NUCLEAR REGULATORY COMMISSION

In the Matter of:

South Carolina Electric & Gas Company)
)
Summer Nuclear Station, Unit 1) Docket No. 50-395 OL
)

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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SOUTH CAROLINA ELECTRIC & GAS COMPANY : Docket No. 50-395-OL

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(Summer Nuclear Station, Unit 1) : :

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Assembly Room I
Carolina Inn
Columbia, South Carolina

Friday, July 17, 1981

Evidentiary hearing in the above-entitled matter was resumed, pursuant to adjournment, at 9:07 a.m.

BEFORE:

HERBERT GROSSMAN, ESQ., Chairman,
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D. C.

MR. GUSTAVE A. LINENBERGER,
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D. C.

DR. FRANK F. HOOPER,
Administrative Judge
Atomic Safety and Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D. C.

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PROCEEDINGS

CHAIRMAN GROSSMAN: The thirteenth day of hearing is now in session. We will resume with Mr. Goldberg's voir dire of Dr. Kaku.

MR. GOLDBERG: Thank you, Judge. Just as a preliminary matter, in light of the Board's reconsideration of its ruling to at least preliminarily, subject to specific motions to strike, admit Dr. Kaku's testimony, I would like to now move to readmit those portions of the testimony of Mr. Kevern and I believe Mr. Beale that address related matters, which I understand to have been excluded on the grounds that we were not going to provide Mr. Bursey with the opportunity to edduce an affirmative case on those matters.

CHAIRMAN GROSSMAN: Thank you, Mr. Goldberg. You anticipated something that I intended to do right off the bat, too.

With regard to Mr. Knotts' testimony that was the testimony of Mr. Knotts' witnesses gave, that had already been offered. And we had stricken a portion, and we will reverse that and admit the testimony.

With regard to the testimony your witnesses offered, Mr. Goldberg, you had not offered that portion which you are offering at the moment, and we therefore admit that. And of course, that does not include the TID's.

MR. GOLDBERG: Yes, Judge.

CHAIRMAN GROSSMAN: But it does include the other portion relating to Contention 10. And we are of course reinstating Contention 10 of Fairfield United on the same par as we have reinstated or permitted all the other contentions of Fairfield United.

And in referring to that we will indicate on the record that the only basis on which we threw out Contention 10 was to make that action consistent with not allowing Dr. Kaku's testimony, and so therefore, of course, the basis has changed.

Mr. Goldberg?

MR. GOLDBERG: Just for clarity, Judge, I move to readmit it not on the grounds that we did not think that the contention was objectionable. We do not waive that argument. Just, if we are going to have a record, we may as well have the full record.

CHAIRMAN GROSSMAN: Fine, thank you.

MR. BURSEY: Sir, could I get this again, the specific page number and witness?

MR. GOLDBERG: Well, I do not have it immediately available, but it was the question and answer that I posed in the prefiled testimony to Mr. Kevern regarding FUA Contention 10 and the relationship between the supplement to the draft statement and emergency planning for the Summer

station, which I believe also included a figure about dose curves for certain generic accidents and for Summer specific accidents, about which there was some testimony yesterday.

CHAIRMAN GROSSMAN: That curve or graph was I believe contained in page 17, attachment C, and that is reinstated with the body of the testimony.

MR. GOLDBERG: Okay, thank you.

CHAIRMAN GROSSMAN: Excuse me for a second.

(Board conferring.)

CHAIRMAN GROSSMAN: Why don't we proceed, Mr. Goldberg.

MR. KNOTTS: Judge, would it be a good idea, so that we all know what this schedule -- what is to be covered today, to either have a conference off the record and then put that schedule on the record, or just have me read what I think it is and I can be corrected by the other parties?

CHAIRMAN GROSSMAN: Fine. Why don't you, Mr. Knotts.

MR. KNOTTS: Completing the voir dire of Mr. Kaku. I understand Mr. Goldberg has about 15 minutes on that and I have five or ten minutes of follow-up on answers that Dr. Kaku gave to Mr. Goldberg and that will complete my voir dire.

Then we have whatever summary of his direct testimony Dr. Kaku is planning to give. And then I think

cross-examination is best held off because -- well --

CHAIRMAN GROSSMAN: You do not want to venture into that except to the extent that you do want voir dire, is that it?

MR. KNOTTS: I think that is right. I think there is a schedule constraint. It is largely preparation, but it is also a schedule constraint.

CHAIRMAN GROSSMAN: Mr. Goldberg would like to say something.

MR. GOLDBERG: I just want to remark on that. In that same context about preparation, since it looks like we are going to have a further session if some of Dr. Kaku's testimony remains, I think it might be better to have him give his direct testimony at a time when the other parties have their experts present, so that we can, you know, hear the testimony given and, you know, present -- develop our cross-examination questions accordingly.

CHAIRMAN GROSSMAN: Well, are you apprehensive that we might accept his direct testimony without an opportunity for cross-examination, Mr. Goldberg, because I do not see that we could do that in due process, or whatever.

MR. GOLDBERG: No, I guess I am not. It is the timing of his direct testimony. And maybe on another point about direct testimony, I hate to interrupt Mr. Knotts on

scheduling, but just to go back to what my understanding is about the process, and that is that we are talking about Dr. Kaku's prefiled testimony. And to the extent that he is giving supplemental testimony, it would not be admissible. And I think we discussed this on July 1.

CHAIRMAN GROSSMAN: Except to the extent that it is rebuttal testimony, that is right.

MR. GOLDBERG: To the extent it is rebuttal of testimony that has already been received in the proceeding on any issue whatsoever?

MR. KNOTTS: Or has been prefiled and not yet given, I would assume.

CHAIRMAN GROSSMAN: I would think so also, yes, Mr. Knotts, certainly.

MR. KNOTTS: Mr. Barker has not testified yet. I do not know that Dr. Kaku would be rebutting Dr. Barker, but that is just hypothetical.

CHAIRMAN GROSSMAN: You may object, of course, on the grounds of lack of qualification.

MR. GOLDBERG: Okay. I think it will be good, when we complete our voir dire, we do have a variety of grounds to objections to, you know, portions of the prefiled testimony which I think would also obtain for what may be the rebuttal testimony -- I am not sure that it would be profitable to make those objections here or just reserve

those until our next session.

CHAIRMAN GROSSMAN: Mr. Knotts may tell you that he thinks it would be better trial tactics to have Mr. Kaku give his case now and give his witnesses time to prepare.

MR. GOLDBERG: I just wanted to make that clear, you know, for the record. But Dr. Kaku, if I said "Mister" I apologize.

MR. BURSEY: Judge Grossman, I would like the opportunity to preserve my ability to respond in a direct fashion to the inclusion of the previously struck testimony.

CHAIRMAN GROSSMAN: To the what?

MR. BURSEY: The previously struck testimony that you just readmitted. It is essentially, the part that I am concerned about is like the dose estimates. And Dr. Kaku can generalize on that.

But I would want the opportunity to be able to present a direct case on the testimony that you just readmitted.

MR. KNOTTS: Do you mean rebuttal, Mr. Bursey?

MR. BURSEY: Whatever it is, just an opportunity to speak directly to it at a later date. And Dr. Kaku would be my expert in that matter. And he had not -- we were not prepared to present the direct specifically like on that chart, the specifics.

CHAIRMAN GROSSMAN: I see. You are saying you have some rebuttal on that chart, okay, which had been previously struck. Well, that is well taken. When Mr. Kaku comes back he can present rebuttal on that.

MR. KNOTTS: Shall I proceed with the schedule?

MR. GOLDBERG: Go ahead.

MR. KNOTTS: I am optimistic at least getting through that.

CHAIRMAN GROSSMAN: Not if we are going to continue this way.

MR. KNOTTS: Then I would propose that we respond to the Board's question about lowering the reservoir, Mr. Nichols and Mr. Moore and I guess Mr. Crews. And then we have a cleanup or clarification matter regarding what exhibits were included. When we introduced our FSAR, we meant for that to include the application, but we did not say so. The transcript does not reflect it.

So I think to be clear we ought to make that a separate exhibit. And I think the environmental report ought to be part of the record, too. That was prefiled, but it has not been offered and received, so we will clean that up.

Then I would like to point on two seismic witnesses just for a few minutes, to obtain a better understanding of the Board's questions and perhaps respond

to some of them if the Board --

CHAIRMAN GROSSMAN: Well, my understanding and my preference is that I tell you what it is that we are interested in and why, and perhaps when contact is made with the persons we are interested in you can supply -- whoever is going to supply it. I assume the staff would supply those one or two pages of indication of what the Board wants to the potential experts with the prior record.

MR. GOLDBERG: Well, let me understand, first of all, the process. I do not think the staff would be prepared to provide copies of the transcripts to some experts that the Board may call. I think if these are the Board's witnesses that -- I assume these are not staff witnesses, by the way, that the Board is going to call.

CHAIRMAN GROSSMAN: Let me say this. I believe we are interested now in a USGS witness and someone who is not. Now, there have been Board witnesses called, especially in the seismic area, and whatever arrangements were made in those cases can be made here, Mr. Goldberg, whether or not you are reluctant to make them.

But I think we will follow the same procedures we followed in the other cases. And as a matter of fact the witness -- I have two witnesses in mind. I do not want to get into that now. I want to keep it in one place. One is USGS and another one is the witness that has already been a

Board witness and was arranged for as a Board witness. We we will bear that in mind.

MR. KNOTTS: I think, Judge Grossman, that probably Mr. Bursey would agree with me that neither he nor I care to get into budgetary questions, which part of the NRC pays for the witnesses.

MR. GOLDBERG: Well, are we going to discuss the resumption of the seismic hearings at the close of this? Because I will not prolong this, but obviously there are some things that need clarification.

CHAIRMAN GROSSMAN: Yes, we are.

MR. GOLDBERG: Yes, we are going to discuss it?

CHAIRMAN GROSSMAN: Yes. We have a time slot here for discussing it. Mr. Knotts has indicated he wants to put on seismic witnesses and I have indicated that we will have our discussion first and I do not think then we will have any need for the seismic witnesses. But we will see.

MR. KNOTTS: I think the procedure I have in mind would be to put the witnesses on and ask them a few questions, which will give the Board an opportunity, if it wishes -- I think it might be better if we heard from them very briefly first and in very summary fashion, and that might sharpen up the areas that we do not understand that might -- it is a lot easier for them to understand what we do not understand than it is for them to tell me and have me

tell you.

CHAIRMAN GROSSMAN: Okay, fine.

MR. GOLDBERG: On the subject of scheduling, I would just like to say that I hope we could accommodate Dr. Branigan, who is from out of town --

MR. KNOTTS: He is on my list.

MR. GOLDBERG: -- before perhaps we deal with Dr. Barker or some of the other witnesses who are available locally. Mr. Knotts, would you mind --

MR. KNOTTS: No, I would not mind. I will then say that we do seismic and then Branigan and then Barker.

MR. GOLDBERG: Okay, fine.

MR. KNOTTS: And then there is the matter of -- we have agreed with Mr. Bursey -- the exact details may still need to be cleaned up, but we have agreed that he can introduce the testimony of one of those affidavit witnesses as if the witness appeared and testified.

CHAIRMAN GROSSMAN: Okay. I am still reserving our position on the seismic until we get a summary from you before they get on, because I am afraid that it is going to provoke quite a lot of examination by the Board and that is going to interfere with the rest of the schedule, and that is what I am really concerned about. You know, it is fine if you have in mind the simple questions you asked, but they may provoke a lot more complex questions than the simple

questions that you ask. So that is what I am a little wary of.

Now, I do not want to prolong the discussion here. But after Mr. Barker, what do we have, Mr. Knotts?

MR. KNOTTS: I have Branigan, Barker, Mr. Bursey's introduction of the portion of one of his affidavits that deals with Dale Campbell and schedule matters.

CHAIRMAN GROSSMAN: Okay.

MR. KNOTTS: Closing matters, proposed findings, closing the record, all that stuff.

CHAIRMAN GROSSMAN: Okay, fine.

Mr. Goldberg, did you have a comment?

MR. GOLDBERG: No, not on that.

CHAIRMAN GROSSMAN: Are we ready to go, then? Is everyone agreed on that schedule tentatively?

(No response.)

CHAIRMAN GROSSMAN: Fine. Mr. Goldberg, why don't you continue?

Whereupon,

DR. MICHIO KAKU

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

VOIR DIRE EXAMINATION

BY MR. GOLDBERG:

Q Dr. Kaku, you indicated you read the depositions of Mr. Ford and Whisennant as they related to welding deficiencies at the Summer station; is that correct?

A I read the depositions that Mr. Bursey showed me.

Q Are you aware of the Applicant's quality control and quality assurance programs?

A Yes.

Q Do you know whether or not the Applicant has conducted investigations regarding these welding allegations?

A I think all of the allegations have been investigated.

Q Do you know what if any corrective action was taken as a result of those investigations?

A Yes, certain corrective actions were taken. In other areas it was deemed not that important.

Q Yes. I believe you indicated yesterday you heard the testimony of the I&E panel -- by the way, I&E is shorthand for the Office of Inspection and Enforcement -- about the investigation they conducted into the welding allegations of those gentlemen; is that correct?

A That is correct.

Q And you are aware of the corrective action that was initiated as a result of those inspections?

A That is correct.

Q Do you know how many welds were involved in those allegations?

A The total number of welds is 14,000, of which large classes of the 14,000 welds were under investigation.

Q Okay. Do you know how many welds were actually investigated at the site?

A About less than one percent of that total.

Q Do you know how many welds there are at the site?

A In the deposition that I read from Mr. Bursey, 14,000 welds were in question.

Q Do you know how many welds there are?

A Total?

Q Yes, total at the nuclear plant site.

A No, I do not.

Q You indicated, I believe, that you believe that the investigation into these welding allegations was inadequate; is that correct?

A That is correct.

Q How many welds do you believe it was necessary to inspect in order to provide adequate assurance that the plant was safely built?

A I think all 14,000 should have been investigated.

Q Have you ever conducted an investigation into quality assurance or quality control matters at a nuclear power plant?

A No.

Q Have you ever conducted any investigations into alleged faulty deficiencies in a nuclear power plant?

A Indirectly. At the Shoreham trial concerning certain allegations of welds in a General Electric BWR Mark II reactor in Long Island, I was submitted as expert testimony on the reliability of certain class 1 violations of the ASME codes.

Q Back to the welds involved in these investigations. Do you have any concern, after hearing the testimony or, I assume, familiarizing yourself with the testimony of the Applicant and the Office of Inspection and Enforcement about its investigations, that there is a safety problem concerning those welds?

A I think there is a reasonable case that can be made, given the fact that the witness admitted that some of these welds in question were in the primary, and the witness also alluded to the fact that they were possible code class 1 violations of the ASME boiling water code section 3.

Q Okay. You have no first-hand knowledge, however, that there are welds that were not properly corrected, that indeed present a real risk to the -- to the safety of the plant as built, no first-hand knowledge?

A Nobody has any first-hand knowledge, because nobody has ever looked into 99 percent of the welds at

hand.

Q And you have not even been to the site; is that correct?

A That is correct, I have not been to the V.C. Summer site.

Q Let's talk about emergency planning. Are you familiar with the four standard emergency classifications established in the Summer emergency plans?

A I have the 654 in front of me, which lists the various procedures given in an evacuation, if that is what you mean.

Q I am not sure that is what I mean. Are you familiar with the term "emergency classification"?

A I am.

Q What does that term mean to you?

A Well, given an accident at a nuclear power plant, there are various levels going up to site emergency and general emergency, general emergency being declared, for example, at Three Mile Island on March 28th, 1979.

Q Are you familiar with the conditions under which these classifications would be declared under the Summer emergency plans?

A I could look it up. I do not have it in front of me.

Q You do not know of your own knowledge. Do you

know the emergency action levels contained in the Summer emergency plans?

A No.

Q You do not know under what conditions those emergency action levels could be initiated?

A I could look them up very easily, but I do not have them --

Q But you do not know them?

A No.

Q Have you ever been responsible for implementing protective action in the event of a radiological emergency at a nuclear power plant?

A No. I am not affiliated with the commercial end of nuclear power plants, and as a consequence I do not have any contact concerning the authorizations for emergency classifications at nuclear power plants.

Q Have you ever been responsible, then -- I take it your answer is probably going to be the same -- for the implementation or initiation of evacuation of numbers of people in the event of a radiological emergency at a nuclear power plant?

A No. I am a theoretical physicist and I am not associated with the commercial end of nuclear power.

Q Yes. So would it be fair to say you have not taken the Summer emergency plans into account at all in the

preparation of your testimony?

A No. I have looked at the 654, which is sitting in front of me. And I had a chance to sit through the cross-examinations of many of the witnesses who will be in charge of evacuation.

Q Okay. Your testimony was prepared, I believe, before the testimony was offered by these witnesses.

A That is correct, that is correct.

Q Okay. Do you have any experience in civil defense matters?

A No.

Q Okay.

A As I said, I am a theoretical physicist without contact with the commercial end of nuclear power.

Q Did you take into consideration the provisions of the state emergency plan or the four local county emergency plans that surround the Summer ten-mile emergency planning zone in the preparation of your testimony?

A No.

Q With regard to ECCS, what in your opinion is an acceptable level for the maximum cladding temperature in the event of an accident?

A I think the maximum cladding temperature should be very much below the oxidation point of the zirconium. I think 2,200 degrees Fahrenheit already puts it very close to

the autocatalytic point of zirconium, which was exceeded at Three Mile Island. I think that is a very serious situation because you would have cladding failure, you would have splintering, disintegrations of the cladding, of the fuel rods, at 2,200 degrees Fahrenheit.

Q Let me ask you, do you agree with the 2200 degree Fahrenheit peak cladding temperature level established in the Commission's emergency core cooling system rule?

A The point of my testimony is not to challenge 10 CFR 50. I only state that to clarify 10 CFR 50 the writers of 10 CFR 50.46, Appendix K, realized that at 2,200 degrees Fahrenheit, which is the maximum allowed temperature limits within Appendix K, there would be a serious problem with core disintegration because we are beyond the oxidation point of zirconium and we are very close to the autocatalytic point of zirconium, at which point you reach the point of no return.

The hydrogen gas bubble at that point begins to be generated rather furiously, like what happened at Three Mile Island.

Q Okay. Dr. Kaku, I let you give your answer, but just please give me a yes or no answer. Do you believe that the limits in the regulation are acceptable, namely the 2200 degree Fahrenheit temperature limit?

A That is not the subject of my testimony, to

challenge 10 CFR --

Q Could you just give me an answer. Do you regard -- in your professional opinion, do you regard it as acceptable or not?

A I have doubts as to whether 2200 degrees Fahrenheit should be the maximum allowed temperature limits in 10 CFR 50.46K.

Q Thank you. You have probably given some background for your opinion.

Let me ask you, are you familiar with some of the Commission activity in connection with augmenting its requirements in the light of lessons learned from the TMI accident?

A I have gone through the lessons learned, the NUREG's that have come out of the NRC since Three Mile Island.

Q Are you familiar with a document entitled "Clarification of TMI Action Plan Requirements"? This is 0737, dated November, 1980.

A 0737, I have gone through it. I have not gone through it in detail.

Q Did you factor any of these new requirements into your testimony?

A I did. But given the fact that I thought that a lot of them were cosmetic, I did not think that a lot of

them addressed the main points, that is the reliability of the ECCS and the criteria as set forth in 10 CFR 50.

Q Let me ask you to give me some examples of the manner in which they were factored into your testimony?

A They were -- as I said, they were -- I did not think that the lessons learned task force of the NRC did an adequate job in evaluating the full impact of the Three Mile Island accident. The changes made by the NRC I thought were largely cosmetic. They did not address whether or not the ECCS would ever be given a full-scale one to one test, as has been urged by nuclear physicists for the past 20 years. Physicists for the past 20 years have urged that the Government test nuclear power plants the same way we test cars: we crush them, we put them under maximum stress. And a nuclear power plant has never ever been tested against the maximum break of a cold water pipe of the primary system of a reactor.

Q Dr. Kaku, is it fair from that statement, then, that you do not agree with the Commission, then, that the TMI action plan requirements are adequate and sufficient in terms of additional requirements as a result of that accident to factor into our licensing practice? Is that correct? Is that your statement?

A That is not correct. All I am saying is that the recommendations of the lessons learned task force I think do

make nuclear power plants safer, but I do not think they have addressed the crucial question and that is whether or not the ECCS will ever be given a full-scale one to one test like we test cars.

Q Okay. Let me just say, is it fair to say, then, you do not regard them as sufficient?

A That is correct. I regard them as basically cosmetic.

Q Okay. Are you aware -- by the way, we are back to ECCS. I note that part of the rulemaking considered requiring an actual test. Are you aware of that fact?

A No test has ever been done and to my knowledge no test will ever be done.

Q I appreciate that and I think you have indicated that. But will you give me an answer to my question, do you know whether or not those arguments were made in the context of the ECCS rulemaking and considered by the Commission?

A For the past 20 years physicists have testified at almost all the various rulemaking hearings recommending that the Government conduct the acid test.

Q I will accept that as a yes answer, if that is okay with you. Can I interpret that you have answered me in the affirmative?

A I am not sure specifically whether at that rulemaking hearing whether or not a scientist recommended

that. All I am saying is that for the past 20 years physicists have, at MIT and other places around the country, recommended the Government do the acid test on a nuclear power plant.

Q Okay, then, I guess the answer is you do not know?

A Specifically for that one I do not know.

Q Okay, you do not know. Are you familiar with the Commission's fire protection requirements in Section 50.48 of its regulations?

A I have gone through that section.

Q Have you factored those requirements into your testimony?

A I have not stressed the fire hazards, even though I do mention Browns Ferry.

Q What way have you factored them into your consideration of fire protection to the extent it is a subject of your testimony?

A Because in my testimony I refrain from stating flatly that the Browns Ferry-like incident could happen again in the same way it happened on March 22nd, 1975, outside Decatur, Alabama. A very serious fire, about 1,600 cables destroyed, $10 million damage done, emergency core cooling system destroyed in Unit 1, crippled in Unit 2.

I did not say in that report, and I was very

careful not to say in that report, that there could be an exact repeat of the Browns Ferry incident, given changes in the fire codes of the NRC.

Q Okay. Are you aware of the unresolved safety issues -- First of all, are you aware of that term, "unresolved safety issues"?

A That is right right. There have been several --

Q Are you -- I did not mean to cut you off.

A Yes, I am.

Q Okay. Are you aware of what unresolved safety issues pertain to the Summer Plant?

A All of them concerning PWRs.

Q Yes. Have you reviewed the Summer safety evaluation report and the supplement to see how the Commission staff has addressed the issue of unresolved safety issues for this license?

A I have. I have NUREG-717 in front of me.

Q Are you familiar with -- excuse me.

(Counsel for staff conferring.)

Have you reviewed Supplement 1 to the SER?

A That is correct.

Q I notice the subject of unresolved safety issues is addressed in your testimony. Can you tell me how the staff review of unresolved safety issues was factored into your testimony?

A It was factored into my testimony to the degree that I do not feel the NRC has adequately dealt with the unresolved safety problems: for example, water hammers,

anticipated transients without scram. Even the NRC admits that many of these allegations are still subject to study. The NRC itself recognizes that they are still unresolved.

(Counsel for the staff conferring.)

Q All right. The TMI accident, which you also refer to in your testimony, have you reviewed the accident sequence for the TMI accident?

A Right. I have gone through NUREG-0600, the Rogovin Report and the Kemeny Commission Reports on the incident.

Q Yes. Which sequences, then, did you consider in the preparation of your testimony?

A I did not consider any specific sequence stemming from Three Mile Island. I merely mentioned Three Mile Island in the testimony to mention the impact that human error and luck can have in preventing an accident from escalating. The Three Mile Island accident was probably a PWR-9 and it came very close to escalating to a PWR-3. It was sheer luck that it did not escalate to a PWR-3.

So I factored it into the testimony to the degree that luck plays a part in every nuclear accident.

Q Yes. I just want to indicate that on page 9, paragraph 7 of your prefiled testimony, you describe what appears to be an accident sequence at TMI. Can I just ask for the source of that particular description of the

accident sequence?

A Right. The source of the description of the scenario of a nuclear accident comes from the reviews of Modern Physics, summer 1975, where it gives a blow-by-blow description of how an accident which would today be called a PWR-3 would progress. It is on page F-84 of the Reviews of Modern Physics, summer 1975, published by the American Physical Society.

Q Is that the American Physical Society's description of the TMI accident?

A No, not the TMI accident.

Q Well, I am talking about just the TMI accident. Is that their description of the TMI accident, which I think was my question?

A Oh, no. I mean this report was done several years before the Three Mile Island incident.

Q Okay.

CHAIRMAN GROSSMAN: Mr. Goldberg, the reporter is having quite a bit of difficulty because sometimes you do not let Mr. Kaku finish.

MR. GOLDBERG: I apologize to the reporter and Dr. Kaku.

THE WITNESS: As I was saying, the Reviews of Modern Physics, summer 1975, was done several years before the Three Mile Island accident. I did not use Three Mile

Island as a basis for my accident scenario. I used the Reviews of Modern Physics as a skeleton for my scenario. Like I said, Three Mile Island was probably a PWR-9, and I wanted to include a PWR-3 in the accident scenario.

MR. GOLDBERG: Maybe we can get at this a little differently.

On page 9, the final paragraph, you give a description of what appears to be an accident sequence. I just wanted to ask you what is the source for that accident sequence.

A Right. Let me just read to you from my own testimony: "Here we will give our own scenario based on some of the results found in WASH-1400 and the 1975 American Physical Society report.

Q By the way, at the risk of interrupting, I do not believe that that is the final paragaraph on page 9, paragraph 7 of your prefiled testimony, unless we have different copies.

CHAIRMAN GROSSMAN: Dr. Kaku, the question does relate to what you said about the TMI accident on page 9, and the question, if I understand it, is where you derived the facts from that.

THE WITNESS: Could you read that? I have a slightly different pagination.

MR. GOLDBERG: I'm sorry. I will begin reading.

If you find it anywhere --

THE WITNESS: Point No. 1?

BY MR. GOLDBERG: (Resuming)

Q It is paragraph number 7. It is on page 9. It begins "It was pure luck that the reactor did not melt down. If the plant supervisor, Brian Meyler, did not close the PORV two hours into the accident, the core would certainly have melted. But because the plant operators did not know what they were doing" -- Have you found it?

A I found it.

Q Okay. What is the source for that accident sequence?

A The source of that analysis comes from the special inquiry group of the NRC called the Rogovin Report, volume 1, which I have in my hand here. The Rogovin Report states flatly that a lot of very fortunate incidences took place to ameliorate the accident.

On page 20 of that report, "Engineering calculations done for the special inquiry group show that within 30 to 60 minutes, a substantial portion of the fuel in the core, certainly the center of the top half of the core and perhaps as much as half of all the fuel, would have melted. An eventual full core meltdown probably would have occurred, especially if one assumed that the operators cut off all the water being pumped into the core."

Okay. It is Brian Meyler who has just come in to relieve Bill Zewe as shift supervisor who gets credit for the day's first major move. In other words, during the course of the accident there was basically one fortunate incident that was initiated by Brian Meyler, and that was he turned off the PORV.

"For whatever reason and by whatever route, Meyler has arrived at exactly the right decision just 20 minutes after coming on the scene fresh from the outside. Armed with this intelligence, any of the foremen could have expected to reason that with the pressurizer relief valve stuck open for more than two hours, a loss of coolant accident had been in progress and so operation of the high pressure injector system was critical. Instead, never having asked the second question, all will grope in bewilderment for another whole day before the truth strikes."

I think any reasonable interpretation would say that it was sheer luck that Brian Meyler initiated the only correct decision that day on the morning of March 28, 1979.

Q I think some of the problem with that is I notice appended to your prefiled testimony is about 20 enumerated references, but I see no correlation to the text, so is it your position that somewhere in the text there are statements for which these 20 references provide some basis?

CHAIRMAN GROSSMAN: Excuse me. I see item 8 in the

references that I believe refers to that report.

MR. GOLDBERG: Yes, I understand. There are a list of 20 references. However, there is no indication in the 13-page text of the prefiled testimony what statements are attributed to which references, although the references really do not have very much meaning without knowing to what particular portion of the testimony they refer.

THE WITNESS: I would apologize on behalf of my secretary, who did not type in the numbers corresponding to the references that I have at the back of the report. But the reference for that particular section, that is, that it was pure luck that the reactor did not melt down, that is a subjective conclusion from the paragraph that I just read to you, pages 19 and 20 of Volume 1 of the Rogovin Report, the report of the special inquiry group of the Nuclear Regulatory Commission.

MR. GOLDBERG: I would just like to ask that if any portions of this prefiled testimony are admitted, that the references to those admitted portions be provided either in a revised text of the prefiled testimony or just given once a ruling is made on which portions will be admitted.

CHAIRMAN GROSSMAN: Well, I am not going to compel the witness to do that, but you are certainly doing a fine job in tying him down to the references. But if he would like to do it and has a copy, he is certainly welcome to

supply that to you.

MR. GOLDBERG: Okay, Judge. I will not take a lot of time up with that. It is at the witness's discretion, then. I am nearing the end, by the way, for everyone's benefit.

BY MR. GOLDBERG: (Resuming)

Q Let me just direct your attention to page 10, paragraph 9. You discuss four separate reactor incidents. I wonder if you can tell me what significance -- explain to me the significance or relevance these have in your estimation to our consideration of the safety of the Summer site.

A The whole point of point number 9 is that even after Three Mile Island there have been many serious incidences which point to the fact that there are, I feel and other physicists feel, inadequate monitoring of nuclear power plants in the United States. Specifically I mean to say that a Class 8 accident could be pushed into a Class 9 accident unless a nuclear power plant is operating at peak performance.

Multiple failure, common mode failure, which have not been factored into WASH-1400 and which today constitute the main criticism of the Rasmussen Report, show that incidences can take place which were not predicted by the Rasmussen Report at the probability given by the Rasmussen

Report.

These incidences, the incidences at Crystal River, the incident at Indian Point and the incident at Browns Ferry, Unit 3 all point to the fact that there is substandard monitoring of nuclear power plants even after Three Mile Island.

Q Are you familiar, by the way, with the four events that you describe?

A I have most of the NRC documents on them.

Q I mean do you regard yourself as reasonably familiar with how they occurred?

A I am reasonably familiar.

Q How would you classify each of those events in terms of, say, the significance and importance?

A In terms of the classification, they would not be a Class 8. They would probably be within Class 1, 2, 3.

Q Okay. Summer is a Westinghouse PWR, I believe, isn't that correct?

A That is right, 900 megawatts.

Q Oyster Creek, I see here, is a BWR.

A Yes. Oyster Creek is a MARK I General Electric boiling water reactor.

Q Crystal River. That is a Babcock and Wilcox reactor?

A I understand that to be true.

Q Browns Ferry, is that a BWR?

A Browns Ferry is a General Electric BWR. Indian Point is a Westinghouse PWR.

Q Right. Okay, do you regard yourself as an expert in either structural or metallurgical engineering?

A As I said before, I am not a qualified professional engineer. My doctorate is physics, specifically areas of nuclear and subnuclear physics. I am familiar with aspects of engineering to the degree which they relate to accident scenarios at Nuclear Power Plants, but I am not a licensed engineer.

(Counsel for staff conferring.)

MR. GOLDBERG: Can I have a moment, please, Judge? I think I am concluded.

CHAIRMAN GROSSMAN: Surely.

MR. GOLDBERG: All right, just two questions.

BY MR. GOLDBERG: (Resuming)

Q Do you consider yourself an expert on the health effects if ionizing radiation?

A I am very much familiar with the health effects of ionizing radiation. I am not a health physicist.

Q Okay. Have you ever performed any epidemiological studies?

A No, I have not. I am not an epidemiologist.

CHAIRMAN GROSSMAN: Okay, Judge, I have no further

voir dire. I understand perhaps that Mr. Knotts has some further voir dire. I could either move at this time to strike the testimony on grounds that I will indicate. I do not know whether I should do that now or let Mr. Knotts finish his voir dire.

CHAIRMAN GROSSMAN: We will let Mr. Knotts conclude.

VOIR DIRE -- Resumed

BY MR. KNOTTS:

Q Dr. Kaku, you told Mr. Goldberg that a physicist or a scientist must consider all the available data in reaching his conclusions; is that not right?

A That is correct.

Q And you also told him that you were relying on the alleged deficiencies in welding referred to in certain depositions in this proceeding.

A That is correct. Mr. Bursey was kind enough to show them to me.

Q Yes, and you told them also that you read Mr. Nauman's testimony regarding those welding allegations; is that right?

A Mr. Who? I am not aware.

Q Mr. Nauman. The Applicant's witness, Mr. Nauman.

A I do not know. I have only read the reports given to me by Brad Bursey.

Q Oh, I see.

MR. BURSEY: Excuse me. Which could have been portion of Mr. Nauman's responses to the statements by the witnesses, I mean the previous deponents, Wisfenant, Fort, et al.

BY MR. KNOTTS: (Resuming)

Q I understood you to say, Dr. Kaku, that no one has ever looked into 99 percent of the welds, that only one percent were looked at.

A The NRC. I understand that the Licensee has looked at a substantial number of those welds but the NRC has not.

Q Would it surprise you to learn that the Licensee looked at 100 percent of the welds, according to Mr. Nauman's testimony?

A According to the testimony I heard, a large fraction of the 14,000 welds were looked into by the Licensee, but the NRC has looked into less than 8 percent.

Q Would your concept of a large fraction include 100 percent?

A On the part of the Licensee, I think 100 percent would constitute a very large fraction. On the part of the NRC, I think one percent constitutes a substandard fraction.

Q Would it surprise you to learn that according to Mr. Nauman's testimony, not only were 100 percent of the welds reinspected, but there were two parallel separate

inspection groups doing it?

A I imagine there was such activity taking place.

Q Do you have any reason to challenge Mr. Nauman's testimony?

A Only to the degree that the NRC did not check up on him and did not perform a parallel study of its own.

Q Is part of the reason that you do not find the NRC's testimony persuasive the very fact that it is the NRC's testimony?

A No, I consider one percent considerably below 100 percent.

Q Do you approach Mr. Nauman's testimony with an open mind or do you think he might tend to misrepresent the facts because he works for the utility?

A I approach everything with an open mind. I am simply stating that as far as the NRC's performance is concerned, I think it is substandard. I have no disagreements with looking at 100 percent of the welds on the part of the Licensee. I think that is commendable.

Q Your field of special expertise, among the fields that we went over last night, I believe you indicated as thermohydraulics; is that correct?

A Thermodynamics.

Q Thermodynamics. Thank you for the correction.

Q What do the initials "DNB" stand for, Dr. Kaku?

A DNB? I am not aware of those initials.

Q Would it refresh your recollection if I gave you the words "nucleate boiling"?

A Pardon?

Q Nucleate boiling.

A No, it would not refresh my memory.

Q All right.

Which of the following is the most effective regime for heat transfer: film boiling, nucleate boiling or steam binding?

A Repeat the question again.

Q Yes. Which of the following is the most effective heat transfer regime: film boiling, nucleate boiling or steam binding?

A It would have to be one of the first two because the third, steam binding, is very, very uncharted area of thermodynamics and thermohydraulics. Very little is understood about steam binding.

Q But you do not know which of the first two.

A I do not know which one of the first two, no.

Q When you say you are a nuclear physicist, Dr. Kaku, you do not mean to imply that the area of nuclear physics that you deal with is power reactor core physics, or do you?

A A large part of my training has been on the

theoretical side, that is, the question of nucleon structure, nucleon-nucleate interaction, hydronic physics, and part of that training in turn deals with neutron transport theory and nuetron diffusion theory, which is useful both in the building of the atomic bond, the building of breeder reactors and the building of light-water reactors.

Q Is your branch of physics high energy physics, Dr. Kaku?

A I do high energy physics as well as physics outside of the high energy regime, including low energy physics.

Q I see.

What sorts of machines does one work with in high energy physics and low energy physics? Does that include accelerators, for example?

A That is right. You have low energy, heavy ion accelerators like the one at Pittsburgh, and then you have high energy proton accelerators like the one at Brookhaven, Long Island.

Q In your current work do you use nuclear reactors?

A In the current work, like I said, I have three areas that I mentioned yesterday, the first being theoretical nuclear, the second being the unified deep field theory, a the third being the question of accident scenarios, including the release of radionuclides from a

nuclear power plant. It would fit into the third category.

Q I am sorry, I almost cut you off and I did not hear the last three or four words of your answer.

A Okay. The question of the performance of nuclear cores would be under the third category.

Q Very well. What percentage of your time in the last, say, four years have you spent on the analysis of Class 9 accidents?

A The percent of my professional time?

Q Yes, sir.

A Would be approximately a third.

Q Approximately a third?

A Yes.

Q And where have you presented the results of your analyses of Class 9 accidents on which you spend a third of your time?

A First of all there is the issue of Technology Review, which is the magazine of the Massachusetts Institute of Technology, which published an article of mine on the question of the reliability of the emergency core cooling system.

Q Are there any other places where the result of this work in which you have spent a third of your time has been published?

A They will be published by the Institute for Safe

Technology. It is very difficult to get these published in the standard journals because the standard journals exercise a certain amount of peer review from the national laboratories.

Q Dr. Kaku, I take it from what you told me about DNB that you would not know what the minimum ratio for design transients in this reactor is.

A Repeat the question.

Q I take it from what you told me about DNB that you would not know what the minimum DNB ratio is for design transients in this reactor.

A I would need clarification. I would not know on the basis of that statement.

Q All right. Would you know what the peak lanier power expressed in kilowatts per foot would be for determination of protection setpoints?

A No, I would not.

Q Would you know what a hot channel factor is?

A No, I would not. That is jargon.

Q How about a heat flux hot channel factor?

A No.

Q F ?

Q

A No. You are asking questions specifically on the thermohydraulic systems of the operation of nuclear cores. Like I said, my expertise deals with the release of

radionuclides; and to the degree that you require a certain knowledge of reactor physics including neutron transport theory and neutron diffusion theory, then my training would overlap in the third part of what I mentioned.

You are asking specific questions in an area which I did not claim expertise.

Q You would agree with me then, Dr. Kaku, that a scientific witness should not claim to be an expert in areas where he is not -- if he wants his opinions to be believed in the areas where he does have relevant training.

A No one can be an expert in every picky are of science, that is correct.

MR. KNOTTS: I have no further voir dire at this time.

CHAIRMAN GROSSMAN: Mr. Wilson, did you have any voir dire?

MR. WILSON: No, Mr. Chairman.

CHAIRMAN GROSSMAN: Mr. Goldberg, you may --

MR. GOLDBERG: Can I have one or two follow-up voir dire if I might?

VOIR DIRE

BY MR. GOLDBERG:

Q I appreciate, Dr. Kaku, your regard for the NRC credibility when it comes to inspecting reactors. I am mindful of your criticism oftentimes of the NRC. I am not

assuming now that the testimony will show the number, what percent of the welds were or were not inspected, but I believe you indicated that in your recollection there were 14,000 welds involved in the allegations by those two gentlemen.

Is that your understanding?

A My understanding is that the deposition shown to me by Brad Bursey mentions 14,000 welds.

Q So that if we assume one percent of those is 140 welds -- is that correct?

A The man on the stand said 50 to 100.

Q How long do you think it would take to inspect 50 to 100 welds in the locations where you understand them to be at the Summer Nuclear Plant?

A How long would it take to inspect 50 to 100?

Q Yes.

A It would take several hours.

Q Yes. How long would it take to inspect 14,000?

A You would have to ask the Licensee which actually performed that operation.

Q Would it surprise you to learn that that might be a substantial length of time?

A I imagine it would be, given the fact that each one would take several minutes to an hour.

Q It would not surprise you, I am sure, to know that

the NRC Regional Office of Inspection and Enforcement has a great deal of responsibilities and a wide number of plants to inspect, would it?

A Agreed, and I think it should include inspecting 14,000 welds. The Licensee performed that function. I do not see why the NRC cannot follow suit and follow the sterling record of the Licensee.

Q So basically your position is that the NRC should duplicate basically everything the Applicant does -- excuse me, the Licensee, as you put it.

A Not necessarily, but I think it is penny-wise pound-foolish to scrimp on a few hundred thousand dollars here and wind up with a billion dollar albatross around your neck called Three Mile Island.

MR. GOLDBERG: Okay. I have no further questions. I do not know whose court the ball is in.

CHAIRMAN GROSSMAN: Well, Mr. Bursey had not yet offered the testimony, and perhaps that is where we crossed our signals yesterday as to what is cross-examination and what is voir dire. I assumed you were just going to voir dire the qualifications.

MR. GOLDBERG: Well, I believe that my voir dire would go to the grounds for my objections to this testimony, both qualifications, foundation, et cetera. So I regard all the voir dire as relevant, as I hope will become evident.

CHAIRMAN GROSSMAN: Okay. But I think now it is up to Mr. Bursey to offer the documents and then we will hear your objections, to offer Mr. Kaku as the expert and to offer his --

MR. BURSEY: Yes, sir. I would also like to back up one step and move that Dr. Kaku's professional qualifications be entered into the record, which I mean he gave orally. There was an oral recitation yesterday which precipitated the voir dire.

CHAIRMAN GROSSMAN: It is already in the transcript [illegible] we do not have to bother with that, Mr. Bursey.

DIRECT EXAMINATION - Resumed

BY MR. BURSEY:

Dr. Kaku, do you have before you your prefiled testimony on Contention 8, the inadequacy of the emergency plans at the V.C. Summer Plant?

A Right. I have the testimony in front of me.

Q And do you have any changes that you would like to make to that testimony?

A Yes, I would. I would very much like to make a change beginning on the first page, starting with the sentence "It is the purpose." It is the third sentence in point number one. I would like to delete that, specifically the parts that say, and I quote, I would like to delete "It is the purpose of this statement to show that substantial

scientific objection can be raised contesting this ten-mile limit. A logical, compelling case can be made on scientific evidence to support the conclusion that a ten-mile evacuation radius does not take into account the full impact of a Class 9 accident at the plant. A ten-mile radius severely underestimates the full impact of a nuclear accident which could potentially endanger the health and safety of hundreds of thousands of people downwind of the reactor site, especially the people of Columbia, South Carolina."

I would like to move to delete that from the testimony.

Then also four pages later with the sentence starting "Both WASH-740" --

Q Is that page 5, Dr. Kaku?

A That is page 5. I would like to strike that first sentence that says "Both WASH-740 and its update show the clear inadequacy of the ten-mile evacuation radius."

In other words, in conforming with the rules and regulations of this hearing, I would like to delete any challenge to the ten-mile radius.

Q Thank you, sir. And was there a new cover letter to your testimony?

A That is right, there is.

Q And without reading that at this time, if you

would look at it and see if there are any changes that you want to make to that.

A No, there are no changes that I would like to make in the amendment to my testimony.

Q Now let me bring your attention to a handwritten change on mine. Let me see if that is on yours and on the ones that the rest of the parties have.

In the third paragraph, second sentence, "I am convinced that the Applicants would be" --

A Unable.

Q Unable.

A Right. There should be an "un" before the "able," which changes the meaning 180 degrees.

Q A small note there to include the "un" in front of "able" in the second sentence of the third paragraph of the new cover letter.

CHAIRMAN GROSSMAN: Okay. To clarify it, I understand, Mr. Bursey, you are removing that first page, really the affidavit with the caption from the original prefiled testimony, and substituting in its place that two-page statement with the caption filed on longer paper, with that one correction, changing "able" to "unable." And I take it your are going to offer those --

MR. BURSEY: Yes, sir. I would now move that Dr. Kaku's prefiled testimony and the changes that he has

indicated be entered into the record as if read.

CHAIRMAN GROSSMAN: Mr. Knotts, do you want a short recess now?

MR. KNOTTS: I would move to strike portions of it but I would like to hear from Mr. Goldberg, who I understand is prepared to go through sentence by sentence virtually.

MR. GOLDBERG: Not sentence by sentence.

MR. KNOTTS: Section by section.

MR. GOLDBERG: Perhaps section by section.

MR. KNOTTS: In the interest of saving time, I will let him go first if I may.

CHAIRMAN GROSSMAN: Do you want a recess now or can you proceed?

MR. GOLDBERG: Perhaps we could take a five-minute recess.

(Recess.)

CHAIRMAN GROSSMAN: Mr. Goldberg?

MR. GOLDBERG: Yes, Judge. I just want to make it clear for the record, I want to iterate my overriding objection to the contention -- I am sorry, -- to the proffered testimony.

To briefly summarize, one is that we feel it is a challenge to the Commission's emergency planning requirements to require site-specific consideration of Class-9 accidents in connection with an individual review of emergency plans. We believe that the pre-filed testimony constitutes a challenge to the Commission's June 1980 policy statement of the consideration of Class-9 accidents which limits those to a showing of special circumstances. And by the way, there is current case law which I will provide to the Board and parties, I think, on returning to the office which indicates the validity of that principle. And special circumstances in the past have been confined to population density considerations and also, whether any unique characteristics about the siting -- in other words, a floating offshore power as opposed to a land-based plant, and certainly, there is nothing unique in either of those respects about the Summer Plant or site.

Also, we believe that it is an untimely introduction of the Class-9 issue for which opportunity was afforded Mr. Bursey in November of 1980 at our prehearing conference

and which he did not take advantage of.

And another overriding objection is it is, in its entirety, irrelevant to Mr. Bursey's contention no. 8 which deals with the preparations that the applicant has made to implement its emergency plan in those areas where the assistance and cooperation of offsite officials is required.

Now turning to the specific testimony, if I understand correctly from page 2 of the new addition to the prefiled testimony, it states that the testimony, quote, "should be considered as questioning the applicant's state and local agencies' abilities to implement the plan, even within the specified ten-mile emergency planning zone."

MR. BURSEY: Could I get you to be more specific? The first specific site in the 10 CFR policy that you cited in Part 1, and then again, you are reading from Kaku's testimony. If you could tell me exactly where?

MR. GOLDBERG: The policy statement I referred to is one of June 1980. I do not have it before me. It has been referenced earlier in the proceeding, and in fact, even formed the basis, I think, for some of your questioning, Mr. Bursey.

MR. BURSEY: And was there a concurrent regulation or are you simply relying on the policy statement for your strike?

MR. GOLDBERG: I am relying on the policy

statement, interpretive case law, which stands for the proposition that in order to adjudicate Class-9 accidents in individual licensing proceedings, there must be a showing of special circumstances, and I could probably get you some case law perhaps before we leave today when I have a chance to refresh my recollection on what those cases are. I will nonetheless provide citations to that body of case law to you, Mr. Bursey.

MR. BURSEY: Yes, sir. Do you contend for the purposes of this strike that your basis is that it is a rule challenge?

MR. GOLDBERG: Well, I am not sure why I am engaging in this discussion with Mr. Bursey.

CHAIRMAN GROSSMAN: I am not sure, either. But you can state your grounds, Mr. Goldberg.

MR. GOLDBERG: I think I have stated my grounds. I can repeat it.

CHAIRMAN GROSSMAN: You did not complete point four. You started to refer to page 2.

MR. GOLDBERG: That is where I began. I understand Mr. Bursey also wanted my reference. We were handed a two-page addition to the pre-filed testimony of Dr. Kaku, the last sentence of which begins with the word "Therefore," and it says, quote, "Therefore, my testimony should not be construed as such an attack," meaning attack

on the Commission's emergency planning rule, "but should be considered as questioning the applicant's state and local agencies' ability to implement the plan even within the specified ten-mile emergency planning zone."

And I just indicated that given the fact that that is the purpose, I will, you know, treat my objection to the testimony on that basis.

CHAIRMAN GROSSMAN: By the way, that was .5, not .4, I am sorry.

MR. GOLDBERG: All right. Turning now -- I'm going to be a little confused about the pages because in the earlier version this was -- page 1 began, evacuation and accident hazards at the V.C. Summer Plant.

CHAIRMAN GROSSMAN: It is still the same.

MR. GOLDBERG: All right, fine.

CHAIRMAN GROSSMAN: Let's decide on that now. We will treat the page numbers as the page of the body of the -- when we refer to the preamble or to the preface, use 1 and 2, also.

MR. KNOTTS: How about 1 and 1-a? If we renumber the second long page as 1-a, the first original page has been eliminated and the numbers will follow.

CHAIRMAN GROSSMAN: All right. The long page?

MR. KNOTTS: The first long page is 1; the second is 1-a.

CHAIRMAN GROSSMAN: It does not follow that way. The question -- .

MR. KNOTTS: Oh, I'm sorry, they were numbered -- I had numbered them.

CHAIRMAN GROSSMAN: I have no objection if you want to number them so that the long pages are 1-a and 2-a.

MR. KNOTTS: That is good.

CHAIRMAN GROSSMAN: And then the body of the testimony just with numbers. That is fine. Why don't we use that system, then.

MR. GOLDBERG: I guess the most efficient way would be to perhaps go on a paragraph basis. I am not going to go over each sentence. I do not think that would be profitable. I do not know if the Board prefers ruling on them paragraph by paragraph and getting whatever argument there is, or hearing -- .

CHAIRMAN GROSSMAN: Why don't you just proceed with your argument and we will decide?

MR. GOLDBERG: Okay. Paragraph 1, the first sentence we have no objection to. The next paragraph, the second paragraph in paragraph 1, that would constitute a challenge to the emergency planning rule, and also by virtue of the reference to releases and destruction in a 150,000 square mile area, is clearly irrelevant to the purpose for which Dr. Kaku's testimony is offered. Namely, the effects,

I assume, of some accident within the ten-mile emergency planning zone for Summer.

Paragraph 2 constitutes both a new contention regarding an alleged inadequacy in the emergency core cooling system without the proper showing under Section 2.714 of the Commission's regulations for amending contentions. And it further constitutes a challenge to the ECCS rule in Section 50.46, which I believe I elicited comments from Dr. Kaku which he does not regard as adequate.

Paragraph 3 involves the welds and concludes with a recommendation that hearings be called to investigate these charges and locate the precise welds mentioned by these welders. And by that, he is referring to Mr. Wisfenant and Mr. Fort. I assume that has been satisfied because that is, in fact, what we had yesterday. And I notice that Dr. Kaku was in the room conferring with Mr. Bursey as he examined at least I&E witnesses on that matter.

Certainly, Dr. Kaku has no firsthand knowledge to offer about the location or disposition of the welds. There was an opportunity, if Dr. Kaku wished, to testify on Mr. Bursey's behalf on contention 9 to re-file some testimony. It was not. And also to the extent that this is relied upon as a basis for the adjudication of a Class 9 accident, it does not constitute any special circumstances unique to this site which would warrant the adjudication of that under the

Commission's policy statement or case law.

I think we have testimony that all of the welds were inspected either by the applicant or NRC, that they were adequately corrected and that in the opinion of the NRC office, -- by the way, we had testimony from seven individuals with probably about 75 years of combined experience conducting inspections, that there was no concern over the structural integrity of the Summer plant. And that the problem of poor welds is not unique to Summer, moreover, but that it occurs at many plants, and it is something of a generic problem as well.

So there is certainly no additional evidence here that we have not already addressed.

CHAIRMAN GROSSMAN: I do not want to have prolonged argument here. We have a schedule. We just want to get your position. But I do want to point out to you that we are not here deciding the issues, and we are not deciding, you know, whether there are defective welds right now. To the extent that Dr. Kaku's testimony relies on our finding of certain facts and we do not find those facts, of course, the testimony will fall.

But that is not a reason why we ought to at this time exclude that testimony, but I just want to make the point. You can continue, Mr. Goldberg.

MR. GOLDBERG: Well, on that point, first of all,

Dr. Kaku has no firsthand knowledge about the welds in any event, so that his testimony here is really irrelevant and immaterial. We had the deposition testimony of Mr. Wisfenant and Mr. Fort. It was addressed in both the pre-filed and oral direct testimony by the applicant and the staff. There was no rebuttal testimony by either Mr. Wisfenant or Mr. Fort, the only ones who really had firsthand knowledge about the location and the problem with those welds.

So I guess I do see that. You know, it is unlike a situation where you have a contention and then you have evidence. Now we have had the evidence which I think shows the contention to be without merit, and I think that is uncontroverted.

There is also testimony on the basis of my voir dire that Dr. Kaku is not an expert in welding anyway, so that he would not know whether or not they were defective before and adequately corrected afterwards. So it really -- I do not think it could serve as any kind of evidentiary basis to consider some hypothetical Class-9 accident as a result of that.

Paragraph 4 all constitutes a challenge to the emergency planning rule establishing a ten-mile evacuation limit. If we continue on to page 4 we have fatalities ascribed to WASH-740, a document prepared in 1957 which Dr.

Kaku indicated did not assume any emergency protective measures would be implemented. He cites a figure here of a maximum of 43,000 fatalities. I think there is testimony here that within the ten-mile emergency planning zone, we only have 10,000 people, so there is no applicability to those figures or that study to the Summer site.

The same is true of some of these fatality projections given down at the bottom of page 4. We have also had testimony that WASH-740 preceded the development of an emergency core cooling system rule and the final criteria on that. And it is further irrelevant to Mr. Bursey's contention no. 8. I would say that continuing on to the top of page 5, also, the fatality numbers are irrelevant and inapplicable to the site.

Paragraph 5, the introductory language contains no reference there, but we have no objection. Subpart (a) contains no reference; we have no objection. Subpart (b) contains no references but we have no objection. Subpart (c) is argumentative. Subpart (d) is irrelevant. We have rules regarding safeguards at nuclear facilities in 10 CFR Part 73, which the Commission has deemed adequate to prevent any credible sabotage. Subpart (e) constitutes a challenge to the emergency core cooling system rule.

Supart (f) -- it is argumentative. Also, we believe it constitutes a challenge to the emergency planning

rules by going into scenarios outside of the ten-mile zone. Subpart (g) is argumentative, not really adequately comprehendable. Subpart (h) does not seem to be any basis, but we do not really object to it.

Subpart (6) constitutes, at least the preliminary language constitutes a challenge to the emergency planning rule. There is also no special circumstance shown here relevant to the Summer site which would bring into play the Commission's -- which would remove the Commission's prohibiting upon considering Class-9 accidents in individual proceedings.

Subpart (a), we have -- well, I guess we will let that stand. Our position in its entirety on paragraph 6, (a) through (d).

At the bottom of page 8, beginning again with Subprt (a), we are talking here about ATWS. We had a summary disposition. It was the subject of summary disposition after it was determined it met the NRC requirements, so this is an impermissible attempt to re-introduce the ATWS issue.

With regard to Subpart (b), it talks about welding. Dr. Kaku is unqualified, certainly, to offer an expert opinion in welding. Subpart (7) -- I think we have some question about the validity of the description of the accident sequence described here, and we feel somewhat kind

of neutral about it. I guess we will not -- well, I think we will let it stand on the strength of the reference given by Dr. Kaku.

Paragraph 8, all of the deficiencies at TMI precedes the Commission's Lessons Learned report, its new requirements in the TMI Action Plan requirements and the effect that they would have on the kind of -- such things as operator error, which are described here, and inadequate inspection procedures. And the Commission has decided that those are adequate and sufficient response to TMI. I know that Dr. Kaku obviously does not share our opinion that the Commission has gone far enough, but in any event, there has been a great deal of post-TMI additional requirements imposed which should alleviate those kinds of problems, certainly.

There are no circumstances which one might be able to describe peculiar to Summer that would warrant going into consideration of the TMI accident here.

Paragraph 9 is irrelevant to Summer. Three of the four plants are BWR's. Summer is a PWR; Indian Point is a PWR. It is okay insofar as it is a statement of fact, and we do not object to that statement of fact. It is certainly -- sorry, I may have misspoke. Crystal River is a B&W BWR. If I did misspeak -- is a PWR. The distinction there being the manufacturer and not the BWR/PWR.

Paragraph 10 is okay.

Paragraph 11 challenges the ECCS rule, and this is unrelated to the purpose of Dr. Kaku's testimony or contention 8. To the extent there were plant-specific unresolved safety issues, they have been addressed in the SFAR and an adequate basis for making a decision on licensig provided. In addition, one of the unresolved problems is not applicable at all -- that is stress, corrosion, cracking in BWR piping -- because we have a PWR.

Paragraph 13 again, the GE Mark I, II and III BWR is irrelevant to this Westinghouse PWR. Talking about such things as inadequate fire protection. And I think the witness testified we did not factor in the new fire protection rule in Section 50.48 in his testimony. Also, the cracking in the spargers is a phenomenon in BWR's and not PWR's.

And finally, I guess, in Section 14 we get to what I thought was the purpose for the whole thing with Dr. Kaku to begin with; that is, that Dr. Kaku was supposed to describe some kind of credible plant-specific accident for which it was alleged that the specific plant and offsite emergency plans would be unable to cope.

I might say -- it is probably a good point right here -- that understanding that our objections to the introduction of that issue have been overruled, that Dr.

Kaku probably is competent to develop Class-9 accident scenarios, and if the Board is apparently determined to hear the issue, I think that what we ought to do is have Dr. Kaku come up with a credible plant-specific Class-9 accident. And it would assume that given his admission that he knows nothing at all about emergency planning and has not read the applicable emergency plans, either onsite or offsite, that Mr. Bursey is going to find someone else who is going to say what -- how the plan, the specific plans, will fail to cope with the accident that Dr. Kaku is going to postulate.

Now having said that, I do not think that Section 14 is that accident. It is incredible. It is not plant-specific, and we believe contains a number of unreasonable assumptions, particularly past 6:00 o'clock, which you know is contrary to the testimony that we heard from state and local officials.

Now, Dr. Kaku by his own admission has never initiated an emergency response or an evacuation, and has no expertise in civil defense. I do not think he is a medical doctor. He is totally unfamiliar, you know, about epidemiology and other kinds of things which would call into question some of those matters he indicated he was not familiar with the situations in which the various emergency classes would be declared under the plant's emergency plans so that you know what point in time protective action would

be recommended and effected.

Some of the assumptions in the scenario at 12:05 regarding the TMI accident -- again, we have had certain post-TMI requirements, particularly in the area of operator procedures which are that those do, at least in the Commission's estimation, preclude so far as practicable an event like that from happening. Dr. Kaku acknowledged that he was unfamiliar with that document and did not really factor it into his testimony.

CHAIRMAN GROSSMAN: Excuse me. Which document was this?

MR. GOLDBERG: This was NUREG-0737, Judge. This is the clarification of TMI Action Plan requirements, which is the final product of the Commission's lengthy consideration of the Lessons Learned from TMI and their application to reactor licensing. When we are talking about the second part of the event at 12:05, about the -- not filling the vessel faster than the evacuation of the vessel through a pipe break -- that challenges the ECCS rule and assumes it will not be adequate. It assumes more than single failure, more than single error. And otherwise, I think posits an incredible event.

So for all the aforementioned reasons and all those grounds, we move to strike those portions of Dr. Kaku's testimony.

CHAIRMAN GROSSMAN: Mr. Knotts?

MR. KNOTTS: We take a somewhat different approach, and in one respect at least we find ourselves in sharp disagreement with the staff. If there is one thing that was established by the voir dire it is that the Board cannot accept Dr. Kaku as an expert on nuclear power plant accident analysis, and impacts. His scenario is clearly opinion, and opinion which he is not competent to give.

Several of his responses revealed that he does not have the expertise which he claims to have, relative to nuclear power plant accident analysis. Some or all of these will be self-evident to the Board, drawing upon common knowledge of the agency, of scientific matters.

In particular, I can refer to Dr. Kaku's claim of expertise in the area of thermodynamics and his unfamiliarity with DNB ratio. He claims to be familiar with Section 15 of the SFAR. It is clear from both that section of the SFAR and from the safety evaluation in not only this but every NRC case, that the touchstone of thermodynamic analysis for accident evaluation is the DNB ratio.

It is further astounding that Dr. Kaku is unfamiliar with film boiling, nucleate boiling if he professes expertise in thermodynamics. I can go on. There are numerous items. The Board may wish me to point them out now or to hear more about it from other witnesses later,

depending on your -- .

CHAIRMAN GROSSMAN: Point it out now.

MR. KNOTTS: Very well. His lack of familiarity with the Hench correlation. He claimed familiarity with both boiling water and pressurized water reactor ECCS analysis. The Hench calculation is, of course, integral to boiling water reactor analysis. His lack of familiarity with the Xenon oscillations, coupled with his response regarding his familiarity with reactor core physics, reveals that he is not a reactor physicist.

His response regarding liquid burnable poisons further confirms his lack of familiarity with the technology. And his statement regarding the melting point of both uranium metal and uranium dioxide are revealing in that regard, as is his lack of familiarity with the type of fuel that was assumed in WASH-740.

Further, Dr. Kaku has revealed that he has not read the evidence on both sides of the question and should not be permitted to frame an opinion, not having done so. He cannot qualify in the areas where he does not claim special expertise through his own reading and being self-taught. He must have formal training or work experience in these areas, as is made clear in the ruling which I understand to be the leading ruling on the subject in the Diablo Canyon case, 8 NRC 567,570 in 1978.

CHAIRMAN GROSSMAN: I am sorry, what is the citation?

MR. KNOTTS: 8 NRC 567 at 570, 1978. That was a Licensing Board -- I understand it is the leading case. There are statements, other pertinent statements, at page 573 of that Licensing Board decision.

One cannot qualify through being self-taught is also a ruling which was recently made by the Licensing Board in the McGuire operating license case.

Dr. Kaku is offered as an expert in nuclear power plant accident analysis and impacts, and to the extent no already not covered by what I have said, that is, to the extent health effects are implicated, we would also suggest that there is absolutely nothing in his qualifications which suggest that he is competent to give opinions on health effects.

So our primary argument is that the opinion in evidence from this witness should be excluded.

MR. GOLDBERG: Judge, before we hear from Mr. Bursey, could I just clarify one point, because I think Mr. Knotts misunderstood, and maybe the Board did, too. You know, if the Board is going to abide by its ruling that it wants to consider the effects of a site-specific credible Class-9 accident at this station, you know, I think we still have yet to hear of such an accident.

I did not mean to say that we accede that Dr. Kaku is an expert -- can offer an expert opinion on the impact of Class-9 accidents. What I meant to say is he can probably develop a scenario. I do not think he has any expertise at all to say what the radiological or radio-ecological or radio-biological effects of that would be at all, as he had indicated in answers to my questions. That would apparently be for someone else to say.

CHAIRMAN GROSSMAN: Mr. Knotts, do you think a person in Dr. Kaku's area or in his position with regard to where he has advanced in the field of physics if he wants to, develops some expertise in engineering related to those areas in physics that he is concerned about, would enroll in undergraduate courses and take formal training in engineering? Is that how someone would go about it in Dr. Kaku's position?

MR. KNOTTS: If we are talking on a personal level, Judge Grossman, no, I do not think so. I concede that Dr. Kaku is an extremely intelligent man who is also highly articulate, but that does not make him competent to give opinion evidence where he lacks either of the two key elements; formal training and a degree or demonstrated experience.

(Board conferring.)

MR. BURSEY: Judge Grossman, if -- .

CHAIRMAN GROSSMAN: Yes, Mr. Bursey, can we hear from you?

MR. BURSEY: Yes, sir. I would certainly stand on Dr. Kaku's professional credentials and proffered testimony as evidence of his capability to contribute to the record in this instance, and this specific technical objection as raised by Mr. Knotts I am not even capable of understanding to respond to.

But I would submit that if the Board wants Dr. Kaku to respond to those, they could direct questions to him. I think that my inference from some of Mr. Knotts' statements were there may have been minor discrepancies, not a total of lack of knowledge. And it seems that Mr. Goldberg's prime objection goes to his position that I concur with that we are not here to litigate Class-9 accidents. I concur with that.

The primary purpose of Dr. Kaku's testimony has been -- as has been admitted by all parties -- is to provide us with an understanding and a basis for assessing the adequacy of local and state response to postulated accidents at the V.C. Summer plant. Now, Dr. Kaku cannot postulate accidents. He can tell us the radionuclide inventory and he can tell us what kind of computer models are used to be able to calculate the time and dispersion.

Now, he is, I think admittedly, an expert in that

area, and it is not the burden of any singular witness to present the totality of my case. I myself will do it or bring in someone else that can contribute to tying the parts of it together. And I do not think that Dr. Kaku's lack of qualifications as a health physicist would be sufficient grounds to strike his testimony.

(Board conferring.)

DR. HOOPER: Mr. Bursey, in light of what you just said, what is the purpose in Dr. Kaku's testimony of the scenario he has presented?

MR. BURSEY: The purpose of the specific scenario in the prefiled testimony?

DR. HOOPER: Yes. What is the purpose in light of what you have just said? What is the pupose of the scenario in his prefiled testimony?

MR. BURSEY: There is nothing on the record that would indicate that any of the local and state officials have any idea as to the consequences of postulated accidents. Now, everyone stipulates that these accidents have a degree of probability, but there is nothing on the record that indicates that the local officials, certainly, and most of the state officials have any notion of what the consequences of that could be. I would submit that common sense would dictate that if you do not have any notion of what the consequences are, the adequacy of your preparations to mitigate them is going to be in question.

DR. HOOPER: Then your argument here is this is just a sequence of events to educate the emergency planners. Is that the argument you are presenting?

MR. BURSEY: No, sir. No, sir.

Dr. Kaku is indicating he might want to respond, if that is all right with you, Judge Hooper.

CHAIRMAN GROSSMAN: Dr. Kaku.

THE WITNESS: I would like to respond to some of the allegations being made.

First of all, the bulk of the testimony does affect the performance and the adequacy of the V.C. Summer Plant.

CHAIRMAN GROSSMAN: Excuse me for a second.

(Board conferring.)

Okay. Judge Linenberger would like first for you to respond directly to the point that was raised by Judge Hooper. Do you have a response to that?

THE WITNESS: I have a response to the objections raised by these two lawyers.

CHAIRMAN GROSSMAN: That will come after. Do you have a response to Judge Hooper on the particular item he raised?

THE WITNESS: Could you repeat the question again?

DR. HOOPER: Well, I think I asked Mr. Bursey what the relevance of your Class 9 accident sequence is, and he responded that it was -- I understood his answer to be that it was necessary to educate the various workers, and this is what I got out of his answer as being the reason for your Class 9 scenario, because previously he had said that this was not a challenge to the regulations or was not a unique Class 9 accident sequence, but the purpose was to educate

the various evacuation personnel.

MR. BURSEY: Judge Hooper, I am sure that I did not use the word "educate." It is not the Board's job to educate people. It is the Board's job to assess the adequacy of the local and state officials' ability to implement emergency planning.

DR. HOOPER: This is the purpose of the testimony, then, is to have some focal point for evacuation planning.

MR. BURSEY: Yes, sir. What we will be doing with Dr. Kaku's testimony -- I mean at some point I am going to be able to summarize and take points A and B and add C to it and be able to draw conclusions. Now, I am not going to be able to draw conclusions about the adequacy of evacuation procedures, decontamination procedures, crop destruction, ingestion zone problems without having Dr. Kaku's testimony on the record.

DR. HOOPER: Yes. Well, all right. In other words, your contention is you have to have this specific scenario to do this.

MR. BURSEY: I am not sure exactly what you mean by specific. If you are postulating a certain pipe breaking for a certain reason, I do not think that is the question as much as it is the fact that various Class 9 accidents are probable, at PWRs are probable, and they release a certain amount of radionuclide inventory.

MR. LINENBERGER: Mr. Bursey, excuse me. You are talking completely around the subject. Dr. Hooper asked you a very specific question. There is a specific scenario in Dr. Kaku's testimony. Dr. Hooper asked you what was the point of it. You talked about the Board's duty not to or to instruct people. You have talked all around it.

Can you answer that question of Dr. Hooper's: What is the purpose of that specific Class 9 accident scenario in Dr. Kaku's testimony? Now please do not talk about what the Board has to do. What is your purpose in having that accident scenario?

MR. BURSEY: Yes, sir. I thought I had spoken to that. The purpose is to lay a basis for the release of radionuclides that would form the accident to which emergency people have to respond to.

CHAIRMAN GROSSMAN: Okay. Now Dr. Kaku, in view of the fact that Mr. Bursey is pro se here and he admits to not having any technical expertise, we will allow you to respond to positions raised by Mr. Knotts and Mr. Goldberg.

Mr. Goldberg.

MR. GOLDBERG: Yes, Judge. I do not mind you doing that, and I think it is clear that it is the party that is proffering the testimony and has indicated for what purpose he believes it is being offered, and I think there was some very enlightening responses given to the Board's

question. So can we readdress those in connection with our motion? I mean after Dr. Kaku answers.

CHAIRMAN GROSSMAN: Yes, fine. Why don't we give Dr. Kaku that opportunity, sir.

THE WITNESS: I would like to offer it as my opinion, my professional opinion, that the statements of Mr. Goldberg and Mr. Knotts are specious, irrelevant, immaterial to the discussion that we are here gathered to discuss. I would like to go through my testimony again page by page to show that Mr. Goldberg does not understand the thrust of what I am saying, and then to show that Mr. Knotts' objections are irrelevant and immaterial.

First of all, on page 1 of my testimony it gives a specific plant site criticism of the way in which the Summer Plant is going to be licensed. I will specifically reference the Safety Evaluation Report, NUREG-0717, and show that the NRC has not yet completed its review of W-CAP-7907, which is the basis upon which the ECCS is evaluated.

Given the fact that the NRC has not yet given its approval on the validity of the computer codes for the ECCS, it throws the whole thing wide open, and in this proceeding I would like to make a challenge. I would like to make a challenge and I would state that W-CAP-7907 does not fulfill the criteria given in 10 CFR 50.46, Appendix K, concerning the thermal hyraulic efficiencies of the FLECHT Program and

the W-CAP series, specifically W-CAP-7907 and W-CAP-9230 given on page 15-5 of NUREG-717.

I repeat, the point of number 2 on page 1 is to show that the NRC has not yet completed its review, and let me just quote now from page 15-5. "Those for which we have not completed our review are described in the following topical reports, which include W-CAP-7907 and W-CAP 9230.

So I would like to make a specific challenge, and that is the whole point of point number 2, and that is the specific computer codes, not the generic codes, the specific computer codes used in NUREG-0717 do not conform to the criteria as laid down by 10 CFR 50.46, Appendix K, concerning the interaction of water and steam in the ECCS.

It is a plant-specific objection, and I would like to make a direct challenge, a direct challenge to the applicability, the reliability of W-CAP-7907, which the NRC admits "have not yet been completed our review." That is the point of paragraph number 2.

Paragraph number 3 on page 3 deals specifically with the defects that exist inside the reactor. Under sworn testimony it was admitted that yes, there may be Class 1 weld violations inside the primary. Given the fact that the NRC inspectors have admitted that yes, it is indeed possible that Code Class 1 violations of the American Society of Mechanical Engineer Boiling Water Code Section 3 may exist

inside the primary system of the Westinghouse PWR, then it is relevant to raise whether or not a Class 8 accident can be pushed into a Class 9 accident.

There are precedents for this. The Three Mile Island accident was a Class A accident before being pushed into a Class 9 accident by a combination of human failures and mechanical failures. Paragraph number 3 specifically deals with the V.C. Summer Plant.

In the question of whether or not 99 percent of the welds not yet inspected by the NRC indeed have code Class 1 violations, I would like to remind the report that the code Class 1 is the highest, most sensitive rating given by the American Society of Mechanical Engineers around the year 1910. The ASME laid down those codes because of a number of very unfortunate explosions that took place in the steam boilers around the United States, and to limit the numbers of incidences, injuries and fatalities, Section 3 of the Boiling Water Codes was laid down, and the NRC has now admitted publicly in yesterday's testimony that yes, there are perhaps indeed in the primary circuit of a PWR code Class 1 violations.

Number 4 on page 3, yes, this does deal with the plant-specific site. The purposes of given the total number of fatalities is not to give a scenario beyond the ten-mile limit. The purpose of giving those scenarios is just to set

the background. This is historical information and it is historical information and it is valid to include as an explanation of the reasons for believing certain plant-specific defects.

The reason for point number 4 is to show that within the ten-mile limit, within the ten-mile limit the dispersions of radionuclides will be sufficient to overwhelm evacuation procedures that have been laid down in this hearing. That is the point of number 4, not to simply lay down the generic studies, but one, to lay down the historical background of what has been done on Class 9 incidences, and two, to lay the case that this will overwhelm the evacuation personnel within the ten-mile limit.

Number 5. Number 5 now comes to the heart of what we have been talking about. The V.C. Summer site rests totally on probability calculations. I am not talking about generic reactors, I am not talking about the V.C. Summer Plant. According to all the environmental studies, the probability calculations are based totally on the Rasmussen Report and therefore it is germane, relevant and important that we talk about the major criticisms of the Rasmussen Report.

If the plant's licensing did not involve the Rasmussen Report, then Mr. Goldberg would be correct that this point could be thrown out. But because the entire sand

castle rests upon this foundation of the Rasmussen Report, the V.C. Summer Plant specifically can be challenged on the basis of inadequacies of the R.S.S. that even the NRC is willing to admit in its own repudiation of major sections of the executive summary of that report.

Therefore, it is germane, it is relevant and it is important, point number 5 on page 5. That deals specifically with the scores of criticisms done by perhaps the highest scientific bodies of the United States, including the American Physical Society, physicists in the Ford Foundation Meter Study, the Union of Concerned Scientists and other scientific bodies that have looked into the adequacies of the R.S.S., including the Lewis Study which, like I said, repudiated major sections of the executive summary of that report.

Point number 6. Point number 6 is also germane to the V.C. Summer Plant because it lays down the background by which breachment of containment can take place. The whole point of showing this scenario, like a PWR-3, is to show that within the ten-mile limit, the evacuation program and systems would be incapable of handling the full magnitude of a catastrophic release of radionuclides.

Therefore, it can be challenged. It can be challenged that perhaps these accidents are impossible. Point number 6 will show that far from being improbable,

they in fact have been analyzed in Appendix 8 and Appendix 6 of the WASH-1400, specifically overpressurization, the China Syndrome, and in-vessel steam explosion. This will lay down the groundwork by which I will begin to analyze the event sequence by which the V.C. Summer Plant can undergo a Class 9 accident.

It is not an academic question anymore since Three Mile Island was given a Class 9 designation around September 1979. A Class 9 accident has taken place, a Class 9 accident which released 13 million curies of xenon-133 and 12 to 16 curies of iodine-131 into the biosphere.

Therefore, point number 6 is to lay the groundwork by which a sequence of events can take place at the V.C. Summer Plant. Therefore, point number 6 is germane, relevant and important in laying the groundwork for an accident sequence at the site.

Point number 7. Point number 7 is important because it deals with the inadequacy of computer codes and also the track record of the industry luck. It was lady luck that prevented a PWR-9 at Three Mile Island from escalating into a PWR-3 and perhaps a PWR-2 two years ago. Point number 7 is to show that the R.S.S. studies have not taken into account human failure, luck that goes into creating a Class 9 accident.

The probability of a PWR-1 is once in one billion

reactor years, according to the R.S.S., but that fails to recognize that once you are in a PWR-9 scenario as now understood at Three Mile Island, it does not take that much to push a PWR-9 into a PWR-3 or a PWR-2.

The purpose, quoting from the Rogovin Report, page 20 of the Rogovin Report, is to show that it does not take that much to push a PWR-9 into a PWR-3. Therefore, these statistics of a 10^{-9} figure given by the Rasmussen Report I think can be challenged, and I repeat, the Rasmussen Report is the foundation, the very foundation upon which the V.C. Summer Plant rests. By taking away the Rasmussen Report, we now have a sand castle without a foundation.

Point number 8 on page 10 was to basically go and summarize the Kemeny Commission's findings, and I will later in my testimony make a link as to why the Kemeny Commission Report is so valuable to what we are doing here today. The point of number 8 is that the Kemeny Commission laid down certain recommendations which still have not yet been met. The recommendations of the Kemeny Commission, some of them have been looked into but not all of them.

Number 9. The track record of the industry even after Three Mile Island. So far in 500 reactor years of operation, the industry has sustained three major incidences beyond design basis: the Fermi incident of '66 involving 2 percent core melt of a commercial breeder reactor on October

5 of '66 outside the city of Detroit, the Browns Ferry incident in which a fire devastated the ECCS of Unit 1, crippled the ECCS of Unit 2, and now Three Mile Island.

The point of number 9 is to show that even after Three Mile Island there have been serious flaws in the way in which the NRC has conducted itself, and this is to lay the groundwork for our confidence in the NRC in case of an incident at the V.C Summer site.

Number 10. The point of number 10 is to show that you can have what is called a cascading sequence of multiple failures. I understand that Appendix K only talked about single-mode failures. I am not here to challenge Appendix K. I am only here to show that there do exist multiple failures and that is a statement of fact.

It happened at Three Mile Island. Three Mile Island was a multiple failure incident cascading from a reportable occurrence. A 15 cent part in the PORV manufactured by Dressler Industries escalated a Class 1 accident into a Class accident. And it was only luck that prevented a PWR-9 for escalating into a PWR-3. That is the point of number 10.

The point of number 11, we have to establish the credibility of the NRC because the bulk of the reports from which I am going to be quoting come from the NRC, and the bulk of the studies on the V.C. Summer Plant come from the

NRC. I only wish to show that its predecessory, the Atomic Energy Commission, has been shown and I think a strong case can be shown that it was engaged in obstructionism, obstructionism in the sense that the update report of the 740 was classified between 1965 and 1973, and during the hearings in 1972 on the ECCS, Dr. Morris Rosen said, "The consummate message is that the ECCS system performance cannot be defined with sufficient assurance to provide a clear basis for licensing."

I mention point number 11 because point number 11 alludes to the 1972, the often bitter and acrimonious hearings on the ECCS, which was supposed to last a few months and lasted over a year. The reliability of the ECCS shows major deficiencies with the way that the AEC and the NRC have handled itself, including obstructionism.

Number 12. Number 12 addresses unresolved problems, and I understand that ATWS anticipated transient without scram cannot be admitted into this hearing. I only mention point number 12 to show that there are indeed unresolved safety problems inherent in multi-PWR and BWR designs, and the people of Columbia, South Carolina should know that that reactor may be licensed with a series of unresolved safety problems in that reactor.

Point number 13. Point number 13 is to show that in congressional testimony, four nuclear engineers, three

from General Electric, one from the NRC itself, at considerable personal sacrifice resigned, quitting $20,000, $30,000 a year jobs to go to Congress in February of 1979 to say: I quit, I can't take it no more; I quit because of the problems, the unresolved safety problems of water hammers, flow-induced vibrations, pressure transients, thermal shock that exists within the Westinghouse reactor which is the subject of discusssion, as well as the General Electric MARK I, II and III, which are not subject of discussion.

Point number 13 is to lay the groundwork to show the people of South Carolina that the V.C. Summer Plant will be licensed with a series of unresolved safety problems.

Point number 14. Many of the early points are to build up to point number 14, and the message of point number 14 is very simple. Why are we gathered here today? Why are we having these hearings in the first place? Why do we have an evacuation program if fission product release is impossible? Nowhere in the entire hearing has there been an expert qualified to talk about PWR-1. Nowhere in this hearing has there been anyone qualified to discuss the basis upon which the entire hearing is based, and that is what is a PWR-1, what are the generic Class 9 accidents and how are they relevant to the V.C. Summer site?

Point number 14 is to show, and I will elaborate in excruciating detail, I will elaborate for the benefit of

any and all engineers in the audience the precise accident sequence by which a Class 1 accident can cascade into a Class 8 accident and, given the design deficiencies in the V.C. Summer site, push a Class 8 accident into a PWR-9, and given a series of human failures and failures of the ECCS, including multiple failures, push a PWR-9 into a PWR-3.

That is the basis of point number 14, is to show that yes, indeed, Class 9 accidents do exist, they have happened, and to show that it can happen at the V.C. Summer site given the deficiencies in the site, given: one, major allegations of code Class 1 violations, Section 3 of the ASME code in the primary system; two, major challenges to W-CAP-7907, that is, the reliability of the V.C. Summer site computer codes to handle a major accident at that site; and three, given all the evaluations, the Rasmussen Report, WASH-740, the classified version of WASH-740, the Ford Meter study, the studies of Yellin, the studies of Beyea, the studies of von Hipple and the studies of the American Physical Society, all of which point out major deficiencies in the way in which probability calculations are done.

That is the relevance of 14, to show that given the sequence, a strong case can be made that it will overwhelm within the ten-mile limit the capabilities of the personnel to handle a PWR-3 as evaluated in point number 14.

If people want, I will revise that to handle a PWR-1. I was being generous in not giving you the full impact of the maximum credible accident. I gave a slow overpressurization, I gave a scenario of a PWR-3. On request I will revise that and give you maximum credible accident.

CHAIRMAN GROSSMAN: Okay.

THE WITNESS: On Mr. Knott's statements, I find them largely irrelevant and immaterial. I think it is possible to challenge any scientist, any set of credentials on the basis of points which are too insignificant to ramify on -- to elaborate on, I am sorry. Specifically, the point of discussion is not to get into the uncertainties in the thermal hydraulics of a meltdown. As I said before, I am not a licensed engineer, and I think it is unfair and I think it is improper for Mr. Knotts to mention things beyond the stated level of expertise.

I am a nuclear physics. I am a Fellow of the American Physical Society. A Fellow of the American Physical Society is one of the higher rankings within the American Physical Society given to people it deems to have led and contributed significantly to the field. My limit of expertise is clear. It is laid down flatly.

I have conducted on a PDP-10 major accident scenarios, comparing them with the Rasmussen Study. There

are specifics of thermal hydraulics that can be gotten out of a standard textbook for which I will not have specific knowledge, but that is irrelevant and it is also immaterial because my stated level of expertise is to handle an accident, a Class 9 accident at a nuclear power plant.

On the question of formal education and experience, many of the reactor engineers in this country have never had formal education because they are the ones who founded the field. We are path breakers. We do research. I do not take courses in the unified field theory. I publish papers in the unified field theory. I do not take courses in nuclear physics. I publish papers in nuclear physics. I do not take courses in thermal hydraulics. I do not take courses in accident scenarios. I publish papers on accident scenarios.

I repeat, on the basis of formal experience, formal education, we could probably eliminate half the nuclear engineers. On the basis of experience, what better experience is there than to conduct the highest level of investigation of the ECCS, a computer study. You do not have to be an engineer onsite to conduct a computer study because that is all that is required in Appendix K of 10 CFR 50.46.

That is, my qualifications include the doing of -- the performance of computer programs which are state of the

art. You cannot take courses, you cannot take courses at almost all major universities in the United States giving you the intricacies of the Gauchen plume model and wedge model because these are state of the art. Therefore, I think it is irrelevant and immaterial. I think half the nuclear engineers in this country would be disqualified on the basis "formal education."

The experience I have is the highest experience you can have, conducting computer studies equivalent to the studies being conducted by the NRC itself. On this basis I think that my testimony is germane, is relevant and is important.

MR. KNOTTS: May I ask just a few points, Judge, in regard to what Dr. Kaku has just told us?

CHAIRMAN GROSSMAN: Certainly.

MR. KNOTTS: First of all, it was Dr. Kaku who claimed special expertise in the area of thermodynamics in the context relevant to this hearing. Second, the reference to W-CAP-907 as a challenge to compliance with ECCS amounts to a new, untimely issue in the proceeding.

Thirdly, Dr. Kaku claimed in response to Mr. Goldberg's points just now familiarity through his participation in the Shoreham proceedings with the ASME codes, which he described, as he did in his prefiled testimony, as the boiling water code. I thought perhaps

that was an error and I overlooked it, but I now realize that he has said it several times, and it should be pointed out that the proper term is boiler and pressure vessel code.

An additional point. The rule which I indicated, being the Diablo Canyon rule, is fully consistent with Rule 702 of the Federal Rules of Evidence.

Finally, Dr. Kaku asked me yesterday to define adversary science, and his remarks just now, delivered in an extremely loud and argumentative tone, are what I mean by adversary science.

CHAIRMAN GROSSMAN: Mr. Knotts, the reason I did not cut Mr. Kaku off was that we allowed him to argue like counsel here in Mr. Bursey's stead, and I have been in many courtrooms and have heard counsel argue that loudly on behalf of their clients. So I just want to point that out. That was a matter the Board discussed here while Dr. Kaku was responding.

MR. BURSEY: Judge Grossman, I would also like to note that Dr. Kaku, as helping me as counsel, was also laboring under the burden of having lengthy voir dire on the part of both the staff and the applicant that intuned his professional capabilities and integrity, and in light of that I think his tone and position is understandable.

CHAIRMAN GROSSMAN: Well, Mr. Knotts, let me ask you this. How are we to determine at this point whether in these highly technical fields, Dr. Kaku's lack of formal training is because he is involved in the state-of-the-art as he indicates rather than in something that he could receive much benefit from formal training, undergraduate or graduate, without having your witnesses come in and say that he is not expert in this? Do you expect that in a highly technical area we can say right off the bat here as a preliminary matter, that Dr. Kaku is unqualified because he has not taken those formal courses in undergraduate training?

MR. KNOTTS: I think one good test, Judge, would be Dr. Kaku's answer to the question about publications that have been peer reviewed. He indicated one publication which I was not clear whether it was peer reviewed, on the subject of Class-9 accident analysis, and no other publications. I think one would have to recognize that if one had published peer reviewed publications in the field in question, that one could lay claim to expertise in the field. That is in

an effort to be responsive to the Board.

Going beyond the matter of formal education, of course, Dr. Kaku has admitted unfamiliarity with key elements of the things that he claimed familiarity with. He raised the familiarity.

CHAIRMAN GROSSMAN: Again, Mr. Knotts, isn't that something that your expert witnesses ought to get on the stand and testify? In other words, Dr. Kaku says he is not unfamiliar with these areas. He is fully prepared to go into the areas that he has here, and he has got certainly very, very high credentials in a number of areas.

Now, as to whether that extends into these particular areas, isn't that really a job for your experts to come in and say well, this is an area that he definitely does not have the expertise in? And I think we are starting off with the assumption -- I am anyway -- that he is very highly qualified in a number of areas. Do you dispute that?

MR. KNOTTS: I do not know what areas relevant to his testimony in this proceeding that he is very highly qualified to give expert opinion testimony about. Let me try to address your question, Judge.

Your question is should we wait until the applicant can produce experts to testify about what qualifications an expert ought to have, and I recognize that as a practical matter, even a technical matter, that the

Board will not be able to say on all the subjects I have alluded to what somebody ought to be familiar with.

But I think there are at least a couple of the areas which ordinarily would be recognized by an NRC board. It might depend on the particular background of the members, like the DNB area, as absolutely fundamental to thermal dynamics and accident analysis.

CHAIRMAN GROSSMAN: Well, Mr. Knotts, I would have no problem personally if Dr. Kaku now were to attempt to testify on DNB, of saying that he does not know enough about that to qualify as an expert. But what I am saying is, in view of what he has demonstrated as an expert within related areas, don't we need your experts to undermine -- to connect what the possible or lack of expertise with DNB to his entire testimony or to the areas of the testimony that you indicate he is unqualified for? I do not see anything in here about DNB.

So what I am suggesting is that that is something that you can bring your experts in and say well, anyone who professes to be an expert in these areas has to know about DNB. That is not something that we can right after that say.

MR. KNOTTS: I was inquiring perhaps if it was. If it is not, then we will adhere to the procedure you suggest.

CHAIRMAN GROSSMAN: Mr. Goldberg?

MR. GOLDBERG: Yes, Judge Grossman. I think that Dr. Kaku's part in my return, rather impassioned speech is sort of a perfect illustration in my mind of why the Commission establishes rules and regulations, why it has rule-making proceedings, and why we do not re-litigate the same things which the Commission was mindful of in the development of its rules.

Now, I really maybe am losing the forest for the trees. We have what I thought was a contention on emergency planning that Mr. Bursey raised. Now I suppose incrementally it seems to grow by leaps and bounds now. We have absorbed a lot of information here, and I want to go back and renew -- and add one or two points on a legal matter that I referred to earlier.

But, you know, if the purpose is to show the ability of plans to cope with some credible reactor-specific Class-9 accidents and its effects within ten miles, I am not sure that we have advanced that, you know, one iota, in listening to all this discussion.

CHAIRMAN GROSSMAN: I do not want to cut you off, but I want to ask you to include something in what you say. I am having a little trouble with your argument that we cannot consider a Class-9 accident and the fact that the emergency plans are based upon Class-9 accidents, or else they would not be the way they are. That is one thing.

Secondly, Dr. Kaku's description of the scenario as a PWR-3, which I want to get your comment on not only whether it is but whether that is something that ought to be considered in the emergency plan if it is.

I am not sure that what I said does make sense, but -- .

MR. GOLDBERG: I am not sure as a lawyer I could speak to whether or not that is a PWR-3, but I will address your first point. And I think it is probably going to be something of a reiteration and maybe an amplification of what I said before.

And in fact, Dr. Kaku, as I understand, challenges the efficacy of the reactor safety study. Now, it is entirely probable that the scenario exceeds the scenario of Class-9 accidents contained in the reactor safety study which, as I have argued before, provided the basis for the development of the Commission's emergency planning rule in Section 50.47.

So additionally, not only do we not have a requirement to consider specific Class-9 accidents as we evaluate the ability of applicant's emergency plans to conform to the regulations, but we also have here the inference and the extreme potential that we have here postulated an event beyond that even considered by the Commission as the basis for its development of the

regulation.

And therefore, it constitutes a challenge to the Commission's regulations and can only be accomplished under Section 2.758, which I think essentially would require the showing of special circumstances. But let me just read a little bit to re-familiarize myself.

CHAIRMAN GROSSMAN: Before you read from 2.758 which I am aware of, again, Mr. Goldberg, isn't this a technical area in which we cannot right now determine whether those facts are as you suggest they may be. And you indicate you are a lawyer and not a technical person. How do we know that these, at this point without your putting on technical witnesses, expert witnesses, that these things exceed what was in RSS or any of the other things? Could you address that?

MR. GOLDBERG: Yes. In the first place, I think I posit my argument on the fact that the Commission, the emergency planning rules, do not require individual consideration of Class-9 accidents in evaluating whether or not the plans conform to the Commission's requirements developed after lengthy rulemaking, which took into account accidents in the reactor safety study and obviously considered the effects that those would have in designing a level of emergency preparedness which it deemed to be adequate on balance, the consideration of the risks and the public

health and safety.

Now, it seems to me we are duplicating the Commission's efforts and that's why I said it. I mean, I think we have a perfect illustration here of why, you know, we do not do this in every proceeding. You know, I could bring out I'm sure hordes of staff members to address all of these matters. But, you know, I do not think it really would be profitable -- you know, for instance, I think if you look at Section 15.5, we are talking about the LOFT trend code. You will find very clearly there the basis for the staff position that no one has completed those code reviews. That the plant is adequate.

You know, we are re-introducing issue upon issue.

CHAIRMAN GROSSMAN: Let me ask you, Mr. Goldberg, let's talk about how burdensome it is to have your staff people come in and say exactly what you said now; that the policy, the staff policy, is with respect to these items based on such-and-such, based on this. I mean, we are not talking about -- .

MR. GOLDBERG: I think we are, Judge. First of all, I want to separate them. I could get someone in here to tell me the basis for the staff position on page 15-5 of the SER. I can do that. I think that I can tell you, and I can probably get the Chief of the Emergency Preparedness Division to come in here and testify about what was the

underlying basis, rationale, philosophy and scope of the Commission's consideration in development of its emergency plans. And that might be perhaps more desirable than, you know, embarking on a fairly wide-ranging litigative effort. And I would be prepared to consider that.

What I am saying is I think it is reasonable argument for one as a lawyer to assume, when you look at the regulation and follo[illegible]ts, you know, legislative history, if you will, what was the intent with regard to, you know, litigating particular events.

Now further, I indicated before that quite apart from the challenge to the emergency planning rule, we have a Commission policy statement that prohibits individual consideration of Class-9 accidents in individual proceedings. And I have a few cases to cite for that proposition, and an additional argument to make on that.

One is the offshore power systems case, CLI-79-9-10 NRC 257, Black Fox CLI, 80-8 11 NRC 433; a Commission memorandum and order of September of 15, 1980 in Allen's Creek -- I am sorry, I am advised that that is a Licensing Board decision and a directors' decision of June 19, 1980 reported in 11 NRC 919.

Now, I think what we have to do is go back to my point yesterday or the day before. This policy statement was guidance to the staff. Further, it is our position that

it is the Commission's intention that the staff identify to it, the Commission -- and I think this more recent case law will bear this out -- those cases warranting specific additional consideration of Class-9 accidents. And that that is not appropriately a function that the Board might serve.

Now, you know, going back to this, I think what all of this suggests to me -- and I would be prepared to brief these matters more fully because I think what you are basically asking for repeatedly have been policy and legal considerations which I think it might be more useful to brief and have us fully understand. But what I would say is that I would renew my motion last evening if it would be enlightening, and it might be, for the Board and the parties as well to certify this matter to the Appeal Board or directly to the Commission before we schedule further adjudicatory sessions. And I would renew that motion and further be prepared to brief the legal issue of whether or not, you know, we should as a matter of law or policy, be considering this issue, because this has quite important implications I think, not only at this proceeding but on -- you know, on a process-wide basis because it would be without precedent.

CHAIRMAN GROSSMAN: Mr. Knotts, do you have something to add on that?

MR. KNOTTS: I do not think I have anything to

add, Judge. I do not know whether the Board has meant to indicate that it is going to hold our motion to exclude Dr. Kaku's opinion evidence in abeyance or whether it has not reached a ruling yet.

CHAIRMAN GROSSMAN: We have not reached a ruling yet. We will caucus on the ruling. Now let me say to Mr. Goldberg, we are not -- one thing I am pretty sure we are not going to do is have you -- is agree to certify it to the Appeal Board without your briefing the issue to us.

Now, I do not think that we are in a position now where we think that is an advisable course. We cannot preclude you from filing whatever you want to file with respect to the Board's order, but we prefer to decide the question first. And then you can do what you want to with regard to 2.730, Sub (f).

(Board conferring.)

CHAIRMAN GROSSMAN: Now, I did want to get a response with regard to that PWR-3 question, and perhaps Mr. Knotts can answer that as to whether the emergency plan should take into account a PWR-3 event.

MR. KNOTTS: I think it is enough for the emergency plan to be premised upon a full range of accident assumptions which include very large accidents and assumes large releases.

CHAIRMAN GROSSMAN: Now, do you have an opinion as

to whether that sequence that we have submitted here falls within that PWR-3 consideration?

MR. KNOTTS: Well, I guess -- .

CHAIRMAN GROSSMAN: Category.

MR. KNOTTS: I guess my fundamental problem is, Judge, that I do not think that sequence falls within the contention because it relates to what happens at the plant rather than what happens out in the world.

CHAIRMAN GROSSMAN: Now, that is a point. I understand the point of the testimony to be it lays a foundation for not litigating -- the purpose is not to litigate Class-9 accidents. The purpose is to set some sort of scenario of a Class-9 accident that fits within what can be considered as an event for which the emergency planning would take place, or the emergency plan would go into operation.

And the real question I have is whether if that -- whether that is an area that does fall within it, and I think your position is yes, it does fall within -- I am sorry, that a PWR-3 is one that could be taken into account. And the further question which has not been answered is whether this particular scenario is a PWR-3 so as to be considered in evaluating an emergency plan.

MR. KNOTTS: I am not sure it makes a difference. I assume we are beyond the threshold when you are saying

what you are saying, Judge. That is to say, you are not asking me to agree ab initio. You are asking me, given all the rulings to date, do I agree. You are not asking me to agree with all the rulings that have gone before when you say that.

CHAIRMAN GROSSMAN: I am sure some have gone against you, Mr. Knotts. I cannot expect you to agree.

MR. KNOTTS: That is correct. So I guess I am not really sure what the answer is to that question, Judge. I am not really sure I know the answer to that question.

I just have a difficult time approaching it that way. The way I understand that emergency planners approach it, and the way I understand from the testimony of the witnesses including Mr. Beale, the way they approach it is the Commission considered a full range of accidents and concluded that emergency plans ought to be made on the basis that there could be very bad accidents, indeed. And the accidents it considered were the full range of Class-9 accidents plus the Archer studies, the full range of WASH-1400 accidents, plus the Archer, if I am not mistaken on the name, studies.

And as far as offsite planning is concerned, it is enough to assume there will be large releases of radiation and that you have to move people out or tell them, in the case of people in the non-prevailing wind direction or in

the right sector, to take other suitable protective action.

CHAIRMAN GROSSMAN: Could you read that contention again, Mr. Bursey? Your contention no. 8. Do you have that handy, or does anyone?

MR. BURSEY: Yes, sir, contention 8, reading from an NRC staff motion, contention 8 as rewritten by the Board several years ago read, quote, "The applicant has made inadequate preparations for the implementation -- .

CHAIRMAN GROSSMAN: Go ahead, continue.

MR. BURSEY: Quote, "The applicant has made inadequate preparations for the implementation of its emergency plan in those areas where the assistance and cooperation of state and local agencies are required." And I would certainly want to point out that that was not written by me and that was before Three Mile Island.

(Board conferring.)

CHAIRMAN GROSSMAN: Mr. Goldberg?

MR. GOLDBERG: Yes, Judge. I guess just on the point, I think the contention is on the preparations made in the applicant's emergency plan and not withstanding, by the way, the intervening years, there has been no attempt to amend this contention by Mr. Bursey on the strength of TMI or anything else, which I think might have indicated at some earlier point in time the scope of the issue. And if Dr. Kaku was then going to be an expert on that issue, permitted

discovery and other prehearing procedures, to proceed without this last-minute interruption in the process.

But let me also try and, just for the moment you asked whether or not this is a PWR-3, and I want to see if I can give you some information on that.

I am advised by the staff project manager -- and I have also conferred, by the way, with Dr. Barnigan and I am not offering them as experts in this -- that it is difficult to tell because it appears that Dr. Kaku has used some of his own computer codes for input into the development of the various consequence scenarios. It is difficult to ascertain whether or not this is a PWR-3 even or not. And so I do not know really if the staff can be more helpful than that, even if we were to -- .

CHAIRMAN GROSSMAN: Okay. Let me say something about your first point again, and I have said this a number of times. Whether Dr. Kaku's testimony is used for the emergency planning issue does not require that he be an overall expert on emergency planning. And that I have no problem with.

If he testifies directly on the emergency plan, that is one thing. If he supplies something that Mr. Bursey can use within his contention on emergency planning, he need only be an expert on that small area. That is Mr. Bursey's job to connect that area up with his entire contention.

So let's, you know, just remove that from consideration. Mr. Bursey may say with regard to contention 10, I come to conclusion Z, and in doing that I use X and Y. If Dr. Kaku is an expert for X, that is fine. He does not have to be an expert for Y. And as a matter of fact, Mr. Bursey does not even need his own witness for Y. That witness can be your witness or Mr. Knotts' witness. So that is Mr. Bursey's job, to get up to Z. It is not Dr. Kaku's. His job is only to get by X.

Okay, Mr. Goldberg?

MR. GOLDBERG: Yes. I heard you use the word contention 10. By the way, the emergency planning contention of Mr. Bursey is contention 10.

CHAIRMAN GROSSMAN: No, 10 was only a hypothetical.

MR. GOLDBERG: Yes, I understand. I guess my answer to that is now really a bit more confusion about the purpose for which some testimony was to be elicited from Dr. Kaku. My understanding is that Dr. Kaku was supposed to supply to Mr. Bursey some kind of credible site-specific scenario with consequences within a ten-mile radius, for which Mr. Bursey was going to try to demonstrate through, I would imagine, some further expert testimony, that the emergency plans could not adequately cope.

Now, you know, assuming that is a proper premise without, you know, agreeing that we should be doing that, I

think I just want to, you know, show in the record that Mr. Bursey has presented no affirmative case on contention 10.

Now, we had two days of testimony --.

CHAIRMAN GROSSMAN: Contention 8, by the way. Again, Mr. Goldberg, I do not want to cut you off but we are running out of time, and the point I made about it does not have to be Mr. Bursey's own witness, it could be supplied by the emergency planning people. If he connects up Dr. Kaku's testimony with their testimony and comes to conclusion Z, that is fine. Dr. Kaku does not have to be an expert on the areas that they testify on if Mr. Bursey wants to use that in his case. So I do not think we ought to go any further. But -- .

MR. GOLDBERG: Well in fact, I know Dr. Kaku is, by his own admission, not an expert in emergency planning. I suppose -- .

MR. GOLDBERG: I will say you tried your best to make him into an expert in that area. He was not offered to be an expert in that area and we have not accepted him as an expert in that area.

But now it seems to me, to cut it short -- and I'm not trying to cut you off, but I am trying to save some time -- that we have reached a point where apparently there is no purpose to the Board making a ruling now because we cannot go any further with Dr. Kaku's testimony now in view of the

further schedule and in view of the fact that Dr. Kaku is going to have to come back here again anyway if we adopt -- if we accept his testimony because the parties -- the adverse parties need cross examination.

So perhaps we have enough in the record now so that you gentlemen might want to brief the issue to us, and let's perhaps get off Dr. Kaku's testimony now and get on to something else. But I will hear your comments on that.

MR. KNOTTS: Only, sir, has Dr. Kaku's pre-filed testimony now been offered? Is that the state of the record?

CHAIRMAN GROSSMAN: I believe it has been offered. Yes, it has been offered with the addition of that new preamble to it.

MR. KNOTTS: All right, so the Board is, in effect, saying you would put it in a holding pattern pending the submission of briefings.

CHAIRMAN GROSSMAN: Well, I do not see that there is any reason why not to do it, but, Mr. Bursey, we will hear you on that.

MR. BURSEY: I am sorry, sir, any reason not to do what?

CHAIRMAN GROSSMAN: To put it in a holding pattern, because I do not think if we made a ruling now it could be followed by anything further with Dr. Kaku, because of the time requirements, exigencies.

MR. BURSEY: If, then, the Board's suggestion is to defer the ruling until Dr. Kaku comes back, at which time we would have an opportunity -- .

CHAIRMAN GROSSMAN: No. Before which time you would have an opportunity to brief it and submit your positions to the Board. And I would think right now that we would have Dr. Kaku come back at the same time we have the seismic people coming back, and so that is going to put it off for a few weeks, anyway. Besides, he could not come back within the next couple of weeks anyway.

Now, is there any objection to that procedure?

MR. GOLDBERG: No, I think that is probably best for everyone to brief it and provide statements of their position. And then we could reconsider it.

MR. KNOTTS: We can address schedule matters at the end of the day.

CHAIRMAN GROSSMAN: Fine.

MR. KNOTTS: I will hold off on talking about scheduling matters.

CHAIRMAN GROSSMAN: Scheduling matters and Dr. Kaku, right.

MR. KNOTTS: That's what I mean, right. Or on seismic.

MR. BURSEY: Judge Grossman, I assume that Dr. Kaku will have his opportunity to summarize his testimony

once the admissibility of it is ruled on. Is that -- .

CHAIRMAN GROSSMAN: Yes, certainly.

MR. BURSEY: And the -- I just wanted to make a remark about the positions of both parties. Mr. Goldberg seems to continue to want to litigate Class-9 accidents and we are not here to do that, and I feel that he has narrowed the focus of his objections to that point, and I will let that speak for itself.

Mr. Knotts seems to have narrowed now his objections to the expertise of Dr. Kaku, and I think the fabric of Mr. Knotts' argument was just very thin, and Mr. Knotts is saying that he would have to pick further at these technical issues that he is using to theoretically discredit Dr. Kaku. He would have to bring an expert outside the engineers that run the plant. If we have gone beyond the level of expertise necessary actually to operate the plant, I would submit that we have picked the final nit, and that Dr. Kaku's expertise is certainly sufficient.

CHAIRMAN GROSSMAN: Okay. Let me just say I understand that Mr. Knotts and Mr. Goldberg are not abandoning either objections, even though they may have focused on those particular objections.

MR. KNOTTS: Correct.

CHAIRMAN GROSSMAN: So I will just put that in as the Board's perspective on this.

MR. LINENBERGER: I just wanted to add without commenting on any of the discussions that have recently taken place that I think it is important to keep in mind the wording of Mr. Bursey's contention. That is all.

CHAIRMAN GROSSMAN: Okay, then, we ought to take a short break now for about five minutes and then come back and decide where we are and what we are going to continue with.

MR. KNOTTS: The next group up is our lowering the reservoir people.

CHAIRMAN GROSSMAN: Which people?

MR. KNOTTS: Lowering the reservoir, answering your question.

MR. BURSEY: Judge Grossman, is Dr. Kaku excused?

CHAIRMAN GROSSMAN: Yes, you are temporarily excused, Dr. Kaku. Thank you for appearing.

(Witness Dr. Kaku was excused.)

(A short recess was taken.)

CHAIRMAN GROSSMAN: Mr. Knotts, do you have a panel, sir?

MR. KNOTTS: Yes, Judge. And to expedite things, we have prepared the answers to the Board's question about draining the reservoir and what would be the cost and consequences thereof in written form.

In addition, we have two letters -- three letters and statement of qualifications for Mr. Moore, who although he has previously testified, testified rather hurriedly and we subsequently -- I do not believe his qualifications are in the record.

Whereupon,

WILLIAM E. MOORE

THOMAS C. NICHOLS, JR.

ESCA CREWS

were recalled as witnesses by counsel for the Applicant and, having been previously duly sworn, were examined and testified as follows:

DIRECT EXAMINATION

BY MR. KNOTTS:

Q I should like to begin by asking Mr. Moore have you prepared a statement of your professional qualifications, Mr. Moore?

A (WITNESS MOORE) Yes.

Q Do you have a copy for me, Mr. Moore?

A (WITNESS MOORE) Yes.
Q Do you have any corrections you want to make to that statement?
A (WITNESS MOORE) No.
Q Is it true and correct?
A (WITNESS MOORE) Yes.
Q Do you wish to adopt it as part of your testimony in this proceeding?
A (WITNESS MOORE) Yes.
MR. KNOTTS: I request that Mr. Moore's professional qualifications be bound into the transcript as if read.
CHAIRMAN GROSSMAN: Any objections, Mr. Bursey?
MR. BURSEY: I would like to ask Mr. Knotts the point to which Mr. Moore's being asked to address --
MR. KNOTTS: That is stated in the testimony of William E. Moore which is really an answer to the Board question as is revealed in the first sentence of that testimony. I believe you have this document.
MR. BURSEY: Yes, sir, I have that. I just want to make sure that is the drawdown of the Monticello reservoir.

VOIR DIRE EXAMINATION

BY MR. BURSEY:
Q I want to ask Mr. Moore what in his professional

experience and training qualifies him specifically to postulate as to the cost of drawing down a reservoir?

A (WITNESS MOORE) Discussions with the Federal Energy Regulatory Commission of their experience with Walter Bolden Dam which failed several years ago, and the extent of repair that had to be done to Walter Bolden Dam.

Personally I have no experience with the repair work or modifications that would have to be a dam if we subjected it to this experiment that we are talking about. What I am doing is anticipating what would be required of the Federal Energy Regulatory Commission and what could possibly occur as a limit if this experiment was performed.

Q Yes, sir. Then you are stating that we have other than the one instance of the Walter Bolden Dam failure no real practical previous experience for the cost of purposefully drawing down a reservoir below its design level.

A (WITNESS MOORE) That is correct.

MR. BURSEY: Thank you, sir.

For the limited purposes for which Mr. Moore said he can address, I believe he is qualified and will not object to that.

CHAIRMAN GROSSMAN: Mr. Goldberg.

MR. GOLDBERG: No objection.

CHAIRMAN GROSSMAN: Mr. Wilson.

MR. WILSON: No objections.

CHAIRMAN GROSSMAN: Admitted.

(The information referred to follows:)

(1)
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PROFESSIONAL QUALIFICATIONS

WILLIAM E. MOORE

I am Manager of Hydro and Environmental Engineering for South Carolina Electric & Gas Company. In this position, I report to the Group Manager - Production Engineering. I have responsibility for all licensing, engineering and surveillance monitoring of hydroelectric facilities including pumped storage; licensed environmental requirements; all engineering permitting, and environmental requirements for environmental control equipment of fossil fired generating stations during design and construction; and management of all environmental programs of Production Engineering exclusive of radiological and meterological programs for nuclear.

I graduated from the University of South Carolina in 1959 with a B.S. in Mechanical Engineering. I did graduate work in Nuclear Engineering at Michigan State University in 1967. I also have taken environmental courses at U. S. Public Health Taft Institute in Cincinnati, Ohio.

I was employed in 1959 as Draftsman Engineer with the Equipment Engineering Section of NASA at Langely Field, Virginia.

In 1959, I was employed by South Carolina Electric & Gas Company as a Results Engineer Trainee. In this position, I assisted with performance tests and calculations relative to the operation of power plant, which included combustion, boiler, turbine, pumps, and heaters. I assisted with supervision and operation of water plant which included clarifiers,

filters, chlorinators, and demineralizers. I also assisted with supervision and performed all laboratory tests which included coal, ash and water chemistry and lube oil tests.

From 1961 through 1962, I was Results Engineer at South Carolina Electric & Gas Company's McMeekin Station. In this position, I reported to the Plant Superintendent and had responsibility for the design of modifications to reduce cost and improve efficiency. I was also responsible for the design, construction, purchasing of equipment - apparatus - glassware and chemicals for the new Central Laboratory.

From 1962 through 1967, I was Chemical Engineer at South Carolina Electric & Gas Company's Central Laboratory. In this position, I reported to the Manager of Production and was responsible for water analysis, quality and water treatment programs for all Company power plants. I was responsible for developing cost estimates for construction and supplying large quantities of water to industrial and other customers. This position also included responsibility for all Company environmental programs including water and gaseous emissions, as well as responsibility for the design and construction of modifications and enlargement of water purification and demineralizer equipment.

In 1967, I assumed the position of Engineer, as Assistant to the Vice President of Construction, Operations, and Production of South Carolina Electric & Gas Company. I had the responsibility for evaluation and refitting of electrostatic precipitators to all existing coal fired boilers and

testing the electrostatic precipitators. I also was responsible for the design modification and testing of sewage handling, cooling ponds, ash ponds, and other similar work.

From 1969 through 1975, I was Senior Engineer-Staff Assistant to the Vice President of Production and Operations of South Carolina Electric & Gas Company. In this position, I had responsible charge for boiler overhauls and all environmental matters. I was responsible for relicensing hydro facilities and the preparation and processing of new license for Fairfield Pumped Storage Facility including all permits and approvals. I also had responsibility for environmental program and the design of dams, generating facility, roads, railroads, relocations, and all other modifications to existing hydro facilities required for the new Fairfield Pumped Storage Facility.

From 1975 through 1978, I was Manager of Hydro, reporting to the Group Manager of Production Engineering of South Carolina Electric & Gas Company. In this position I had responsibility for all aspects of hydroelectric licensing, license maintenance, and designs. I also had responsibility for all environmental matters of Production Engineering Projects prior to commercial operation including fossil fired, hydro, and nuclear, exclusive of radiological surveillance. More recent projects include the Fairfield Pumped Storage Facility licensing, environmental and design; Parr Steam and Parr Hydro modifications, design and environmental; relicense of Saluda Hydroelectric; Columbia Canal Hydroelectric; and Stevens Creek Hydroelectric.

In 1978, I assumed my present position.

I am a Registered Professional Engineer in the State of South Carolina.

DIRECT EXAMINATION - Resumed

BY MR. KNOTTS:

Q Mr. Moore and Mr. Nichols, did each of you prepare testimony or supplemental testimony regarding drawdown or draindown of the Monticello reservoir to respond to the Board question in that regard?

A (WITNESS NICHOLS) Yes, sir.

Q Mr. Moore?

A (WITNESS MOORE) Yes, I did.

Q And does each of you have a copy of that before you?

A (WITNESS NICHOLS) Yes, sir.

Q Mr. Nichols, are there any additions or corrections to your statement?

A (WITNESS NICHOLS) No, sir.

Q Mr. Moore, are there any corrections or additions to your statement?

A (WITNESS MOORE) No, sir.

Q You are advised, gentlemen, that you were previously sworn. You are still under oath. That may have been said off the record, but so it is on the record.

All right. Now, there are no corrections in either of your statements, is that right?

Are there any corrections in your statement, Mr. Nichols?

A (WITNESS NICHOLS) No, sir.

Q And Mr. Moore?

A (WITNESS MOORE) No, sir.

Q All right. Do you wish to adopt these statements as part of your testimony in this proceeding?

A (WITNESS NICHOLS) Yes, sir.

A (WITNESS MOORE) Yes.

Q All right. Are they true and correct? Are your statements true and correct?

A (WITNESS NICHOLS) Yes, sir.

A (WITNESS MOORE) Yes.

MR. KNOTTS: All right. I request that they be received in evidence and bound into the transcript as if read.

CHAIRMAN GROSSMAN: Any objections, Mr. Bursey?

MR. BURSEY: Are we going to have a summary before they are entered or --

CHAIRMAN GROSSMAN: No.

MR. KNOTTS: I'm trying to save time. I would be willing to say that if time permits at some later time and the Board wants to hear an oral discussion or have questions to the panel, we could bring them back, if that is the procedure you want to suggest.

CHAIRMAN GROSSMAN: I have one or two questions now, but I think we will want them back later.

MR. KNOTTS: All right.

CHAIRMAN GROSSMAN: But I do not want a summary now.

MR. KNOTTS: I did not think you did, sir.

CHAIRMAN GROSSMAN: I do not see any purpose to it.

MR. BURSEY: Well, the purpose in my mind, sir --

and you may tell me it is a misplaced fear -- but there are some points in Mr. Nichols' testimony -- and I have not even had a chance to look at Mr. Moore's -- that I believe there is perhaps no factual basis for. And I would -- I think that that should lead me to object to the introduction of it, at least at this time until it could be gone into.

CHAIRMAN GROSSMAN: Oh, you do have an objection to the exhibit or you have voir dire, is that it? I thought the question -- the question we had was whether any summary was necessary now, and I did not care to have one because of the time. But do you have voir dire or objections to the exhibits now?

MR. BURSEY: Yes, sir. I have objections based on conclusions of fact that at this point I take issue with and would need to cross-examine the witnesses to determine the factual basis for the conclusions stated therein.

CHAIRMAN GROSSMAN: Fine. Then you have voir dire, and to the extent it may have been picked up on the record that the exhibits were received, that was not the Board's ruling. We have not ruled on it yet.

And Mr. Bursey, you may proceed with your voir dire.

MR. KNOTTS: Only the qualifications have been received, is my understanding. The prefiled -- the written testimony has not yet been received.

CHAIRMAN GROSSMAN: That is correct.

MR. KNOTTS: May I note for the record that certain exhibits -- so that Mr. Bursey can cover everything at once, there are some exhibits associated with this you might want to know about, Mr. Bursey, which have been distributed also during the recess.

BY MR. KNOTTS: (Resuming)

Q Mr. Crews, did you write a letter to the Federal Energy Regulatory Commission regarding this subject?

A (WITNESS CREWS) I did.

Q And what is the date of that letter, sir?

A (WITNESS CREWS) July 13, 1981.

Q And have you received a response to that letter?

A (WITNESS CREWS) I have.

Q All right, and what is the date of the response?

A (WITNESS CREWS) July 14, 1981.

MR. KNOTTS: All right. I would like to have Mr. Crews' letter to the FERC marked as Applicant's Exhibit 32.

(The document referred to was marked Applicant Exhibit No. 32 for identification.)

MR. KNOTTS: And the response of the FERC marked as Applicant's 33.

(The document referred to was marked Applicant Exhibit No.

33 for identification.)

MR. KNOTTS: They are attached to Mr. Moore's testimony.

BY MR. KNOTTS: (Resuming)

Q In addition, Mr. Crews, did you write the South Carolina Wildlife and Marine Resources Department?

A (WITNESS CREWS) No. Mr. Moore wrote that letter.

Q Oh, Mr. Moore wrote that letter?

A (WITNESS CREWS) Yes, sir.

Q All right. We do not have that letter, as I understand it?

A (WITNESS CREWS) I beg your pardon. It was a verbal request.

Q It was a verbal request?

A (WITNESS CREWS) Right.

Q I am sorry. Let me go back.

Have you received a response to a verbal request, Mr. Moore, from the South Carolina Wildlife and Marine Resources Department?

A (WITNESS MOORE) Yes, I have.

Q And what is the date of that letter and who is it from?

A (WITNESS MOORE) July 15, 1981, from James A. Timmerman, Junior, Executive Director, South Carolina

Wildlife and Marine Resources Department.

MR. KNOTTS: All right. Even though these are attached to the testimony, I think the more appropriate procedure would be to mark them as exhibits. So I would request that the State letter be marked as Applicant's 34.

(The document referred to was marked Applicant Exhibit No. 34 for identification.)

BY MR. KNOTTS: (Resuming)

Q And are the copies that have been provided copies of the letters you sent or received, as the case may be, Mr. Moore?

A (WITNESS MOORE) Yes.

Q Mr. Crews?

A (WITNESS CREWS) Yes.

MR. KNOTTS: Thank you.

I will offer those in evidence as well, Judge.

CHAIRMAN GROSSMAN: Mr. Bursey, please proceed with your voir dire.

VOIR DIRE EXAMINATION

BY MR. BURSEY:

Q Mr. Crews, in the letter from the Federal Energy Regulatory Commission, attachment 2 to Mr. Moore's prefiled testimony, did I hear you that this letter was precipitated by a letter written by Mr. Moore to the FERC?

A (WITNESS CREWS) No. It was my letter to the FERC. It is also attached.

Q As attachment 1?

A (WITNESS CREWS) Yes.

MR. KNOTTS: Which is now marked Applicant's 32.

BY MR. BURSEY: (Resuming)

Q In the FERC response, in the first paragraph they mention could they have a concern that the drawdown could cause concern for the safety of the dam. That apparently could also be read as that it might not. I mean, there is no conclusive statement as a statement of fact that it would cause damage to the dam, is there, sir?

A (WITNESS CREWS) No.

Q And in any of the prefiled testimony today or in anything that you all are preparing to present today, do you address what is mentioned in the second paragraph as the effects of rapid drawdown on the dam and the effects of wave action on the unprotected embankments when the reservoir is below the riprap?

A (WITNESS CREWS) We have mentioned we do not cover it thoroughly. It would take a rather intensive engineering effort and some effort to define such problems.

MR. BURSEY: In regards to the Applicant's proposed exhibit, I believe that is the instant motion I am to respond to?

CHAIRMAN GROSSMAN: The exhibits and their prefiled testimony.

MR. BURSEY: Then I have some more.

CHAIRMAN GROSSMAN: Continue, then, Mr. Bursey.

(Pause.)

BY MR. BURSEY: (Resuming)

Q Mr. Nichols, your testimony concerns essentially the cost associated with replacement power; is that correct, sir?

A (WITNESS NICHOLS) Down to the 375 from the 420.5 level, down to the 375 foot level.

Q I have not had the opportunity to review your testimony and so I will just ask you, and if it is in here you could direct me to it: Does your testimony draw the price projections based solely on the cost of replacement power?

A (WITNESS NICHOLS) That is the major cost involved. The major element involved is having the facility unavailable for its optimum use during this drawdown and getting it down to the 375 foot level, and then the time required to maintain it at that level if that is the proper level that would address the Board's concern.

I am only drawing it down to 375 feet. The time it remains at that level unused and then the time required to pump it back up. So the major cost element, Mr. Bursey,

is in the time this facility is unavailable for use. And that is indicated in my appendix A to my testimony.

Q And do you anywhere in your testimony address the excess above peak load that you have with the facility and with the proposed loss of the facility?

A (WITNESS NICHOLS) Yes, sir. What we did was took a computerized model of our system and ran it with the pump storage unit available full capacity for certain monthly periods, and then we ran the same computer model without the Fairfield pump storage available and took the additional energy cost that was incurred by absence of that facility for use.

Q Well, sir, summarize for me now -- let me just ask some pieces of the question here. How many megawatts does the Fairfield pump storage normally generate on -- I know what it is, capacity is rated at, 500 megawatts; is that right?

A (WITNESS NICHOLS) Approximately 500 megawatts.

Q How many does it normally generate?

A (WITNESS NICHOLS) Over what period?

Q The same period you rated it 500. I do not know, is that a --

A (WITNESS NICHOLS) Normally, if you run it eight hours a day, then it would generate about 4,096,000 kilowatt-hours a day the days that you used it.

Q What I am looking for, sir, is that the design capacity -- what percentage of design capacity does the Fairfield pump storage operate at?

A (WITNESS NICHOLS) Full. Mr. Bursey, I might add, it is not always operated at full capacity. It is operated as needed to replace the use of No. 6 oil and No. 2 oil, whichever amount of capacity is required to accomplish that.

Q Yes, sir. And the total megawattage in your system without the Fairfield pump storage isd?

A (WITNESS NICHOLS) It varies from month to month.

Q But your capacity without the pump storage?

A (WITNESS NICHOLS) What about it?

Q I am asking what it is, your capacity without the pump storage?

CHAIRMAN GROSSMAN: Mr. Bursey, could you phrase those things as questions so we do not waste time. If your question is what is the capacity, say what is the capacity, and finish your question. Okay.

BY MR. BURSEY: (Resuming)

Q I will ask the question just exactly as I asked it. What is your capacity, your electrical capacity without the Fairfield pump storage?

A (WITNESS NICHOLS) Well, it would be 3,359 minus 512, whatever that figure comes out to be.

Q That is about 2800 megawatts.

A (WITNESS NICHOLS) Whatever that figure is.

Q And do you operate presently at what percentage of excess capacity?

A (WITNESS NICHOLS) I believe that this year our actual load was above the forecast. I believe it is around 35-point-something reserve, around 876 megawatts or something like that. I do not have those figures readily available, but I can -- that would sound like the correct figures.

Q Yes, sir. I have a document that is from your company that states that in 1981 reserve percentage load is 40 percent. And what I am getting at is it seems to me that the loss of less than -- less than 20 percent of your capability does not seem to necessitate all this expenditure if you have a 40 percent excess.

It looks like even if you did not use the Fairfield pump storage that you would still have a 20 percent reserve capacity. And I understand the FERC recommends 20 percent as being economically feasible to maintain.

A (WITNESS NICHOLS) I disagree with that statement. But 20 percent is not -- is an empirical figure and you cannot use that and apply it to any utility and say that is adequate reserve capacity, Mr. Bursey. I disagree

with that statement.

Q Do you --

CHAIRMAN GROSSMAN: Mr. Bursey, are you voir diring now or cross-examining?

And let me again tell you that Mr. Knotts has agreed to bring the panel back at a later time for cross-examination. So to the extent that you are unfamiliar with what they have filed, you would certainly do better to familiarize yourself with the material before you start asking the questions, if it is cross-examination.

MR. BURSEY: Please help me. I'm not trying to be obstructionist or anything. But in the admission of these documents, am I in any way waiving the factual basis of them? You are asking me to admit these documents into the record.

CHAIRMAN GROSSMAN: No -- yes, we are asking you if there is any reason why they are not admissible, why that testimony would not be admissible. We are not asking you to agree to the facts that the witnesses are stating. And you will be given an opportunity to cross-examine on the facts and also to bring in a rebuttal witness, if you want, on the facts. And the witnesses will be back.

MR. KNOTTS: And I might add, Judge, if he got an answer, since we are bringing them back and he has not had a chance to review the written material, if he got an answer

he could always move to strike something in the prefiled testimony, if he got an answer on cross that shows that there was an error in the prefiled.

CHAIRMAN GROSSMAN: Yes, Mr. Bursey, that is correct. If you discover on cross that there is some grounds for which the document should not have been admitted, you can then move to strike what had already been admitted.

MR. KNOTTS: Or some piece.

MR. BURSEY: And just in regards to the admissibility of the documents, meaning that these people wrote these documents and they are what they purport to be, is that -- do --

CHAIRMAN GROSSMAN: If the people were competent to discuss these areas, that is one grounds for challenging the documents. Another ground might be the relevancy.

MR. KNOTTS: I was just observing, when it is in response to a Board question relevancy would be a hard argument to make.

CHAIRMAN GROSSMAN: Another one might be the procedural, evidentiary objections you might have, such as hearsay.

MR. BURSEY: I think I am going to be best off just not objecting to their admission and trying to deal with it after I have had a chance to review them and take it

up in cross-examination.

CHAIRMAN GROSSMAN: Fine. So no objections?

Mr. Goldberg, do you have any objection?

MR. GOLDBERG: No objection.

CHAIRMAN GROSSMAN: None from you, Mr. Wilson?

MR. WILSON: NO, sir.

CHAIRMAN GROSSMAN: The documents are admitted.

(The documents previously marked Applicant Exhibit Nos. 32, 33 and 34 for identification were received in evidence.)

(The documents referred to, the prefiled testimony of Messrs. Moore, Nichols and Crews, follows.)

(2)

7/17

TESTIMONY OF WILLIAM E. MOORE

CONCERNING

DRAWDOWN OF MONTICELLO RESERVOIR

The Atomic Safety and Licensing Board has requested testimony on the question of the technical feasibility and costs of draining Monticello Reservoir. Mr. T. C. Nichols has provided testimony on the limited issue of the costs involving electrical generation necessary to refill the reservoir and differential energy cost incurred due to the loss of use of the pump storage unit. The purpose of my testimony is to discuss some of the engineering and environmental issues raised by the proposal and associate some time and cost estimates with those considerations, to the extent this could be done in the short time available since the request and with the understanding that no firm conclusions can be drawn without extensive studies in a variety of areas.

At a minimum, we would have to file a request with the Federal Energy Regulatory Commission (FERC). To confirm this, on July 13, 1981, Mr. E. H. Crews directed a letter to Mr. Aarne O. Kauranen, Regional Engineer for the FERC requesting the FERC to consider the engineering, environmental and other ramifications of the proposed drawdown of Monticello Reservoir and advise the Company of obvious specific major studies that must be prepared by the Company for review and approval by FERC before the drawdown (Attachment 1). By letter dated July 14, 1981, Mr. Kauranen

responded (Attachment 2). In addition to observing that the proposed experiment would be unprecedented and could cause concern for the safety of the dams, Mr. Kauranen outlined the following requirements:

1. Reconvene the Board of Consultants to obtain its assessment of the proposed action as to its effects on the structures.
2. Submit an application which would include the following:
   a. detailed data and procedures regarding changes in operation of the reservoir and hydroelectric plant;
   b. costs of conducting the experiment, including the following:
      (1) lost energy due to spilling of flows as they pass through downstream plants;
      (2) costs of capacity losses at Fairfield plant;
      (3) adverse effects on recreation and fish and wildlife;
      (4) repairs to dams;
   c. effects of rapid drawdown on the dam;
   d. effects of wave action on the unprotected embankments below the riprap;
   e. environmental assessment of the proposed action.

The development of the data required to accompany the FERC application would require hiring of external engineering

expertise to develop a comprehensive engineering plan. Such a plan would have to include a careful analysis of dam stability impact which would include but not be limited to new monitoring instrumentation to track internal dam pressures, procedures to minimize wave erosion of the unprotected dam surface and establishing maximum rates of drawdown. In addition, plans would have to be developed for refilling the reservoir which, very broadly, must identify anticipated actions to maintain original design conditions to assure that the dams would be at least as safe after refilling as before draining.

From a civil engineering point of view, it is not inconceivable that sufficient weather-induced damage could occur to cause the reservoir to have to be completely drained and the dams rebuilt. This would cause the Company to incur costs equalling the original cost of the dams, which was approximately fourteen million dollars ($14,000,000) in 1975-76 dollars. Almost certainly there would be some degree of damage which, besides endangering the integrity of the dams, would generate a need for a great deal of examination, study and ultimate repair.

In performing the environmental assessment required for the FERC application, it would be necessary to get assessments of the proposal from a number of State and Federal agencies, to include the South Carolina Department of Wildlife and Marine Resources (SCDWMR). For the past several years, SCDWMR has been conducting an experimental project to establish

Monticello Reservoir as a winter habitat for Canadian geese. Thus far, the project has met with success. Undoubtedly, the drawdown of the reservoir would have an impact on this project. Also, as managers of the State's fisheries, SCDWMR may well be concerned with the impact upon what is currently an excellent fishery (see Attachment 3, SCDWMR letter of July 15, 1981).

Also, there is presently a FERC-required environmental study ongoing. The study began in 1978 after initial filling. The purpose of the study is to monitor and document post-filling development of the Monticello Reservoir and Parr Reservoir ecosystems and, in cooperation with SCDWMR, improve the habitat for fishery and other wildlife resources. The study is scheduled to be completed in 1983. If, however,the ecosystem development is subjected to the shock of drawdown and refilling, it is likely FERC (assuming they allow the drawdown) would require the Company to extend the post-filling environmental study by several years.

It is almost a certainty that the Company's environmental assessment would trigger a full blown FERC environmental impact statement (EIS) involving an even larger array of public agency inputs. An optimistic estimate of time to complete the EIS process on an expedited schedule is one year. Three years is not at all unusual.

One very material point to bear in mind is that after all these efforts to develop a FERC application, there certainly would be no assurance that such an unprecedented request would be granted.

(2)
7/17

TESTIMONY OF THOMAS C. NICHOLS, JR.
CONCERNING
DRAIN DOWN OF MONTICELLO RESERVOIR
BETWEEN ELEVATION 420.5 AND 375.0 FEET

The Atomic Safety and Licensing Board has expressed interest in the cost associated with drain down of Monticello Reservoir. This would be to gain additional information concerning reservoir induced seismic activity, particularly that which might be associated with the unloading of Monticello Reservoir.

This testimony does not in any way suggest that such an undertaking is prudent or practical.

Reference to Appendix A, page 6, attached shows that the range of associated costs to reduce the level of Monticello Reservoir from an elevation of 420.5 to 375.0 feet, which is the bottom of the water intake structure for the Fairfield Pump Storage project, and return the lake to the 420.5 feet level could vary from $1,949,327 to $6,931,919. This range of cost is influenced by several factors:

1) The months during which the Fairfield Pump Storage Project is unavailable for use.

2) Time Fairfield Pump Storage Project is unavailable for use.

3) The type fuel utilized for replacement power and pumpback.

Based on conditions assumed and specified in Appendix A, a realistic cost would be somewhere between these figures.

It should also be understood that only costs involving electrical generation necessary to refill the reservoir and differential energy cost incurred due to the loss of use of the

Pump Storage unit are considered in my evaluation. Other costs such as: extensive repairs due to damage of the dam's surface caused by excessive drawdown below the reservoir's design level; impact on the testing activities of the Virgil C. Summer Nuclear Station; the time and cost associated with draining remaining water below the 375 foot level from the reservoir; transmission losses, forced outages of efficient base load generating units and reduced efficiency of Fairfield Pumped Storage at lower water levels are not included in these cost estimates.

SUPPLEMENTAL TESTIMONY CONCERNING ANALYSIS OF COST TO DRAIN THE FAIRFIELD PUMP STORAGE FACILITY, MONTICELLO RESERVOIR AND REFILL

The Atomic Safety and Licensing Board has expressed interest in the cost associated with a drain down of the Monticello Reservoir. The following identifies real cost associated with such a hypothetical action. Only cost involving electrical generation necessary to refill the reservoir and differential energy cost incurred due to loss of use of the pump storage unit are considered in this evaluation. Other costs are likely, such as repair to dam surfaces due to excessive drain down beyond design levels and delay to V. C. Summer testing activities due to unavailability of circulating water to support testing.

Key information associated with the cost estimate and the associated source of that information is provided below:

Section 2.4 of the Virgil C. Summer Nuclear Station Environmental Impact Report (VCS-ER) identifies that:

- The annual flow from the Broad River Basin above the Parr Dam is 4.3 million acre ft/yr. (VCS - ER 2.4 -1)
- The lowest Broad River daily flow rate of record is 149 cfs. (VCS Nuclear Station Environmental Report 2.4 - 5)
- The ten-year return low flow rate for a seven-day period for the Broad River is estimated to be 860 cfs. (VCS - ER 2.4 - 5)
- The annual average flood rate is approximately 20,000 cfs. (VCS - ER 2.4-1

The report on reservoir induced seismicity for the Monticello Reservoir identifies that:

- Monticello Reservoir contains 265,000 acre feet of water above the 375' elevation. The 375' elevation is the bottom of the water intake structure for the Fairfield Pump Storage Project.
- Seismic activity peaks for a period of two weeks following the initial fill of the reservoir.

The design of the Fairfield Pump Storage Facility has the following parameters:

- The normal drain down of the facility is from 425' to 420.5' and corresponds to 29,000 acre-feet of water.

VCS - ER - Virgil C. Summer Operating License Environmental Report

- The drain down can occur in 8 hours and yield 4,096 MWHRS of generation during that period. (8 hrs x 8 units x 64 mw/unit = 4,096mwhr.)

- The efficiency of the unit pump up + drain down is 71%.

In addition the following information was employed:

- The flow rate below the Parr Dam during the drain down was assumed to be limited to the annual flood rate of 20,000 cfs.

- The flow rate below the Parr Dam during the refill was restricted to a value of 1000 cfs which is slightly above the estimated ten-year return period of seven day low flow value of 860 cfs.

- 290 Mw of Combustion Turbine generation is available with a heat rate of 16,000 BTU/kwhr which is fueled by natural gas or #2 oil.

- 94 Mw of oil-fired generation is available at Hagood Station with a heat rate of 13,500 which is fired by #6 oil.

- 580 Mw of oil-fired generation is available for the remainder of replacement generation at Williams Station with a heat rate of 10,200 BTU/kwhr which is fired by #6 oil.

- Coal-fired generation would be available for night pump back of Fairfield Pumped Storage at a heat rate of 10,000 BTU/kwhr.

- Natural Gas costs $2.99/MBTU

- #6 oil costs $4.33/MBTU

- #2 oil costs $7.54/MBTU

- Coal costs $1.87/MBTU

ANALYSIS:

Broad River Daily Flow Rate

$$\frac{4{,}300{,}000 \text{ acre ft/yr}}{365 \text{ day/yr}} = 11{,}780 \text{ acre ft/day}$$

11,800 acre ft/day will be employed in calculation (limit significant digits to 3)

ANALYSIS (CONTINUED)

Drain Down Rate by Fairfield Facility

29,000 acre ft/8 hr = 3,625 acre ft/hr

or

87,000 acre ft/day

Maximum Flow Rate Below the Parr Dam

$$\frac{20{,}000 \text{ cfs} \times 60 \text{ sec/min} \times 60 \text{ min/hr} \times 24 \text{ hr/day}}{43{,}560 \text{ ft}^3\text{/acre ft}} = 39{,}700 \text{ acre ft/day}$$

Minimum Flow Rate Below the Parr Dam

$$\frac{1000 \text{ cfs} \times 39{,}700 \text{ acre ft/day}}{20{,}000 \text{ cfs}} = 1985 \text{ acre ft/day}$$

(2000 will be employed in calculations)

Maximum drain rate of Monticello is the maximum allowed flow rate of the Broad River below Parr less the normal flow rate of the Broad River, or

Maximum Drain Rate = 39,700 acre ft/day - 11,800 acre ft/day

= 27,900 acre ft/day

Drain Time is the volume above the minimum drain level of 375' less the normal drain down divided by the drain rate, or

$$\text{Drain time} = \frac{265{,}000 \text{ acre ft} - 29{,}000 \text{ acre ft}}{27{,}900 \text{ acre ft/day}}$$

= 8.5 days

Note the 8 hr penalty for generation drain down of the first 29,000 acre ft is not assumed.

The Fill Rate of the reservoir is the average flow rate of the Broad River less the minimum allowed flow rate, or

Fill Rate = 11,800 acre ft/day - 2000 acre ft/day

= 9,800 acre ft/day

Assume Parr Dam is maintained at maximum level during the period from the initial drain until refill.

Fill Time is the volume to be refilled between elevations 375' and normal low level, 420.5', divided by the flow available for refill, or

$$\text{Fill Time} = \frac{265{,}000 \text{ acre ft} - 29{,}000 \text{ acre ft}}{9800 \text{ acre ft/day}}$$

$$= 24.1 \text{ days}$$

During the initial filling of the reservoir, some micro-seismic activity was observed. Following completion of the initial fill, micro-seismic activity was detected for a period of two weeks. For the purpose of generating an estimated cost for the draindown and refill a period of two weeks is assumed for the wait period for seismic activity. The total outage time for the Fairfield Pump Storage is the sum of the drain time from the 420.5' elevation, the wait time for seismic activity and the refill time to 420.5 ft; or:

$$\text{Outage Time} = 8.5 \text{ days} + 14 \text{ days} + 24.1 \text{ days} = 46.6 \text{ days}$$

The outage cost associated with the Fairfield Pump Storage is the loss of utilization of the project in the most economical manner. Normally during the low demand periods for electricity, at night, coal fired generation is maintained at high power levels to pump water to the Monticello Reservoir. At high demand, during the day, the water is employed to generate electricity rather than utilize more expensive oil-fired generation.

For the purpose of this evaluation it is assumed that SCE&G would be able to replace the loss generation of the Fairfield Pumped Storage Facility with Company capacity, namely a mix of combustion turbines, old oil-fired generation at Hagood and new oil-fired generation at Williams.

The fuel cost of generation by the various forms of generation and fuels are:

Combustion Turbine #2 Oil	$120.14/Mwhr
Combustion Turbine Gas	4.84/Mwhr
Hagood (#6 Oil)	58.46/Mwhr
Williams (#6 Oil)	44.17/Mwhr
Coal	18.70/Mwhr

The best estimate of the minimum cost associated with a loss of the Fairfield Facility during a drain down of the Monticello Reservoir can be obtained from the Production Costing and Reliability Assessment

Program, PROMOD III by considering one case where Fairfield would be assumed available and another case where Fairfield would be unavailable. The PROMOD III program calculates the monthly cost assuming a daily and weekly load pattern adjusted by the seasonal demand. PROMOD III most efficiently employs all generation sources to provide the anticipated demand for electric energy at minimum cost. The factors of unit heat rate, fuel cost, fuel availability, maintenance expense, operating restrictions such as minimum load limits, planned maintenance outages and purchase generation are included in the evaluation. The results of those calculations are presented below as the monthly increased cost for fuel and purchased emergency generation (emergency generation would be purchased at the time of peak demand). No cost associated with increased operating and maintenance expense has been included.

INCREASED COST OF ELECTRICAL GENERATION
ASSOCIATED WITH OUTAGE OF FAIRFIELD

Period of Loss of Fairfield	Increased Production (Fuel & Purchases Only)
Oct. 1 - Nov. 16	$1,700,000
Nov. 1 - Dec. 17	2,213,000
Dec. 1 - Jan. 16	3,777,000
Jan. 1 - Feb. 16	6,343,000

The cost is particularly sensitive to system demand and maintenance schedule. It should be noted that during March, April and May refill is not possible due to flow restriction on the Broad River related to the fish run in the river.

The previous costs do not consider additional forced outages of other generation or any other problem. Should a large coal plant forced outage require replacement generation by combustion turbines rather than the less expensive oil-fired generator from base load plants, the related expense of unavailability of Fairfield would significantly increase.

The water to refill the Monticello Reservoir must be pumped from the Parr Reservoir on the Broad River.

Energy generated during draining of reservoir:

$$\frac{265{,}000 \text{ acre ft} - 29{,}000 \text{ acre ft}}{29{,}000 \text{ acre ft}} \times 4{,}096 \text{ MWH} = 33{,}333 \text{ MWH}$$

Pumpback energy = 1.4 x 33,333 MWH = 46,666 MWH
(It requires 1.4 MWHRS of pumping for 1 MWHR of generation)

NET COSTS OF FUEL TO PUMPBACK

Fuel	Cost/MWH	Pumping Energy	Generating Energy	Net MWH	Net Cost
Coal	$18.70	46,666	(33,333)	13,333	$249,327
#6 Oil (Wms)	44.17	46,666	(33,333)	13,333	588,919

LOWEST COST

Outage in Oct. - Nov. and using Coal to Pumpback

$1,700,000	Increased Production Cost
249,327	Cost of Fuel
$1,949,327	TOTAL

HIGHEST COST

Outage in Jan. - Feb. and using A. M. Williams to Pumpback

$6,343,000	Increased Production Cost
588,919	Cost of Fuel
$6,931,919	TOTAL

The above costs do not take into consideration:

1. Increased O&M of pumping units.
2. Increased O&M of units that replace Fairfield.
3. Increased costs due to forced outages on units.
4. Transmission line losses.
5. Reduced flow and generation as the lake's elevation is lowered.

BY MR. KNOTTS: (Resuming)

Q Mr. Nichols, it is my understanding -- let me ask you a preliminary question. During such time as the reservoir were drained down, the Virgil C. Summer station could not operate, could it?

A (WITNESS NICHOLS) No, that is correct, sir.

Q And does your testimony take into account the costs associated with delaying operation of Virgil C. Summer?

A (WITNESS NICHOLS) No, sir.

Q In this testimony -- did the testimony you prepared the other day and which was offered but not received, relating to the costs of delay associated with Virgil C. Summer, illustrate the kinds of costs associated with -- if that would have been -- that would have been associated with not being able to operate Virgil C. Summer, assuming the thing that was standing in the way was draining of the reservoir?

Do you follow me, sir? I phrased the question very badly.

A (WITNESS NICHOLS) I do not exactly follow you.

Q All right. When you say -- granted that the figures in your testimony the other day regarding delay costs at Summer pertain to a particular period of time, the fuel costs, the costs associated with delay and the fuel

costs, the testimony that we offered that the Board did not care to receive, do you recall that, sir?

A (WITNESS NICHOLS) Oh.

Q The full cost.

A (WITNESS NICHOLS) All right, sir.

Q That was prepared, as I understand it, for a period of June and later in 1982.

A (WITNESS NICHOLS) That is correct, sir.

Q Okay. So therefore it might not be applicable to the period that we are talking about here?

A (WITNESS NICHOLS) That is correct, sir.

Q But would it give you a ballpark figure of what kind of costs are associated with not operating Virgil C. Summer because the reservoir is drained?

A (WITNESS NICHOLS) As far as the absence of the Fairfield pump storage and its economic impact on the system by its absence, it would.

MR. KNOTTS: Okay.

CHAIRMAN GROSSMAN: I am just going to ask a very few questions here and reserve the others for when you reappear.

BOARD EXAMINATION

BY CHAIRMAN GROSSMAN:

Q How low has the level in the reservoir gone after it was filled?

A (WITNESS NICHOLS) Sir, I am not exactly certain. I think it has been down to as low as about 418.

Q Okay. Nothing in here indicates anything with regard to a partial drawdown, does it? Any drawdown that is not as low as 375 feet?

A (WITNESS NICHOLS) No, sir.

Q Could you tell me right now at what level the reservoir could be drawn down without any damage at all to the reservoir?

A (WITNESS NICHOLS) Mr. Moore could address that.

A (WITNESS MOORE) The riprap runs between 412 and 413. We would not want to go down any lower than five foot above the riprap, which would put us around 417.

Q Now, if I understand it correctly, it is wave damage that you are concerned about with the riprap, is that right?

A (WITNESS MOORE) Yes, sir. After the water is drawn down to where the trough of waves could be beneath the extent that the riprap goes down, where there would be bare soil exposed to the wave action.

Q Well, now, wouldn't that problem be ameliorated if there was a quick drawdown so that there was no possibility of wave action at that level?

A (WITNESS MOORE) You would get rid of one problem, but you would buy another one a whole lot worse, and that is

when the internal pressures from the water in the dam all of a sudden shoving the earth from the water side back into the water. You would have slumps on the dam as a result of that.

Q Why didn't that happen when the reservoir was being filled?

A (WITNESS MOORE) The pressure was pushing inward instead of outward. When the reservoir was being filled, the water pressure was pushing the soil into the dam, not out of the dam. But if you take the water pressure away from the outside of the dam, you only have those pressures then bottled up on the inside and nothing to hold them back. So it shoves the earth out.

(Board conferring.)

CHAIRMAN GROSSMAN: Okay, fine. Are there any questions that anyone thinks are very necessary at this point, in view of the fact that the witnesses are going to come back?

(No response.)

CHAIRMAN GROSSMAN: No. Gentlemen, we would like to excuse you temporarily now and have you return when we have a further proceeding here, when the seismic issue is fully heard. Thank you.

(Witnesses excused.)

MR. KNOTTS: May I inquire if it would be agreeable for us to introduce the application, the license application for an operating license, as our Exhibit 35, and our environmental report as Exhibit 36 by agreement? Otherwise, I can ask Mr. Crews --

CHAIRMAN GROSSMAN: Has there already been an agreement, Mr. Bursey?

MR. KNOTTS: There was on the FSAR. I am sort of presuming on Mr. Bursey's good offices. The license application and the environmental report, which we did not put in at the same time as the FSAR, according to the transcript.

MR. BURSEY: I have a question about something in the license application that has been brought to my attention recently, that perhaps I can work out between -- to my satisfaction with Mr. Knotts, and so I would request that you not do that until we --

MR. KNOTTS: Fine.

CHAIRMAN GROSSMAN: Why don't we have a report on that after we return from lunch.

MR. KNOTTS: Okay.

CHAIRMAN GROSSMAN: Did anyone have anything further until we take our luncheon break?

(No response.)

CHAIRMAN GROSSMAN: We would like to return about

-- we would like to return at 2:00 o'clock.

(Whereupon, at 12:45 p.m., the hearing was recessed, to reconvene at 2:00 p.m. the same day.)

AFTERNOON SESSION

(2:04 p.m.)

CHAIRMAN GROSSMAN: Mr. Knotts, I think we can begin the afternoon session by discussing the seismic problem and what the Board expects in the way of future testimony.

MR. KNOTTS: Very well. I would like to recall Doctors Robin Maguire --

CHAIRMAN GROSSMAN: No, wait. We do not want to recall the panel. We want to discuss what it is that the Board has in mind and what the parties have to say about it. And then if it seems like it is necessary to have the panel on, well, we will consider that. But meanwhile, your seismic people are in the hearing room?

MR. KNOTTS: Yes, two of them are, yes.

CHAIRMAN GROSSMAN: Okay. Yes, let me tell you what I personally see as a problem with the record that we have so far. I had some concerns about the magnitude, the G values, and the application of response spectra, and those questions become apparent merely from looking at the SER.

Now, I have heard the testimony put on. Basically, with regard to the G values, I have not reviewed the testimony, but my recollection is that there was a use of the Brune model and certain information, data utilized with regard to that, and certain G values were arrived at.

The staff's review, as well as I can recall from the record -- by the way, I do not care to have the staff come on now and give a further justification of what they did and have the Applicant's witnesses come back and give a further exposition. I want to indicate what I see as my -- what my dissatisfaction is so far and lay the groundwork for what I think is the necessity for having independent consultants.

Okay. Looking at those G values, apparently the staff's concern with that formula was taking a look at the data that was plugged in and making the mathematical computation and coming out with -- and approving the G values that result from what the Applicant submitted to the staff.

Now, that to me leaves quite a number of questions, or at least a few prominent ones. One is, is that model the appropriate model to use. Not that it is not a good model, but is it the best kind of evidence of what a G value should be from that magnitude earthquake. I have read Diablo Canyon. I have looked at other information, and I know there is information available as to actual acceleration values from earthquakes. Not only as in Diablo Canyon 5.5 to 8.5 magnitude earthquakes; there also is available strong motion data on moderate size earthquakes. I am not so sure that that could not be better evidence than the Brune model as to what the values ought to.

Now, I am not saying that that is so. But what I am saying is that if the staff is going to determine what the appropriate G value is it ought to first make a determination of what the best data is for it.

Secondly, it ought to make a determination as to the values to be used in conjunction with that formula; and the thirdly, go through the motions of applying that formula to that data.

Well, all I can see is that they tried the third. Now, as a background to that, let me also say this. I have had many years of trial experience. I understand what the obligations are of a trial attorney preparing a case and representing a client. And his obligation is to find the best material that supports his case. If he is looking for experts, he is looking for the best experts that support his case. He is looking for the best information that supports his case.

He is not looking for adverse information. He is not looking for experts who cannot support his case. I am not saying there is anything wrong with the system, but I am saying that is the system.

Now, all I can conclude from what the staff did with regard to those G values is make a determination, which amounts to saying we agree that the Applicant found some information and some experts which could support a G value

in the amount that it found. But what I am saying is that is not -- that may be enough, for the staff to say those are the appropriate values. But for me to say that those are the appropriate values, it just is not enough.

And I -- and since there have been the questions raised as to what the appropriate G values are just from the face of the SER -- and to me it seems like an important issue -- I think the Board ought to make a determination, and I am not happy with the record the way it is now, though at least in that area I think we ought to get an independent consultant who ought to be able to come in and say, yes, this is the best kind of information to look at, this is the best information to plug into the formula, and yes, this is the correct G value.

Now, I can mention the data that I am familiar with. There are, as I indicated, U.S. earthquakes. There is a study that was published by, I think it is, NOAA -- I may have mentioned this -- which shows the strong motion data with regard to earthquakes from, I believe 1939 to 1975. That was published in May of 1977.

I think that whoever gives testimony, an independent consultant -- I think the staff should have done that -- should look at that data. Maybe it is not good enough data to use. I understand that that study is being updated now and that there are figures available to an

expert with regard to earthquakes that occurred after 1975. And I will even give you the name of the person who's updated that.

The name of the original, the person who brought the information together for the original one was Carl Von Hake. That is Carl with a "C" and it is H-a-k-e. That is being updated now by people who, by the way, who work very closely with the USGS, Carlos Angel.

Now, there is that data available. I would expect that an expert witness might look at that or find some better data.

Now, when it came to the response spectra, I find something similar was done there. There is a standard response spectra -- there are standard response spectra. It is very hard to determine where to use plurals and singulars when you are dealing with data.

But in any event, if the Applicant is not going to use a standard response -- a standard response spectrum -- let's refer to it in the singular -- and bring something else in instead, it seems to me that the NRC staff ought to inquire whether what is brought in instead is a better item than the original, either more representative or more applicable to the particular site.

From the testimony that I heard here, I do not believe anything like that was done. Furthermore, part of

the new response spectrum time history was applied to the facility and part of a standard response spectrum was applied to another part of the facility. And again, I hate to venture into this expert area, but it is my understanding that this distribution of released energy has a lot, if not all, to do with the shape of that response spectra curve, and that if you are going to have more energy in the higher frequencies you will have less in the lower and vice versa.

And it does not seem to me that it is appropriate -- and maybe I am altogether wrong; I do not know -- but offhand, it does not seem appropriate to me to use part of one for one thing and part of another for the other thing, when they may be mutually inconsistent.

Now, that is a suggestion. But the main point is also -- well, those are the two main points that have been raised. And that leads me to want an expert in applying response spectra.

Now, a third area has to do with the magnitude of the earthquake. On one -- on the one hand, it seems like the ACRS has recommended considering a magnitude 5 -- approximately 5 magnitude earthquake. The other party, the NRC staff really believes in a 4.5, and the Applicant in a 4.0.

And the staff says, well, actually it has taken into account what the ACRS wants and has really considered a

5.0 magnitude earthquake. But the basis for that is really that they had considered the G values presented by the Applicant, which goes up to a 5.0 earthquake. And since by applying the G values that I have indicated it comes out so that the facility can withstand the 5.0 earthquake, in an offhand way the staff sort of accepts a 5.0 earthquake.

But if the response spectra -- I get the impression that if the application of the response spectra were to flunk the Applicant on the 5.0 magnitude earthquake, the staff really is not committed to a 5.0 magnitude. It is really back to its position that, on the basis of the history in the area, they really do not expect anything more than a 4.5.

And I have some trouble understanding what it is they base that decision on and what kind of probability they really have in mind. I do not have personally, from looking at the data, I do not personally have any problem with saying: Oh, well, the chances are there is not going to be anything bigger than a 4.5 or even a 4.0. But when I say that I really have in mind maybe 10 to one or 20 to one, and I would like to know what it is the staff does have in mind when they say that.

Because as I understand it 10 to one or 20 to one is not sufficient for licensing a facility. It has got to be a very, very low -- or very, very low probability. Now,

I am not asking for a probability study, but I am asking for some concrete basis for determining that that is going to be the maximum.

So I think in those three areas, at least, we do want an independent consultant. Now, I have investigated on my own and I have two names for at least two of the three areas. I understand -- and maybe I am wrong, and that is something that the staff or the Applicant can investigate -- that with regard to G values the USGS does have at least one expert with moderate-sized earthquakes, Dr. Hanks, who I am sure your Applicant's experts are familiar with, as would be the NRC staff. And so I would suggest first to try him.

But of course, I will listen to objections that any of the parties have to any of the names suggested, and if he is unavailable or if there is someone better, certainly we can, you know, try someone better, though I have not heard from my inquiries that, you know, there are better qualified persons to discuss that.

With regard to the application of response spectra, it is my understanding that Dr. Luco is an expert in that area and has been used as a Board witness in at least two cases, Diablo Canyon and apparently at San Onofre. And I understand he has a good reputation and appears to be somewhat of a specialist in that area.

Now, by the way, let me say this. I would expect

that whatever experts we decide to retain for this, that they be permitted to review the whole case, so that even if someone's specialty is heavy on one end of it, nevertheless he may have some expertise in the other end, and therefore have a complete portion of the expert testimony.

So now with regard to magnitude of earthquake, I really do not have anyone in mind, though I am not sure that Dr. Luco is not also an expert in that. But your seismic people, Mr. Knotts, and the staff people, Mr. Goldberg, could venture some -- could offer some opinion on that.

So those are three areas. Now, I did also mention the Charleston quake the last time and not migrating the Charleston quake to the perimeters of the province, the Piedmont Province. And as was mentioned, that was primarily a construction permit question.

However, if there is any drastic change in the information since then, it also, as I understand it, is a question for the operating license. And so I would hope someone in reviewing the case primarily with regard to the reservoir-induced seismicity would also, you know, look at that. But I do not see that as a critical issue in the case.

Now, let -- I am certainly -- excuse me for a second.

(Board conferring.)

CHAIRMAN GROSSMAN: By the way, as far as further information goes, as long as I mention one item of the strong motion figures and the update, I understand there are now reports on the Jenkinsville accelerometers put out by USGS. I have not seen them myself. I understand they are yellow-covered reports and I have no idea what the conclusions are. But I believe they are available from USGS.

And I would expect that someone would refer to those reports in making -- in giving his -- in making his analysis and giving his testimony. And I would also think that whoever were to make the report would also consult with the person who was responsible for the accelerometers at Jenkinsville. I believe Dr. Talwani has been in contact with him. But I would like that independent consultant to be in contact with him, too.

And I did have his name, but it escapes me at the moment. I believe he is now out on the West Coast but could be very easily found.

MR. KNOTTS: Judge, my understanding is that there is a technician named Risovich.

CHAIRMAN GROSSMAN: That is who it is. But he is only a technician and definitely not an expert, and really was guided by advice that was given to him by experts, including Dr. Talwani. So I do not think that he himself

has anything to offer in the way of testimony. But he certainly could be consulted by a consultant if the consultant thinks that what he has to say is of any value. But anything he might have to say might be of value. Fine.

Mr. Knotts?

MR. KNOTTS: Did the Board plan to go any further with clarification or is that -- I am thinking about the time when we break off and ask to caucus briefly. There is no point in caucusing until we have heard --

(Board conferring.)

CHAIRMAN GROSSMAN: Fine. Why don't we allow you some time now.

MR. KNOTTS: All right. May I ask that you think about this question. Maybe the Board has already thought about it. I am in favor of the parties having an opportunity to make nominations to the Board and to comment on the nominations. I recognize that, having heard those comments, it is up to the Board to make the selection.

And just thinking like a lawyer for a moment and not with any reference to the gentleman that has been named, but let's say some other names come up recommended by others, wouldn't it be prudent to be sure that the consultants eventually selected do not get to see the comments that the parties had on whether they should be nominated or not? Is there a procedure that we can follow

to do that? Do you see what I am driving at?

CHAIRMAN GROSSMAN: Yes. I do see that. And perhaps -- did you want to comment now on those particular persons on the record?

MR. KNOTTS: I was just raising the subject in principle in how we would handle comments whenever they are given. I do not know whether I have any comment until after I caucus with the gentlemen. That is why I wanted to make it clear what prompted it was not the identities here, but the principle of the thing.

CHAIRMAN GROSSMAN: I think off the record, before we come back, we will discuss whether there are going to be individuals -- comments on individuals and how we will, if there are, how we will handle that.

MR. KNOTTS: Very well.

CHAIRMAN GROSSMAN: We will take -- oh, I am sorry. Mr. Goldberg, what we were going to do is recess now and allow you to make comments. But if you have comments to make that you prefer to make before the recess, certainly go ahead.

MR. GOLDBERG: I am not sure what comments are invited now. Are we -- this part of the whole discussion of this matter, can we comment on anything that we have just brought out? I am not sure I am going to be in a position now to comment on the identity of the individuals that you

have named, because I do not have any seismic experts here to do that.

I would concur with Mr. Knotts that it might be desirable to have the benefit of nominations. I guess we are going to have more discussion on this topic.

CHAIRMAN GROSSMAN: Yes. Well, the point is, do you want to discuss this now, your questions, or do you want to discuss it after a break?

MR. GOLDBERG: Why don't we have a break, because it looks like the Applicant wants one, anyway.

(Recess.)

CHAIRMAN GROSSMAN: Back on the record.

Off the record we have had some small discussion of experts and we will have further conversations with the parties with regard to the experts after Mr. Goldberg has returned to Bethesda and consult the staff with regard to all the names mentioned and any others that the staff thinks might be even superior to the names we have discussed.

Mr. Goldberg, do you have any further comments? But if it is going to be just an impassioned defense of the staff's position, perhaps you can make those remarks brief.

MR. KNOTTS: Or we can stipulate that they were made.

MR. GOLDBERG: I do not think it is necessarily going to be an impassioned defense. I guess I would just like the record to reflect one or two points.

The staff review was conducted over the period of a year. We believe it was thorough and we believe that our conclusions about the adequacy of the seismic design are valid. By the way, we were talking about the Charleston earthquake. We feel certainly our consultant on that, the USGS, is probably the foremost authority on that, and we had their testimony and their letter report to the staff.

CHAIRMAN GROSSMAN: Do you believe Mr. Morris is the world's outstanding authority on that?

MR. GOLDBERG: I said the USGS is probably the

world's foremost authority, and we had a representative of that office. I suppose that Dr. Devine, the author of that letter, you know, might even be --

CHAIRMAN GROSSMAN: Mr. Devine.

MR. GOLDBERG: Mr. Devine might even be more knowledgeable, perhaps, than Mr. Morris on the subject. We believe that the ACRS has already issued a favorable report on the plant and its seismic design, and I guess what we would just also like to note, that no other parties have requested, by the way, additional witnesses.

And I guess my next point is about procedure. Obviously, I think we have to know certain things, how long it is going to take until the consultants are selected, how long it would take for them to perform their evaluation, what will be the nature of their evaluation, and particularly what kind of interaction will they have with the Applicant and staff experts on the matter, and what degree of documentation there will be on those, when they are going to present their opinions, and I would assume that before we resume hearings, they would be in writing, and I would imagine that there would also have to be some reasonable period thereafter within which all of the staff and Applicant's principals can review those written statements of position so that they can be prepared to address it.

I guess part of my background is this was a rather lengthy review. The ACRS had the benefit not only of seismologists but also structural experts in the development of its position, and I am just wondering, you know, the ACRS takes about a month and a half from the time it receives all the documentation on an application to complete its review. So I think that some of these things we certainly have to get down in terms of scheduling and understand better; but clearly we are talking about a delay of some proportion.

You know, we are not going to second guess the Board on -- they obviously feel the necessity for it. But I think there are some points we are going to have to --

CHAIRMAN GROSSMAN: Well, obviously we cannot tell you how long it is going to take because that is something the experts will have to say, and I personally have been working on finding who are the experts and trying to contact experts on my own. And I assume I will be doing that at the beginning of next week, or some of us will be, anyway. But we certainly expect to get it moving next week.

Now, as far as the arrangements for retaining these experts, one name I mentioned was USGS. Now, I assume that there is a procedure for that that the staff already has, I guess it is through Mr. Morris, with having the USGS witnesses appear. But these are matters that we can attempt to resolve informally off the record next week.

As far as any experts who may have been Board witnesses in the past that I indicated before, whatever procedure was followed in having them appear as Board witnesses in the other cases would certainly be followed in this case, especially if they had just recently appeared as Board witnesses, though we have other names suggested also and we are not sure who is going to be eventually decided on.

But I would expect that we would have a conference call sometime next week, early next week or early the week after next.

Fine. Can we proceed to other business now?

MR. KNOTTS: May I make a few inquiries for further clarification?

CHAIRMAN GROSSMAN: Certainly.

MR. KNOTTS: Judge Grossman, you made reference to one part of the spectrum for one part of the -- I think I heard plant, or one part of structures in another part of the spectrum for another part of the plant. We were not quite sure what you were referring to, Judge.

CHAIRMAN GROSSMAN: Well, it could be different parts of the plant but they were basically different frequencies that were being considered under one set of response spectra, and other frequencies considered under other response spectra. My reflection is that with the high frequencies there were time histories from a recent

California -- from Imperial Valley or Coyote Dam, I do not recall exactly. In fact, the Newmark Hall response spectra was applied to part of the plant frequencies.

MR. KNOTTS: Judge, we think there may be some confusion about that. Is there any chance we could have a run at that to just try and briefly explain it?

CHAIRMAN GROSSMAN: Okay. Mr. McGuire, are you the person who is going to, or Dr. Chen?

MR. MCGUIRE: Either one.

CHAIRMAN GROSSMAN: Why don't you -- you can explain it to us fine from there.

MR. MCGUIRE: I think the source of your confusion may be the way that material was presented, and maybe that was not in the most elucidating fashion possible. The original plant was designed for the entire frequency range using the Newmark Hall spectrum. The question of these reservoir-induced events then came up because they started occurring, and those are very small, very high frequency, very close to the -- would potentially be close to the plant and the small events, which events generally generate high frequency motion, ground motion.

So the imporatant part is to check whether the frequency response spectrum of those motions exceeds the original design spectrum.

Now, checking whether or not that was the case, we

very early on determined that it was only in the high frequency portion that we were concerned because that is the only place the original design would have been exceeded. So --

CHAIRMAN GROSSMAN: I understand that. There was no confusion. If you thought that I meant that the original design was based on some hybrid, I certainly did not intend to suggest that. What I was saying was in determining whether these g values could be accommodated by the plant or could be resisted by the plant -- I am not sure what the right term is -- that there was recourse not to the Reg Guide 1.60 response spectrum to be pegged to the zero period acceleration or to the Newmark Hall response spectra but to some other one for the purpose of testing the plant's ability to withstand that seismic event in the high frequency range.

Have I said anything incorrect so far, Dr. McGuire?

MR. MCGUIRE: No, you have not.

CHAIRMAN GROSSMAN: However, the recourse to those time histories was only with regard to those high frequencies and not also with regard to the low frequencies as far as those time histories went. And it seemed to me as though there was an application of two different things for basically -- for the same purpose but for different portions of the frequency range.

Now, I do not want to get into it any deeper. I have already admitted I am not anywhere near having acquired expertise, but it raised some questions in my mind, and perhaps unfounded ones, but I am certainly in a position where I would like to have someone take a look at that, and I mean someone other than is already in the proceedings.

Does that explain the Board's position on it?

MR. MCGUIRE: I think I understand your concern.

MR. KNOTTS: The next point we would like to comment on, Judge, is the reference to empirical data and whether that was used in the model. Could I let Dr. McGuire explain that?

MR. MCGUIRE: Yes. We wish to respond to your reference to this report which was produced by the USGS on the Jenkensville accelerograms, the one with the yellow cover, which was produced, I believe, in April, and those data were in fact analyzed by the Applicant, by me specifically, and the analysis for the three accelerograms which were printed in that report was presented at the ACRS hearings. That report may not be referenced in any of the documentation here, but certainly those data were used in this analysis.

CHAIRMAN GROSSMAN: Fine. Thank you. I was not aware of that.

MR. KNOTTS: And with regard to the use of strong

motion empirical data, I understood that Dr. McGuire felt that he was confident that the NRC understood why the model was being used and that it was the best model. It happens that he was not asked, as he recalls, to explain here why it was the best model. Is that correct?

MR. MCGUIRE: Yes.

CHAIRMAN GROSSMAN: Let me say I have got some other information. There is some further information with regard to strong motion data, and that is data that was derived from the Imperial Valley event of 1979, I believe, aftershocks, which the USGS has, unfortunately not broken down into the distance in terms of kilometers, but the data does have the coordinates in which you can determine epicentral distances in the strong motion section out in, I guess, Menloe Park. Dr. Brady's group has that information. So that is another source of information for empirical data.

MR. MCGUIRE: Let me make a general response to that. All of those data were considered in this analysis and it was very early determined that those California accelerograms would not be appropriate for estimating the ground motion associated with these reservoir-induced events, and that is why we had to go to a theoretical model which was calibrated with the data we did have from reservoir-induced events.

So we did not mean in our presentations that we did not consider any of those data.

MR. KNOTTS: One other comment or request for clarification, Judge, and then one or two comments on procedure and schedule.

We were confused or did not quite grasp the statement regarding maximum magnitude, which I took to be from reservoir-induced events, which seemed to be seeking a concrete study. I think our view is that our direct evidence shows that there is more site-specific data for this reservoir than for any site in the country, and I guess we are not clear whether you wanted more data or more analysis of a particular kind or what it was.

CHAIRMAN GROSSMAN: If you mean empirical -- some data with regard to the events that had already occurred at this site, no. I think that there has been quite a lot of information with regard to magnitudes. I am not sure that we have had the data presented here with regard to the g values from this particular site.

I do know that as a matter of fact I recall some information that perhaps might not be totally unclear -- totally clear with regard to the g values already experienced here, and let me refer you to the U.S. Earthquakes, 1979 edition, which does have a description of the g values experienced at Jenkensville and indicates one

that was at .253, I believe, which is a little in excess of what was discussed here, and another one which was almost at that value, which had a duration in excess of the longest duration discussed here too.

But you know, these are matters that I think ought to be, you know, covered in the presentation. I do not care to testify on those. But I believe we have had data in the case. Fine.

Dr. McGuire.

DR. MCGUIRE: Just to clarify our concern, this came up with you were talking about probability studies, and then you made the comment that you were not seeking an additional probability study, what you were seeking was a concrete study to determine what the maximum reservoir-induced earthquake magnitude might be. We cannot imagine what more concrete study we could have done and what more data we could have gathered from this area to do such a study.

CHAIRMAN GROSSMAN: Well, to put my remarks in context, it was not with regard to the Applicant's case, it was with regard to the staff's position, which really was in my mind ambiguous with regard to the 5.0 magnitude earthquake, because I just do not recall, even though the staff indicated that it was complying with the ACRS recommendation, as to considering a 5.0 magnitude

earthquake; that it really was making a determination that that was the magnitude to be anticipated here. Nor do I recall the staff giving a firm foundation for such a determination. So it was not with regard to your case.

MR. KNOTTS: Procedural question, Judge. The Federal Rules of Evidence contemplate that an expert witness would be appointed or -- strike "appointed" -- would be informed of his duties in writing and a copy of the assignment or scope of the assignment served on the parties, or that he would be informed of his duties at a conference of the parties.

And I wanted to -- I think that is a salutary approach. I was wondering if the Board was planning to provide or proceed on either of those bases.

CHAIRMAN GROSSMAN: Well, we have not decided, really, except that when you brought up discussing this matter here I thought perhaps our discussion might be what we would present to the expert witness as to the framework in which he would operate.

MR. KNOTTS: I see. You can just give him the transcript of this discussion.

CHAIRMAN GROSSMAN: Yes, a few pages now.

MR. KNOTTS: Yes, that makes sense to me.

CHAIRMAN GROSSMAN: Okay.

MR. KNOTTS: If the need for -- we would like to be able to have the expert be aware of the construction completion schedule of the plant, for one thing, and our concern about timing. We do not want to belabor the point at great length now, but we would like the expert to be

aware that there is a time bind, and I am sure the Board will make the expert aware that time is of the essence.

CHAIRMAN GROSSMAN: Absolutely. We are trying to find someone who can do the work right now.

MR. KNOTTS: While I am talking about time, I mentioned the other day, this is what I know now about the availability of our people, and I might just as well put it on the record. Dr. Talwani has to be in India, as I understand it, August 1 to 15. Dr. Chen has to be in -- out of the country, in China on a business trip July 26 to August 23rd. He is also unavailable much later in the fall, but I am not going to be pessimistic and mention those dates.

Dr. Maguire is unavailable August 24, 25, and 26. He is delivering a paper in France. And all of the witnesses would presumably be unavailable September 13 to 16 because there is a major earthquake engineering conference, and I would expect any of the Board's experts would be unavailable at that time also. To keep up, I am sure all these people feel it is essential that they attend those things, is that right?

WITNESS MAGUIRE: Yes.

CHAIRMAN GROSSMAN: Well, it obviously appears from what you are saying that the beginning of September is the best time, if we can accommodate that, other than, of

course, Labor Day weekend.

MR. KNOTTS: Judge, it certainly looks that way from the schedule. We would like to be able to do better than that and if we can do better than that I would be delighted. But from the schedule -- when I say we would like to do better than that, we would like to be able to twist the arms of these gentlemen sitting here, things of that sort.

But maybe when the Board gets back to us with the consultants, if he could be ready then, maybe we could do something so that we will be ready earlier than that.

(Board conferring.)

CHAIRMAN GROSSMAN: Okay. I would like it as soon as possible.

MR. KNOTTS: I am sure we all would, yes.

CHAIRMAN GROSSMAN: Okay. Mr. Goldberg?

MR. GOLDBERG: I was just going to say, in order to remove any ambiguity, the staff adheres to its position that the maximum reservoir-induced event is a 4.5. But on the recommendation of the ACRS that it consider the effect on the ability of the plant to cope with a magnitude 5 reservoir-induced event, we did independently evaluate the ability of the plant to cope with that.

CHAIRMAN GROSSMAN: I believe that is consistent with what --

MR. GOLDBERG: And so testified.

MR. KNOTTS: I might mention, Judge, that Dr. Maguire was prepared to address the appropriateness of using the Bolt book today. But if we are coming back, I will ask we hold off on that unless we have five or ten minutes later.

CHAIRMAN GROSSMAN: Fine. Why don't we get on and try and get through our schedule, because we have to by 5:00 o'clock.

MR. KNOTTS: My understanding is that the staff's witness, Branagan, is next. And while he is taking the stand, I wonder if Mr. Bursey could tell us whether he has had an opportunity to satisfy himself about Applicant's Exhibits 35 and 36, being the application and the environmental report?

(Pause.)

MR. BURSEY: During lunch I spoke with Mark Whitaker, one of the managers at the facility, and expressed my concern that there is a portion in the license application, in the table of contents, that is noted --

MR. KNOTTS: It is something like "certificates of" --

MR. BURSEY: Amendments.

MR. KNOTTS: -- "amendments." And what is missing from the book, and we will supply it today, are all the

affidavits, the routine affidavits that, "I have read the foregoing and believe it to be true and correct," that are submitted with all the FSAR amendments and shows service on state and local officials.

It is not substantive, but Mr. Bursey is right, they are missing from the book.

CHAIRMAN GROSSMAN: Fine. It is noted on the record and the parties will clear up all that housekeeping themselves.

MR. KNOTTS: Very well. The exhibits are received, then, by agreement, as I understand it?

CHAIRMAN GROSSMAN: Right.

(The documents referred to were marked Applicant Exhibit Nos. 35 and 36 for identification and received in evidence.)

CHAIRMAN GROSSMAN: Let me remind Mr. Bursey there were exhibits he had in mind, such as the interrogatory and answer to interrogatory from the rate case and --

MR. KNOTTS: He has supplied it to us, Judge. I don't know whether he has supplied it to the reporter. We have had an opportunity to look at it.

CHAIRMAN GROSSMAN: And is there any objection to that?

MR. KNOTTS: I think it has already been received. It was just a matter of providing it.

CHAIRMAN GROSSMAN: Okay, fine. If it has not been received, it is received now. And it was Mr. Bursey's Exhibit --

MR. KNOTTS: It was described, Mr. Reporter, as SCE&G's response to a data request, if that helps.

CHAIRMAN GROSSMAN: Well, we do not recall the number for it. It was around 6. But we will do without the number now.

Mr. Goldberg, do you have an objection to this?

MR. GOLDBERG: Have I got my copy of this yet? Brett, do I have a copy of this?

(Counsel distributes documents to Board and parties.)

MR. GOLDBERG: I have no objection.

CHAIRMAN GROSSMAN: Fine. Okay. As I indicated, it has either been received or we are receiving it in evidence now.

Mr. Goldberg, you can proceed with Mr. Branagan.

MR. BURSEY: Judge, there is still a hold on the record.

MR. KNOTTS: The consensus seems to be that it is 7.

MR. BURSEY: 7.

MR. LINENBERGER: Yes, it is 7.

CHAIRMAN GROSSMAN: Well, my recollection was correct. It is around 6. It is 7.

MR. KNOTTS: Close enough.

CHAIRMAN GROSSMAN: And we will receive 7 if it has not already been received.

(The document previously marked Intervenor Exhibit No. 7 for identification was received in evidence.)

MR. BURSEY: Judge Grossman, I wanted to say something about the exhibit that I had proposed to offer on Steven Sherwin's cross-examination and the financial -- the record of the Applicant. And that affidavit is attached to the transcript of the Public Service Commission hearing, but it is three entire volumes of testimony and portions of two other volumes. That is a foot and a half or two feet thick. And at present I have been unable to get it done and/or afford to have it done.

And I just wanted to bring it to your attention that that still was an outstanding exhibit and I do not believe it has been numbered, and would ask that perhaps that I be allowed to review that and see if there is a concise portion of the testimony that I wanted to present or --

MR. KNOTTS: Let me make a more perhaps practical suggestion. The reason that you wanted it in the record, as I understand it, Mr. Bursey, was because one of Applicant's exhibits contained the prefiled testimony, and the reason it contained that prefiled testimony was because the staff asked to see it. How about if we agree that it was submitted, that that particular testimony of Mr. Sherwin was admitted for the limited purpose of showing what the staff considered? And then you would not need the cross, because the staff did not consider the cross so far as the evidence shows.

MR. BURSEY: I think that would be -- I would be able to take that route, but pending my review, if there is something specific that I wanted to bring up to the Board -- if there is not, then the mere mention that Mr. Knotts has made I believe would put the Board on notice as to the character of that exhibit.

CHAIRMAN GROSSMAN: Fine. Why don't the parties then consult on this and come back to the Board when they either have reached agreement or cannot. Fine.

Mr. Goldberg, if you will proceed with Dr. Branagan.

MS. YOUNG: Before we begin, we have distributed copies of a corrected version of Dr. Branagan's testimony that memorializes the corrections that were made July 2. So

it is not necessary to be in the record. It is just for the convenience of the Board and the parties.

Whereupon,

DR. EDWARD F. BRANAGAN,

recalled as a witness by counsel for the Regulatory Staff, having previously been duly sworn by the Chairman, was examined and testified further as follows:

DIRECT EXAMINATION

BY MR. GOLDBERG:

Q Dr. Branagan, would you explain to the Board and parties why you are here to testify today?

A Yes. In reading the transcript for July 2, there was a statement I made concerning genetic risk estimators that might be misinterpreted. And so I want to clarify that statement.

On page 2504 of the transcript I stated, and I quote: "The 0.3 figure genetic occurrences, that is multiplying the dose by the genetic risk estimator. The genetic risk estimator that we used was about 260 potential genetic disorders per million person-rem, whereas I believe Dr. Morgan is saying a value more like 1800 or something. We indicated a range of uncertainty in our values, a core factor of approximately 6 above. So if you put that range on there, I think we are in somewhat agreement. There is not a basic discrepancy when you look at the total range."

End of quotation.

When I stated that Dr. Morgan and I were in somewhat agreement, I was comparing the highest genetic risk estimator that we indicated in the FES. That is about 1500 potential genetic disorders per million person-rem. With Dr. Morgan's genetic risk estimator of about 1800 potential genetic disorders per million person-rem.

Dr. Morgan also stated a higher value. However, on page 2496 of the transcript it shows that he switched his value from 4.4×10^{-2} to 4.4×10^{-3}, and then back to 4.4×10^{-2}. Apparently Dr. Morgan did not give the units on his risk estimator and this led to some confusion.

A more careful reading of the transcript indicates that Dr. Morgan did use a genetic estimator of 4.4×10^{-2} potential genetic disorders per rem, or 44,000 potential genetic defects for 10^{6} person-rem.

MR. BURSEY: Excuse me, Dr. Branagan. For the purpose of my being able to follow you, is everything that you have said in your prefiled testimony in this?

MS. YOUNG: Mr. Bursey, if I could clear up the confusion. That is a copy that has corrections he made on the record on July 2, instead of an errata sheet. Those are the corrections he made in the transcript.

CHAIRMAN GROSSMAN: None of this is in that

rebuttal testimony.

MS. YOUNG: He is doing everything orally now.

THE WITNESS: I need to finish one sentence there. A more careful reading of the transcript indicates that Dr. Morgan used a genetic risk estimator of 4.4 times 10^2 potential genetic defects per rem or 44,000 potential genetic defects per 10^6 person-rem for his calculations. I did not realize that when Dr. Morgan used the figure of 1700 that he was talking about genetic defects, rather than a genetic risk estimator.

I do not agree with Dr. Morgan's genetic risk estimator of 44,000 potential genetic defects per million person-rem or his total of 1700 potential genetic defects due to 30 years of plant operation. Dr. Morgan's genetic risk estimator of 44,000 potential genetic defects per million person-rem is higher than the highest values that can be derived from the major radiation protection organization reports, such as BIRE-1, BIRE-3, ICRP-26 and UNSCAR that was published in 1977.

BY MS. YOUNG: (Resuming)

Q Maybe to go on, Dr. Branagan, could you describe how the risk of potential genetic disorders among offspring of workers were estimated in the Summer final environmental statement?

A Yes. The risk of potential genetic disorders in

all future generations of the exposed work force population was estimated as follows. The annual occupational dose, which was conservatively estimated at 1300 person-rem, was multiplied by the genetic risk estimator, that is 260 potential genetic disorders per million person-rem. Using these values, the NRC staff estimated that about 0.3 genetic disorders might occur in all future generations of the exposed population due to an exposure of 1300 person-rem.

This is a conservative estimate because the average annual occupational exposure at operating pressurized water reactors has been about one-third of the value of 1300 person-rem.

Q What was the source of information that was used to compute your genetic risk estimators?

A The genetic risk estimators were derived from table 4, page 57 of the National Academy of Sciences BIRE-1 report. The derivation of the genetic risk estimators is described more fully a document whose acronym is GESMO or NUREG-002.

The value of 260 potential genetic defects per million person-rem is equal to the sum of the geometric mean of the risk of specific genetic defects and the geometric mean of the risk of defects of complex causes. The range of genetic risk estimators that was given in the BIRE-1 reports extends from about 60 to about 1500 potential genetic cases

per million person-rem.

Q How do your values for genetic risk estimators compare with the values in the International Commission on Radiological Protection?

A ICRP-26 estimates that hereditary damage to all subsequent generations from whole-body exposure is about 80 potential genetic defects per million person-rem. The range of values for genetic risk estimators given in the FES, that is about 60 to about 1500 potential genetic defects per million person-rem, encompasses the value recommended by ICRP. That is about 80 potential genetic defects per million person-rem.

The central value of 260 potential genetic defects per million person-rem that was used in the FES is about three times higher than the value estimated by ICRP.

Q How do your values for the genetic risk estimator compare with the values in the United Nations Scientific Committee on Effects of Atomic Radiation, i.e., the UNSCAR report?

A The UNSCAR 1977 report estimates that about 185 potential genetic defects may occur per million person-rem. The range of values for genetic risk estimators that was given in the FES encompasses a value recommended by UNSCAR. The central value of 260 potential genetic defects per million person-rem that was used in the FES is higher than

the value given in the UNSCAR 1977.

Q I think on pages 2496 and 2499 of the July 2 transcript, Dr. Morgan seems to use a range of genetic risk estimators of about 1800 to 44,000 genetic defects per million person-rem. Can you tell the Board how he obtained these values?

A Dr. Morgan stated on page 2499 of the transcript that his values were derived from Table 4, page 57, of the BIRE-1 report. This is the same table I used. The lower value that Dr. Morgan used, that is 1800 potential genetic defects per million person-rem, is about equal to the highest value that I can derive from the same table, that is about 1500 potential genetic defects per million person-rem.

Dr. Morgan did not explain how he derived any of his values for genetic risk estimators. These are the values of 1800 to 44,000 potential genetic defects per million person-rem.

Q Okay. Finally, do you agree with Dr. Morgan's statement on page 2496 of the transcript that over 1700 genetic disorders will occur due to an annual exposure of 1300 person-rem per year for the 30-year operation of the reactor?

A No. In the FES we estimated that about 0.3 genetic defects could occur in all future generations due to

an annual exposure of about 1300 person-rem. Multiplying the 0.3 genetic defects for one year of plant operations by 30 years of operations leads to a value of about 9 potential genetic defects.

Even using the highest genetic risk estimator that the NRC staff derived from the BIRE-1 report, the number of potential genetic defects would be about 60. This value is obtained by multiplying an annual occupational exposure of 1300 person-rem per year times 30 years times a genetic risk estimator of 1500 potential genetic defects per million person-rem.

It is important to note that these estimates are based on several conservative assumptions. First, the annual occupational dose has been conservatively estimated at 1300 person-rem rather than the average annual occupational dose of about 400 person-rem at PWR's.

Second, although transmitted genetic effects have not been observed in humans at these doses and and dose rates, a linear extrapolation was used to estimate the genetic risk. In regard to the use of the linear model for estimating genetic effects, BIRE-3 states on page 82, and I quote: "Some mathematical assumption is necessary and the linear model, if not always correct, is likely to err on the safe side."

In summary, the NRC's highest value, that is about

60 potential genetic defects from an annual exposure of 1300 person-rem for 30 years of operation, is still much less than Dr. Morgan's value of 1700 genetic disorders.

Q Now, Dr. Branagan, moving on to a different subject, recently the Atomic Safety and Licensing Appeal Board in the Peach Bottom decision of May 13, 1981, adopted radon release values for use in the cost-benefit analysis for the reactors in question in that decision.

Have you reviewed the newly adopted release values and how would it affect the cost-benefit balance?

A Yes, I have reviewed these values and come to the following conclusions: First, the Appeal Board's adopted radon release rates are not significantly different than the values we used in the FES. The Appeal Board uses a radon release rate of about 6600 curies per annual fuel requirement, whereas in the FES we used a value of about 1590 curies per annual fuel requirement.

Second, use of the Appeal Board's long-term radon release rates after mining and milling have ceased, using what the Appeal Board calls case two, would not result in significantly different impacts than the values used in the Summer FES. Case two was the case in which -- the Appeal Board looked at three cases and case two was the case in which the tailings were covered to reduce the radon flux to low levels, but the mines were left unsealed.

In case two the appeal board adopted a value of 91 curies per annual fuel requirement per year. In the Summer FES, we estimated long-term radon release rates as follows: 38 curies per annual fuel requirement per year for the first 100 years after the milling operations have ceased; 47 curies per annual fuel requirement per year for the next 400 years; and 137 curies per annual fuel requirement per year for periods beyond 500 years.

Using these values, I conclude that use of the new radon release values to estimate health effects in the Summer FES would not change the validity of the favorable benefit-cost balance.

MS. YOUNG: I have no further questions.

CHAIRMAN GROSSMAN: Thank you. Mr. Bursey?

MR. BURSEY: As the Board recalls, my direct case as well as my cross-examination of this contention, my presentation and the response to it, was presented by Dr. Morgan. And I am not qualified to respond to the points that Dr. Branagan has raised, and would need to get a copy of today's transcript and send it to Dr. Morgan for his examination and rebuttal, in that I do not know whether the points that Dr. Branagan has pointed out were substantive factual errors or misstatements that did not contribute to changing the findings.

These are things that we need to find out from Dr.

Morgan.

CHAIRMAN GROSSMAN: Well, when you consult with Dr. Morgan, if there are any further matters I think it would be appropriate in this case to submit an affidavit to the other parties to see whether they would accept the affidavit in clarification or in substitution of further hearing on -- of Dr. Morgan. And then consult with the Board if the parties do agree or if they do not agree, and we will determine a further course.

It does not appear to me at this point as though we would need anything further or Dr. Morgan would consider anything further is necessary. And if he did, I would assume an affidavit would suffice.

But Mr. Knotts, what would you say now?

MR. KNOTTS: Oh, I guess, speaking in lawyerlike fashion, I would say my preference would be to close the record, but Mr. Bursey has the option to request reopening, which would be accompanied by the affidavit that the Board had in mind. And what the Board is suggesting is a somewhat more informal procedure which would give us the opportunity to agree on reopening without the Board having to rule on it.

And so, at the end of a long week, you know, what can I tell you?

(Laughter.)

MR. BURSEY: The affidavit mechanism is fine with me. My resources and Dr. Morgan's time evaporated. I am sure that the affidavit would be adequate.

MR. KNOTTS: I think the Board correctly characterized the likely situation. Dr. Branagan has done nothing more than straighten out something that might have been very confusing in the transcript the way it was left.

CHAIRMAN GROSSMAN: Dr. Branagan did.

MR. KNOTTS: That is right.

CHAIRMAN GROSSMAN: I thought you said Dr. Morgan.

MR. KNOTTS: I thought I said Dr. Branagan.

CHAIRMAN GROSSMAN: I am sorry. I heard it wrong. It is late in the day.

MR. KNOTTS: What he has done is straighten out what his view is, the NRC staff's view, and he has not done anything material to Dr. Morgan.

CHAIRMAN GROSSMAN: Just to clarify, the Board is certainly not accepting an affidavit of Dr. Morgan. We are awaiting the possible production of an affidavit and the possible agreement of the parties.

MR. KNOTTS: Or the possible argument that there should be some good cause to receive it, if it comes to that.

CHAIRMAN GROSSMAN: Right.

MR. KNOTTS: Which we all hope it will not.

MR. BURSEY: I would like to take note that Mr. Knotts' characterization of Dr. Branagan's testimony that we have just heard was just mere clarification. I did not quite hear it that way. And like I say, I am not even versed enough in the issues to understand if that was simply a clarification or if it was actually -- raised questions of fact.

But I would like to seek from the Board a copy of Dr. Branagan's testimony from today. In that I am not receiving service of the testimony, I need some way at least to get that portion of the transcript that contains Dr. Branagan's testimony.

CHAIRMAN GROSSMAN: Along those lines, let me suggest that the Applicant may want to supply a copy of the transcript not only for this very small portion, but for the briefing of the other matter, which will require some mechanics of -- some arrangement either with the parties or the Board.

MR. KNOTTS: I cannot really commit to anything at the moment, Judge. But what I can observe is in the past we have had no difficulty making available materials in the company's law library for use there by primarily Dr. Ruoff and Mr. Guild. It has been available to Mr. Bursey as well, I understand.

CHAIRMAN GROSSMAN: Let me inquire, off the record, from the court reporter what the new procedures are with regard to the copy going to the information room?

(Discussion off the record.)

CHAIRMAN GROSSMAN: Let's go back on the record. Mr. Bursey?

MR. BURSEY: Well, I was going to note that the transcripts are not in the public document room. And someone --

MR. KNOTTS: I do not know whether they are or not.

(Board conferring.)

MR. BURSEY: The Applicant has passed two copies, I am informed, and Mr. Mahan has agreed to work out arrangements with me to borrow on a short-term loan a copy that I can -- 20 minutes, he said. I can read the whole thing in 20 minutes. And I would like to note that I wish there was some way I could have a copy, but I understand the Board is constrained from ordering that.

CHAIRMAN GROSSMAN: That is correct. We did set for the briefing a two-week deadline but shortene it to one week if a copy is supplied you and therefore make it very clear to the Commission and everyone else that we need that copy in your hands to expedite the proceeding, which is the main problem here. But I believe it can be resolved informally with the parties.

My understanding is you will get a copy from someone as soon as a copy is delivered to the parties.

MR. BURSEY: And from the date of my receipt I have two weeks, then, to respond? Was there a time mentioned?

CHAIRMAN GROSSMAN: No, no one mentioned any time. I was discussing the briefing of the other issue. We ahave not yet established a time for that.

MR. KNOTTS: We will get to that, I am sure.

CHAIRMAN GROSSMAN: Yes. Okay.

Now let's conclude with Dr. Brannagan, and let's pass the ball to Mr. Knotts.

CROSS EXAMINATION

BY MR. KNOTTS:

Q Dr. Brannagan, my question is kind of a general one and it is only one question, but in talking to some of the members of the public who have attended the hearing, I would like to ask it for the benefit of the public record.

Are these genetic effects that you have been discussing known to occur, observed in the population, or are they postulated to occur? And I am asking you only what you observed from the literature.

A The genetic effects have not been observed transmitted to future generations in the human populations exposed at these low doses and dose rates.

MR. KNOTTS: Thank you.

MR. BURSEY: I might ask a question in response to Mr. Knotts' last question.

BY MR. BURSEY: (Resuming)

Q Has there been an adequate passing of time since the postulated exposures in order for us to actually see any genetic disorders?

A Okay. In order to see genetic disorders at this low a dose and this low a dose rate if they were to occur,

you would need a very large population and you would have to follow them for a very long time period to observe effects at these low doses and dose rates.

Q Then we would infer that Mr. Knotts' question is have they been observed, is -- that there has not been enough time in order to make an adequate observation of that.

A That is true that there has not been enough time.

(Counsel for Intervenors conferring.)

CHAIRMAN GROSSMAN: Mr. Knotts, do I understand you have completed?

MR. KNOTTS: You do so understand, Judge.

CHAIRMAN GROSSMAN: Mr. Wilson.

MR. WILSON: No questions, Mr. Chairman.

CHAIRMAN GROSSMAN: We have no Board questions.

Mr. Goldberg, did you have any questions on redirect?

MR. GOLDBERG: Nothing further.

CHAIRMAN GROSSMAN: Thank you again, Dr. Brannagan, for appearing. The witness is excused.

(The witness was excused.)

MR. KNOTTS: The Applicants call Dr. James Barker.

Whereupon,

JAMES H. BARKER

was called as a witness by counsel for the Applicant and, being first duly sworn under oath, was examined and

testified as follows:

DIRECT EXAMINATION

BY MR. KNOTTS:

Q Dr. Barker, have you prepared a statement of your professional qualifications for use in this proceeding?

A I have.

Q Are there any corrections you wish to make in that statement?

A Yes. They are minor.

Q Well, would you please tell us what they are.

A On the second page it says from 1973 through 1976 I was an assistant associate professor. That is not a new rank. I was an assistant professor. The "associate" should be struck. And then a little further in that paragraph there is a reference to some grants that I had. It says that in 1975 I received a travel grant from Oak Ridge Associate Universities to support research at the Oak Ridge isochrone cyclotron. This grant has been continuously renewed. It has obviously not been renewed since I stopped doing research and have taken a job in a commercial power plant.

Q So what do you want it to say, Dr. Barker: "This grant was continuously renewed until I left"?

A That is right, until I was employed by South Carolina Electric and Gas.

Q All right. Any other corrections, Doctor?
A No.
Q Is the statement as corrected true and correct?
A Yes, it is.
Q Do you wish to adopt it as part of your testimony in this proceeding?
A Yes, I do.
Q Dr. Barker, you previously filed an affidavit in thi proceeding dated May 6, 1981.
A That is correct.
Q Consisting of was it three pages, and I am not clear, were these references attached to the affidavit?
A There were three pages and then there were references attached.
Q And Attachment A to that affidavit was your statement of qualifications which you have just addressed yourself, to, is that right?
A That is correct.
Q All right. Are there any corrections or additions, or perhaps I should better say updating of that affidavit that you wish to do, or is that done in your prefiled testimony?
A There is an update but it is done in my prefiled testimony.
Q All right. Is your affidavit done except for that

update? You have already sworn to the truth of it, but do you still believe it to be true?

A Yes.

Q Very well, sir. Do you wish to adopt it as part of your testimony in this proceeding?

A I do.

Q All right.

Now let me ask you if you have prepared prefiled testimony for use in this proceeding which was dated May 28, 1981.

A That is correct.

Q And are there any corrections or additions which you wish to make in that?

A No.

Q Very well, sir. Is it true and correct?

A Yes, it is.

Q Do you wish to adopt it as part of your testimony in this proceeding?

A Yes, I do.

MR. KNOTTS: Judge, I understand Dr. Barker has a very brief summary if you would like.

CHAIRMAN GROSSMAN: Please proceed.

THE WITNESS: The summary is very brief.

I understand that this issue that I am addressing, the ALARA issue was actually a Board question, and I have

provided prefiled testimony on it. So I would just like to basically state that South Carolina Electric and Gas is committed to a policy of ALARA; that this commitment exists at three levels: the corporate level, in management and the corporate health physics group; the station management and station health physics group, and the worker level, both supervision and the crafts people themselves. That is the statement. ALARA is the philosophy.

And if you have specific questions about how we propose to implement it or whatever your questions were, I would be pleased to answer them.

CHAIRMAN GROSSMAN: Mr. Bursey, do you have any objections to the qualifications or the statement being introduced into evidence?

MR. BURSEY: I have a few questions on Dr. Barker's qualifications.

CHAIRMAN GROSSMAN: By the way, Mr. Knotts, have you yet offered them? I forgot.

MR. KNOTTS: I do so offer them now, Judge; and before Mr. Bursey proceeds with his examination, perhaps I should offer the exhibit which was referred to in Dr. Barker's update, which is toward the back of his prefiled testimony.

This is the first time the system broke down. Can I have just a moment, please?

(Pause.)

BY MR. KNOTTS: (Resuming)

Q All right, Mr. Barker.

Did you receive a copy of a letter dated May 13, 1981 with some attached tables from Dames and Moore?

A I did.

Q Subsequent to a conversation that you had with them.

A That is correct.

Q The letter is actually addressed to Mr. Whitaker, but was it based on your conversation with Dames and Moore?

A Yes, it is.

Q Very well, sir. Does that relate to the update of your prefiled affidavit, the update of your prefiled testimony?

A That is correct.

MR. KNOTTS: Thank you.

That would be Applicant's 37 if it may be so marked.

(The document referred to was marked Applicant's Exhibit No. 37 for identification.)

And we would like at this time to offer Dr. Barker's qualifications, his affidavit, his prefiled testimony and ask that they be bound in the transcript as if

read, and offer the May 1981 letter from Dames and Moore, which is intended to show what Dr. Barker considered in his update as well as to reflect conditions in the -- is it the FSAR, Dr. Barker?

THE WITNESS: It is the FSAR and Operating License Environmental Report.

MR. KNOTTS: Thank you.

CHAIRMAN GROSSMAN: Mr. Bursey.

VOIR DIRE

BY MR. BURSEY:

Q Dr. Barker, what is heavy ion nuclear physics?

A Heavy ion nuclear physics relates to scattering experiments in which the projectile is heavy, something heavier than an alpha particle, let's say nitrogen, for instance. You are looking at effects of collisions between heavy ions.

Q Would that have to do with health effects on human beings?

A No.

Q And charged particle spectroscopy? What is that, sir.

A Spectroscopy? I do not know what you are reading.

Q It is the third paragraph in your professional qualifications. It is an area of research that you have done.

A Yes, charged particle spectroscopy.

Q What is that sir, just briefly? Well, let me just ask a simpler question. Is that a health-related study?

A I am an experimental nuclear physicist at the time you are reading.

Q Oh.

A I mean the research area was experimental nuclear physics.

Q And this specific nuclear health physics training that you have had, could you expand on that a little bit?

A All right. Let's see if I have it in the summary here. There is an omission, apparently, in this. I will expand on it.

In 1975 I participated in I think it was a Department of Energy-sponsored program for retraining of professors at universities to initiate programs in health physics at their home institutions. I went through a ten-week resident program at Oak Ridge National Lab sponsored both by Oak Ridge National Lab and Oak Ridge Associated Universities.

A requirement for entry in the program was a Ph.D. in physics, and it was a fairly intensive program designed to prepare me for teaching in that area.

Subsequent to that, as is listed, I applied to and received from the NSF a grant for initiating a program at

St. Louis University in health physics. That is the program that subsequetly I did initiate, founded, taught in. So my background in health physics is at the academic level. That is, I received formal training, I received a grant from NSF based on a proposal I submitted to them, and then I taught at it for two years.

I would point out also that my background in low energy nuclear physics is a fundamental requirement in the understanding of the interaction of radiation with matter, which is the basis for all health effects.

Q Does the field of -- just a moment.

(Pause.)

I was wondering if as low as reasonably achievable dose expsosures for workers responsibility that you have with the company -- which aspects of your professional background relate directly to that.

A My training in health physics. You should be aware that I do not have responsibility for ALARA in the company. I am one of many people that have responsibility for ALARA. I am in the corporate health physics group, and that group within SCE&G is charged with formulating policy and ensuring the implementation of ALARA, but it is not my sole responsibility.

MR. BURSEY: That is all, Judge Grossman. Thank you.

CHAIRMAN GROSSMAN: Mr. Goldberg.

MR. GOLDBERG: No questions.

CHAIRMAN GROSSMAN: Mr. Wilson.

MR. WILSON: No questions.

MR. KNOTTS: Judge, may the qualifications and the two items of testimony be received and bound in the transcript as if read.

CHAIRMAN GROSSMAN: There were no objections.

MR. BURSEY: No objections.

CHAIRMAN GROSSMAN: Yes, they are received.

(The professional qualifications, affidavit and prefiled testimony of James H. Barker follow:)

7/17
(3)

JAMES HOWARD BARKER

PROFESSIONAL QUALIFICATIONS

I am a Staff Health Physicist for South Carolina Electric & Gas Company, Columbia, South Carolina. My principal responsibilities with South Carolina Electric & Gas Company are in making offsite dose calculations, developing radiological technical specifications, formulation of corporate ALARA policy, providing technical expertise in the area of computers to the V. C. Summer Station onsite health physics group, and in providing health physics input to the Radiological Emergency Plan for the V. C. Summer Nuclear Station.

I graduated from Loyola University in Chicago, Illinois in 1966, receiving a B.S. in Physics. I received my Ph.D. in Physics from Texas A&M University, College Station, Texas, in 1971 and engaged in further postgraduate studies in health physics at Oak Ridge National Laboratory in 1975.

From 1966 to 1971 I was a Teaching and Research Associate in the Physics Department at Texas A&M University. As a full time graduate student I was involved in research in the area of charged-particle spectroscopy utilizing solid state detectors and magnetic spectrographs.

From 1971 to 1973 I was a Postdoctoral Research Associate and Instructor with the Department of Chemistry at Washington University in St. Louis, Missouri during which time I had teaching duties in introductory qualitative and quantitative analysis laboratories and was engaged in research to in-beam

gamma-ray spectroscopy involving particle-γ and γ-γ coincidence measurements, Doppler-shift lifetime measurements, and neutron time-of-flight energy determinations.

From 1973 to 1976 I was an Assistant Associate Professor of Physics at St. Louis University where I taught lower division courses in physics program as well as upper division and graduate courses in atomic and nuclear physics. I redesigned the undergraduate laboratories in atomic physics and optics. During this time I was engaged in research in the area of gamma-ray spectroscopy involving $(\alpha,p\gamma)$ reactions on nuclei in the Ni region. In 1973 I obtained a grant from the Research Corporation to support work in the area of Doppler-shift lifetime measurements and in 1975 I received a travel grant from Oak Ridge Associate Universities to support research at the Oak Ridge Isochronous Cyclotron. This grant has been continuously renewed.

From 1976 to 1980 I was an Associate Professor of Physics with tenure at St. Louis University. During this period I taught both lower and upper division courses in the physics program and in 1977 I received an NSF grant to initiate an undergraduate program in health physics. I designed and taught all courses and implemented three extensive laboratories in this area. My research during this time was in the area of experimental heavy-ion nuclear physics. The most recent work has involved the use of gamma-ray multiplicity measurements to obtain nuclear properties of the continuum. I was a principal designer of

the $450 k "spin spectrometer" now being installed at the Holifield Heavy Ion Research Facility at Oak Ridge National Laboratory.

From 1980 to 1981 I was Faculty Research Participant, Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

In 1981 I accepted employment with South Carolina Electric & Gas Company as Staff Health Physicist.

TESTIMONY OF

JAMES H. BARKER

SOUTH CAROLINA ELECTRIC & GAS COMPANY

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

My name is James H. Barker. I am employed as a Staff Health Physicist by South Carolina Electric & Gas Company. My business address is 320 S. Main Street, Columbia, South Carolina 29218. A statement of my professional qualifications is attached hereto (Appendix A).

The purpose of my testimony is to discuss SCE&G's commitment to and implementation of an ALARA program, with specific reference to maintenance activities, as requested by the Licensing Board.

South Carolina Electric & Gas Company has fully embraced the fundamental concepts outlined in Regulatory Guide 8.8, and is committed to keeping radiation exposures to workers at the Virgil C. Summer Nuclear Station as low as reasonably achievable, ALARA. This commitment is implemented through a triad of groups. The triad consists of corporate management at all levels and especially the corporate health physics group of which I am a member, the Summer Station operational health physics group, and finally the individual workers and their supervisors. This order of listing should not be construed as to indicate

relative importance. In simple fact, the attainment of ALARA objectives depends upon everyone involved, including the individual worker and his supervisors. The workers must adhere to the methods and procedures in which they have been trained. The corporate group and the operational health physics group must assure that the workers are provided with necessary professional radiation protection supervision, have the appropriate equipment, follow applicable practices, and work in a well engineered environment.

Discussion of elements of the SCE&G ALARA program is found in FSAR Section 12. The complete ALARA program will be provided in an ALARA program manual and numerous implementing procedures generated by the corporate and station health physics groups. In order to summarize the corporate program, I propose to describe the principal responsibilities of each of the three members of the triad and to offer a few illustrative examples.

The corporate component of the triad has had responsibility for formulating basic policy and for assuring that plant design has incorporated good ALARA features. To this end, the corporate nuclear engineering group and SCE&G vendors have used construction practices and materials that will provide long-term support for

ALARA. By way of examples: Components with a potential for significant exposure have been placed behind concrete walls that shield workers in nearby areas and in particular allow actuation of related valves and pumps without encountering direct radiation exposure; adequate lighting and access have been provided for components that require rapid servicing to minimize exposure; and piping component selection and layouts have been made to minimize radioactive corrosion product buildup in systems in order to minimize potential worker exposure.

The corporate health physics group has special responsibility for implementing ALARA. It is charged with a specific list of duties directly related to ALARA. It reviews Station health physics procedures, audits the Station implementation of ALARA, reviews historical radiation data, reviews Station design changes and provides technical support for the Station health physics group. All of these functions have their basis in a commitment to minimize the radiological impact of Virgil C. Summer Nuclear Station on workers and the general public. Some specific examples of its functions include: providing technical support in the development of the off-site dose calculation manual (ODCM), providing technical review of the radwaste solidification and liquid radwaste systems,

reviewing emergency plan procedures and developing the Corporate ALARA Program Manual.

The second member of the triad, the Station operations health physics group, is charged with the day-to-day implementation of corporate ALARA policy. It is responsible for establishing a radiological surveillance program, providing radiological monitoring for maintenance activities, providing training for radiation workers and, in general, assuring that good ALARA practices are followed. The basic tool for assuring that their technical expertise is utilized is the radiation work permit (RWP).

All work activities in a radiation area require that a health physicist review with the supervisor and workers the details of the proposed work. He will then determine any special requirements for the activity, such as protective clothing, special shielding, time limits, etc. An estimate of planned exposure must be made and a formal comparison of planned vs. actual exposure must be carried out in order to better plan future work. The RWP is a formal administrative check performed by a radiation proteciton specialist to insure ALARA.

In addition to the direct analysis of individual work assignments, the Station health physics group will utilize an online computer system to analyze trends in radiation

exposures with the intent to minimize future exposures. Trend analysis by worker, worker type, system, component or building will help in locating areas of concern. These areas can then be addressed by an appropriate response such as additional worker training, or corrective engineering of the system.

The final member of the triad, the individual workers and their supervisors, must be adequately trained in their jobs and committed, motivated and disciplined to follow good health physics practices. Specifically, supervisors must plan work to minimize worker exposure by specifying special tools, organizing pre-work reviews using drawings, photographs or mock-up equipment and detailing any other special practices that will minimize exposure. Workers must rigidly adhere to the regulations prescribed by the Station health physics group and work procedures as planned by their supervisor.

I should now like to turn to a second purpose of my testimony, which is to update my previous affidavit in this proceeding dated May 6, 1981.

In my previous affidavit in this proceeding, I did not have access to the Final Environmental Statement (FES) subsequently issued by the NRC on May 22, 1981. I originally used the Draft Environmental Statement (DES) as

a reference. I have now reviewed the (FES) and wish to note two changes in the report, neither of which significantly alters the results or conclusions, but which deserve mention so as to avoid confusion.

First, the dose calculations for releases to the environment have been revised downward and are now in agreement with those in the SER, the FSAR, and the ER, rather than being two to six times more conservative. Since the other reports are still conservative, no fundamental change in interpretation will result.

Second, the FES now uses 1300 man-rem as the contribution from worker exposure to the total population dose. The FES points out that this represents a worst case estimate derived from the worst actual operating experiences. The FES quotes 410 man-rem as an average value. When these new results are combined in the FES with the results of BEIR III, the conclusion is that there will be no measurable health impact on man.

I again concur with the FES conclusions.

MR. KNOTTS: And may the exhibit be received for the purpose stated.

CHAIRMAN GROSSMAN: Mr. Bursey, did you have objections?

MR. BURSEY: Is the exhibit being received for the purpose stated different than --

CHAIRMAN GROSSMAN: You have no objection?

MR. BURSEY: No.

CHAIRMAN GROSSMAN: It is received then.

(The document previously marked Applicant's Exhibit No. 37 for identification was received in evidence.)

(Board conferring.)

CHAIRMAN GROSSMAN: Mr. Bursey, do you have questions on cross-examination?

MR. BURSEY: Yes, sir, I have just one or two questions.

CROSS EXAMINATION

BY MR. BURSEY:

Q Mr. Barker, you were involved with South Carolina Electric and Gas in establishing the levels of worker exposure that are currently in effect.

A That is not true. I am aware of the levels of exposure that are proposed. The function of the corporate

health physics group is to review the operational procedures for adequacy; it is not to establish them. ALARA is a philosophy, and it is our function within the corporation to ensure that the operational people within the company stick to the philosophy of ALARA.

But I do not perform operational health physics, and the operational health physics people have established levels. Those levels will be reviewed formally before the plant is operational, and I know what they are, and we have informally reviewed them.

Q Do you know why the calculations assessing the dose impact of routine gaseous releases was revised by Dames and Moore?

A Yes. I mean are you referring to the -- what are you referring to?

Q The May 13 letter.

A The May 13 letter was revised because of an inconsistency I found when reviewing the data.

Q Could you be a little more specific about the inconsistency?

A There were -- Well, what I had found was when I reviewed the data, a new source term -- we have to look at the data specifically here. Table 5.2-2 is an example. It is source terms, annual releaes, curies per year. There was an original number chosen when the FSAR was first

promulgated. It was a number that subsequently was used by the staff in their draft environmental statement, and later some of the values in that table, noticeably the Xenon-133 number, was upgraded to a value of 2700 from a value of around 1600 curies per year release, and I noted that.

I then was looking over the calculations, that is, the offsite does that are projected doses that appear in tables, such as 5.2-3 or 5.2-6, and I noted that while the source terms had been changed, the offsite doses had not been changed. That is, someone had updated the FSAR but had not changed the results of calculations based on the updated source terms.

I did a back-of-the-envelope calculation and concluded that numbers were not significantly different but requested that Dames and Moore rerun the computer codes so that we would have internal consistency.

Q Table 5.2-6 predicted doses of the population within 50 miles. There is a question in my mind about the baseline as you figure predicted doses. Now, I understand that the Applicant applied for an exception that would require them to establish a baseline for milk ingestion pathways for iodine.

And does that baseline that you were exempt from have anything to do with figuring the predicted doses to the population within 50 miles?

MR. KNOTTS: Excuse me.

THE WITNESS: No. No.

MR. KNOTTS: Excuse me, Judge. I wanted to make clear for the record that what Mr. Bursey is referring to is the Amendment No. 1 to our construction permit, which was explained to the Board in my letter of early December, I think it was, December 5, 1980. The Appeal Board removed a condition from our construction permit, and the change Mr. Bursey is referring to in our construction permit merely implemented the Appeal Board decision.

THE WITNESS: With regard to the question, it is completely irrelevant. I mean this does not make a measurement based on baselines. This is just a measurement based on source terms.

BY MR. BURSEY: (Resuming)

Q Thank you.

Are you involved in any of the considerations for mechanical or structural changes in the plant to achieve doses being kept as low as reasonably achievable?

A Yes, again in the capacity that any planned changes to the plant have to be reviewed by the corporate ALARA group. The corporate ALARA group consists of the corporate health physics group, of which I am a member, and the manager of corporate health physics and environmental programs.

Q On page 3 of your prefiled testimony on the ALARA question, you mention by way of example some concrete walls that were placed to shield workers from potentially significant exposures, and I am wondering, sir, if there have ever been any discussions in the corporate health branch about a cost-benefit for achieving ALARA. That would be a dollar figure balanced off against a certain level of reduction by percentages of millirems, like we can spend up to $100,000 per whatever fraction of millirem to reduce the levels.

Do you have a guideline like that?

A There is a guideline under development. It is certainly not several hundred thousand dollars per millirem. Do you want a discourse on this? It is actually a fairly important area. I cannot give you a very simple-minded answer to it.

Q I may not be able to understand anything much beyond that.

You said that there was a guideline in the making. Is that a company guideline?

A Yes. And if I was going to describe the situation, what I would do is describe the philosophy in the guideline.

Q Let me just ask a few short questions, and I think maybe if the Board is interested in this, they can proceed

with their questions. But the reasonably achievable part of the ALARA concept is the reasonableness based on cost-benefit that takes into account how much it costs, is that right, in dollars?

A Well, it is certainly one of the things that is involved, yes.

Q And at present there is no guideline.

A There is no guidelines. There is one number which people have quoted. It is available in 10 CFR 50, Appendix 5. It makes the suggestion that for interim planning purposes for doses to the public, one could choose $1000 per man rem as a reasonable number.

Q If there were need for you to reduce, say, by a factor of 2 your worker exposures, is that something that you could afford reasonably to do and keep operating the plant?

A I do not know if reducing it by a factor of 2 is ALARA. I am not sure that is reasonable. And I certainly have not done a cost-benefit analysis on whether I could cut the exposures in half for the entire work force on average and what the cost to the company would be for that.

MR. BURSEY: That is all the questions I have for Dr. Barker.

CHAIRMAN GROSSMAN: Mr. Goldberg.

MR. GOLDBERG: No questions.

CHAIRMAN GROSSMAN: Mr. Wilson.

MR. WILSON: I have just a few here.

BY MR. WILSON:

Q Dr. Barker, on page 4 of your prefiled testimony, if you can clarify that first full paragraph where you say first the dose calculations for releases to the environment, you say those have been revised downward?

A Hold on a second. You are now referring to my affidavit rather than my prefiled testimony?

Q I am sorry. No, I am referring to the last page, page 6 of your May 28 testimony.

A Oh, excuse me.

Q You say that the dose calculations for releases to the environment have been revised downward. Are those the calculations in your previous affidavit or where?

A Those are the calculations in the final environmental statement as compared to the calculations in the draft environmental statement.

Q All right. And for what reason were those revised down?

A Well, if you recall, in my original testimony if you looked at it you would see that the original draft environmental statement had rather high estimates of the offsite dose, higher than either the SCE&G, FSAR calculations or environmental report calculations, or the

Safety Evaluation Report done by the NRC, and also it was the least well explained at the time calculation.

I do not know what methodologies they were using. However, subsequently the explanation of what they did became somewhat clearer and their calculations now seem to be in good agreement with the other calculations done. That is, notably they are in agreement with the FSAR, the environmental report and the safety evaluation report.

So, while the number is reduced, it has not been made lower than others.

Q Dr. Barker, what is the difference between the operational health physics group and your group, or is there a difference?

A There is a large difference. The operational health physics group is charged with the day-to-day duties of keeping the workers at the plant informed of hazards and training them, giving them health physics coverage.

Q Is there an instructional purpose, is that the distinction, or what?

A They also instruct -- No, the corporate health physics group is much like -- I do not want to use the word "QA," but we are programmed to make sure that the corporate concepts of ALARA are being carried out. So we served as a review function and a resource to the operational health physics group.

The only time we actually take an operational arm is in doing ALARA reviews, or in the case of an emergency we actually have responsibility for offsite dose calculations.

Q All right. I take it, then, that any health physics decisions would ultimately come from your group. I mean general if there were any conflicts between the operational health physics group, their view and your group's view, yours would prevail. Is that right?

A That is my belief, yes.

Q What is your belief based on? I mean is there some foundation that makes it a little more than just a belief?

A Yes. Well, I have in front of me a draft version of the corporate ALARA program, and ultimate responsibility has been delegated to the corporate ALARA group.

Q All right, thank you.

Now, has there been any or does your group conduct any onsite observations of work practices?

A Since there is no work going on, the answer to that is no at this point.

Q Is it anticipated?

A Yes, we will. We are charged with reviewing both the procedures and the implementation of those procedures, so not only will we review health physics procedures derived at the plant, let us say, for respiratory protection; we

will also go out there and see that in fact they are implementing the procedures, that is, that it is not just a paper procedure.

Q So I take it then that your group will be involved generally in all on-site health physics or work practices that involve the radiation areas, is that right?

A In the sense that we will review them. We will not take part in day to day operations. There is a staff at the site that takes part in day to day operations. We will be physically separated unless we make the trip to the site.

Q Yes. Do you conduct -- I take it from your testimony you also conduct reviews or will conduct reviews of work exposures?

A That is correct. One of our procedures says that we will review work exposures on a yearly basis to see if we can find any trends that would warrant looking at a particular area.

Q As part of your ALARA program, have you built in any kind of cushion or margin for the worker exposures in the plant?

A I do not know what you are saying.

Q Well, the annual worker exposure I believe is set at five rems per year; is that correct?

A That is correct.

Q And works out to approximately what, 1250 a quarter?

A That is correct.

Q And have there been any efforts to build in, for worker safety or whatever reason that you may have, perhaps consistent with ALARA, a lower level?

A There are administrative limits and I am not sure whether the actual procedure that sets those is currently in a draft stage or has been accepted. I can check. I --

(Pause.)

A Okay. It has been officially adopted at this point. It has been adopted. That is at the site. It has not received a review of the ALARA group yet, the corporate ALARA group. But assuming we accepted it, it is currently set at 1,000 millirem per quarter. That would be four rem per year.

Q And your group then also does things -- that ALARA group that you work with would also review job performance standards as well and set them?

A Try to be more explicit. I am not sure I know what you're saying.

Q Well, the procedures that would be involved in protecting the workers in the radiation areas, their jobs there.

A If you are speaking about the procedures set up by the supervisors of the crafts themselves, that would be reviewed onsite, unless a trip level of ten man-rem, I believe, is reached, at which point the corporate group

would review it as well. But for ordinary procedures that is reviewed onsite.

Now, if after some time has evolved and we see a trend that a particular class of worker is exceeding, then what we would expect, we would review the procedures. But generally speaking, the work procedures of the crafts people on site is reviewed, if necessary, by the station health physics group.

Now, the procedures that are used by the station health physics group themselves, that is their procedures, will be reviewed by the corporate group. But we would not generally go down and check to see if the electrical foreman was performing correctly. We would check to see if the health physics supervisor was performing correctly.

MR. BURSEY: I believe that is all I have, Mr. Chairman. Thank you.

CHAIRMAN GROSSMAN: Any redirect?

MR. KNOTTS: One question, Judge.

REDIRECT EXAMINATION

BY MR. KNOTTS:

Q Dr. Barker, who if anyone looks at worker exposure on a more frequent basis than the corporate health physics group?

A The station health physics group is charged with tracking workers. They look at them basically daily.

MR. KNOTTS: Thank you, Dr. Barker. That is all I have.

RECROSS-EXAMINATION

BY MR. BURSEY:

Q Dr. Barker, the Applicant has a responsibility to advise state and local governments about the level of radiological hazards posed by the plant so as to ensure a minimum effective response capability. I think that is a fair paraphrase of 10 CFR.

Who advises them? Is that the corporate health physics department?

A Do you want --

MR. KNOTTS: Does the witness understand the question?

THE WITNESS: I would like the question stated again.

BY MR. BURSEY: (Resuming)

Q When someone from the company goes and talks to the state about potential health hazards due to radiation from the plant, who goes?

A I do not know that that has arisen. If you are questioning something like the FSAR and the radiological effluent release, most probably the corporate health physics group would be the responsible group. But we do use consultants. But ultimately, if someone from the state had

a question about our FSAR or one of our offsite doses, they would contact the corporate health physics group.

Q Then you are unaware that the Applicant has a responsibility to advise state and local officials about the radiological releases they could expect from the plant?

MR. KNOTTS: Mr. Bursey, is your question emergency planning?

MR. BURSEY: I was asking -- I don't -- it could be a corporate health question if his response is yes, that is my department, or if his office has any responsibility.

MR. KNOTTS: What part of his direct testimony are you cross-examining him about, Mr. Bursey?

MR. BURSEY: It was on response to a response to a question from Mr. Wilson that it was his responsibility to keep workers informed of hazards, and I was asking him then was it his responsibility to keep state and local officials informed of hazards.

THE WITNESS: That does not -- as far as I know, that is not one of my duties. I mean, we are the lead organization within the company with knowledge in the area. But I have not been assigned an educational function to the public, no. If somebody -- I mean, that is not my function.

BY MR. BURSEY: (Resuming)

Q Is it your function, when you are informing

workers of hazards, to advise them of, specifically women that may be pregnant, do you advise them of increased hazard?

A Again, that is not my function. But the station health physics group has procedures and the procedures do specifically delineate and give a warning to potentially pregnant women.

Q So then it is the station health physics?

A The station health physics group is the operational group with regards to worker training and safety.

MR. BURSEY: Thank you, Dr. Barker.

CHAIRMAN GROSSMAN: Thank you, Mr. Barker. You are excused.

(Witness excused.)

MR. KNOTTS: My list tells me that if Mr. Bursey wants to put in those portions of the affidavit of Dale Campbell and Judy Cotchit which consists of the answers of Dale Campbell, with an exception which Mr. Goldberg will point out, I do not have any objection with that exception.

CHAIRMAN GROSSMAN: Do you have any objections, Mr. Goldberg?

MR. GOLDBERG: Can I locate those for a moment?

CHAIRMAN GROSSMAN: Certainly. Let's take two minutes off the record right now.

(Recess.)

CHAIRMAN GROSSMAN: Mr. Goldberg, did you have any objection?

MR. GOLDBERG: Yes. My only objection to receiving those portions of the joint affidavit of Dale Campbell and Judy Cotchit, which I understand is being consigned merely to -- is it Mr. Campbell or Dr. Campbell? I am not sure. Mr. Campbell -- is the question which appears on page 5 by Mr. Bursey about inquiring about, "What is your understanding of the term 'maximum credible accident' used to describe possible nuclear accident scenarios?" and the answer given by Mr. Campbell.

MR. KNOTTS: May I inquire, what was the Board's alternate terminology for maximum credible accident?

CHAIRMAN GROSSMAN: I thought it was a core melt. No, no, it was not.

MR. GOLDBERG: Serious reactor accident.

MR. LINENBERGER: There is not really a valid analogue any more to that term.

MR. KNOTTS: No, sir, there is not. I was just thinking of a way to save some time.

MR. GOLDBERG: That is sort of my point, that it does not have any real --

CHAIRMAN GROSSMAN: No, there was some phrase.

MR. KNOTTS: Which the Board used at some point,

and I cannot call it to mind. I just was going to say that the man did not know -- I think it is safe to say that he would not know any analogue to that either. His answer would be the same.

MR. LINENBERGER: Perhaps --

CHAIRMAN GROSSMAN: Mr. Goldberg -- oh, I am sorry.

MR. LINENBERGER: It is just possible that this refers to what is now considered to be design basis, but I do not know because I can't put myself into their minds.

MR. BURSEY: No, we were certainly referring to a core melt, PWR-3 through 1.

CHAIRMAN GROSSMAN: I was going to suggest, Mr. Goldberg, that perhaps it was not used as a term of art, and that if it were not you might not have any objection to that.

MR. GOLDBERG: Well, you know, given the answer, I suppose I am not -- you know, it is not that terribly important. I guess I just want to be, you know, consistent with my position, you know, throughout on the inquiry using that term, that it does not have any definitive meaning. And to the extent that the individuals being questioned about their understanding of the term -- it has no meaning and no basis in the record for assigning any meaning to the term.

So you know, both the term and I suppose the answer with regard thereto has no, you know, definitive meaning.

CHAIRMAN GROSSMAN: We will take note of your comments on that.

MR. KNOTTS: Our agreement is that had the gentleman, Mr. Campbell, appeared and testified, he would have testified as shown in the affidavit; that what was said by Ms. Cotchit or by the questioners is obviously not part of the evidence, and that we waive cross.

It may be received.

CHAIRMAN GROSSMAN: Do you agree to that?

MR. GOLDBERG: Yes.

CHAIRMAN GROSSMAN: Mr. Wilson?

MR. WILSON: I have no objection to that.

CHAIRMAN GROSSMAN: Then it will be entered in the transcript as supplied to the court reporter under those conditions.

(The Joint Affidavit of Dale Campbell and Judy Cotchit as described follows:)

7/17
(3)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
SOUTH CAROLINA ELECTRIC & GAS COMPANY	)	Docket No. 50-395
	)	
(Virgil C. Summer Nuclear Station, Unit 1)	)	

AFFIDAVIT OF JAMES H. BARKER
ON PROJECTED POPULATION DOSES

My name is James H. Barker, Staff Health Physicist for South Carolina Electric & Gas Company, and my qualifications can be found in Attachment A. The purposes of this statement are to summarize the methodology and results of population dose projections made in support of the license application for the Summer Nuclear Station, and to address the question whether such doses have been conservatively estimated (i.e. more likely over- than under-estimated).

Dose projections can be found in four separate documents. The four documents are the Final Safety Analysis Report (FSAR), the Operating License Environmental Report (ER), in both of which, dose estimates were prepared by subcontractors for SCE&G, the Safety Evaluation Report (SER), and the Draft Environmental Statement (DES), both prepared by or for the NRC Staff.

I have reviewed all four documents with regard to dose projections. I find that they use standard analytical

techniques and conform to current regulatory procedures in arriving at their projected doses. The FSAR and ER both include detailed descriptions of the methods used and assumptions made. Briefly, they use the PWR-GALE computer code (NUREG-0017) to predict effluent source terms. These predictions are consistent with historical results obtained from operating plants. These source releases are then propagated into the environment using the methods of NRC Reg. Guide 1.113 for water transport and Reg. Guide 1.111 for gaseous transport. Dose calculations are made following the procedures outlined in Reg. Guide 1.109. A similar methodology is used by the NRC Staff in the SER, but less information on their assumptions is presented. Finally, the DES implies similar methodology but is not as specific as to its exact choice of models or assumptions; from the results reached, however, the DES obviously uses more conservative models and assumptions for dose estimates.

A comparison of the predictions of the four reports leads to the following conclusions. The FSAR, ER, and SER, while containing minor differences, are in basic agreement on dose projections. The DES appears to be a more conservative calculation since it projects doses in the range two to six times larger than the other analyses. In my judgement, the results of the FSAR, ER, and SER already contain conservatism, but because the overall doses are small, independent of report chosen, it seems reasonable for the purposes of this discussion (i.e. whether doses might have been underestimated for NEPA purposes) to err on the

side of further conservatism and choose the results obtained for NEPA purposes in the DES analysis.

The summary results of the DES projections can be found in Tables 4.9, 4.10, and 4.11. These tables show that, even for this conservative analysis, the projected doses to the maximum exposed individual are at least an order of magnitude less than the design objectives found in Appendix I, 10 CFR Part 50 and the position statement of the NRC Staff RM-50-2 also published as Annex to Appendix I 10 CFR Part 50.

Table 4.11 shows a projected one year dose to the population of the United States in the year 2000 to be 537 man-rems. This population dose is combined with results of the 1972 BEIR report to estimate health effects. The results show no significant or measurable health impact on man from the routine operation of the Summer Nuclear Plant.

It is appropriate to note that the largest single contributor to population dose is the 500 man-rem assumed to be received as occupational exposure. That estimate is conservative in that current industry experience with Westinghouse PWR's similar to Summer indicates that 375 man-rem would be a more realistic estimate. (Summary Proceedings, Westinghouse 1980 REM Seminar, Pittsburgh, Pa., October, 1980.)

I hereby certify that the foregoing information is true and correct to the best of my knowledge and belief.

James H. Barker

JAMES H. BARKER

Subscribed and sworn to before me
this 6th day of May, 1981.

Carlene G. Stone (L.S.)
Notary Public

My Commission expires: 12-22-88.

NRC Reports

Draft Environmental Statement related to the operation of Virgil C. Summer Nuclear Station, Unit No. 1. NUREG-0534, June 1979, and Supplement November 1980.

Safety Evaluation Report related to the operation of Virgil C. Summer Nuclear Station, Unit No. 1. NUREG-0717, February 1981 and Supplement.

Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors. NUREG-0017, April, 1976.

Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I. Regulatory Guide 1.109, Rev. 1, October 1977.

Methods for Estimating Atmospheric Transport and Dispension of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors. Regulatory Guide 1.111, Rev. 1, July 1977.

Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I. Regulatory Guide 1.113, Rev. 1, April 1977.

EPA Reports

Summary of Radioactivity Released in Effluents from Nuclear Power Plants from 1972 thru 1975. EPA 520/3-77-006, June 1977.

Other Reports

Virgil C. Summer Nuclear Station Operating License Environmental Report, SCE&G.

Virgil C. Summer Nuclear Station Final Safety Analysis Report, SCE&G.

The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1972 BEIR I, NAS/NRC.

The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1980 BEIR III, NAS/NRC.

Summary Proceedings, Westinghouse 1980 REM Seminar, Pittsburgh, Pa., October, 1980.

MR. BURSEY: Intervenor's Exhibit 8.

MR. KNOTTS: As if it were testimony.

CHAIRMAN GROSSMAN: Yes.

MR. BURSEY: And on this point, I should have prefaced others' remarks, but coming in behind to state that it is the intent of the affidavit, and I do believe it does show -- and if anyone wants to take issue with that, Mr. Campbell is present -- is the radiation safety officer for the largest hospital in the 50-mile ingestion zone, and that their plans are for trauma, not decontamination for workers, and that were there to be -- that he has never been apprised or aware of the numbers of people that could be involved in a nuclear accident of any kind.

MR. KNOTTS: This is all in the affidavit, isn't it, Mr. Bursey?

CHAIRMAN GROSSMAN: Is it in the affidavit? You cannot testify to that, Mr. Bursey. Is it in the affidavit?

MR. BURSEY: It is in the affidavit, and if that sentence is being -- that is being struck --

CHAIRMAN GROSSMAN: Nothing was being struck.

MR. GOLDBERG: Did the Board overrule my motion to strike that?

MR. KNOTTS: I thought we just extracted agreement from you that it was not terribly important, that the Board was reading it as not being used as a term of art.

CHAIRMAN GROSSMAN: That is my understanding. If you do want to interpose an objection --

MR. GOLDBERG: Well, I guess I will adhere to the motion that I made to strike it, and the objection to the form if not the substance of the question, for the reasons I have already given.

CHAIRMAN GROSSMAN: Okay. We will overrule the objection.

MR. KNOTTS: What is not being admitted is the portions of the affidavit which purport to be the testimony of Ms. Cotchit. Mr. Bursey does not care about that and we did not even examine what she said. We just looked at what Mr. Campbell said.

CHAIRMAN GROSSMAN: That is the understanding on which the Board entered that item into the transcript as though it were performed at the hearing.

MR. KNOTTS: And the questions by Ms. Bowman are taken in the same way as if they had been Mr. Bursey's questions.

CHAIRMAN GROSSMAN: That is correct.

MR. LINENBERGER: There is one point of confusion here. Right after the Chairman said "entered into the transcript," I heard Mr. Bursey say something about Intervenor's Exhibit 8.

CHAIRMAN GROSSMAN: No, my understanding is Mr.

Bursey withdrew that. It is not an Exhibit 8. It is entered into the transcript instead of being offered as an exhibit. Is that correct, Mr. Bursey?

MR. BURSEY: Yes, sir.

CHAIRMAN GROSSMAN: Fine. That leaves us with our last piece of business, according to my notes.

MR. GOLDBERG: Judge, if I might, I just have one piece of unfinished business. I think it will be brief.

I distributed a few days ago an affidavit of Dr. Carl Newton which contains his corrections to the ACRS and subcommittee transcripts, and I marked them Staff Exhibit 4-D. I would like to enter those in the record at this time.

CHAIRMAN GROSSMAN: Any objections?

MR. KNOTTS: No objection, Judge.

CHAIRMAN GROSSMAN: Mr. Wilson?

MR. WILSON: No objection.

CHAIRMAN GROSSMAN: Entered in the transcript of the ACRS, is that correct? Is that what it was?

MR. KNOTTS: They are corrections to --

MR. GOLDBERG: There are corrections to both his testimony before the subcommittee and full committee, that is correct.

MR. KNOTTS: Were the other three received, Mr. Goldberg?

MR. GOLDBERG: Yes, they were, and provided to the

reporter.

(The document referred to was marked Staff Exhibit No. 4-D for identification and received in evidence.)

MR. KNOTTS: Were they exhibits?

MR. GOLDBERG: Yes, they were marked Exhibits 4-A through 4-C. This will be 4-D.

CHAIRMAN GROSSMAN: Those, I believe, were Board exhibit numbers, weren't they?

MR. GOLDBERG: No. Judge, the Board had assigned exhibit numbers to the transcript themselves, and we had assigned staff exhibit numbers to the witness's corrections to the transcripts.

CHAIRMAN GROSSMAN: This will now be received as Staff Exhibit 4-D.

MR. GOLDBERG: Correct.

CHAIRMAN GROSSMAN: Fine.

And last, a piece of business was setting a briefing schedule with regard to the Kaku testimony.

MR. KNOTTS: I would propose we close the record on all issues that have not been explicitly open, brief those, and if the time sequence allows, that the Board plan to write a partial decision if the seismic issues are going to be well behind the other issues. We could have the

standard briefing schedule on all issues except the ones that explicitly remain open.

Do I make myself clear?

CHAIRMAN GROSSMAN: Yes. As far as I know, there are two that are definitely open. One is seismic and one is emergency planning.

As to the health effects issue, I think that we would prefer to consider that as a closed issue.

MR. KNOTTS: I think that is reasonble.

CHAIRMAN GROSSMAN: And if there is anything that is necessary with regard to Dr. Morgan's review of today's transcrip., then --

MR. KNOTTS: We will cross that bridge when we come to it. I did not mean to put words in your mouth, sir. I was thinking out loud.

CHAIRMAN GROSSMAN: Right. But Mr. Bursey can contact the parties and suggest any modification of the schedule. But otherwise we ought to set a briefing schedule on all the other issues

Mr. Bursey, do you have any comment?

MR. BURSEY: Yes, sir. I mean it just seems to me that there is an additional hurdle placed in front of me in regards to closing when there is still some question of an outstanding issue. If there are questions of facts raised by Dr. Morgan's review of today's testimony, then I have not

only to deal with the questions of fact but also to move to reopen the record.

Is that something that is a pro forma move or am I in danger of losing my access to the record on Contention 10?

MR. KNOTTS: Only, I think -- if I may contact on that -- if we cannot come to some agreement, which under the circumstances should not be difficult to obtain, and if it is, the Board can rule. But I do not, you know --

CHAIRMAN GROSSMAN: Well yes, you would have to make a motion, but you can do that in a conference call. We will permit a conference call anytime within the next two weeks, that is, two weeks from Monday, or any communication to the Board to set up a conference call, and we would expect that at this conference call you would be present, Mr. Bursey.

And so we will close the record on that issue also, but that is only provisional in the event you want that record reopened during that two week period.

MR. KNOTTS: So on any supplement from Dr. Morgan to respond to Dr. Brannagan Mr. Bursey would have two weeks from today to initiate a conference call.

CHAIRMAN GROSSMAN: Yes.

MR. KNOTTS: And I think the Board expects Mr. Bursey, if he has a problem, would have contacted the other parties and sought their agreement before resorting to the

Board.

CHAIRMAN GROSSMAN: Two weeks from Monday.

MR. KNOTTS: Two weeks from Monday, sir. I am sorry.

MR. BURSEY: Can I ask: The transcript that we had mentioned, is that immediately available?

CHAIRMAN GROSSMAN: Let me say with regard to the scheduling on the briefing, these transcripts, if I understand it, will be delivered to the parties tomorrow, and that Mr. Mahan should have a copy by Monday, and that on the assumption that a copy is made available to you, Mr. Bursey, on Monday, we will set a briefing schedule for that particular issue of Dr. Kaku's testimony.

And I would think what I have in mind is possibly requiring the briefs by Tuesday the 28th, which is eight days after the transcript would be supplied to you.

MR. GOLDBERG: Judge, that would be too short a time. I am not sure that it will be in our hands on Monday, given the transmittal. I also have an appeal in another case that I am working on.

CHAIRMAN GROSSMAN: What is your suggestion, Mr. Goldberg?

MR. GOLDBERG: I would suggest three weeks from today. That would be August 7th.

CHAIRMAN GROSSMAN: Mr. Knotts.

MR. KNOTTS: Let me try to understand. Is Mr. Goldberg a moving party in this brief? Is he going to get --

CHAIRMAN GROSSMAN: Let's do this. I was thinking in terms of simultaneous plus a reply about a week later.

MR. KNOTTS: That is fair enough. That is fair enough. That is fine.

CHAIRMAN GROSSMAN: And so August 7, and let's make the reply on August 17. Well, the problem with that is service, and we are not sure when you can get the copies unless there is some agreement as to delivery. Now, why don't we have an agreement for -- are all those days weekdays, I assume? They obviously must be.

CHAIRMAN GROSSMAN: The 7th is a Friday and the 17th is a Monday.

MR. KNOTTS: Okay. So if something were to be served on a Friday, were gotten in the other parties by the following Monday, would that be good enough, do you think, to allow that sort of --

CHAIRMAN GROSSMAN: Let's make the reply, then, on the 19th.

MR. KNOTTS: Okay.

MR. BURSEY: Then, Judge Grossman, let me see if I understand this completely. By August 7 I need to serve a brief on the outlines, the Contention 10 and the purpose of Dr. Kaku's testimony in relation to it. And then I will

have the other parties' brief at that same time and will have till the 17th to respond to them?

CHAIRMAN GROSSMAN: Well, let me say I think perhaps we are short-changing Mr. Bursey on this. The more I think of it, the more I think simultaneous is not appropriate in this case.

MR. BURSEY: If I could observe -- and I do not think this is a strange observation -- that the parties' positions on resisting Dr. Kaku have either been very finely-honed to a point of my almost not being able to understand them, in the case of Mr. Goldberg's rule objection, or changing -- I am not even sure what I am supposed to be shooting at, and I would, if I could, like to see theirs before --

CHAIRMAN GROSSMAN: Right. Well, let's start off again on the scheduling. I think that Mr. Knotts and Mr. Goldberg ought to file their briefs first, and I think there ought to be a more equitable distribution of time then to allow Mr. Knotts and Mr. Goldberg three weeks and Mr. Bursey one week. So let's modify tha if we can.

Mr. Goldberg, that means I would be cutting you down again, and you are still holding out for the August 7.

MR. GOLDBERG: All right. What kind of time frame did the Board -- you know, I do see by this briefing schedule that we are getting into the mid or latter part of

August, I guess, before we have a ruling on whether to admit any or all of Dr. Kaku's testimony, and that is a dilemma.

CHAIRMAN GROSSMAN: If you could cut your time to August 3 and we keep Mr. Bursey at August 17 --

MR. GOLDBERG: Now let me ask you. I assume the Applicant and the staff would have an opportunity then to reply to Mr. Bursey. I am not sure that I really see the inequity in, frankly, not having simultaneous filings.

Let me explain. I mean this is Mr. Bursey's contention. Mr. Bursey is offering this testimony purportedly to demonstrate something about his direct case. Now, we have, you know, indicated our objections on the record quite fully. We thought that the Board might want to have the benefit of a written brief, and by the term "brief," that also could be really a statement of position on Dr. Kaku's testimony.

Far from seeing really the inequities, in fact I really think that it is Mr. Bursey who is the party that I think all of us really need to hear from quite clearly on what the purpose of Dr. Kaku's testimony is.

Now, you know, my brief and statement of position will basically be a recitation of arguments that we have already made, so I really think that in order to fairly consider the issue, Mr. Bursey has been here throughout the weeks that we have discussed it, and my arguments I do not

think are any secret, and I do not think that Mr. Knotts' arguments are any secret, and certainly there are not going to be any surprises in our brief. It is really just going to be a memorialization of those arguments.

So I really think we ought to have a simultaneous filing on August 3, and I am really prepared to waive any reply. I think it will have been probably exhaustively, you know, considered by then.

CHAIRMAN GROSSMAN: Okay, fine.

Mr. Bursey.

MR. BURSEY: My recollection, sir, is that Dr. Kaku, one of the reasons that he did not complete testimony and be cross-examined in this session was that the other parties said they were not ready to cross-examine him even though we had prefiled testimony in a timely fashion, even though they knew Dr. Kaku was going to be here at least as an offer of proof to preserve the record for the Appeal Board, which I would assume they would want to cross-examine anyway.

So I think that some of the burden is on Mr. Goldberg, and I have the additional burden of communicating with Dr. Kaku for my response.

CHAIRMAN GROSSMAN: Well, I think on reconsidering again it does appear as though there is enough in the record now for all the parties to state an initial position, and

why don't we then have the simultaneous briefs for -- what date, Mr. Goldberg?

MR. GOLDBERG: I will go for August 3, Judge.

CHAIRMAN GROSSMAN: August 3. And responses, in order, again, that you be able to communicate with Dr. Kaku and whoever else is helping you, Mr. Bursey, by August 12.

Now what is the problem with that, Mr. Bursey?

MR. BURSEY: Well, the August 17 was preferable. I mean two weeks in order to respond may seem like a long time unless I am exchanging letters with Dr. Kaku in New York.

CHAIRMAN GROSSMAN: Okay, let's leave it at August 17, then, the 3rd and the 17th. And the Board will not be very indulgent with granting extensions.

Now let's set a briefing schedule for the issues that are already closed.

MR. KNOTTS: The standard briefing schedule, since it is clear that we are probably going to be coming back -- I don't know where I get "probably." It is clear we are going to be coming back. The standard briefing schedule would seem reasonable to me, 30 days after the close of the record for the party with the burden of proof, and that is me, 40 days for Mr. Bursey and Mr. Wilson if he has a brief to submit, 50 days for the staff, and then we get 5 days for reply after the staff.

CHAIRMAN GROSSMAN: Is that your recollection, Mr. Goldberg?

MR. GOLDBERG: Yes, and I think those are newly revised.

MR. KNOTTS: I think those are the current numbers.

MR. GOLDBERG: Yes.

CHAIRMAN GROSSMAN: Does that sound reasonable to you, Mr. Bursey? That sounds reasonable to us. Why don't we set that as the briefing schedule.

MR. BURSEY: Sure.

MR. KNOTTS: And we can conclude -- is there any further order of business?

MR. BURSEY: Yes, sir.

CHAIRMAN GROSSMAN: We have one minute to get out of here before they --

MR. BURSEY: It will not take a minute. I wanted to make a motion that Dr. Kaku on his return trip be a Board witness. There is nothing secretive about that in trying to get you to embrace him or anything, but it is merely trying to get him here. I have had to buy two plane tickets for him. It is just a motion.

MR. KNOTTS: What Mr. Bursey is saying, I think, is that he wants the funds; right?

CHAIRMAN GROSSMAN: Yes, I understand. Maybe he will have better luck passing the hat around in the hearing

here to Mr. Knotts and Mr. Goldberg, but I do not know that we are prepared to grant that motion. I do not see any reason why we would call Dr. Kaku as a Board witness.

MR. KNOTTS: Judge, would there be any point to trying to schedule anything that could be done before -- I guess our whole schedule for coming back depends on when the seismic thing can be done. We would be hopeful that it could be done promptly, as I have already said. The Board will tell us when the experts can get it done, and at that time perhaps we could address whether it might make sense in the circumstances to go earlier on the other two issues and get them out of the way and get them closed out if that is dragging behind.

I do not see how we can address that now. It is all very --

CHAIRMAN GROSSMAN: No. I will commit myself to making some phone calls on Monday and Tuesday of next week to seek out the Board witnesses and question some sources with regard to the names that you have supplied also, Mr. Knotts.

MR. KNOTTS: Fine. Very well. I just want to be sure my expectation is correct that the Board would grant the parties leave if not expect the filing of supplemental testimony trying to pull the record together a little bit on seismic matters, and comments on whatever the consultant

comes up with within a fairly short time before the hearing for prefiling so we need not have an artificial prefiling date for any such comments holding up the commencement of the hearings.

CHAIRMAN GROSSMAN: I do not know if your question relates to rebuttal or further testimony in light of the experts' reports. Certainly you would be permitted that opportunity.

MR. KNOTTS: I thought so, sir, and what I was really trying to get to, I was beating around the bush a little bit, but what I was really trying to get to is I think the experts' report might come out at whatever time it comes out. Shortly thereafter the parties would address it if they were going to address it in writing, but perhaps we need not have them address it in writing. I was just trying to get an idea of the time sequence after the report comes out.

CHAIRMAN GROSSMAN: We will have conference calls, I am sure.

MR. KNOTTS: Fine.

CHAIRMAN GROSSMAN: And decide it at both times.

Anything further, Mr. Goldberg?

MR. GOLDBERG: Nothing further.

CHAIRMAN GROSSMAN: The hearing, then, is concluded on all the issues except for emergency planning

and seismic, and we will try to negotiate those issues informally.

Thank you very much, gentlemen.

(Whereupon, at 5:00 p.m. the hearing was adjourned.)

This is to certify that the attached proceedings before the

NUCLEAR REGULATORY COMMISSION

in the matter of: SOUTH CAROLINA ELECTRIC & GAS COMPANY, SUMMER 1

Date of Proceeding: JULY 17, 1981

Docket Number: 50-395 OL

Place of Proceeding: COLUMBIA, SOUTH CAROLINA

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

DAVID PARKER

Official Reporter (Typed)

Official Reporter (Signature)