pick it off, but it was equal to a distance -- it was a distance at least twice the depth of the arcuate features that we see in figure JLS-W. And, if I estimate from that, I would say something on the order of 1,000 feet, perhaps more.

Q. Therefore, did it not go east of the freeway?

A. No.

Q. Did you examine aerial photos of the marine terraces on both sides of the freeway?

A. In general, I have in the past, but not in the context of investigating the landslides at Horno and Dead Dog Canyon.

Q. You did not.

Are you aware of en echelon faulting patterns on the marine terraces north of Horno Canyon and parallel to the Canyon?

A. No, I'm not.

Q. On Page 16 of your testimony, you begin discussing Target Canyon offset and, on the bottom of Page 17, beginning Line 24, you say, "The displacements are chiefly dip-slip normal with minor apparent horizontal and reverse slip on some shears."

Is this the same sort of displacement that's observed on the Cristianitos fault, dip-slip normal?

MR. PIGOTT: I'm sorry. Is the question -- it seems to have changed. What is the question, Mr. Barlow?

MR. BARLOW: Let me rephrase the question.

BY MR. BARLOW:

Q. Does the Cristianitos fault have dip-slip normal faulting?

A. Yeah.

Q. Or dip-slip normal displacements?

A. Yes.

Q. Is it possible that the dip-slip normal displacements in Target Canyon offsets are of the same origin as the displacements on the Cristianitos fault?

A. I don't know.

Q. Okay. Moving on to Page 18, Line 17, you say the gradual dying out upward of the displacements tends to support this possibility of landsliding, I assume, rather than that of fault origin which would more likely have displacements indicating abrupt, episodic movements.

Then you're asked, "What conclusions do you draw from your investigation?" You say, "At this time, a conclusion that these offsets have either a tectonic or non-tectonic origin can be supported.

And then you go on to state that your opinion is that it's non-tectonic.

What evidence is there that indicates a possible interpretation of the offsets as being of tectonic origin?

A. Well very little, really. The only suggestion would be their discontinuous, linear distribution with individual shears being quite widely separated from each other and not forming a systematic joint or fracture pattern, but displaying vertical offset relatively far

removed from one another.

The evidence against faulting of a tectonic origin is greater, in my opinion -- and that's why I said the weight of the evidence supports a non-tectonic origin.

Q. Would part of the evidence for tectonic origin be the fact that there are displacements with chiefly dip-slip normal displacements?

A. That's part of it because we have exposed in the bottom of the Canyon some San Onofre breccia, a small nob that has an orientation similar to the general trend of the shears that we see and it exists in that area as a stratigraphic high across which the layers of the Monterey Formation were deposited. And it's a rather sharp, ridge-like feature. The overlying sediments are much softer and incompetent compared to the hard and well-cemented San Onofre Formation.

The orientation of the shears is roughly parallel to this elongate, varied ridge, if we can call it that. The sense of slip on either side is compatible with settlement and differential compaction on either side across that ridge so that the inclination of these minor faults parallel to the ridge. These minor shears are such that they dip away from the ridge, indicating greater movement downward on either side of the ridge and less movement across the crest of the buried ridge.

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The fact that these shears did not display episodic type different displacements of overlying sediments of different age suggest that the shearing took place over some period of time but of a more continuing nature rather than as short, jerking, stick-slip motions as is common along faults.

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It also suggests that the downward motion, presumably through compaction across this high ridge, ceased at a certain point in time, some tens of thousands of years ago; I don't know exactly when, when either no more compaction could be accommodated by the sediments or there was no further load to drive the compaction above them, because they clearly die out before they reach the ground surface.

Added to that are the observation that if one wants to assume perhaps that these a fault, you project it to the north, where we have some exposures across the highway to the east.

Dr. Ehlig's mapping has shown a number of stratigraphic horizons in the hillside there, which appear to be continuous across the projected trend of these features, suggesting that if it is a fault, it doesn't go that far, or its displacement is so small that it doesn't offset these continuous horizons.

I think that is the majority of reasons that I felt tended to support the non-tectonic origin more than the tectonic origin.

Q If these features were of a tectonic origin, would they have been formed by a similar stress mechanism as that which formed the Cristianitos fault zone?

MR. PIGOTT: I am sorry, but by "similar," you are not putting it in any time relationship; is that correct?

MR. BARLOW: That is correct; only the stress mechanism.

JUDGE KELLEY: Aren't stress mechanisms, at least in some sense, a function of time?

MR. BARLOW: Well, in geologic time, you have alternation and stress mechanism.

JUDGE KELLEY: That is what I was thinking of.

MR. BARLOW: You could get this same stress mechanism at different times, as I understand it.

JUDGE KELLEY: Yes.

THE WITNESS: I don't think you can really tell here at Target Canyon the nature of the shears. Their short, discontinuous nature just doesn't give you enough information, for me at any rate, to decide on what tectonic mechanism might be producing them. Perry Ehlig would be a better one t answer that, since I think he is aware of the features in this map and the region.

BY MR. BARLOW:

Q In your opinion, could these features be a result of wrench faulting?

MR. PIGOTT: I am going to have to ask for a basis of what we are talking about when you are using the term "wrench faulting."

BY MR. BARLOW:

Q Were you here yesterday when we discussed the

definition of "wrench faulting" with Dr. Greene?

A It was a long discussion. I recall that. So I was definitely here.

Q As I understand it, "wrench faulting" include -- well, looking back at your testimony, on Page 17, you indicate displacements of dip/slip normal, horizontal and reverse slip on some shears and, as I recall, the definition of "wrench faulting" included all three of these type of displacements and shears.

A Well, the definition of "wrench faulting" included a lot more things than that, as well, depending upon the context in which one uses it. I don't think that it is proper to identify them as typical of wrench faulting simply because they have certain orientations and certain senses of slip. I think it is necessary -- in the context, it is important for us here to know the mechanism and the structural connections between various features in order to come to some conclusion on wrench faulting.

Q If you projected the strike of these features to the south, would they extend offshore?

A If you simply projected the direction? Is that your question?

Q Yes.

A Yes. Their strike is oblique to the coastline, so any southerly projection would take them offshore. But we

only have one feature exposed, as shown on JLS-2, that even reaches the seacliff.

Q Okay, thank you.

MR. BARLOW: I have no further questions of this witness, Your Honor.

JUDGE KELLEY: Mr. Chandler.

CROSS-EXAMINATION

BY MR. CHANDLER:

Q Mr. Smith, at Page 5 of your testimony, and again, I believe at Page 15 of Exhibit 25, JLS-1, you describe a length of about 800 feet to the longest of the A-features, and I believe you, in response to a question to Mr. Barlow, gave some explanation of that length.

Could you, if you would one more time, explain what the basis for 800 feet was?

A In very simple fashion, it was the measurement off of one of the maps where the A-features were plotted, to measure their longest exposed length. As I explained further, and as perhaps implied on Page 15 in the exhibit by the Features portions that are identified in the parenthesis as A, A-1, A-2, A-3, that this is an additive length of individual A-features and portions of A-features.

So that there really is no A-feature that is 800 feet long. There really is no A-feature that is more than several tens of feet long without interruption by the B-features.

Q Are you suggesting that the B-features broke up what was previously a continuous A-feature into separate segments, or rather that the A-features were formed separately and are thus additive?

A I am not sure there -- I don't think there ever was one continuous, long A-feature. The A- and B-features occurred simultaneously as a result of compression with the almost simultaneous formation of one, so that a slight amount of offset, greater on one, would cause offset of the other.

As that compressional stress is relieved and accumulates, the other feature could slip and offset the other. This is displayed in some of the figures; not only in the testimony, but in the exhibits. It is described as "mutual offsetting." The A-features offset the B-features, and vice versa. It is a mutual offset, and it indicates a number of episodes of readjustment of the San Mateo formation to compressive stresses.

Q Just to help me out for a moment, if we look at Figure JLS-N and we locate, say, feature A-6, which is up on the upper left-hand portion near Number 84, do I understand you to be saying that you would not trace A-6 as a single, through-going feature to where A-6 appears at the bottom to the right of the word "excavation?"

A Yes, that is right. At this scale, it would appear to be continuous, but at much higher magnification it would not

be, and I can explain that by first referring you to Figure JLS-P in my testimony, which is a photograph of an A- and B-feature.

Now, the white streaks that you see in the photograph that are parallel to the bottom of the figure and trend from left to right, they represent a B-feature.

The diagonal white streaks that you see going from the upper left to the lower right represent an A-feature. You can see at the intersection there, which is an X-shaped or cross-shaped intersection, that the boundaries or the A-feature do not exactly match -- the A-feature above the B-feature do not exactly match across it, indicating an offset, a right lateral offset.

But if you look at the B-feature, you will see that, as it passes the A-feature, it doesn't exactly match, either. So what this indicates is, there has been a series of mutual offsets, of first A over B, and B over A, and the latest movement, as indicated here, would be, the last shift or adjustment here was such that B offset A.

Now, that is not the case at all intersections, but there are many intersections where B offsets A.

Q So, in short, at no time -- if we are looking, for example, at JLS-P, at no time was the A-feature depicted here a single, through-going feature?

A Yes, I think that is correct.

Q On Page 6 of your testimony, you mention areas outside the San Onofre site at which the A- and B-features have been found. I believe, in response to some questions by Mr. Barlow, you drew on, or you made reference to Drawing 25 of JLS-1 and indicated two additional areas in which these A- and B-features were found; Areas 3 and 4. Is that correct?

A Yes.

Q We located Area 3 approximately at Number 13; is that correct?

A No.

Q All right.

A The Number 3 area would be a circle having a radius of something on the order of a quarter mile. That would be on the ridgecrest of the ridge that is north of that Number 13 you see on the map. It is the ridgecrest lying between San Onofre Creek on the south and San Mateo Creek on the north. It is a northeast/southwest-trending ridge. That ridge is crossed by a pair of lines with dots along it on this map, which is the transmission line, and where it crosses the crest of the ridge, there is a vicinity of about a quarter-mile radius where a number of A- and B-features are exposed.

Q That would be just northeast of Elevation 100?

A I am going to challenge my eyesight here, now.

Q Or is it at the 200-foot elevation?

A Oh, no. It is up on the crest of the ridge,

generally above Elevation 300.

Q Okay.

A It is not down on the flank of the ridge at 100, or where the Number 13 is.

Q Okay. And Area 4 was essentially northwest of the word "San" in "San Onofre?"

A That is right, and below the letters "BM."

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GHP 1

A It is up on the crest of the ridge generally above elevation 300. It is not down on the flank of the ridge at 100 or where the number 13 is.

Q But Area 4 was essentially north of the word San in San Onofre?

A That is right, and below the letters, B M.

Q Now I believe in JLS-3 at page 3 under the paragraph, "Description of Investigation," you have a number of items identified, the fourth one being, mapping of features in San Mateo formation at two areas outside of site property. Does that have reference to Areas 1 and 2?

A Yes.

Q Does JLS-3 represent a report prepared by Fugro for submission to the Nuclear Regulatory Commission?

A Yes.

Q That is also true of JLS-1 and 2?

A Yes.

Q Were Areas 3 and 4 ever identified in JLS-1, 2 or 3?

A I don't believe so.

Q Can you explain why those areas were not included?

A No, I don't know the reason for that. It would be speculation on my part. We were not aware of the features at that time, particularly in Area 3.

Q When were the Area 3 and 4 identified, if you know?

A I don't know exactly. I have observed them on two

hp 2

or three occasions in that vicinity. The last time was in early this year. The earliest time would have been in the preceding one or two years.

Q To your knowledge, was the existence of Areas 3 and 4 ever provided to the Staff in the form of a report or the SFAR Applicant's Exhibit No. 1?

A I am not aware that it was. We never prepared a report on it. Fugro never did. I was never involved in any report preparation. The observations there were essentially of a confirmatory nature. The exposures at 1 and 2 were really excellent and I saw no reason to prepare any reports regarding them.

Q Were Areas 3 or 4 trenched at all?

A No, only insofar as the access roads for the transmission lines would represent excavations to expose them.

Q But not deliberate trenching with respect to A and B features?

A That is correct.

Q You talk about the ages of these features in your testimony, for example pages 9 and if you look at page 22 of JLS-3. Is it fair to summarize your conclusion that the A, B, C, D features are capped by the 120 or 125 thousand-year-old marine terrace?

A Yes.

Q Is that true at all areas, including Areas 3 and 4?

ghp 3

A It is certainly true at 4. I don't know if it is true at 3 because that mar e terrace platform doesn't exist at 3 and we have not tried to trace the features to the nearest location of the terrace platform.

Let's see, you asked me about 1 and 2 as well; is that correct?

Q Yes.

MR. PIGOTT: I am sorry, didn't you start by saying that 1 and 2 were capped? I have lost the thread of this questioning, Mr. Chairman, I am sorry.

MR. CHANDLER: Well, the question was, I think, quite simple. I just wanted to assure that in all areas we are talking about the same thing.

MR. PIGOTT: Okay.

BY MR. CHANDLER:

Q Was any dating work done in Area 3?

A No.

Q Page 10 of your testimony, just one final question, you have used the word, joi . on a number of occasions in your testimony and in your response to a number of Mr. Barlow's questions. Could you first define a joint?

A Yes, I can. A joint is a fracture across which there is little or no dislocation parallel to the orientation of the fracture.

Q No offset?

ghp 4

A Little or no. In a very strict definition according to some glossaries and textbooks, joints are defined as having no displacement, but in structural geologic textbooks that address joints in the field, particularly conjugate joints, it is not -- that is not a practical definition. There will always be a very small amount of displacement along joints.

There are different kinds of joints, of course. Conjugate joints, in particular, are formed by compression. That compression and the subsequent yielding to produce the cross-shaped intersections are implicitely indicated so it must be sheer or offset. The question is, is it a small amount.

Q I have just one more question. I am afraid I am going to take you back to the length question one more time. I believe you responded to Mr. Barlow that in certain areas trenching is either impractical or just impossible; is that correct?

A That was north of the site to trace the A features, yes.

Q Given a lack of ability to trace features in certain areas, what assurance do you have that there may not be some offset below a level which is observable? That is to say, I think we have heard testimony on other features that we have been considering in this proceeding where certain surface manifestation just doesn't exist.

A Part of the reason is that the motion on these

ghp 5

features is strictly horizontal. There is positive evidence against vertical so that the kind of compressive forces that would tend to cause displacements are being exerted over a large area and that movement on an A feature at one location would be observable at another location.

Let me put it this way. The movement at one part of the A feature should result in movement at another part of the A feature so that when you are able to put a cap on that movement as represented by the 5-E, then you can effectively preclude any motion having occurred along that feature anywhere.

One would not expect to find no movement on part of an A feature and sub-movement on another part of an A feature.

MR. CHANDLER: Thank you; I have no further questions.

JUDGE HAND: I have one question, Mr. Smith. I have lived in California long enough to know that slumps, slips and landslides get into the headlines every so often. Highway 1 falls in, a bunch of houses on the top of a sea cliff start down toward the seashore and maybe it is inland from the seaside.

These nuclear units are sitting in an area that apparently is prone to slumping in some sense all the time. What assurance do we have that the whole site isn't going to slump?

WITNESS SMITH: I think that is a very pertinent

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question. The evidence at the site as depicted by the San Mateo formation and the S age 5-E marine terrace platform indicates not only has landsliding not been occurring except in a very gross regional sense as Dr. Ehlig has described, but it certainly hasn't been occurring for in excess of 125 thousand years in response to whatever forces may be continuing to work on this region of Southern California, be it tectonic forces or heavy rainfall which is the mechanism, together with gravity, that is responsible for most of the sliding.

Secondly we have a formation that is quite solid. It is very firm. It is an excellent foundation rock for the site. There is abundant evidence of no landsliding involving that rock at the site or in the immediate vicinity.

The landslides that you refer to in the region clearly are occurring where the softer portions of the sedimentary section represented by the Capistrano formation and the Monterey formation are undermined along the coastline or along the gullies by erosion, either due to the ocean or streams.

Also the gravity needs some topographic relief for the ground to move in the form of a landslide. We are in an area of low relief, both along the coast on shore as well as off shore.

As I indicated in my testimony the first day, the slope of the sea floor for several miles out to the edge of the shelf is very very flat, only a percent or two of slope.

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So there isn't really anyplace for anything to go and really no place for it to come from.

JUDGE HAND: The Chairman just asked me if I could call a three-minute break. I think you have answered my question and we will be back in just a moment. Thank you.

(Brief recess.)

JUDGE KELLEY: Back on the record.

I have just one question, maybe more, for the reassurance of the record. You testified that the A and B features were 125-thousand-plus years according to the location of the marine deposit, I believe, a marine terrace.

I don't know that we need to get into any elaborate explanation, but does the record and perhaps your exhibit set forth the age dating technique that was used here?

WITNESS SMITH: The age dating technique for the A and B features?

JUDGE KELLEY: Well, to get to the 125,000, right. You explained that the carbon technique didn't work past 30 thousand or so and you mentioned a couple of other techniques, but what technique was used to establish that date?

MR. PIGOTT: Excuse me, Mr. Chairman, I think that will probably be established by Dr. Roy Shlemon, whose testimony does go to the age of those terraces. I won't answer for the witness but I believe he does rely on that testimony.

WITNESS SMITH: That is correct.

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JUDGE KELLEY: You do look to Dr. Shlemon?

WITNESS SMITH: Yes.

JUDGE KELLEY: Fine.

WITNESS SMITH: My testimony did not directly describe all the techniques.

JUDGE KELLEY: I knew it didn't and I just wondered whether that was coming and now I know. So thank you very much, Mr. Smith.

Do you have redirect or will you have redirect?

MR. PIGOTT: I would like again the liberty of the evening recess.

JUDGE KELLEY: Very well, you are excused, at least for today.

(Mr. Smith leaves stand.)

JUDGE KELLEY: Do you have your next witness here?

MR. PIGOTT: Yes, I do.

JUDGE KELLEY: Why don't we go ahead and at least get through the overview part and I don't know -- well, we will see where that takes us. We are prepared to go for a while yet this afternoon but not too terribly long.

MR. PIGOTT: I will call as Applicant's next witness in order Dr. Perry Ehlig; actually recall Dr. Perry Ehlig to the stand.

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Whereupon,

PERRY EHLIG

was recalled as a witness herein, and having been previously duly sworn, was examined and testified further as follows:

DIRECT EXAMINATION

BY MR. PIGOTT:

Q Dr. Ehlig, you were previously sworn. Would you identify yourself for the record?

A Yes, I am Perry L. Ehlig.

Q And you did, in fact, appear earlier and testify on another issue before this board?

A That is right.

Q Do you have before you a document entitled, "Testimony of Dr. Perry L. Ehlig," consisting of four pages of questions and answers and one figure entitled, PLE-Q? Do you have those before you?

A Yes, I do.

Q Do you have any corrections to make in either the text or the figure?

A No, I don't.

Q And if you were asked those questions, would your answers be the same today?

A Yes, they would.

MR. PIGOTT: I would ask that the identified testimony of Dr. Perry L. Ehlig be admitted as evidence in this

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proceeding.

MR. CHANDLER: No objections.

JUDGE KELLEY: Hearing no objections, so ordered.

MR. PIGOTT: I might note that all of this testimony has been previously provided to the Court Reporter and has been copied into the transcript to this time.

JUDGE KELLEY: Yes.

BY MR. PIGOTT:

Q Dr. Ehlig, do you have a general description of the testimony you are presenting at this time?

A Yes, it deals with the E and F faults.

Q Would you proceed?

A This is the Figure PLE-Q and it is taken from my 1977 geologic map which I understand is in the FSAR.

The plant site is located on the coast. The E fault runs along this line and the F fault over here. The F fault can be mapped relatively accurately for a distance of approximately 2,000 feet.

It has dropped down the unconformity or contact between the Monterey formation and underlying San Onofre bracciá approximately 25 feet with the west side of the fault down.

The fault strikes approximately north 15 degrees west.

The fault is well exposed in this area where quarrying of sand which forms the base of the Monterey has

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exposed the unconformity between the Monterey and underlying San Onofre braccia.

The quarrying operations have removed the sand right to the unconformity and at the rear of the quarry face the fault itself is exposed and then above that quarrying has again removed the sand to the base of the unconformity.

The fault plain that is exposed has slickened sides in various directions but predominantly they are down-dipped. It is a normal fault which dips steeply to the west and again it has approximately 25 feet of displacement.

The fault cannot be traced at least on surface exposures beyond the point indicated by the pointer here where the most northerly exposure of the Monterey formation occur. Beyond that it would be entirely within San Onofre braccia where, last seen, it has a relatively small displacement, less than 25 feet as far as its displacement of the unconformity and there is no expression in the topography beyond that point.

To the south of its occurrence in the quarry it is overlayed by non-marine terrace cover that rests above the 125-thousand-year-old erosional bench of marine origin.

The E fault is approximately 2,000 feet further west. It can be mapped relatively accurately for a distance of a little over 4,000 feet. Again, it down drops, or in this case, it down drops the unconformity between the Monterey formation in the San Onofre braccia down on the east side.

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So it is just the reverse of the down drop on F fault.

The unconformity does not extend to the fault on the west side so it is necessary to project the unconformity from exposures further to the west along the flank of the hill. When those are projected upwards and then distances taken between the unconformity on either side of the fault, it would be between 300 and 400 feet of dip separation.

The fault dips eastward. It was exposed in a trench, in a trench that runs across a ridge here. The trench exposed two possible traces of the fault. One was rather steeply dipping to the east and the other one was dipping to the east at about 45 degrees.

That particular trench was cut in an area where there is a marine bench, wave cut bench, which has some gravel on it -- some old marine gravel -- however, it seems not to be in place, but there is a well-developed soil horizon that is rich in hemotite on top of the bench.

The soil horizon and the bench appear to be undisturbed by faulting. The bench at that location stands at about 360 feet above sea level.

Marine bench at that position is probably on the order of 300 thousand or more years of age. Dr. Shlemon can go into the basis for this. Very roughly the coastal bench has been dated at approximately 125 thousand years old.

In using sea level curves based on oxygen isotope

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determinations, the previous high stand and sea level, a major one, occurred at what is called Stage 9, which would be approximately 300 to 350 years ago.

Another stage is Stage 11, which is about 400 to 450 thousand years ago.

The stacking of marine benches in this area suggests that this bench would be at least Stage 9, and consequently at least 300 thousand years old.

As one follows the fault to the north, there are no other marine benches that it crosses. However, there is no topographic expression whatsoever along it except that which is due to erosion or soft parts of the Monterey formation.

When one goes beyond this point there is no expression of a fault along here. However, further west there is another area where a small amount of the base of the Monterey formation has been down dropped.

In my original mapping I projected a fault across to that point, connected with that one, and then there is another very small spot of Monterey far over toward San Onofre Canyon and I projected the area to the west of it is up and I projected the fault over to that.

There is only one natural exposure of the fault. That is on this ridge. The fault dips steeply to the east. It has slickened sides on the fault surface which are trending down dipped, so again I concluded it is a normal fault.

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We cut a trench through this area. It exposed the fault, but because of the very deep weathering, the slickensides were not preserved, and we were not able to get any data on the direction of movement along that trench. That was also true of the other trench I mentioned. It was not possible to get information on the direction of movement.

The combination of the two faults indicate a small block of the San Onofre breccia has dropped down. It would be what we might term a Groeben structure.

The dating on the age of the faulting is fairly open between about the age of the Monterey, which in this area is 14 to 15 million years old, fairly precisely dated by microfossils, and the terrace that I mentioned, which is probably older than 300,000 years.

The best estimate as to the age is that it probably is about the same age as the Cristianitos fault; within the age range of 4 to 10 million years ago and may well be the result of bending down of this area during the early stages of development of the Cristianitos fault.

The Cristianitos fault started by slippage along its base, along a bedding plain, and then propagated upward. It is very common, when landslides do this sort of thing, that there will be cracking along quite a few traces near the ground surface as the ground surface is stretched, as the material starts to move out, and then one crack will

propagate to the surface and become the main slide head, and the others that are most upslope from it will be simply be abandoned. That is one possible way in which this may have formed.

MR. PIGOTT: The witness is tendered for cross-examination.

MR. WHARTON: Mr. Chairman, we would like to do cross-examination tomorrow, so that we could do it all at one time. Mr. Barlow indicated to me it would be at least an hour. He has been cross-examining all day. It is 10 after 5:00. I would suggest we do it tomorrow.

JUDGE KELLEY: Well, the Board, too, needs to save a little bit for this evening's activities.

MR. PIGOTT: One minor thing. I believe we would like to reflect circulation to the parties of the forms of the stipulation of issues with respect to emergency planning.

JUDGE KELLEY: That would be helpful, and then perhaps you could state exactly who stipulates and --

MR. PIGOTT: I was looking for Mr. Casey, who has to do that.

They will be circulated if we need further explanation on the record tomorrow morning.

JUDGE KELLEY: Yes, I think that would be okay.

I might just state for the record that we are going to adjourn now and come back here at 7:30 for a continuation

of our limited appearance session of the other day. The Board will be here. Will we have the pleasure of your company, Mr. Pigott?

MR. PIGOTT: There will be representatives from the Applicant.

MR. WHARTON: I believe Mr. Carstens will be here.

JUDGE KELLEY: Okay. And Mr. Chandler, we can count on you, I know?

MR. CHANDLER: You can count on me, Mr. Chairman, and Mr. Rood will also be here.

JUDGE KELLEY: Fine. Here is Mr. Casey now, if he wants to talk a bit about his stipulation.

MR. CASEY: Mr. Chairman, in view of the decision to just submit this thing, I did want to come back on the record and present the Board and the parties with the result of rather lengthy negotiation on GUARD's and the Applicant's stipulated contentions.

JUDGE KELLEY: Yes. We need to have on the record just what these papers represent and where we are, and so please do tell us.

MR. CHANDLER: Could we go off the record for a couple of minutes, Mr. Chairman?

JUDGE KELLEY: Yes.

(Recess.)

JUDGE KELLEY: Back on the record.

MR. CASEY: Mr. Chairman, I have presented the parties and the Board with two forms of stipulation on GUARD's contentions.

Let's go back a little bit.

GUARD was basically agreeable to the proposed consolidated Intervenor's contentions which we proposed at the final pre-hearing conference but wanted to have more opportunity to review them.

They then filed a brief, their earthquake brief, and attached to it revised contentions, and then that led to further negotiation, and the product of that negotiation is now in front of you.

The first form of stipulation is a form of language which is agreeable to Applicants and GUARD.

JUDGE KELLEY: Would you differentiate between the two documents? Which one are you referring to?

MR. CASEY: Well, there is one document in front of you which shows that it is a stipulation only between Applicants and GUARD, and the other document, almost identical, indicates that it is a stipulation between Applicants and the Nuclear Regulatory Commission.

JUDGE KELLEY: Line 4 has typed in, "NRC," or Nuclear Regulatory Commission.

MR. CASEY: Yes.

MR. CHANDLER: That is an error.

With all due respects, Mr. Chairman, I cannot speak for the Commission. I can speak for the Commission's Staff.

MR. CASEY: I stand corrected.

JUDGE KELLEY: Okay. Go ahead.

So one form is acceptable to you and GUARD, and the second one is acceptable to you and GUARD and the Staff?

MR. CASEY: I am afraid not. The second form is acceptable to Applicants and the Staff.

So there we are, Mr. Chairman. We are asking for the Board to resolve this quandary by Order.

JUDGE KELLEY: Well, let me just thank all of you who were involved for your efforts. I think this is a useful step toward getting to where we need to get, and we will do what we need to do.

MR. CASEY: One more thing. The only difference between the two contentions as far as Applicants are concerned are semantics. We think the first contention means the same thing.

JUDGE KELLEY: Fine. Now, I do not understand you to have been involved in these particular discussions. Is that correct?

MR. WHARTON: No, I have not, Mr. Chairman.

JUDGE KELLEY: And what you would like is what we have before us from you, and there probably is some overlap between the two but, in any event, you were not involved in

these negotiations?

MR. WHARTON: No.

JUDGE KELLEY: Okay. There is one other thought. Here is our problem: Tonight we are having this session, as you know, and we had a gentleman from our Docketing and Service Section here to run the sign-up sheets and help us, generally. He went home. Does anybody volunteer?

You saw a hand raised? Oh, fine. I appreciate it very much. Maybe we can get together. We will be here a little before 7:30 and figure out the logistics.

Thanks a lot.

MR. CHANDLER: P. T. Barnum was right.

MR. PIGOTT: I think that is the responsibility of NRC Staff.

JUDGE KELLEY: That was meant in jest.

MR. CHANDLER: Mr. Chairman, just for the record, I have one request to make. I am sure my colleague, Mr. Ketchen, appreciates the notoriety he continues to get.

JUDGE KELLEY: He withdrew.

MR. CHANDLER: Yes, sir; several weeks ago.

JUDGE KELLEY: I am sure, by the end of the case, we will have him removed from all the service lists.

I think we would like to start a little late tomorrow, for the simple logistical reason, we are going to be working here tonight, we don't know how late, and a couple

of us are flying tomorrow night and have some packing to do, and so on. How about 9:30 tomorrow morning as a starting time here?

Okay, thank you.

(Whereupon, at 5:18 p.m., the hearing was adjourned and was scheduled to resume the following day, Thursday, July 2, 1981, at 9:30 a.m.)

This is to certify that the attached proceedings before the

NUCLEAR REGULATORY COMMISSION

in the matter of: SAN ONOFRE NUCLEAR GENERATING STATION

Date of Proceeding: July 1, 1981

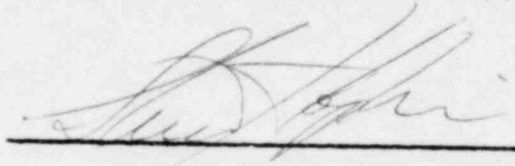
Docket Number: 50-361/362 OL

Place of Proceeding: San Diego, California

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Steve Hopkins

Official Reporter (Typed)



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