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NUCLEAR REGULATORY COMMISSION

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(CONTINUATION FROM 4/27)

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Thursday, May 3, 1990

The Commission met in open session, pursuant to notice, at 10:00 a.m., Kenneth M. Carr, Chairman, presiding.

COMMISSIONERS PRESENT:

KENNETH M. CARR, Chairman of the Commission
THOMAS M. ROBERTS, Commissioner
KENNETH C. ROGERS, Commissioner
JAMES R. CURTISS, Commissioner
FORREST J. REMICK, Commissioner

STAFF SEATED AT THE COMMISSION TABLE:

SAMUEL J. CHILK, Secretary

JOSEPH SCINTO, Office of General Counsel

JAMES TAYLOR, Executive Director for Operations

DR. THOMAS MURLEY, Director, Office of Nuclear Reactor Regulation

DR. THEMIS SPEIS, Office of Research

CHARLES MILLER, Director, Standardization and Life Extension Project, NRR

ASHOK THADANI, Director, Division of Systems Technology, NRR

WILLIAM TRAVERS, Assistant Director for Special Projects, NRR

JAMES RICHARDSON, Director, Division of Engineering Technology, NRR

P-R-O-C-E-E-D-I-N-G-S

10:00 a.m.

CHAIRMAN CARR: Good morning, ladies and gentlemen.

The purpose of today's meeting is for the NRC staff to brief the Commission on evolutionary light water reactor certification issues and their relationship to current regulatory requirements.

On April 27th, 1990, the staff briefed the Commission on the related topics of advanced reactor reviews and scheduling. At that meeting, the Commission requested this briefing to allow discussion of the specific certification issues currently before the Commission.

I understand that copies of the staff presentation slides are available at the entrance to the meeting room.

Do any of my fellow Commissioners have opening remarks?

If not, Mr. Taylor, please proceed.

MR. TAYLOR: Good morning, sir. With me at the table is Doctor Murley, Mr. Thadani, Mr. Richardson, to my left, Doctor Speis from Research and Bill Travers and Charlie Miller from NRR.

Doctor Murley will present the briefing.

DOCTOR MURLEY: Thank you.

Mr. Chairman, Commissioners, last year the Commission asked the staff to identify where in our reviews of the EPRI Requirements Document or the evolutionary plants we were proposing to go beyond the regulations or to relax the regulations. That is the one common element among the 15 issues that we're going to discuss today, namely the fact that they either go beyond or relax current regulations.

But, in fact, there are four classes of issues and it's probably useful to talk about -- a little bit about each class.

The first class is a current or an emerging safety issue that has not been resolved completely, even for current plants, and intersystems LOCA would be an example of that class.

The second class are those requirements that were backfit on operating plants usually by a regulation, but where the staff believes there's a better solution for new plants that are still on the drawing board under design, and the station blackout issue is an example of that.

The third class is a design solution for dealing with the severe accident issue for which we do not have a regulation. An example of that would be the

requirement to have depressurization capability, to prevent high pressure core melt ejection.

And the fourth class would be proposed relaxations from current requirements and the OBE/SSE separation would be an example of that.

The first issue to talk about then is safety goals. The staff is -- I'd say we were guided by the proposed safety goals, but they didn't control our thinking on these issues. That is we didn't necessarily decide to propose a new requirement simply to meet a numerical safety goal. I think a more basic guideline that we used in considering these issues was the Commission's policy statement on severe accidents, that future designs should be safer than current designs for severe accidents. Of course that raised the question should we give birth to the design of a new generation of reactors where the staff thinks there are safety issues that still have not been resolved. We thought not.

The Commission's severe accident policy statement also guided us to strike a balance between severe accident prevention and severe accident mitigation. These requirements or these proposed requirements do that and in particular it's covered in the containment performance guideline that we're going

to talk about.

With regard to how we actually use the safety goals, the staff is proposing to accept EPRI's proposed core damage frequency goal and their large release safety goal. We're not proposing to push them for more conservative safety goals, but the staff does expect that the evolutionary light water reactor applicants to demonstrate that they've taken reasonable steps to achieve their stated goals. We would not hold them rigorously to bottom line demonstrations that they have met their safety goals, because we realize that there's a number of uncertainties in that kind of analysis at this stage, most importantly in the area of human error rates and that sort of thing. They are really not known. They can't be known at this stage. There are no tech specs available to review against and that sort of thing.

What one does is establish some average values for human error rates and then evaluates the design against the goals, against these targets. We think the EPRI goals are useful at this stage of design for setting safety system reliability design objectives, for example, and they would do -- just as I said, they assume some average value for human error rates and then from that they would evaluate various trade-offs for

system configurations.

We think that's a very useful way to do it and that's how, in a nutshell, I guess, we have used the safety goal and that's how we're proposing that it be adopted by the Commission.

COMMISSIONER REMICK: Mr. Chairman, do you want to, as each one of these 15 issues come up, ask questions at the end of each?

CHAIRMAN CARR: Sure. Whatever you want.

COMMISSIONER REMICK: It might be more orderly to do that.

DOCTOR MURLEY: That would be more logical, I think.

COMMISSIONER REMICK: Tom, this is one area where I guess I continue to have some difference with the staff. You used the word "accept" the EPRI. I view it a little bit more strongly, "impose" the EPRI safety goal.

The problem I have, suppose they had suggested 10^{-6} for a core damage. Would the staff have accepted that? The problem I have is that by imposing at 10^{-5}, you're avoiding the Commission's safety goals. I think it makes it inconsistent with the health objectives which the Commission has set to say, "We think this is how safe is safe enough," and it makes it inconsistent

with proposed large release guidelines because the 10^{-5} you're talking about is for core damage and there's some probability beyond core damage that -- less than one, that there would be release from the primary system and you have hopefully such things as plate-out and scrub-out and then you have some kind of a containment performance also. So, you've gone far, far beyond the 10^{-6} release guideline and you've certainly gone far, far more than the health effects.

So, I think what the staff is proposing here is something which would void the safety goal. You're establishing a de facto new safety goal which ACRS --

DOCTOR MURLEY: I think it's clear that the EPRI guidelines are more stringent than the Commission's health effect safety goals, yes.

COMMISSIONER REMICK: And I applaud that. I think industry, for reasons, we encourage it and we expect. The Commission said that they expect that they will be safer. The question comes down whether you take their design objectives, which have many considerations beyond public health and safety, and impose those as a public health and safety requirement.

DOCTOR MURLEY: Well, I guess I'm uncomfortable with the notion that this is some staff conspiracy to go beyond Commission guidance. I don't

think it's that case at all. These are industry proposed goals. They sound reasonable to us. They, in fact, meet the Commission's policy statement which is that future plants ought to be safer than current plants for severe accidents, and so --

CHAIRMAN CARR: Are you going to require them to be met, I guess is the question.

DOCTOR MURLEY: Not, as I said, in an absolute demonstration of a bottom line sense. But we are going to expect that they would make effort to meet them. Now, I don't mean to be cute, but we're not going to get into a big numbers analysis to demonstrate -- if it's 9.6 times 10^{-6}, that's okay, or if it's 1.1 times 10^{-5}, that's not okay. I think that would be a misuse of the goals.

COMMISSIONER REMICK: How about others in a hearing process? Knowing that the staff says that they should meet 10^{-5} and the question logically arise, then do they? With what uncertainty? Can they demonstrate it?

DOCTOR MURLEY: My guess is we would be faced with those kinds of questions in a hearing, very likely. We haven't -- at the Indian Point hearing, if you'll recall, we've litigated PRA analysis before.

COMMISSIONER ROGERS: Could I just --

COMMISSIONER REMICK: Oh, please.

COMMISSIONER ROGERS: -- step in there? My understanding is that what you're doing is setting a target that you expect them to aim for and that they are expected to demonstrate that they're aiming for that target. Then how it ultimately comes out in the end is going to be judged on some reasonable basis without trying to hold the designers to actually achieving 1.0 times some factor of 10, that the objective of the design is to reach a certain target and if the design exceeds it a little bit, okay. If it falls below it, that that's the way it comes out. The staff is going to be somewhat relaxed on that --

DOCTOR MURLEY: Exactly,

COMMISSIONER ROGERS: -- on that interpretation of the meaning of that or the use of that target. That's my understanding of how you're proposing to do it.

DOCTOR MURLEY: That's the way I view it.

COMMISSIONER CURTISS: Let me expand on that. I gather, as I understand the argument that EPRI makes, they would like to know what the regulatory requirements are going to be and then beyond those regulatory requirements they would set, in this case, the two objectives that they'd lay out so that they can

demonstrate that they have met the licensing requirement with margin.

The argument or the concern, as I understand it's been expressed, is if we regulate or approach this with an objective of achieving the EPRI numbers, what we've done then is to erase the margin that is very important to them from the standpoint of demonstrating licenseability, which is one of the five objectives that they've set out in the Requirements Document. The concerns about the precise use of numbers and how you're going to approach that are the same concerns, I guess, in my mind, whether you're talking about the safety goal numbers or the EPRI numbers. The question that Commissioner Remick has raised, I think, and I share his concern, is that we've got safety goal numbers that we've established, first, and secondly, EPRI is seeking to go beyond that. I think that's a laudatory thing to do. As I understand it, they're proposing to do that so that they have that licensing margin.

But maybe you can expand on the question of the concern that's been expressed that as they set objectives to go beyond to achieve excellence, if you will, or go beyond what we require in the regulations, as our level of regulations rises up to whatever the objective is, you've just thereby eliminated the margin.

What is the response to that concern, if any?

DOCTOR MURLEY: I guess I don't understand it. I mean I've heard it before and I just don't understand it, that somehow they want to be able to use these numbers in a public relations kind of sense, but they don't want to be held to them. That's how I view it. I think we ought to at least not rigorously hold them to it, but expect them to demonstrate that they've made some effort to really meet the goals. If they're going to use them and they're going to use them in a public relations sense, as I sense they want to do it, then I think the staff has some responsibility to see that they've made a fair effort that way. And they are useful, I think.

Here's, I think, an example of how a designer might use the safety goals and it goes back. I mean I had some experience with this when I was working in AEC on the Clinch River project. We would take a goal and break it down to targets for subelements and one could, for example, for aux. feedwater system reliability, use this goal to set targets for the reliability of the goal, to show that they -- for that particular sequence, loss of all feedwater, that they've actually met it.

Now, what are we supposed to do if we don't uses those numbers as guidelines to evaluate the

reliability of an auxiliary feedwater system?

COMMISSIONER CURTISS: Yes. I'm not sure I understand the distinction, but that question is going to come up whether you use as your goal the safety goal level or the higher EPRI level. The question that you're raising is should we have a goal like this that permits you to do the kinds of things that you've just described. If I understand at least what Commissioner Remick is saying, there's not an objection to using a goal, the question is whether it ought to be the higher EPRI goal which is set as a target or the lower goal that's proposed in the safety goal. It's not a question of not having a goal at all, it's a question of what that goal should be.

COMMISSIONER REMICK: That's correct.

I favor -- if the staff needs what I call subsidiary design objectives which are surrogates for the large release or something else, to have those, what we're differing on is what that number should be. I don't want to pursue it further because we owe you a vote sheet on 89-102 and 90-016 where I think the Commission will speak --

DR MURLEY: I think the real thing the Commission has to struggle with is what do the words in the severe accident policy statement mean with regard

to future plants ought to be safer than current plants for severe accidents? And that's going to drive you to --

CHAIRMAN CARR: Well, but the advanced reactor policy statement says we expect at least the same degree of protection. While we expect that the future plants would be safer, the implication is we're going to require at least the same degree of protection as current plants. I'm not sure I see a dichotomy between those two. You've got a requirement and an expectation and as I read you, you would like to change the requirement.

DOCTOR MURLEY: We have been reading it, and perhaps wrongly. We have been reading it as -- that future plants ought to be required to be safer than current plants.

CHAIRMAN CARR: That's why I thought you said you were expecting a change of requirements.

DOCTOR MURLEY: Yes. We've been misreading it.

COMMISSIONER REMICK: But at the same time the Commission said this is how safe we think is safe enough at the same time.

DOCTOR MURLEY: Have they said that?

COMMISSIONER REMICK: The policy statement

is out from the standpoint of at least health objectives. That policy statement was issued.

CHAIRMAN CARR: Well, we owe you some guidance.

COMMISSIONER REMICK: Yes.

COMMISSIONER ROGERS: That's the point.

MR. TAYLOR: The health objectives, they are very loose standards.

CHAIRMAN CARR: We owe you a clarification of current guidance, one or the other.

Shall we proceed?

COMMISSIONER REMICK: Yes, please.

COMMISSIONER ROGERS: That's all I had.

DOCTOR MURLEY: The next topic then is ATWS.

COMMISSIONER CURTISS: Tom, could I -- actually, I have a suggestion here at the outset, if it would fit well with what you're planning on doing. As I read through the individual overviews, it would be helpful as we go through here, because the question comes up with a number of issues, if you could, in the course of your discussion, highlight where we stand with EPRI on the individual issues, whether we're in agreement with EPRI, whether we're in disagreement but all the information is in, or whether we're waiting for information from EPRI on these individual issues. Would

it be possible to do that? Is that a --

DOCTOR MURLEY: Yes. Ashok Thadani and Jim Richardson are going to talk about most of these issues and I'll ask Charlie Miller to help us if he knows the status of EPRI views on things.

So, ATWS is one of those areas where we do have a rule, but the staff believes that there are better ways to -- better solutions for plants that are under design.

MR. THADANI: Okay. (Slide) May I have viewgraph number 3, please?

As Doctor Murley indicated, our approach to these reviews was to see how one could get better design in terms of its ability to deal with severe accident issues. We started out by looking at background information. This is operating experience, insights from various probablistic risk assessments that have been conducted to date, the severe accident research program, the containments performance improvement program, to see what we could learn in terms of challenges, severe accident challenges, as well as challenges to the containment. So, we're focusing attention on both prevention issues as well as mitigation issues.

I'll briefly discuss one of the prevention

issues.

(Slide) Viewgraph number 4, please.

The first issue is anticipated transients without scram. This issue has long been recognized as an important safety matter. And, in fact, in 1984, a rule was promulgated, 50.62, the purpose of which was to reduce the likelihood of a severe ATWS event. The rule is prescriptive in nature, specifies hardware improvements that were believed to be appropriate and it's our judgment that for these advanced light water reactor designs, one can do more, be more effective in dealing with an ATWS event.

For the pressurized water reactor designs, one area where we think more can be done is to provide improved diversity in the electrical portion of the protection system, unless the consequences can be shown to be acceptable for an ATWS event, in which case the requirement for diversity would not exist. That's the key difference as far as the 50.62 requirement and what we're doing here.

For the boiling water reactors, the proposed design by General Electric actually goes beyond the requirements of 50.62 in one area and that is the diversity of the scram system. They have a good diverse system. However, they have proposed that one

requirement in 50.62 that says the standby liquid control system be automatically actuated, be changed, they would prefer that that be a manual system. We are currently evaluating their proposal on this issue. Our decision will be based in terms of the relative impact on risk from this change.

COMMISSIONER ROGERS: Before you go onto the next slide --

MR. THADANI: Certainly.

COMMISSIONER ROGERS: -- I wonder if you could just say something with respect to the ACRS comments on the diverse -- on the appropriateness of analyzing -- or the difficulties of analyzing the logic of a diverse scram system. What is your view on that?

MR. THADANI: I think our approach would be similar to that proposed by the ACRS. As a matter of fact, the choice would be to design out ATWS. That would be our choice too. It seems that that might be doable in a pressurized water reactor, but will be very tough to do in a boiling water reactor system.

As for difficulties in terms of the value of diversity, there is merit to what the ACRS says. But we do believe after some of the studies that have been done in the past few years that implementation of diversity does improve overall reliability of the

system. But it's tough to quantify as to how much improvement one really achieves that way. But the thrust of ACRS comment, I think, was try to write out an ATWS, which is a fair --

COMMISSIONER ROGERS: Well, it seems to me there is a little never-never land here in between those two as to how much, to what extent you can really design out the possibility of an ATWS and to what extent additional protection is given by diversity so that, you know, you've brought the two together. It seems to me that that's something of a question, of how does one know when you're there that you have sufficient confidence that diversity will do something, that it would be adequate to meet a less than totally comfortable design that can ride out an ATWS.

MR. THADANI: It's a tough area. We've made some estimates and there are often arguments as to how much benefit one really gets. But the judgment has been that if you go for diversity and if it's done fairly well, that one can perhaps get an order of magnitude improvement. Again, it's -- there are disagreements even on that.

COMMISSIONER REMICK: I had some questions.

MR. THADANI: Yes?

COMMISSIONER REMICK: It's mostly for just

one of understanding. I'm not sure. When you're talking about diversity, what I read ACRS has written about diversity and what was in the SECY document, when I read the SECY document the staff mentions diverse scram systems. In my mind, I pictured the proposed ABWR design with the electric and hydraulic scram. I said, "Okay, that's diverse." Throughout, you talk about diverse systems and I thought that's what you were talking about, but the ACRS letter talks about logic and now you just mentioned the electrical systems and the advantages or possible disadvantages of diverse.

So, are we talking about diverse electrical components or are we talking about diverse scram things similar to perhaps the ABWR, although they're using one rod system, but two different means of scramming? I'm not quite sure what we're talking about here and what the staff's position is on PWRs.

MR. THADANI: Okay. If I may back up now, to go into the background. The ATWS rule for boiling water reactors requires that diversity be provided in the electrical components. The scram system is hydraulic. The diversity was not required in the hydraulic control units.

The ABWR goes beyond in that they also provide not only the hydraulic insertion system, but they also

provide the electric insertion system, which clearly seems to us as diverse and would improve reliability.

For the pressurized water reactors, the rule required for Babcock & Wilcox and Combustion Engineering plants that diversity be provided in the electrical components of the protection system, not the rods themselves. It was all the electrical components, downstream of sensors, as a matter of fact.

For the Westinghouse design, because it was more tolerant of an ATWS event, the requirement was only to provide diversity in actuation of auxiliary feedwater system and turbine trip. But there was no requirement in place that the electrical components in the protection system be diverse to meet the ATWS rule.

COMMISSIONER REMICK: And the staff here -- diverse here is other than redundant? You're talking about definitely diverse.

MR. THADANI: That's right.

COMMISSIONER REMICK: Okay.

MR. THADANI: Now we're talking about for the advanced light water reactor designs, PWRs, to in fact have one of two approaches they could utilize. One is to provide diversity in the electrical components, or to be able to ride through an ATWS.

CHAIRMAN CARR: And diversity you don't mean

dual systems, you mean different components?

MR. THADANI: Diversity can be achieved in a number of different ways. One could be through manufacturing diversity. One could be buying components that operate on different principles. There's some other forms, energized versus deenergized and so on.

COMMISSIONER ROGERS: That's not really part of the logic though. That's an actuation system.

MR. THADANI: It's actually -- the distinction comes then as downstream of the signal conditioning equipment in the protection system on up to the actuated devices. So, that's the portion. I admit we have used different terms to characterize it.

COMMISSIONER ROGERS: I wouldn't really call that logic. Yes.

COMMISSIONER REMICK: It's more than logic.

MR. THADANI: It's really more than logic, yes. Logic is just a set of cards, yes.

CHAIRMAN CARR: All right.

COMMISSIONER ROGERS: We ought to clarify that though, I think --

MR. THADANI: Okay. We'll do that. Yes.

COMMISSIONER ROGERS: -- that we don't really mean just logic.

COMMISSIONER CURTISS: Where do we stand with

that?

MR. MILLER: Well, EPRI's approach is compliance with the ATWS rule. We haven't proposed requirements beyond that.

MR. THADANI: That's correct, yes.

DOCTOR MURLEY: Okay. The next item is mid-loop operation and this is one of those emerging safety issues that we have not resolved completely yet, even for operating plants.

MR. THADANI: Okay. As a result of the operating experience and particularly the Diablo Canyon event of 1987, staff has required the industry to take certain actions to minimize the significance of this issue. Some of the requirements have been to provide better level instrumentation, tighter technical specifications in terms of the available equipment to provide make-up and better procedures for being prepared to take specific actions if they become necessary.

That's generally been the thrust for the operating reactors. And for the advanced light water reactors, we believe that they should also provide features that would significantly reduce the challenge to the operators, the likelihood of getting in trouble during mid-loop operation. The type of features that Westinghouse has discussed with us would, in fact,

provide much greater margin in terms of available level before one can get in trouble, better devices to minimize vortex effects and so on for air ingestion concerns.

It seems to us that that's a good design, a good way to go, and we have required that all evolutionary designs incorporate such features for pressurized water reactors only.

Again in terms of EPRI, they have only addressed the requirements. They indicate they'll meet the requirements as they were imposed on the operating reactors. They have asked for a design that they have not proposed to go beyond in terms of specific design features.

COMMISSIONER CURTISS: So they come up short here on what you're proposing essentially?

MR. THADANI: Yes. Yes.

MR. MILLER: They've offered to meet the requirements in generic letter 88-17, which is primarily procedural. It doesn't get to just --

MR. THADANI: I'm sorry, no. Let me correct that. It's not procedural. It does go into enhancements. These are called program enhancements. As I indicated, they improve instrumentation, particularly level instrumentation because that's a

critical item. So, there's some hardware involved.

MR. MILLER: Some of the things that Ashok said concerning design modifications that might get to the root cause of the problem have not been identified.

COMMISSIONER ROGERS: Have not been?

MR. MILLER: Have not been identified.

COMMISSIONER ROGERS: Do you intend to pursue that with them?

MR. MILLER: Yes, we do.

MR. THADANI: Yes.

COMMISSIONER ROGERS: Because it did seem to me that the ACRS recommendations there, the four points of recommendation seem to be very important to try to press for.

MR. THADANI: In fact, I think they are very important, yes, sir.

COMMISSIONER CURTISS: What is the precise posture there? Is the ball in our court analyzing their information or are we waiting for more information from EPRI? Just where are we?

MR. THADANI: We have indicated to EPRI specifically that what they propose is insufficient and here are the areas we expect them to address and tell us why not.

COMMISSIONER CURTISS: I guess one of the

generic questions that I have as we look at these issues and when we get to hydrogen I'll pursue it in more detail, but if you could expand upon where we disagree with EPRI on an issue, I'd be interested in knowing whether we've got all the information that EPRI intends to submit, they've got all the views that we intend to provide them, and if so how we reach the point of saying, "This is our bottom line. This is the position that we intend to take on hydrogen," as distinguished from they've got Qs and As from us, we're waiting for information from them, they're waiting for analysis from us. I'd just like to know how it is we get -- on those unresolved issues or what we call still unresolved issues, how we get to a resolution.

DOCTOR MURLEY: Many of these issues are unresolved between us and EPRI. We've sent out Chapter 5 of the Requirements Document just within a few months. But at the Commission's direction, we've put in there a very big disclaimer that this is not the Agency position, it's the staff views. So, we can't, by ourselves, come to a resolution until you tell us what the resolution is. That's what we're here for.

COMMISSIONER CURTISS: Yes, but I guess I'm trying to distinguish -- and you've come to us with recommended approaches on a number of these. For a

couple of them, it wasn't clear to me whether we've reached the end of the rope with EPRI. They've got all their information and we've got all our information or whether we're waiting for additional information.

I guess what I'm looking for is some kind of mechanism where you all think you've done everything you can do in the context of discussing the issue back and forth with EPRI and where you're prepared to come to us and say, "This is the final position that we intend to take. We've got all the information in and we propose to resolve it this way." And as we go through this, we can talk about that on matters like hydrogen and others.

DOCTOR MURLEY: I think that was the purpose here. We may not have all those adjectives, but where we say EPRI's position is as follows, they haven't changed -- if they have changed them, it will bring it up to this briefing.

COMMISSIONER CURTISS: All right. But what you have here on the 15 issues represents your view that you've undertaken all the discussion with EPRI that you think is fruitful, everything is in from them and this is your final call?

DOCTOR MURLEY: Yes.

COMMISSIONER CURTISS: Okay.

MR. MILLER: I guess I'd add to that, Commissioner, that these issues were addressed primarily in our draft safety evaluation, with caveats. In fairness to EPRI, they haven't said that they wouldn't continue the dialogue on them and we're anxious to continue some dialogue. But at this point in time, we haven't seen that they've offered --

COMMISSIONER CURTISS: Okay. Fair enough. I understand.

MR. MILLER: -- to come towards what the staff position is. The staff position is on the table.

COMMISSIONER CURTISS: Okay. Let's proceed.

CHAIRMAN CARR: Well, let me ask you one more. You say these are not yet -- this particular mid-loop problem is not yet resolved for operating plants. Will the fix you're putting in for the EPRI Requirements Document going to apply to operating plants, to fix that?

DOCTOR MURLEY: Yes. Now, I said that. What I meant is that we're still -- we think that the generic letter 88-17 is adequate.

CHAIRMAN CARR: So, if we just incorporate that into the EPRI Requirements --

DOCTOR MURLEY: This goes beyond that a little bit even. We are still looking. What I meant is it's

not totally resolved for operating plants as we're still looking to see whether there are some other vulnerabilities that we've missed. But we think -- we're quite confident that the generic letter 88-17 is adequate to resolve the issues with mid-loop operation that we know about.

CHAIRMAN CARR: I guess my question is then, as I understand it, EPRI said, "Hey, we'll comply with the generic letter."

DOCTOR MURLEY: This goes beyond that even.

CHAIRMAN CARR: You're requiring them to go beyond the generic letter?

MR. THADANI: That's correct.

CHAIRMAN CARR: In what?

MR. THADANI: It's the one area and that is to provide -- now that they have this opportunity for a proper layout and so on that the operating reactors can't deal with, it seems to us there are some simple things that can be done today to significantly reduce the likelihood of getting in a situation of losing decay heat to move a system completely.

CHAIRMAN CARR: Okay. So you want them to design the pipes so you don't have --

MR. THADANI: That's exactly what it is.

CHAIRMAN CARR: Yes, I understand.

DOCTOR MURLEY: Loop seal configurations.

CHAIRMAN CARR: It's a design fix. It's not --

DOCTOR MURLEY: Exactly.

MR. TAYLOR: Now it's more cost effective if you get it in in the design stage. You'll see others like --

CHAIRMAN CARR: Just don't have air traps.

MR. THADANI: Almost not global.

COMMISSIONER REMICK: I'd like to mention something along this line in case there are designers out there somewhere who might be listening. But Glen Reed, some years ago when this came up, claimed that there was a fix in some of the earlier reactors for this that was very simple. He claimed that the people are having to reduce the level for mid-loop operation lower than if they had this fix. He claims that apparently to get down to the mid-loop operation level, they have to reduce the level to drain the water out of the steam generator tubes. If I understand, he indicated that some of the early plants, that they had some sort of event. So it was not necessary to lower water as low as they currently do. I take it as fact. I don't know that it's true, but I just throw it out in case anybody's interested, but he proposed it was a very

simple fix and it was apparently in Point Beach perhaps or other -- enough said.

CHAIRMAN CARR: Okay. Let's proceed.

DOCTOR MURLEY: Okay. The next issue is station blackout.

MR. THADANI: (Slide) Next viewgraph, please.

Again, station blackout is another important safety issue and it was only in 1988, June of '88 I believe, that 10 CFR 50.63 was issued. And that rule required the operating reactors to do one of two things. One was to determine the duration for which the plant would have to be able to cope with station blackout and show that the plant could, in fact, cope with station blackout. Or the other option offered was that alternate AC power source be provided to deal with station blackout. In fact, the rule indicated preference for the choice of alternate AC power source.

What we're proposing to do here is to say really since that's the preferred option, let's stay with that for these advanced light water reactors. And so, our recommendation is that an alternate AC source, diverse from the existing source, be provided. As for EPRI, in fact, they do meet this requirement.

COMMISSIONER REMICK: Your wording of -- excuse me -- of diverse design, I could interpret that

to mean it could be two diesel generators and two different manufacturers. I assume you mean here something like a gas turbine is diverse rather than diverse design.

MR. THADANI: That's what we meant, yes, gas turbine. In fact, the next viewgraph --

CHAIRMAN CARR: You mean if I want to buy another FM and I've already got an FM diesel, I've got to buy a GM or something?

MR. THADANI: That's what we --

CHAIRMAN CARR: You'd like to have airplanes fly around with four different kinds of engines? I mean that doesn't make sense to me.

MR. THADANI: The intent here simply is to do whatever we can in a reasonable manner to minimize common cause failures. That's the goal. If we're worried about multiple systems failing, it's very likely they'll fail from one common cause. Then how should one go about achieving that? One way to achieve that would certainly be to have a combustion turbine versus an emergency diesel generator.

CHAIRMAN CARR: But the idea that you couldn't have two separate diesels with separate systems, you would try to convince me that's not as reliable as having two different kinds of diesels with separate

systems?

MR. THADANI: Two different kinds of diesels with separate systems as long as each one is very reliable. I think that's a clearly important factor. It's tough to know up front, for example --

CHAIRMAN CARR: We're creating a maintenance and spare parts problem that, in my opinion, is not worth it.

MR. THADANI: That would add to that problem, yes.

CHAIRMAN CARR: I mean that's an opinion. You can take that diverse design so far that it becomes ridiculous.

MR. THADANI: In general, the focus on diversity has been in a limited number of areas, limited number of systems, protection systems, diesels and I think the auxiliary feedwater system.

MR. TAYLOR: I agree it could become ridiculous. I think this is just an example.

CHAIRMAN CARR: Yes. We've got to be very careful there, I think, my personal view.

All right. Let's --

COMMISSIONER ROGERS: Well, I just question whether EPRI really was buying that interpretation of diverse, that if they had two diesels they had to be

different manufacturers. Is that -- are they in agreement with that?

MR. THADANI: Well, I can't say whether they agree with that interpretation. What they have proposed is, I believe, gas turbine as the alternate source. So, --

MR. TAYLOR: That answers -- that satisfies the issue.

CHAIRMAN CARR: Well, but there are other advantages to that machine over a diesel.

MR. TAYLOR: Certainly.

DOCTOR MURLEY: Why don't you mention what, in fact, the ABWR design is in this area?

MR. THADANI: Okay.

DOCTOR MURLEY: Do you recall that?

MR. THADANI: Yes, I have it in front of me. They have actually three independent trains of AC power, any one of which can provide shutdown capability. They are also proposing to have an alternate gas turbine.

COMMISSIONER REMICK: And each one of those systems has 100 percent diesel?

MR. THADANI: That's my understanding.

CHAIRMAN CARR: And they're three identical diesels?

MR. THADANI: Yes, identical diesels. And it

seems to us it's an outstanding way to deal with this important issue. I think they've just done a tremendous amount.

DOCTOR MURLEY: Now, this is an area where EPRI really pushed the designers further than they wanted to go initially. In this case, this is an example where the EPRI Requirements Document and that effort improved in our judgment.

COMMISSIONER REMICK: This is a true N plus 2.

MR. THADANI: That's how I interpret this, yes. I might note they have another feature that's very important and one we discussed with you from our plants and that is the tie-in with the fire water system as well, to be able to depressurize and provide water to the core as well as to the sprays capability.

CHAIRMAN CARR: All right.

MR. THADANI: It's a good system.

DOCTOR MURLEY: Okay. The next issue is fire prevention.

MR. THADANI: Fire -- in some of the past risk assessments, fire has been identified as a relatively important contributor to core damage frequency. And two areas that appear to us to be most significant in terms of where we could do better now are to make sure that

there is total separation, that the fact that fire were occur in a specific room or area, that we have a redundant trend totally separate that can safely shut the plant down. That goes beyond Appendix R requirements which would permit a 20 foot separation.

The other area -- next viewgraph, please.

COMMISSIONER ROGERS: Well, just on that, how do we stand currently on being able to satisfy that kind of requirement, that we could get safe shutdown assuming total loss of all equipment in any fire area? How many plants can we do that with now?

MR. THADANI: I think there are two exceptions in terms of areas. One is the control room, the other is the containment.

COMMISSIONER ROGERS: Well, the control room, yes.

MR. THADANI: The control room we have alternative shutdown.

COMMISSIONER ROGERS: Right.

MR. THADANI: For containment we said to the extent practical, you're still within the containment provided as much separation as can reasonably be provided. Outside of those two areas, most of the designers say that they don't see any real problem, as I understand EPRI, I don't believe, has indicated that

to us.

Charlie, do you recall?

MR. MILLER: EPRI's approach was the Appendix R approach.

MR. THADANI: That's what I thought.

MR. MILLER: You know, three hour fire barriers and 20 foot separation approach. We've stated our concerns with that in the Chapter 5 draft SER.

CHAIRMAN CARR: What do you -- let's discuss that environmental control system comment by the ACRS a minute. I assume, like you did, that that meant air conditioning.

MR. THADANI: That's how we interpreted it, yes.

CHAIRMAN CARR: But I didn't quite understand just how far they were going to go with it. I mean do you want to have separate air conditioning for the emergency shutdown panel too?

MR. THADANI: I don't think so. I don't think so.

CHAIRMAN CARR: Or at least have them rigged so that if you lose the control room, you lost that air conditioning and if you lose the emergency shutdown, you lose that air -- you could at least separate them that way.

MR. THADANI: There may be other ways of dealing with this without having to --

CHAIRMAN CARR: Well, that raised my curiosity when you said, "However, other options may be available to the designer," and I was trying to think of one and I couldn't come up with some system.

MR. THADANI: Ventilation. They may be able to do things with dampers and so on. It's not clear to me all the things they could do, but we thought there might be other options available.

CHAIRMAN CARR: Well, is it your intent to include that air conditioning requirement?

MR. THADANI: Is that -- I'm sorry?

CHAIRMAN CARR: Is that your intent then to include some kind of redundancy in the air conditioning systems?

MR. THADANI: Not in terms of air conditioning systems, no. But let me confirm that.

Conrad, can you address that?

MR. McCRACKEN: Conrad McCracken, Plant Systems, NRR.

The reason we did include the requirement, and it was as you had expressed, Mr. Chairman, that the ACRS said they should have a redundant system. Basically a train A should have a train A ventilation

system, train B, a train B ventilation system and the control room would be, in fact, separate from the alternate shutdown panel.

The reason we, in our position we took with EPRI, didn't do it that way is because we didn't have any evidence of there being a problem significant enough to cause us to change at this time. It's a good idea. It makes sense. We would like to see them do it, but we didn't have any evidence on a PRA basis or anything else that showed it to be a big problem. We would like to see them go in the direction ACRS recommended. But in the other things we did in the area of fire protection, these were based on a known problem in plants and the design could change it and make it better.

Without having that, we felt that we were going beyond the regulations without a basis in going beyond the regulations, other engineering judgment and intuition and therefore we didn't include it. If you ask me if I'd like to include it, yes.

CHAIRMAN CARR: Okay. Thank you.

DOCTOR MURLEY: Let's see. Did you want any more discussion on the EPRI --

COMMISSIONER CURTISS: Just to make sure I understand what Charlie said. The different between

EPRI and us on this issue, does it boil down to a treatment of in containment systems? Is that the -- when you say they've agreed to -- they take the Appendix R approach, is that --

MR. THADANI: No, I think the difference might be greater in terms of -- I believe EPRI would stick with the three R barrier concept rather than separation.

COMMISSIONER CURTISS: Okay. I understand.

DOCTOR MURLEY: The next issue then is intersystem LOCA, which is an emerging issue. It may or may not be a problem for current plants. We're looking into it, but it's one of those things that we believe is easy to fix with a fresh design.

MR. THADANI: (Slide) Okay. Can we go to viewgraph number 10, please?

Okay. As you have heard us say this before, the intersystem LOCA sequence is one where the barrier between the reactor coolant system and the low pressure system extending outside the containment is -- such sequences can lead to core damage as well as bypassing the containment, and hence the concern.

We believe that at this stage for these evolutionary designs, measures can be taken to essentially eliminate this problem. That's if the low pressure systems were designed such that they would not

fail if exposed to reactor coolant system operating pressure, then the concern for this issue would essentially go away.

The ACRS also told us that in so doing we should not ignore certain other pieces such as pump seals and things like that and they're quite correct. We do intend to discuss this matter with EPRI and vendors.

CHAIRMAN CARR: What's your estimate of the added cost of the plan of that design?

MR. THADANI: Added cost of --

CHAIRMAN CARR: You're making high pressure piping, a lot of high pressure piping that's not now required to be high pressure piping.

MR. THADANI: Yes.

CHAIRMAN CARR: And so it will be welded and x-rayed and all that. So, it's going to cost --

MR. THADANI: Yes, indeed. It would cost more. Currently, for example, this issue is more of a concern for PWRs. The RHR system is designed to about 450 pounds and they have indicated that if they designed a system to 900 pounds, that actually it would be okay even under the operating conditions, pressure of 22, 2300 pounds. And that would indeed add to costs. How much, I don't know.

CHAIRMAN CARR: Do you have any feel for how many welds and how many feet of piping and that kind of thing we're talking about?

MR. THADANI: We are talking about quite a bit of piping.

CHAIRMAN CARR: Now, my experience is it would -- I wouldn't say it would probably add half the cost of the primary system, but it's going to add a lot of money. There's a lot of manhours to fabricate those small pipes and that kind of stuff. I don't know -- you think 900 pounds would take care of a 2300 pound system?

MR. THADANI: We have not seen the capacity factors in the final calculations.

But Tad, do you want to --

CHAIRMAN CARR: Would you identify yourself, please?

MR. MARSH: Yes, sir. Tad Marsh, Chief of Mechanical Engineering Branch. Let me try. I too don't have an estimate of cost, but my perspective is that it would not be, in fact, an increase in pipe size, it would only require an increase in pipe schedule.

CHAIRMAN CARR: Yes. I understand that.

MR. MARSH: In other words, an increase in pipe thickness. Other welds that, of course, would have to be qualified for the extra thickness. But my

judgment is it wouldn't be an extra significant increase in cost.

CHAIRMAN CARR: Okay.

DOCTOR MURLEY: That was the impression I received also. We talked about this both with General Electric and with Westinghouse and they seemed to think it would really only be a modest increase in cost.

CHAIRMAN CARR: My experience with small gauge lines is it's a lot of work. You're talking material costs. I'm talking manpower to install and all that kind of stuff as well, but that's all right. So be it.

MR. THADANI: (Slide) Next viewgraph, please.

DOCTOR MURLEY: The next -- oh, you're still on intersystem?

MR. THADANI: Yes.

The other aspect of this requirement is that where system pressure, design pressure is not increased to be able to deal with intersystem LOCA, specific features should be provided that would, A, indicate to the operator quickly if the barrier is lost. There would be alarms, indication and ability to be able to close these valves and so on.

CHAIRMAN CARR: Is the intent here to do away with check valves as a protection?

MR. THADANI: Not necessarily. I think the

check valves may still be there in the design, but I can't tell you for sure if they have got rid of all the check valves.

CHAIRMAN CARR: So, the leak testing capability is not going to be required for a check valve?

MR. THADANI: It would still be required. If there are two check valves in between, they would have to have some capability to be able to determine if there's leakage.

CHAIRMAN CARR: Okay.

DOCTOR MURLEY: Is that all?

MR. THADANI: Yes.

DOCTOR MURLEY: The next issue then is hydrogen generation and control, which is a severe accident issue.

MR. THADANI: Okay. Those were largely the prevention type issues and our focus in terms of mitigation issues was on those types of challenges to containment that could lead to early containment failure. One such challenge is, of course -- potential challenge is from hydrogen.

The TMI accident generated between 30 and 50 percent hydrogen and even though we have been studying this issue since then, questions and uncertainties still

remain regarding hydrogen generation, detonation, impacts on continuing and survivability of containment. A large number of questions still remain on this issue.

In presence of this uncertainty and questions, the staff believes that it is appropriate to go forward with the 50.34(f) requirement which says in terms of generation that one should consider 100 percent of the active clad reacting and generating hydrogen and that in terms of containment, that it be able to deal with hydrogen concentration not in excess of ten percent. First the issue of the -- using 100 percent active clad, we believe that's a reasonable level as a surrogate for both in-vessel hydrogen generation as well as ex-vessel hydrogen generation. We think 75 percent for in-vessel is reasonable based on a number of analyses and work that we've done and that 25 percent ex-vessel is a reasonable value to use for hydrogen generation.

There are experiments planned and underway now at Argonne. Our expectation is that those experiments would confirm what we're doing is appropriate.

In terms of the global hydrogen concentration, some experiments have been done at varying conditions in terms of temperature, presence of steam, different geometries, scaling factors are involved. The results

seem to indicate that one can get detonation in the range of nine to 15 percent hydrogen. A lower percentage of nine, ten percent is driven if, in fact, you have hydrogen air mixtures largely. If you have more steam, then you shouldn't get detonations at those levels unless the temperatures are pretty elevated.

All of these -- the work that's been done so far, there's still a lot of questions remain. National Academy of Sciences on combustion, hydrogen combustion, indicated that the use of ten percent to minimize likelihood of detonation was a reasonable kind of thing to do. And our judgment at this stage is -- in the presence of some of these uncertainties, that that is, in fact, a prudent thing to do. EPRI has, of course, disagreed with us. They have given us a document. About two months ago they sent in a report which we are reviewing and we expect to stay with this position unless there is some substantial evidence provided to the contrary.

DOCTOR MURLEY: Let me as Themis Speis, do you want to comment on this then?

DOCTOR SPEIS: We have been also doing quite a bit of research in this area, mostly with small scale bundles. We try to see if there are mechanisms that would slow down or limit the production of hydrogen.

Earlier on, people thought that maybe the blockage is in the core itself, but we found out that the blockages are formed in an incoherent way and somehow the steam always is able to get to the zirc. So, as long as there is steam or water, which is turned into steam, you keep producing hydrogen basically. Okay?

Earlier on, also, there were discussions that maybe the initial hydrogen production will blanket the fuel and maybe that will retard additional production of hydrogen, but that was put to bed also. So, the key thing is that as long as the core has been heated up and there's some water. Of course, if you're able to cool the debris with lots of water and bring the degraded core to a stable configuration, then you stop producing hydrogen.

So, basically, as we said, the EPRI position is one that they say that we shouldn't be considering ex-vessel challenges. Okay? The core is a retaining vessel. That is their thing and that is their design basis condition. We feel that based on what we know from Research and PRA, that we should be more prudent and consider scenarios that involve additional hydrogen production from ex-vessel scenarios.

Also, I might point out that this 100 percent of active fuel, actually there's much more zirc and also

other materials in the core that could lead to the production of hydrogen. For example, in the ABWR, I think has an equivalent amount of zirc in boxes which are made up of zirconium and also has something like 40,000 pounds of iron. So, this 100 percent really represents of less than 50 percent of the potential material that could lead to a production of hydrogen.

CHAIRMAN CARR: Is that mostly where the EPRI disagreement occurs in how much hydrogen can be generated or are they also disagreeing with the explosure number of ten percent?

DOCTOR SPEIS: I think it's how much hydrogen can be generated.

DOCTOR MURLEY: I think there are two.

MR. THADANI: Themis, let me say -- two parts. I don't believe they disagree with us in terms of the use of 75 percent in-vessel hydrogen generation. As Themis correctly noted, they are talking about recoverable degraded accidents. That is the damaged core is kept within the vessel. Whereas what we're talking about is a core melt going through the vessel and that 25 percent hydrogen generation from ex-vessel. So, that's one disagreement.

The second disagreement, and I think a bigger one, really is to do with the global concentration of

hydrogen where they believe one would be concerned about detonations and potential impact on containment integrity. They would propose that 13 percent is a reasonable value for global concentration of hydrogen, whereas we're recommending a ten percent global concentration. I think that's a bigger issue simply because it has -- if you stay with 13 percent, you probably don't have to have an ignitor system. But if you go with ten percent, you probably have to have an ignitor system. So, my sense is that's the bigger issue.

CHAIRMAN CARR: Okay.

COMMISSIONER CURTISS: Has the Department of Energy done any work on this issue and, if so, where are they going to go?

MR. THADANI: Department of Energy, in fact, has been working with EPRI on this issue and the work done by, I think, Fauske Associates is supported by EPRI in conjunction with Department of Energy. That is the report I referred to earlier. I believe it was done by Fauske Associates.

DOCTOR SPEIS: It's mostly analytical.

MR. THADANI: That's right. That's right.

COMMISSIONER CURTISS: Two additional questions on this subject. This is one where from what

you've described it sounds to me like the staff review of the Fauske report is still underway, that there may be additional staff views that emerge as a result of that, although I gather from what you're recommending here that your opinion is firming up, if not set at this stage.

The first question focused on the evolutionary reactors. Number one, what are those folks doing? I know GE, I guess, is inerting the containment to address the issue. Secondly, as we move forward with this issue and as it becomes more important for the passive reactor designs, what's going to transpire between here and there? Is the work going to continue on this or have you pretty much brought this issue to a technical conclusion subject to completing review of the Fauske report?

DOCTOR MURLEY: Let me answer that. I think for the passive plants this is a very important issue for some fundamental aspects of the design, mainly the size of the containment and some elevations and so forth. So, my judgment, it needs to be resolved fairly quickly in order to set some ground rules for continuation of the design. Otherwise, they may go down a path thinking that they're going to prevail in their arguments and, I don't know, three, four, five years

from now, if the staff's view prevails, they may have to scrap major aspects of their design.

So, we can continue discussion or a dialogue, but I sense from the staff, from the research staff and my technical staff is we have not seen any really new information in the last few months that's going to change our position. So, we would recommend technically that our position is still sound. But also from a programmatic point of view, we think it's important to make a decision so we can move on.

COMMISSIONER CURTISS: And this approach, I gather from what you say, would be incorporated in both the evolutionary and the passive requirements document, that it is the approach to be taken?

DOCTOR MURLEY: Yes.

COMMISSIONER CURTISS: Any feel for when we reach that point where continued discussion of this issue might, in fact, if EPRI expects to prevail on it, might adversely effect their design? How far out can we go before we reach that point?

DOCTOR MURLEY: I don't know.

Charlie, do you have any thoughts on that?

MR. MILLER: Concerning the evolutionary plants?

COMMISSIONER CURTISS: Passive.

MR. THADANI: Passive.

MR. MILLER: EPRI is in the final stages of trying to prepare their passive requirements document. We anticipate the receipt of it in the next few months. So, I think the issue is going to be on the table then. If our decisions are not changed because of no new information over the next few months and we're trying to do the EPRI Requirements Document before proceeding with the actual reviews of the passive plant reviews, I would certainly say less than a year.

COMMISSIONER CURTISS: Okay.

CHAIRMAN CARR: Did I understand you to say it would effect the size of the containment decision and would it also effect core design, do you think?

DOCTOR MURLEY: I don't think it would effect the core design, no.

CHAIRMAN CARR: So we're only discussing the size of the containment or whether it's going to be inerted or not.

DOCTOR MURLEY: Also major aspects of the containment too. Not just the volume, but I think probably some features of the containment. I don't know all the details of where it might -- certainly ignitors or no ignitors and the electrical system that would be needed to supply the power for those ignitors would be

an impact.

MR. THADANI: If I may just add, the issue is certainly the volume of the containment. There still would be some issues in terms of local concentrations, stratification and so on, and that EPRI, as I understand, would address those issues because you can get substantial amount of hydrogen in some pockets, some areas, so that one could handle this with volume. As I understand, there have been developments in terms of passive ignitor systems and so on too.

CHAIRMAN CARR: Okay.

COMMISSIONER CURTISS: One last question on the ACRS views. They recommend on this issue that the staff seek further technical information on the effects of, among other things, stratification before setting an average hydrogen concentration. Could you comment on that?

MR. THADANI: As far as I know, we have looked at all the relevant information on this subject. We have had discussions with a number of eminent people in this area and I think what's needed is better information. There's just a set of experimental data that's available, that all of us have looked at. Research currently is talking to MITI, for example, for further work in the hydrogen area.

But unless this big set of information that exists out there that we just don't know about, I don't know what else we can really do.

COMMISSIONER CURTISS: Let me just read what they say. "We are not aware of any experimental or analytical work that demonstrates the detonation of hydrogen 10, 13, or some other level could damage the integrity of the containment and essential components." Is it just they're not aware of what you've looked at?

MR. THADANI: No, I think it's not just detonation. People worry about multiplication of shock waves and so on that can be generated. It's a complex, complex phenomenon. A single detonation may, in fact, not do anything to the containment structure. But these things can develop and become worse.

DOCTOR SPEIS: Also, we're looking at -- these type of calculations have to have in front of it the final decision, all the surfaces, all the constraints, all the geometries to make sure that there are no reinforcing waves. But if you have a simple geometry, these calculations are not very difficult. All of us have learned that maybe the pressure of detonation is approximately twice the conflagration, but then in the process of getting different surfaces and constraints and other things, then you can get -- so, it's difficult

to calculate that.

So, the more prudent thing is to avoid. But if we have then do a multi-dimensional calculation and wait until the end and then if things don't work out, then they have to put something. At that time, that doesn't make sense.

DOCTOR MURLEY: And we did have one explosion in a reactor containment and it did damage equipment and containment. You can't say that it affected the integrity, but it sure affected a lot of the equipment because I've seen it.

CHAIRMAN CARR: No doubt in my mind that a hydrogen explosion will affect --

DOCTOR MURLEY: Yes.

CHAIRMAN CARR: I've seen it in a submarine.

COMMISSIONER REMICK: The staff for a long time --

CHAIRMAN CARR: It didn't affect the hull of the submarine, but it affected a hell of a lot of equipment.

COMMISSIONER REMICK: The staff for a long time had a consultant, I think from the University of Virginia, in this area, hydrogen. Are his views consistent with the staff views on detonation and so forth?

MR. THADANI: I will have to check on that.

COMMISSIONER REMICK: Okay.

DOCTOR MURLEY: We'll get back on that.

The next issue then is core-concrete interaction and that is a severe accident litigation issue.

MR. THADANI: Well, this issue -- I don't think there's any significant disagreement between either the vendors, EPRI or us. The goal here is clearly to minimize core-concrete interactions. What's been proposed is that adequate surface would be provided for spreadability of core debris and that capability will be provided to be able to flood this debris to hopefully terminate rapidly core-concrete interactions. But this clearly goes beyond our current requirements.

Again, as I indicated earlier, experiments are underway at Argonne and they may have some bearing on this.

CHAIRMAN CARR: Yes. Are they going to be out in time to have an effect?

MR. THADANI: The results will be available in eight to ten months, I think. Right?

DOCTOR SPEIS: Yes. They will be available in time.

DOCTOR MURLEY: Okay. I think this one is

clear. It's just sensible design changes that people can make the help the issue.

CHAIRMAN CARR: But it's not a core catcher solution.

DOCTOR MURLEY: Not a core catcher, no.

CHAIRMAN CARR: Why not? I mean somebody is using core catcher, I gather.

DOCTOR MURLEY: I don't know if they are or not. People have tried for years to lay out the design requirements for a core catcher and also to somehow do an experiment or fashion an experiment that you could say met the requirements and that's the tough one. You don't know that what you've done can really contain a whole core. So, the idea here is do some sensible things that make sense.

MR. THADANI: The other thing that is done in association with this is the availability of water to cool the debris. So, you have the available area and the water and between the two it's the most sensible thing to pursue at this time.

DOCTOR MURLEY: Yes.

COMMISSIONER REMICK: And what's the difference now between the ABWR which has a design that would collect any core and then water come in. Why isn't that a core catcher or is there something I'm

missing here? They propose -- I remember some walls so that if the core did come down it would be retained underneath and then you have the provision of water coming in.

DOCTOR MURLEY: The classical notion of a --

CHAIRMAN CARR: But the steel lined thing though.

DOCTOR MURLEY: -- core catcher is a ceramic feature that sometimes even has active cooling and so forth.

COMMISSIONER REMICK: So, it's just the definition of core catcher in this case.

DOCTOR MURLEY: Yes.

COMMISSIONER REMICK: Because this is the design that retained the core that might melt and then cool it, right?

MR. THADANI: That's correct, yes.

COMMISSIONER REMICK: Okay. You're thinking of a ceramic or --

MR. THADANI: Yes.

COMMISSIONER REMICK: Okay.

DOCTOR MURLEY: The next issue is core melt ejection, another severe accident mitigation.

MR. THADANI: Okay. There are a number of

issues that develop when one is addressing the high pressure melt situation. First, within the primary system itself, one can get natural circulation from the hot gases in the hot core and the rest of the system and some concerns have been developed that this might lead to a potential impact on steam-generated tubes and the potential failure of those tubes.

But even beyond that, if one does get into high pressure melt scenario where a vessel is breached, two issues come up. One is the issue of direct containment heating which you have heard a great deal about in the last year or two, and particularly last week. This is a phenomenon where core debris, under high pressure, is ejected into the containment atmosphere where it's dispersed in fine particles and could, could lead to rapid addition of energy and potential containment failure exists.

The other issue is that this dispersal of debris can also lead to production of hydrogen through reaction with steam. This hydrogen could, again, lead to combustion and so on and so forth.

And then Research briefed you last week indicated that the issue of direct containment heating would likely have a technical resolution in about two years.

For the advanced light water reactors, again there's no disagreement on this issue between the vendors, EPRI or us. We think there are two things, two useful ways to deal with all these concerns. First is to provide a depressurization system which EPRI is proposing and the vendors are also proposing, as well as to make sure that the cavity design up front is such as to minimize the potential for this ejection of debris to the containment atmosphere.

Again, this is one issue where I don't think there's any disagreement, but it goes beyond current requirements.

DOCTOR MURLEY: Okay.

COMMISSIONER CURTISS: Could you comment on the ACRS views?

MR. THADANI: You know, I think we probably are stuck with some words here. High pressure melt scenarios, you have concern within the primary system also. It's not only containment that you're worried about. You're worried about primary system as well. And if you have depressurization system, it deals with potential concerns for primary system. It can also deal with the discharge of elevated pressures in direct containment heating issue.

But a number of questions still remain

regarding the effectiveness of such a system, cut-off pressure, for example, where direct containment heating is no longer an issue. Timing of sequences and so on still remain.

It seems to us that prevention of depressurization system may be the answer to both issues, but we're not sure.

DOCTOR MURLEY: Let me add a thought here. They're quite right. They say this is an extremely improbable event and we see no need to require two modes of coping with it. Now, if we could be certain that either one of those were going to solve the problem, then I think we would say yes. But you don't know that either depressurization or the design features that people have thought about in the cavity for sure is going to fix this issue. So I think it's a matter of really just prudence in this case.

COMMISSIONER CURTISS: Okay.

COMMISSIONER REMICK: What kind of design features do you have in mind? One was described somewhere in here was at least three feet of concrete --

MR. THADANI: Yes.

COMMISSIONER REMICK: -- above the line error and so forth. Is that the type of thing? I'm not sure

I could picture which --

MR. THADANI: No. I think the cavity design -- what you'd like to see is when the core debris comes down at elevated pressures, you'd like to have a design that will push it in a specific direction and then have some kind of, hopefully, a tortuous type of path which would lead to retention of a lot of the material and substantially minimize the likelihood of this stuff getting in the atmosphere, containment atmosphere. So, that kind of a design would deal with the issue.

COMMISSIONER REMICK: And I have no problem and what, I guess, concerns me here, somewhere there might be a tradeoff that by doing that there might be some adverse effects that affect it and I assume the staff is -- and it might be a tremendous cost, I don't know. Is the staff viewing this as an absolute requirement or a prudent type of thing in design that they would look for?

DOCTOR MURLEY: Are you talking about the depressurization?

COMMISSIONER REMICK: No, not the -- no, the features, the cavity design.

MR. THADANI: It's a prudent thing. And in fact, I quite agree with you, one has to be very careful that one doesn't introduce big down sides through this

change. And we expect -- once we get to that stage of our discussions, we would certainly be addressing issues like that. Not just on this, I expect on other issues.

CHAIRMAN CARR: We've given the designer a problem here of predicting the most likely area of failure, it seems to me. Otherwise you're going to have to surround the whole pressure vessel with something.

MR. THADANI: No. In fact, we've seen, I believe, a design that I think Combustion Engineering discussed with us. It seemed to be a fairly effective way of retaining a bulk of the debris.

DOCTOR MURLEY: But let's answer --

CHAIRMAN CARR: Do you think it's going down or --

DOCTOR MURLEY: Yes. We're assuming that the melt goes downwards, right?

MR. THADANI: Yes.

DOCTOR SPEIS: The issue is --

CHAIRMAN CARR: Why are you doing that?

DOCTOR MURLEY: Well, we're reasonable and we had to draw the line somewhere.

DOCTOR SPEIS: The issue is one of entrainment here because the particles are entrained by steel and is there a potential to de-entrain to make sure that they fall right there before they get a chance to go

into the volume, and there are cavities already that can do things like that in existing plants. So, there is enough information to configure an appropriate cavity without adding substantial complications with designs. We think with some attention ahead of time, this can be taken care of.

DOCTOR MURLEY: We have not heard of any down sides to this, but you're exactly right, I think we need to be alert to that and we will be.

Let's move on to one where there is controversy, and that is the containment performance guideline. We have had a containment performance guideline in the LRB for the GE ABWR now for three years. EPRI does not agree with this. The staff believes that a containment performance guideline, either a conditional containment failure probability of 0.1 or a deterministic performance goal that offers comparable protection is necessary to give the ALWR designers guidance on what is acceptable for containment performance under severe accident conditions.

The alternative to having a containment performance guideline is to design the containment for the traditional design basis accidents, primarily a large loss-of-coolant accident, and then to evaluate its severe accident failure probability after it's

designed and after the fact. That's the situation we find ourselves in now for current containments and that's the controversy, for example, that's surrounded the Mark I containment. It was not designed for severe accidents.

So, the issue in our mind is as simple as that. We thought that we should give the designers some guideline to let them take into consideration severe accidents early in the design. The ACRS said that we believe the staff proposal will be adequate for ELWR review if it's supported by an appropriate reg guide, developed on a timely schedule, and if it can be reasonably demonstrated that a containment that meets this guidance has a conditional containment failure probability of not more than 0.1. We essentially agree with those comments and we will work with the ACRS on this, because we know they're working concurrently on a containment performance guideline.

Now EPRI does not agree with us. We have sent out the Chapter 5, where we've offered them the opportunity: if they did not like the one-tenth guideline, would they like to propose an alternative? And I don't know that we've heard back.

Charley, do you know if we heard back on that?

So I've had some private discussions with some

EPRI people where they took that as a challenge to come back. I mean, they didn't really disagree with the notion in general of a containment performance guideline, but they'd kind of like to come up with one of their own. So my sense is they're working on it, but I can't really tell you where they stand now.

CHAIRMAN CARR: If we require that one-tenth, will that lead to all future designs needing vents?

DOCTOR MURLEY: No, particularly not the large dry containments. But go ahead --

MR. THADANI: Certainly not the large dry containments. The ABWR type of design, yes.

CHAIRMAN CARR: It doesn't need a vent?

MR. THADANI: It would need a vent.

CHAIRMAN CARR: It does need a vent.

MR. THADANI: It does, yes.

COMMISSIONER CURTISS: Do I read the attachment on that issue correctly when I draw the conclusion that the ten percent criterion did lead to the vent in the case of the ABWR?

MR. THADANI: If one were to apply ten percent criterion, based on the PRA in-house, which the review has not been completed, yes, indeed, it would indicate that you would have to have a vent system to meet the ten percent criterion.

DOCTOR MURLEY: I don't know if --

MR. THADANI: I might expand on that a little bit. The definition they used was 25 rem all-body dose at I think it was half a mile to say what do we mean by failure of a containment. That's not a straightforward issue itself.

So if one defines failure by using certain dose level at some distance, then I think the point one would be made if you have the vent system.

DOCTOR MURLEY: I don't know that I've actually directly asked GE that.

Do you know, Charley, would the vent be required to meet the one-tenth?

MR. MILLER: The way GE came to the vent was through their PRA analysis and the commitments that they had made up front in their LRB concerning .1 CCFP. And as a result of that --

DOCTOR MURLEY: So it did lead to the vent.

MR. MILLER: -- led to them putting that in initially. But I think the more that they looked at it, the more that they liked it as an over-pressure protection device in total.

CHAIRMAN CARR: What drives this requirement? I mean, what are we really trying to do with it?

DOCTOR MURLEY: I think it's fairly simple in

my mind that a proper consideration of balancing of mitigation and prevention says that at some stage everything that you do to prevent an accident you do the best you can, but you can't really rule it out. If you could, you wouldn't need containment.

CHAIRMAN CARR: So mitigation really --

DOCTOR MURLEY: So it's mitigation, right. And if you're going to --

CHAIRMAN CARR: It's not a safety margin number, it's just mitigation of --

DOCTOR MURLEY: Right. And also, I think that the designer needs some guidance along this area. And just to design for a large LOCA is not enough, and so it's that simple.

CHAIRMAN CARR: And the ten percent is a magic number?

DOCTOR MURLEY: No, there's nothing magic. I think it's kind of, I thought, a reasonable target. It's the fact that we think we've driven the chances of a severe accident down fairly low anyhow. Be nice to get another order of magnitude protection beyond that, and it's about as simple as that.

COMMISSIONER REMICK: It's entirely consistent with the safety goal and the proposed large release guideline. There's some consistency in there.

MR. THADANI: I was going to say that it is in conformance with the thought process of core damage of 10^{-5} and a release of 10^{-6}. There's some relationship there.

DOCTOR MURLEY: Themis, were you going to say something?

DOCTOR SPEIS: No. I was going to say that, but Commissioner Remick --

COMMISSIONER CURTISS: Just a procedural question. If we vote the paper out tomorrow and approve this particular approach, where are we in terms of EPRI's look at alternatives here? How do we coordinate with that initiative? Or, to put it differently, should we defer on this one pending EPRI's response on Chapter 5?

DOCTOR MURLEY: Well, see, what we're asking your approval for is either the .1 or an alternative. So we would even agree that we wouldn't impose the .1 across the board if they could come up with a deterministic goal that is roughly comparable.

CHAIRMAN CARR: And the proposal gives them an option if they don't want to do the .1.

COMMISSIONER CURTISS: I guess I thought the deterministic one that we talked about last time was starting to firm-up on 48 hours.

DOCTOR MURLEY: Yes.

COMMISSIONER CURTISS: Okay. That's the current staff thinking on deterministic?

DOCTOR MURLEY: That's the current staff thinking. I think it's a good goal. And if EPRI would prefer that, I think we would go along with that.

COMMISSIONER CURTISS: Okay. Let me ask what's the status of the staff's effort to develop some guidance on the implementation of either of the two alternatives, picking up on the ACRS comments?

DOCTOR SPEIS: We're working with Ashok here. We have some people at Brookhaven National Laboratory who are putting together a guide for PRA for future plants. And as part of that, these are issues associated with that: containment performance, how you calculate conditional containment value. So we're working and I don't know exactly -- in the next six months -- the coming year, I guess. We should have something by then, a year or so.

We have been discussing this with the ACRS, so this is something that is ongoing in a kind of open way. It's not some contractor working on a report and all of a sudden it will make its appearance.

COMMISSIONER CURTISS: Okay.

DOCTOR MURLEY: I suggest we move on. We want

to make sure we talk about source term today.

The next issue is the containment vent design.

MR. THADANI: Well, we've already touched on the vent issue. Its value is maximum for pressure suppression type containment, and so we believe that it does offer some substantial benefit for ABWR design.

COMMISSIONER CURTISS: What's the timing of Brookhaven's review of GE's PRA? Can you tell us when that will be complete?

MR. THADANI: Well, they have a number of questions. They expect, assuming that they get a fairly rapid response to those questions, they expect to complete the review I think it's August of this year, I believe.

CHAIRMAN CARR: We're not addressing whether this vent ought to be filtered or not?

MR. THADANI: It's already filtered, because it's in the wet well area.

CHAIRMAN CARR: Okay.

DOCTOR MURLEY: But we're not requiring across the board for other designs either a vent or a filter.

CHAIRMAN CARR: All right.

DOCTOR MURLEY: This is just for the ABWR.

COMMISSIONER CURTISS: Just on this particular question, at the last meeting we got into some

discussion of whether it ought to be actuated by the rupture disks or human actuation. Does that issue get sorted out when we approve this, or is that still a subject of some discussion?

MR. THADANI: It's a subject of discussion, because what we want to make sure is whatever vent design is utilized it is one that:

(a) provides adequate control if it is needed;

(b) minimizes downsides venting.

So there are questions regarding the design that was proposed by GE, but we will pursue that once we come to the decision.

COMMISSIONER CURTISS: Okay.

DOCTOR MURLEY: Okay. The next issue is equipment survivability.

MR. THADANI: Okay. Since we're talking about very low probability events, we're not treating severe accidents like classical design based accidents, and since as we discussed the thought process that was utilized in coming up with some containment performance goal, we have applied the same approach to saying what would be considered adequate in terms of the equipment that would be needed to deal with severe accidents. To that extent, this equipment need not be safety grade, need not have redundancy, but that it be able to perform

its intended function in the environment it's expected to see, that it be designed to good engineering standards. This we believe, based on our experience to date would lead fairly reasonably reliable system to deal with severe accidents.

COMMISSIONER REMICK: Want to address the ACRS comment that what you underline in the SECY isn't the whole story? I'm not sure what was meant there.

DOCTOR MURLEY: Yes. We should explain that.

Charley, why don't you explain that?

MR. MILLER: In our dialogue with the ACRS, it was noted that if you look at the section in the SECY paper there are some things that the staff is talking about and asking for that didn't end up in the underlined portion at the bottom. And I think in our dialogue we agreed that the whole story just wasn't painted by what was underlined at the bottom.

The ACRS wanted to make sure that the Commission knew that they had to focus on the whole section to really capture everything that the staff was saying, not just on the underlined portion. I promised Chairman Michelson that I would address that.

COMMISSIONER REMICK: Okay. Could you quickly summarize what that includes?

MR. MILLER: Yes, I can. I think the best

thing would be for me to just take the excerpts from the paper.

We've said that the mitigation features must be designed so that there's reasonable assurance that they will operate in the severe accident environment for which they're intended.

We go on to say that for the ALWR designs for credible severe accident scenarios, the equipment needed to perform mitigative functions and the conditions under which the mitigative functions must function will be identified: equipment survivability expectations under these conditions, for example station blackout or earthquakes; and the environment, for example pressure, temperature, radiation, in which the equipment is relied upon to function.

What the ACRS was looking for is a measure of-- we're saying that we would like to see this equipment function for the period of time and for the purpose that it was designed for in the severe accident scenario. They wanted to make sure that we got to the bottom line, that we weren't trying to make it totally pedigree in accordance with equipment qualification. And I think that's where the dialogue ended up. We wanted to let them know that we expected it to function, but that it didn't have to be totally pedigreed.

And we went on to give some specifics in there concerning its capability: to be powered from an alternate power supply, as well as from the normal Class IE.

COMMISSIONER REMICK: It's all in there. It's just not underlined.

MR. MILLER: It's in the paper.

COMMISSIONER REMICK: It's not underlined, okay.

MR. MILLER: It wasn't underlined.

COMMISSIONER REMICK: All right.

MR. MILLER: And I think the ACRS felt, as a result of the dialogue and what would be approved, that maybe it should have been underlined and I conceded.

COMMISSIONER REMICK: Thank you.

DOCTOR MURLEY: The next issue is source term. There are policy aspects of source term that either are or will be before the Commission that go beyond what we have here, but there are some aspects that we would like some guidance on.

MR. THADANI: (Slide) Could I have viewgraph number 19, please?

Okay. The staff is considering decoupling siting from the Part 100, and as a matter of fact is meeting with the ACRS scheduled for next week on this

issue, and it is our intention to brief you in the near future on this issue and also complete a paper, I believe, by end of June on this subject.

DOCTOR MURLEY: Excuse me. We do not need the Commission's action on that to proceed with these reviews.

MR. THADANI: (Slide) In fact, that's viewgraph number 20 is what we really need.

What we're doing on the evolutionary designs is to say they have to meet 10 CFR Part 100 requirements. However, where there is adequate technical justification to deviate from the requirements -- for example, Reg Guide 1.3 and 1.4 assumptions -- that we would provide relief in those areas. I'll give you two examples.

One has to do with, for the ABWR, giving credit for retention hold-up in the steam lines and the condenser. Even though the system is not designed to safe shutdown earthquake level, we believe there is-- we're reviewing the information base, but we believe there is enough evidence to indicate that the pipes generally hang together, even in case of some very severe earthquakes and so on, that one can put together adequate technical bases to give such credit. And we expect to complete our review this summer on this issue.

COMMISSIONER REMICK: Excuse me, if I can interrupt. Giving credit to that enters into the picture of whether one standby gas treatment system is sufficient? I'm not sure I --

MR. THADANI: It would basically do away with the requirement for leakage control systems.

COMMISSIONER REMICK: Leakage control systems.

MR. THADANI: Yes. And one can go to greater leakage through MSIV valves and so on.

We are also -- we expect to complete our technical evaluation on some parts of the source term: fission products release time, and the quantity of radionuclides released in the containment. Those two areas we expect to reach our conclusions this summer also, and depending on how that comes out we'll expect to apply these in an assessment of evolutionary designs.

So that's really what we're looking for from you.

COMMISSIONER REMICK: Can you help me? You discuss the one train -- or standby gas treatment, but somehow I got disconnected with what you finally recommend. What was the point you were making? I realize the ABWR is proposing one train and not safety grade, I guess. I'm not sure about that. But how does that relate to what you're talking about here? Is that

one of the examples that you would consider if you had the flexibility to?

MR. THADANI: In fact, depending on how one comes out, the source term getting in the containment issue --

COMMISSIONER REMICK: Okay.

MR. THADANI: -- that would have an impact on the --

COMMISSIONER REMICK: Right, sure.

MR. THADANI: But the broader question also is, if one has to have filter, should one have two filters?

COMMISSIONER REMICK: Two filters.

MR. THADANI: Questions of what's active, what's a passive device. And unless there's some data out there that indicate much higher reliability of filters than what we've seen, we believe that filters are in fact active components. Currently, GDC, I believe, 41 and 43 would require such --

COMMISSIONER REMICK: Redundancy.

MR. THADANI: -- redundancy. And that's where we would be.

But the big impact we see would likely be on valve operations, leakage control system, leakage from containment, .5 percent or higher per day.

COMMISSIONER REMICK: So if the Commission agreed with staff position here, you would be looking at those things on a case by case technical merit basis? Is that right, that's what you're --

MR. THADANI: Exactly, yes.

COMMISSIONER REMICK: Okay. I got disconnected when I read it. I wasn't quite sure what you -- okay.

DOCTOR MURLEY: Now EPRI would like to go further in this source term changes.

Charlie, would you like to sum up?

MR. MILLER: I think the crux of the kinds of things that Ashok talked about are encompassed in what EPRI wants. But I think the total goal there would go farther. I think we're going to get ultimately, hopefully, to some agreement with EPRI on some of these issues. Themis may be able to back me up on this.

We are trying to look at ways where we can stay within the regulations, but look at some of the reg guides and some of the assumptions that were used traditionally: for example, like the iodine form and the timing of the release and things like that. EPRI has asked for that as part of their source term submittal and we are looking at that.

But I think they want to go farther, in that

I think the ultimate goal in doing some of this is the opportunity to be able to pull in the EPZs and the LPZs as a final goal. And I think the thing that we tried to make clear was that we don't see that as part of our planning horizon in the near future, that there's other reasons for why we might not want to take that on.

The source term refinements I think may lead to things like Ashok was talking about with regard to the valve closure times and the possibility of the leakage control system that may affect some of the system designs. But I think what we want to make clear is that we don't want to try to use that as a basis for altering siting considerations at this point.

DOCTOR MURLEY: They would like to see and I believe there's data that would allow us to modify, revise TID 14.844.

MR. MILLER: Yes. And the goal there would be to try to come up with a new source term itself to replace 14.84 in its total, but I think that that would be the basis for trying to get to the end, which was the siting consideration.

COMMISSIONER CURTISS: Well, let me follow up on that, because I guess we've talked about this in a number of meetings and the staff is, as you've indicated, going to continue to pursue it with the

pieces that you've got coming back before us. But if I can be blunt, let me see if I can't get my arms around what I detect is going on.

My sense is that there's a great reluctance to go in and actually change TID 14.844, because of the consequences or implications or impacts that that would have on all of the plants that have been licensed out there to date, whatever regulatory implications that might have, whatever actions we might be petitioned to take once we change that TID 14.844.

Let me ask you just a narrowly focused question. Looking at what EPRI has submitted to us from a technical perspective on changing the existing TID, is the information incomplete or does it make a technically sound case? Leave aside the question of whether they're driving for a change in the EPZ or the LPZ or what the hidden agenda might be, if anything. Is there a technical case that can be made and that, indeed, has been made by EPRI to modify the existing TID 14.844?

DOCTOR SPEIS: Let me address that to some extent. Maybe I'll have Len Soffer say a few more things.

Some of the things that they're proposing to do, they have technical basis. Okay? Whether we'll

precisely reach agreement on the precise quantify, the precise timing, that's not a question we're discussing. For example, the timing of the appearance of the source term, we think that indeed there is information that shows that the source term does not appear instantaneously. Okay? There is some delay time. So whether they will accept the one hour or whatever they are demanding or whether it's something else, that's something that we're discussing right now. Okay? And we'll be coming to you, I guess, this summer or fall with our technical evaluation.

Also, the form of iodine, there is some technical information that indicates that indeed it is not all molecular iodine. Okay? But it's not also all in the other direction, because of the different type of environment that the accident creates and so on and so forth.

Now in addition to that, EPRI is proposing some more radical changes to the TID itself: reduce the amount of iodine, maybe add some additional nuclides. But their arguments are two-fold. One of them is technical, the chemistry, the physics. The other one is PRA-related, and I think it became very clear to us when we met with them two weeks ago that they say for passive plants some of the sequences will have such low

probability that therefore you should eliminate them completely, and therefore those sequences do not contribute to a specific source term which is integrated to the total source term. And that would be a more difficult one, because right now we don't have a design in front of us. We don't have a PRA. We don't know whether the containment will have sprays or no sprays. There are so many questions to be dealing with, whether we can accept those type of arguments.

So our process is one of, you know, indeed go forward and look at the chemistry and the physics and the technology and see what we can bite as we go forward. But as far as our going forward with those radical changes which rely substantially on a future design whose sequences of core melt are very low probability, I think it's premature.

Maybe Tom can say something.

DOCTOR MURLEY: I haven't anything to add.

DOCTOR SPEIS: Did I say it all?

CHAIRMAN CARR: Well, is the intent, then, as soon as you come to agreement on the technical issues, to change the portion we can change?

DOCTOR SPEIS: Yes, sir, and we're working to that. And in fact, we will be briefing the ACRS next --

CHAIRMAN CARR: Because, it does have a big impact on design and timing of closure of valves and things like that.

DOCTOR MURLEY: And we agree there are some things that can be changed right now, and that's what we're proposing to do in this review.

COMMISSIONER CURTISS: Just on the piecemeal changes you've made in here, we're supposed to -- the staff is supposed to have something up here for us on chemical form of iodine here pretty soon. Is that one on its way? What's the timing for that one?

DOCTOR SPEIS: It's on its way. It's on its way to you.

COMMISSIONER CURTISS: A week or month or -- I'd like to know. It was due April 30th, as I recall.

CHAIRMAN CARR: They're a week late.

COMMISSIONER CURTISS: Okay. How about -- you indicated that the timing of release paper was summer or fall. Is there some slippage in that paper? That was July, as I recall, that we're looking for.

CHAIRMAN CARR: Why don't you identify yourself at the microphone?

COMMISSIONER CURTISS: Could we just review the schedules for the submission of the papers that you're working on?

MR. SOFFER: Yes. I'm Len Soffer from the Office of Research. Yes, we expect to meet that by this summer, sir.

COMMISSIONER CURTISS: Okay. One final question on this one. I gather, from what you're saying here, Themis, that the approach that EPRI's arguing for, particularly on the probablistic front, is going to depend upon the particulars of the reactor design. Does that suggest that when we get closer to that in the EPRI Requirements Document and flesh that out in that context that you would expect to see the second prong of their argument addressed and perhaps resolved with a change for the passive plants?

DOCTOR SPEIS: I'm not so sure I can address that.

Ashok, you'll have to help me on that one.

MR. THADANI: EPRI proposed some numerical cut-off point for certain sequences that could be eliminated from consideration in terms of source term. That presumes we know a fair amount about the design. That presumes we know a fair amount about the probablistic study. That presumes a great deal of knowledge, and I think what Themis is saying is that might not be as simple a way to deal with the issue as it might appear on the surface, because one can easily

say, "Well, I'll pick a frequency and I won't consider anything below that frequency cut-off point." But there's a large set of questions regarding credibility of what is really above that frequency level. That's a tough --

COMMISSIONER CURTISS: Well, I gather what you're saying is that even as we get additional design information to address the uncertainties that you identified, Themis, you don't even envision with that further information reaching the point where the two arguments that EPRI is advancing would be addressed and perhaps resolved, say, in the passive requirements document?

MR. THADANI: I certainly don't know the answer today.

COMMISSIONER CURTISS: We'll get back to that. I'd be interested in pursuing that.

DOCTOR MURLEY: Okay. We have two final issues. Jim Richardson will talk about those.

The first is the separation of the OBE, operating basis earthquake, from the safe shutdown earthquake.

MR. RICHARDSON: The current regulations require that the OBE be at least one-half of the safe shutdown earthquake. What this has led to is that the

OBE really dictates the design, because of the associated allowables associated with the SSE and the OBE, and this really doesn't make a lot of sense. What you're dictating is an overly conservative -- in general, overly conservative pipe design and structural design dictated by the OBE rather than the safe shutdown earthquake.

We're working with the Office of Research in a long-term solution to this problem, and it probably could very well result in a proposed rulemaking of Appendix A to the Part 100. But in the meantime, we plan to consider requests to decouple the OBE from the SSE on a design-specific basis for the ALWR designs. And I would just note we -- this is not unprecedented in that we have for some plants -- and there are about ten sites of operating plants where in fact we have granted exemptions from that rule and allowed the OBE to be somewhat less than half of the SSE. So we, in this case, are asking the Commission to grant an exemption to Appendix A to Part 100 to allow the OBE to be decoupled from the SSE.

In reality, the OBE ought to be an earthquake level such that you would shut the plant down and go in and perform inspections to determine if there's been any damage and then continue operation. It should not be

the design basis earthquake. It makes more sense and more logic to have the SSE perform that function.

DOCTOR MURLEY: This is a relaxation. I think that's clear. That doesn't affect -- we don't think it affects safety at all, because the SSE is going to be whatever it is, and that should be the level that the plant is designed for to protect public health and safety.

The OBE is a level that was set such that as long as it wasn't exceeded a plant could just ride right through it and keep on operating, basically. It wouldn't have to shutdown or anything. As Jim has said, it doesn't make really too much sense to us that we ought to be regulating that sort of thing even, that maybe it makes sense after you've had a certain level of earthquake to go in and take a look rather than set very tight requirements on the operability that the plant can ride through a certain level earthquake.

COMMISSIONER REMICK: From what you're saying, is it -- are you saying that if you design for an OBE that's one-half the SSE, you've more than met the design for the SSE? Is that basically --

MR. RICHARDSON: By a -- it turns out to be a substantial margin in most cases.

DOCTOR MURLEY: If I can make an analogy, just

to set ideas, it's like requiring your car to meet a ten mile per hour front end collision with no damage whatever, just back off and drive away, versus the requirement that your automobile be able to meet a 30 mile an hour collision without a fatality. It would turn out that the no damage requirement is much tougher for the designer and costlier for him to meet.

Okay. The last issue is in-service testing of pumps and valves.

Jim?

MR. RICHARDSON: (Slide) Could I have viewgraph 22, please?

The current regulations endorse Section 11 of the ASME Boiler Pressure Vessel Code and establish testing requirements for ASME Class I, II, and II pumps and valves. A combination of operating experience and research that's been conducted over the past few years have shown us that these testing criteria set forth in the Code really don't do a complete job for -- I think, in my opinion, even a sufficient job in verifying that pumps and valves are capable of carrying out their safety function under design basis conditions.

We are proposing that for ALWRs -- and I might also mention that we have issued two significant generic letters in the past two years that address this issue

for operating reactors in the IST arena and more specifically in operation of motor-operated valves. So the issue is being addressed by operating reactors in response to those generic letters. And we think in principle that the issues set forth in those generic letters are worthy of consideration by the ALWRs.

And they really fall into three basic areas: that we believe that pumps and check valves particulary ought to be tested under full-flow conditions where they are currently sometimes not tested under flow conditions at all in some cases of some check valves. And in the cases of pumps, they in many cases just use a bypass flow and do not test the pump at full-flow.

We also believe that it's important that motor-operated valves that are called upon to close under full differential pressure ought to demonstrate that by being tested under their full differential pressure.

We also believe that in the case of check valves the industry ought to be exploring and developing some advanced non-intrusive techniques for check valve testing. We believe there are ways of looking at the check valve to see if it is intact, its internals are intact. We believe that can be done. We're encouraging the industry to do that.

Finally, one last point is that the frequency of inspection and disassembly of these valves needs to be studied. That should not be an arbitrary period of time, but based on some reliability calculations and tests to determine what is the proper time that you might perform these, one, non-intrusive tests, when you might need to perform full-flow or full differential pressure tests, and when you may in fact have to disassemble the valve to perform maintenance and determine if the valve in fact is intact.

So we're asking the Commission to again go beyond our current regulations and impose these additional requirements that we've asked the industry and the operating reactors to undertake currently.

DOCTOR MURLEY: Clarification, Jim. We're working with the Code Committee, is that right?

MR. RICHARDSON: Yes. We are also working closely with the ASME Code to change the Code to recognize these problems. But the Code is -- has a lot of built-in inertia. It takes a considerable amount of time to get the Code to change its ways.

DOCTOR MURLEY: But I think they're headed in the same direction that we're heading.

MR. RICHARDSON: Yes.

DOCTOR MURLEY: So I don't think we're at real

variance.

COMMISSIONER ROGERS: My question is that they're recognizing some of the problems that come about by not doing full-flow tests, that bypass tests very often damage pumps in doing the test.

MR. RICHARDSON: Yes, exactly.

COMMISSIONER ROGERS: So that that's really a bad idea very often in some situations, so that the full-flow test really is a safer way of doing the test on the equipment.

CHAIRMAN CARR: Is the intent to qualify these valves on a one-time test? But you're talking about, as I understand you, testing them in the pipe in service.

MR. RICHARDSON: We believe that that would be the --

CHAIRMAN CARR: But think of the test rig you've got to build to test something in service at full-flow.

MR. RICHARDSON: We understand that there may be cases where that is impractical and we would certainly consider that in looking for prototype testing and qualification tests, and then some lesser test in-situ. But we believe that in some cases there are some valves and pumps that, in fact, even in a practical

sense can be tested under full-flow conditions.

CHAIRMAN CARR: Yes, but full-flow and open end break are two different things, full-flow in operation, whereas full-flow against no head at all is a completely different test, and I don't know which one you're talking about.

MR. RICHARDSON: I'm talking about full-flow operational.

CHAIRMAN CARR: Well, that's not going to give you the same test as an open end.

MR. RICHARDSON: No, but we would expect that to be demonstrated in test rigs --

CHAIRMAN CARR: One-time check?

MR. RICHARDSON: -- and one-time checks outside the plant.

CHAIRMAN CARR: Well, designing that test system for in-service testing is going to be an engineer's dream.

DOCTOR MURLEY: In some cases, yes.

Do you know what --

COMMISSIONER ROGERS: Well, it's a very active code area right now.

MR. RICHARDSON: Oh, yes. Yes. And the industry is marshalling substantial resources to address this question and are planning to sink some substantial

resources into this area.

DOCTOR MURLEY: Do you know what EPRI's views are on this item?

MR. RICHARDSON: No. They fully understand our position. We have not received from them -- and Charlie will verify -- we've not really received a response from them on this area.

MR. MILLER: The original submittal was really silent on this kind of thing. Our views have been made known to EPRI. That will get back to --

CHAIRMAN CARR: I certainly have no trouble with the idea, but practical implementation of it is going to be a real tough job, in my opinion.

COMMISSIONER REMICK: On this matter, you discuss in-service testing of pumps and valves. What are the staff's expectations of non-intrusive in-service surveillance testing and maybe instrumentation and so forth? A lot of our transients result from people conducting surveillance testing on instrumentation. Has staff considered anything in that area, looking for improved methods, human factors considerations in surveillance testing, and so forth?

MR. THADANI: In terms of impact of surveillance testing, as you know we have reevaluated our requirements on operating reactors and have modified

our requirements, wherein the interval between testing is much greater now than it used to be because of just the concern you raised. We have raised this specific issue with EPRI. I'm not sure we have an answer to this specific issue.

Scott Newberry can expand on that.

MR. NEWBERRY: Scott Newberry, Instrumentations in NRR.

Yes, the issue has been identified as an issue with EPRI and of course is still under review. But clearly our expectation is that the systems, as we understand them to be designed, will have far better capability to perform on-line testing, diagnostic self-testing without -- with virtually no human intrusion. We expect they'll be vastly improved in this area.

CHAIRMAN CARR: Well, we certainly ought to get to the point where we don't have to open up panels and rig jumpers.

MR. NEWBERRY: Right. Yes, sir. Absolutely.

COMMISSIONER REMICK: I hope so.

DOCTOR MURLEY: Mr. Chairman, that concludes the discussion of the 15 items.

One point I would recall from the beginning of our discussion. Many of -- all of our positions, in fact, in this paper were based on our understanding that

the guidance in the severe accident policy statement amounted to a requirement that future plants would be safer than the current generation of plants. If that's not the case, then I guess our understanding coming into this has been wrong. I should say that we would be uncomfortable if that understanding were incorrect, but that's -- you should understand that.

CHAIRMAN CARR: Commissioner Remick?

COMMISSIONER REMICK: Just a quick comment on that. To me, expect is expectation. I want to compliment the staff on the SECY document. I think it was a particularly well-written concise summary of a number of very important policy issues. It was really, I thought, very well done and you should know that. And today's presentation was particularly helpful to me in preparing my vote sheet, enabled me to go ahead on that, so I appreciate that.

I assume we've had no request from EPRI or anybody else to address the Commission or anything on these items? I assume not.

DOCTOR MURLEY: We have not.

COMMISSIONER REMICK: And I also assume that your response to the ACRS comments now is your position, is a clarification of your position?

DOCTOR MURLEY: There are some clarifications.

COMMISSIONER REMICK: The one question I have, as you've indicated, some of these things go beyond our current regulations, so our normal process would be to have some kind of a -- the words miss me. How we go about making regulations? I'm sorry.

COMMISSIONER CURTISS: Rulemaking.

COMMISSIONER REMICK: Rulemaking, thank you. We'd have a normal rulemaking.

Now I understand that this has been considered and we plan to -- would add these additional requirements as part of the rulemaking of the certification process. But I don't fully see the mechanics of how that will be carried out. We'll have some kind of an application which will consist of the rulemaking, but we might be proposing something that goes beyond what's in the application. And maybe I needn't worry about that, but I hope somebody is on staff, OGC, about how do we conduct kind of a dual rulemaking I see, a rulemaking that's taking a particular design and application and then adding requirements perhaps beyond what's in that application.

DOCTOR MURLEY: My impression of how it would work -- and then perhaps Mr. Scinto could add to it -- the application will be the applicant's proposal to

meet what he understands to be our current requirements and our current thoughts, some of which will go beyond our current regulations: for example, if you approve some of these items. The staff will then review it and we'll come to -- through a series of questions and answers and information, we'll come and write a safety evaluation report, essentially a final design approval report.

But then it goes into hearings and other interested parties have the possibility to bring up what they consider even further requirements. And it could emerge from that hearing process that the proposed rule would have requirements beyond what even the staff wants. That would come to the Commission, then, for final decision. And once the Commission makes a decision on that final rule, those are the requirements that that design has to meet for all time, unless it's changed through a rulemaking process.

COMMISSIONER REMICK: So we basically on our SER, then, our position is it might go beyond what the applicant has proposed would be in the SER?

DOCTOR MURLEY: Yes.

CHAIRMAN CARR: Wouldn't it be better to make those rulemaking decisions first?

DOCTOR MURLEY: It would have been, yes.

CHAIRMAN CARR: Well, could we do it in parallel?

MR. TAYLOR: We have talked about doing it. We have talked about that subject of initiating a whole series in --

CHAIRMAN CARR: Avoid it at the hearing.

MR. TAYLOR: Right. And we, because of where we were, decided to proceed in the direction outlined by Doctor Murley, and I'll let Joe Scinto add to what I have to say.

Then, of course, you're going to have a lot of very specific issues with specific types of reactors. So your, quote, "generic rulemaking" may only cover one or two types. So that's how we got to where we are today.

To stop now and proceed, we've had several papers on the subject and talked about it, would be-- literally, we'd have to stop everything and go into--

COMMISSIONER CURTISS: The horse is out of the barn for the evolutionary plants.

Is there any -- obviously, the passive plants are a ways off or at least further off than the evolutionary plants.

MR. TAYLOR: I think we're going to have to gauge this as we work through these years.

CHAIRMAN CARR: But if manpower permitted a parallel approach, it seems that might work.

MR. TAYLOR: That might work, if we could have a --

COMMISSIONER CURTISS: Let me pursue that, and I'm not sure where I come down on this issue so I'm going to be asking questions to try to flesh-out both perspectives.

What is the advantage of doing a -- Tom, as I understood your description, these technical requirements will in fact be codified in a rulemaking. It's the design certification rulemaking.

MR. TAYLOR: Certification rulemaking.

COMMISSIONER CURTISS: Just a point of clarification. We may or may not have a hearing under Part 52. That could be an informal notice and comment rulemaking. Is that correct?

MR. SCINTO: Part 52 provides for an informal hearing. It's not notice and comment.

COMMISSIONER CURTISS: Okay. Would there be a hearing on it in the adjudicatory sense that we've had for reactor licensing?

MR. SCINTO: No. It's the informal hearing process. It provides that the Licensing Board can request the Commission on specific issues to go to the

formal adjudicatory process on specific issues.

COMMISSIONER CURTISS: Okay.

MR. SCINTO: But it's an informal hearing, not notice and comment.

COMMISSIONER CURTISS: All right.

Let me ask, since General Counsel raised it here in the SECY paper, what is the advantage of doing a rulemaking in addition to the design certification rulemaking that the staff has laid out here? You note in the SECY paper that, for example, let me just read it, "If the NRC staff can impose additional requirements for certification, other parties should be able to do so as well." It's not clear to me why that's the case. And more generally, what is the advantage of a generic rulemaking beyond the design certification rulemaking?

MR. SCINTO: OGC has, for a long time, always recommended the rulemaking processes to get rid of these. In connection with the design certification process, the design certification rulemaking process presently has a judgement standard in the rule. Commission put -- that was put in in Part 52 when it was promulgated. The standard is 50.48, which is that the designs must conform to the present regulations.

The staff here today is discussing at least 15 areas in which the staff proposes that it go beyond

the present regulations in some regards, and in a few cases less than the present regulations. So the staff proposal going into the design certification rulemaking is not to conform to 50.48. It's to satisfy 50.48 and then some. Those points will be litigable in the design certification rulemaking process, litigable in this informal process, but those will be challengeable.

And the standard is -- if the staff can go in proposing standards beyond those presently required in the regulations, we don't see how the other parties are precluded from proposing requirements beyond the current regulations.

In order to preclude that, to preclude raising -- turning the design certification rulemaking process itself into a full-fledged rulemaking process on all of the additional things that one might add, you -- it would be possible -- we think it would be possible to develop a rulemaking process that goes on either simultaneously, slightly in advance, that couldn't occur until, of course, the staff had decided what the elements of such a rule -- what it thinks such a rule ought to be.

Now, in 89-311, that was discussed and it was a discussion at that point that the staff felt that it could not develop generic standards for all of the rules

in a timely fashion, that that would take a fairly extended period of time if we attempted to do that first.

There are some -- we've now got 15 points that the staff has at least identified and perhaps, for example, some limited rulemaking to go ahead with some portion of those. Those are the processes that we've now got ongoing discussions with NRR as to what would be desireable steps.

DOCTOR MURLEY: Can I point out -- just to add, Commissioner, to that point, I think our information, for example, on the passive plants has convinced me even stronger that we probably could not write a rule right now for severe accidents that would encompass both the evolutionary and the passive plants because the passive plants have such different approaches to accidents that I think it would be virtually impossible to write a comprehensive rule.

COMMISSIONER CURTISS: Could you write a rule just for the passive plants?

DOCTOR MURLEY: I don't think we could today, no. I don't think we know enough about how -- the approaches. For evolutionary plants, perhaps.

COMMISSIONER CURTISS: Let me --

CHAIRMAN CARR: When you get the essentially

complete design, you obviously can.

COMMISSIONER CURTISS: Let me just ask a hypothetical question here. If the plants, the evolutionary plants that will be certified came in and in all respects complied with 50.48, that is to say the existing regulations --

DOCTOR MURLEY: Right.

COMMISSIONER CURTISS: -- would that lead to the result that in the hearing no issues could be raised because you cannot challenge the regulations at a hearing?

MR. SCINTO: If we go into the hearing process with that, the issues can be raised. In our hearing process, you may challenge regulations. We have a procedure for challenging regulations and this is, in fact, a rulemaking type proceeding. So it's the kind of proceeding where you encourage -- we'll assist you in developing a rule. So, you can raise issues beyond the rule.

But in the statement of considerations, when they put out Part 52, when the provision that provided for specific standards was put in, the specific standards being compliance with the existing regulations, the Commission noted that there may be a need for additional standards and that those -- that

was the genesis of the recommendation that the staff should advise the Commission as to the practicability of going ahead with some additional rulemakings now. That was 89-311. The staff felt it was not ready to go ahead with rulemaking "now" when -- and OGC does not recommend we go ahead with rulemaking when we're not ready to do so. But when we are ready, when the staff feels that they have identified issues that are generic that they believe should be imposed generically and settle an issue generically, we recommend going ahead with rulemaking.

COMMISSIONER CURTISS: What you're suggesting is an approach that sounds kind of akin to plant life extension where the technical requirements are being developed and they'll be tested out in the first couple of pilot cases and then at some point, as soon as we can, we're going to codify those in a rule. Is it along the same lines? First question.

Second, if it is, is that something that the technical side thinks is feasible here?

MR. SCINTO: Yes. Plant life extension rule, the last I saw it, doesn't quite sound like that. That may be an element to what the plant life extension rule right now identifies the nature of the review process that the licensees are to carry out to identify aging

issues on the basis of the current licensing basis. I'm not quite sure it identifies the additional technical standards that will be developed and added on in the future.

COMMISSIONER CURTISS: Okay.

MR. SCINTO: And that is in the same sense what we have here when Part 52 was promulgated, a recognition -- in Part 52 particularly there was a recognition that there may very well be additional technical standards that need to be imposed and that those should be done when they're practical to do so.

DOCTOR MURLEY: The license renewal rule was a process rule much like Part 52.

COMMISSIONER CURTISS: Okay.

DOCTOR MURLEY: This would be much like -- I mean a rule here would be really just extending the general design criteria for severe accidents.

COMMISSIONER CURTISS: One final question from the Research perspective. Do NRR and Research share the same views about rulemaking on particularly the passive plants at this stage?

DOCTOR MURLEY: I don't know.

Themis, do you want to speak to that?

DOCTOR SPEIS: Definitely because we know very little about passive plants right now and what we have heard keeps

changing to fast. So --

COMMISSIONER CURTISS: Okay.

DOCTOR SPEIS: But once we know more about it, it might be -- we'll see if it makes sense to make an example of issues that could be handled --

DOCTOR MURLEY: By the rulemaking.

COMMISSIONER CURTISS: That's all I have.

CHAIRMAN CARR: Commissioner Remick, your time.

COMMISSIONER REMICK: I can't resist making the point that if we're thinking about rulemaking in passive plants, it reinforces my view that the staff has to be involved up early with these designs so we know what the issues are early, that we can consider rulemaking.

MR. TAYLOR: I was just saying the same thing.

COMMISSIONER REMICK: Okay. Fine. That's all.

CHAIRMAN CARR: Commissioner Roberts?

Commissioner Rogers?

COMMISSIONER ROGERS: Well, I just want to say I think this was a very excellent presentation. I got a great deal out of it and I think that it was very clear and very helpful certainly to me and I'm sure to others. I certainly want to congratulate all the staff

for a very fine job today. I think it was excellent.

The ARCS letter in response to one of the SECYs, 90-016 I guess it was, had some additional comments from some of the other members of the ACRS that I just wanted to touch on very briefly. I know we've been here a long time and probably you're getting a little jaded. But one was some criticism that none of us are looking sufficiently at what we've learned from past experience of the last ten years ago and incorporating that into these requirements for new designs. It seems to me that you are doing that to some extent. We're hearing about it here.

I wonder if there couldn't be some clarification sought from ACRS on exactly what they think is required more in this regard because it does appear to me that you are using past experience and relaxing some requirements. Maybe they think you haven't gone far enough. I don't know. But their criticism did not seem to fit what I heard here today and I felt that I wanted to say something on that.

The other matter is the question --

CHAIRMAN CARR: I guess it's fair to say staff didn't respond to those additional comments.

DOCTOR MURLEY: We did not.

COMMISSIONER ROGERS: No.

DOCTOR MURLEY: No, we normally don't respond.

COMMISSIONER ROGERS: But it's an issue that I think is a general issue that's worth considering.

The other one is the so-called criticism of lack of coherence in our processes, wrapping together the requirements for new reactors, design requirements, and the safety goals and an attack on the lack of coherence in Commission processes and positions.

I'd like to just saw a few words about the use of that term "coherent," because I think that it is a very unfortunate term. As a physicist and probably in the minds of those who wrote the criticism using that term "coherence," it has a relatively neutral connotation. It means in phase, working together in some sense, some degree of consistency outside the scientific domain. But if you look in your dictionary, you'll see that the very first meaning of the word "coherent" is capable of intelligent speech. Therefore, if we're not operating in a coherent fashion, we're unintelligible.

I think that's what the average man on the street is apt to interpret a criticism of lack of coherence in our processes and I think it doesn't fit at all. I do think we -- I think the notion that we should be trying to achieve a degree of consistency in

what we're doing, in our total view of regulatory practice, but I don't think what we've done is incoherent. I think it's very understandable, very intelligible, but it may not always be entirely consistent.

I think that's probably what the ACRS commentors had in mind was the physicist's point of view that our activities should be in phase and fit together neatly and I certainly think that's a very laudable goal and one that we should strive for. But I don't think the word "incoherent" in the first meaning of the dictionary fits our processes and I wanted to get that on record.

Thank you.

CHAIRMAN CARR: Commissioner Curtiss?

COMMISSIONER CURTISS: I don't have any questions. I'd just like to thank all the staff that I know put a lot of time and effort. I thought this was an excellent meeting. I'm glad we set aside the separate time to do it and the effort that went it. I know across the board on all of these issues in response to an earlier Commission request to have exactly this kind of discussion I think has been most helpful for me and I commend all of you for that.

CHAIRMAN CARR: Well, I'd also like to thank

the staff for this presentation. I'd also like to thank the Advisory Committee on Reactor Safeguards, in absentia, for their diligent efforts to provide their views to the Commission before this Commission meeting. They spent a lot of time to get ready for us in a hurry.

Currently, the Commission has several papers before it dealing with various aspects of advanced light water reactor reviews. Since the advanced reactor review schedules depend on Commission guidance in many of these areas, I would urge those of my fellow Commissioners who have not already done so to vote on these papers.

In reviewing the issues in SECY-90-016, which you've described today, it seems to me that staff is advising the Commission of generic criteria for judging the safety of these designs which go beyond existing standards. Consistent with the statement of considerations in Part 52, the Commission must decide whether additional rulemaking beyond the design certification process is needed to resolve these generic questions.

Accordingly, I request the staff once Commission guidance is received on these certification issues to provide the Commission with a paper detailing the advantages and disadvantage of proceeding with

generic rulemaking, including resource impacts, in parallel with reviewing the specific designs.

Do any of my fellow Commissioners have any additional comments?

COMMISSIONER CURTISS: No. I think that's a good suggestion. I'm glad you proposed that.

CHAIRMAN CARR: And no comments? We stand adjourned.

(Whereupon, at 12:25 p.m., the above-entitled matter was adjourned.)

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING ON EVOLUTIONARY LIGHT WATER REACTOR CERTIFICATION ISSUES AND RELATED REGULATORY REQUIREMENTS

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: MAY 3, 1990

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Carol Lynch

Reporter's name: Peter Lynch

ALWR TECHNICAL ISSUES

NRR BRIEFING TO COMMISSION
MAY 3, 1990

ASHOK THADANI
JAMES RICHARDSON

STAFF APPROACH TO ALWR SAFETY

EXPECTATION OF IMPROVED SAFETY

PROPOSAL BY VENDORS AND EPRI

- MEAN CORE DAMAGE FREQUENCY TARGET
  $< 10^{-5}$ EVENT/REACTOR YEAR, AND
- DOSE AT 0.5 MILE BOUNDARY < 25 REM
  FOR EVENTS WHOSE CUMULATIVE
  FREQUENCY $> 10^{-6}$/REACTOR YEAR

MAINTAIN DEFENSE-IN-DEPTH

DEFENSE -IN-DEPTH APPROACH

RECOGNIZE UNCERTAINTIES IN PRAS

- LEVEL OF INFORMATION
- MAJOR PARTS NOT MODELED
- DIFFICULTIES IN MODELS FOR COMMON CAUSE FAILURES AND HUMAN ACTIONS

FOCUS ON CONTAINMENT

- ESTABLISH A PERFORMANCE GOAL

BACKGROUND INFORMATION

REVIEW

- OPERATING EXPERIENCE
- PRA INSIGHTS
- NRC SEVERE ACCIDENT STUDIES

IDENTIFY SIGNIFICANT ISSUES AND, IF PRACTICABLE, ELIMINATE THROUGH DESIGN FEATURES

ATWS

SHOULD PROVIDE DIVERSE SCRAM SYSTEM LOGIC (PWR) UNLESS CONSEQUENCES ACCEPTABLE

MANUALLY ACTUATED STANDBY LIQUID CONTROL SYSTEM FOR ABWR REPRESENTS DEVIATION FROM 10 CFR 50.62 (ATWS RULE)

VG-4

MID-LOOP OPERATION (PWR)

SHOULD INCLUDE DESIGN FEATURES TO REDUCE LIKELIHOOD AND VULNERABILITY TO LOSS OF SHUTDOWN COOLING WHEN IN MID-LOOP OPERATION.

EXAMPLES ARE AIR INGESTION BREAKERS AND ELIMINATION OF HIGH POINTS IN DHR SUCTION PIPING

STATION BLACKOUT

SHOULD INCLUDE AN ALTERNATE AC SOURCE OF DIVERSE DESIGN FOR EVOLUTIONARY ALWRS (REQUIREMENT VS OPTION IN 10 CFR 50.63).

AAC SOURCE SHOULD BE CAPABLE OF POWERING AT LEAST ONE COMPLETE SET OF NORMAL SHUTDOWN LOADS.

STATION BLACKOUT (CON'T)

DIVERSITY REQUIREMENT WOULD NOT PRECLUDE USE OF DIESEL GENERATORS AS AN AAC SOURCE

FIRE PROTECTION

SHOULD INCLUDE ENHANCEMENTS TO FIRE PROTECTION ACCEPTANCE CRITERIA INCLUDING:

- ABILITY TO ACHIEVE SAFE SHUTDOWN ASSUMING TOTAL LOSS OF ALL EQUIPMENT IN ANY FIRE AREA, WITHOUT RE-ENTRY OR REPAIR
- ALTERNATE SHUTDOWN CAPABILITY FOR CONTROL ROOM FIRE.

FIRE PROTECTION (CONT'D)

- FOR FIRES IN CONTAINMENT, REDUNDANT SHUTDOWN TRAINS MUST ENSURE, TO EXTENT PRACTICABLE, ONE SHUTDOWN DIVISION WILL BE FREE OF FIRE.

- SPREAD OF SMOKE, GASES OR FIRE SUPPRESSANT WILL NOT ADVERSELY AFFECT SAFE SHUTDOWN CAPABILITY.

INTERSYSTEM LOCA

TO EXTENT PRACTICABLE, LOW-PRESSURE SYSTEMS EXTERNAL TO CONTAINMENT SHOULD BE CAPABLE OF WITHSTANDING FULL RCS PRESSURE.

VG-10

INTERSYSTEM LOCA (CONT'D)

SYSTEMS NOT DESIGNED TO WITHSTAND FULL PRESSURE SHOULD HAVE:

- LEAK TESTING CAPABILITY FOR VALVES ACTING AS PRESSURE ISOLATION BARRIER
- VALVE POSITION INDICATION IN CONTROL ROOM
- HIGH PRESSURE ALARMS FOR INTERFACING SYSTEMS

HYDROGEN GENERATION AND CONTROL

SHOULD ACCOMODATE HYDROGEN EQUIVALENT TO 100% METAL-WATER REACTION OF ACTIVE FUEL CLADDING (10 CFR 50.34(F)).

SHOULD LIMIT CONTAINMENT HYDROGEN CONCENTRATION TO $\leq$ 10% (10 CFR 50.34(F)).

ALTERNATE HYDROGEN CONTROL REQUIRED, (I.E., INERTED CONTAINMENT OR IGNITORS) IF CONCENTRATION CRITERIA NOT MET.

CORE-CONCRETE INTERACTION/ ABILITY TO COOL CORE DEBRIS

SHOULD PROVIDE SUFFICIENT REACTOR CAVITY FLOOR SPACE FOR DEBRIS SPREADING TO ENHANCE COOLABILITY.

SHOULD PROVIDE FOR QUENCHING DEBRIS IN REACTOR CAVITY.

HIGH PRESSURE CORE MELT EJECTION

SHOULD INCLUDE:

- DEPRESSURIZATION SYSTEM

- CAVITY DESIGN FEATURES TO REDUCE DISPERSAL EFFECTS OF EJECTED CORE DEBRIS.

CONTAINMENT PERFORMANCE

SHOULD PROPOSE A CONDITIONAL CONTAINMENT FAILURE PROBABILITY THAT DOES NOT EXCEED 10% FOR THE DOMINANT CORE DAMAGE SEQUENCES, OR A DETERMINISTIC CONTAINMENT PERFORMANCE OBJECTIVE(S) THAT OFFERS COMPARABLE PROTECTION.

ABWR CONTAINMENT "VENT" DESIGN

ABWR DESIGN SHOULD INCLUDE CONTAINMENT OVERPRESSURE PROTECTION SYSTEM.

VG-16

EQUIPMENT SURVIVABILITY

FEATURES PROVIDED FOR SEVERE-ACCIDENT PROTECTION SHOULD BE CAPABLE OF PERFORMING THEIR INTENDED FUNCTION UNDER THE ENVIRONMENTAL CONDITIONS THEY WILL BE EXPOSED TO DURING A SEVERE ACCIDENT.

EQUIPMENT SURVIVABILITY (CONT'D)

SUCH EQUIPMENT NEED NOT MEET REQUIREMENTS OF 10 CFR 50.49, AND APPENDICES A AND B OF 10 CFR PART 50 IF NOT OTHERWISE SAFETY-RELATED.

SOURCE TERM

STAFF CONSIDERING DECOUPLING SITING FROM PLANT DESIGN FOR FUTURE REACTORS, REQUIRING REVISIONS TO 10 CFR PART 100.

STAFF WILL, TO EXTENT PRACTICABLE AND JUSTIFIABLE, USE NEW SOURCE TERM INFORMATION IN ITS DESIGN-RELATED DECISIONS.

SOURCE TERM (CONT'D)

IN INTERIM:

- EVOLUTIONARY DESIGNS SHOULD MEET REQUIREMENTS OF 10 CFR PART 100

- DEVIATIONS MUST HAVE TECHNICAL BASES WHICH JUSTIFIES TREATMENT DIFFERENT FROM CURRENT PRACTICES

OPERATING BASES EARTHQUAKE/ SAFE SHUTDOWN EARTHQUAKE (OBE/SSE)

OBE SHOULD NOT LOGICALLY CONTROL THE DESIGN OF SAFETY SYSTEMS, STRUCTURES, AND COMPONENTS.

REQUESTS TO DECOUPLE THE OBE FROM THE SSE WILL BE CONSIDERED ON A DESIGN-SPECIFIC BASIS, AS HAS BEEN DONE ON SOME EXISTING PLANTS.

INSERVICE TESTING OF PUMPS AND VALVES

SHOULD APPLY FOLLOWING TO ALL SAFETY-RELATED PUMPS AND VALVES:

- FULL FLOW TEST OF PUMPS AND CHECK VALVES

- TEST MOVS UNDER DESIGN-BASIS DIFFERENTIAL PRESSURE

INSERVICE TESTING OF PUMPS AND VALVES (CONT'D)

- USE ADVANCED NON-INTRUSIVE TECHNIQUES FOR CHECK VALVE TESTING

- DETERMINE FREQUENCY NECESSARY FOR DISASSEMBLY AND INSPECTION OF VALVES.