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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

511th FULL COMMITTEE MEETING

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THURSDAY,

APRIL 15, 2004

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ROCKVILLE, MARYLAND

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The full committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Mario V. Bonaca, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

MARIO V. BONACA, Chairman

GRAHAM B. WALLIS, Vice Chairman

STEPHEN L. ROSEN, Member-at-Large

GEORGE E. APOSTOLAKIS, Member

F. PETER FORD, Member

THOMAS S. KRESS, Member

DANA A. POWERS, MEMBER

COMMITTEE MEMBERS PRESENT: (cont'd)

VICTOR H. RANSOM, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER, Member

NRC STAFF PRESENT:

LEE ABRAMSON

BENNETT BRODY

ARTHUR BUSLIK

DONALD E. CARLSON

STEPHEN DINSMORE

FAROUK ELTAWILA

HOSSEIN HAMZAHEE

DONNIE HARRISON

GLENN KELLY

MARK KOWAL

RALPH LANDRY

JAMES LAZEVNICK

DAVID LEW

STU MAGRUDER

EILEEN McKENNA

YURI ORECHWA

GARETH PARRY

MARK RUBIN

STUART RUBIN

NRC STAFF PRESENT: (cont'd)

ROB TREGONING

MIKE TSCHILTZ

I-N-D-E-X

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

(8:30 a.m.)

CHAIRMAN BONACA: Good morning. The meeting will now come to order. This is the first day of the 511th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting the committee will consider the following: action plan for implementation of the phased approach to PRA quality; SECY-04-0037, issues related to proposed rulemaking to risk-inform requirements related to large break LOCA size and plans for rulemaking on LOCA with coincident loss of off-site power; options and recommendations for functional performance requirements and criteria for the containments of non-lightwater reactors; criteria for evaluating the effectiveness of quality of the NRC research programs; and preparation of ACRS reports.

Dr. El-Zeftaway is the Designated Federal Official for the initial portion of the meeting.

We have received no written comments from members of the public regarding today's session. We have received a request from NEI for time to make oral statements regarding SECY-04-0037.

A transcript of portions of the meeting is being kept, and it is requested that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

I will begin with some items of current interest. In front of you you have, in fact, a package of items of interest, and you see there there is -- it includes a Staff Requirements Memorandum, speeches by the Chairman and Commissioners, and congressional correspondence and testimony.

With that, if there are no comments or issues on the part of members, I will proceed with the meeting.

The first item on our agenda is action plan for implementing the phased approach for improving PRA quality. And Dr. Apostolakis will lead us with that.

MEMBER APOSTOLAKIS: Thank you, Mr. Chairman.

In a Staff Requirements Memorandum dated December 18, 2003, the Commission approved the implementation of a phased approach to achieving an appropriate quality for PRAs for NRC's risk-informed regulatory decisionmaking. The SRM requested an action plan that would define a practical strategy for the implementation of the phased approach to PRA quality.

The Reliability and Probabilistic Risk Assessment Subcommittee met with the staff on March 25th to discuss this plan.

The SRM distinguishes between a baseline PRA and the risk-informed decisionmaking elements. The baseline PRA characterizes the actual risk of the facility, in terms of core damage frequency and large early release frequency. These are the words of the SRM.

The baseline PRA cannot assess plant changes. Therefore, it's not usually utilized by itself in regulatory decisionmaking. The risk-informed decisionmaking elements help in assessing changes and are more difficult to define.

Now, there is a sentence in the SRM that I find intriguing. The risk-informed decisionmaking elements "are by definition issue-dependent and they don't play a role in judging the quality of the baseline PRA."

So one of the things I'd like us to discuss today is how this distinction between baseline PRA and risk-informed elements, decisionmaking elements, is made in the plant, and to clarify what we mean by PRA quality.

Are we referring to the baseline PRA? Are we referring to the risk-informed decisionmaking elements, but the Commission says they don't play a role in judging the quality of the baseline PRA? This is something that was not discussed last time.

MEMBER POWERS: Professor Apostolakis?

MEMBER APOSTOLAKIS: Yes.

MEMBER POWERS: I continue to get confused when people present PRA information, because it seems to me that what is missing, they present a -- only a subset of what has been asked. I mean, people ask what the -- what is the risk to this plant as a baseline? And they -- they give you a number. And you ask them, is this a mean? And they say yes, but it turns out to be only a point estimate.

And you ask them, well, does this include the risk of -- due to fire? And they say no. But we're told that fire is a big risk. I mean, it's very confusing to me.

MEMBER APOSTOLAKIS: It is. It is. And I think the idea of these phases is to maybe get out of it progressively. But, yes, I agree with you. I agree with you.

So we have this issue that at some point today we should discuss -- the distinction between baseline and the extra work you have to do for making decisions.

Now, the phases -- there are four phases. Phase 1 is the application-specific phase, which is really what we are familiar with. It's based on Regulatory Guide 1.174.

Then, Phase 2 is called issue-specific -- the issue-specific phase. And now all modes and initiating events that would change the decision substantially -- this is a word from the SRM -- substantially -- should be included with uncertainty analysis.

Now, I'm also confused. It's not clear to me what the distinction is between Phase 1 and Phase 2. I'm sure there is one. This appears to be one of the distinctions -- that all modes and initiating events that could change the decision substantially should be included with uncertainty analysis.

MEMBER KRESS: How does one know which modes would influence the decision?

MEMBER APOSTOLAKIS: That -- yes, that's a good question. That's another question. How can you know a priori? Yes.

But the term "substantially" is something we have to focus on, and I'll come to it a little later.

So Regulatory Guide 1.174 in Phase 2 is to be supplemented by a PRA standard for the particular issue, plus a PRA review process.

And then there is an example of 50.69 which says that full implementation would require a broad spectrum of systems and quantification, which in my mind means Phase 3.

But then it says for a system-by-system implementation a Phase 3 PRA is not required, in the sense that you don't need to have all of the initiating events and modes.

Now, this system-by-system implementation of 50.69 is something that I don't recall. Maybe I missed something, but that's another thing that I would like to have an answer to.

And another interesting statement in the SRM within Phase 2 is that the staff should give low priority, or even return non-conforming applications. Phase 3 is a no-applications phase, and the words "all currently envisioned issues" are in the SRM.

It is envisioned that a single baseline PRA -- now we are not talking about the distinction between baseline and issue-specific decisionmaking elements, and I don't know whether that's intentional or not. But there is a clear statement that the single baseline PRA should be fully capable to support these uses.

So my question, again, to be discussed today is: what happened to the issue-specific decision-making elements? Are they part now of the baseline PRA in Phase 3? Are they separate? And if they are issue-specific, and we are talking about all currently-envisioned issues, surely we know what they are, because we know what the issues are. So they should be part of the baseline PRA perhaps.

Examples are given that are a little confusing, at least to me. 50.46 is mentioned all over the place, and I just don't see how you can do 50.46 in Phase 2, or in Phase 1 is out of the question.

Okay. Now, the important thing is that Phase 3 -- Phase 2 should be implemented in the near term and Phase 3 by December 31, 2008. Phase 4 is a fully-quantified PRA, which is supposed to be state of the art. We will need consensus standards for low power and shutdown, for external events, and so on, which again raises the question, why wouldn't you need those in Phase 3?

The Commission says that we shouldn't really spend much time on Phase 4 right now. We should wait until Phase 3 is in place and is proven.

The SRM also wants the staff to discuss the resolution of technical issues, and they mention three -- model uncertainty, external events -- earthquakes and others as relevant -- and human performance.

Now, the staff uses, the way I understand it from the subcommittee meeting, the availability of standards to determine the phases and the priorities. So this is a critical issue. It's the availability of standards that will guide the staff what kind of priority they should give to a particular application.

And an example that is given is that in 50.69, where we put SSCs into various categories, if you have a PRA for the power -- at power mode, the standard exists, we have the Regulatory Guide 1.200, and we rely on real -- on peer review, and that will be given high priority.

And here comes now something that bothered the subcommittee. If the licensee at the same time submits a fire risk assessment for which there is no standard right now, that will have low priority, just because there is no standard, even though the licensee may have used state-of-the-art methods. And that bothered some members of the subcommittee.

Now, coming to the views of the subcommittee members, most did not feel that the technical issues had been addressed adequately -- model uncertainty, earthquakes, and other external events -- and human performance. We felt that these are important to all phases, and they should be given high priority.

The reliance on the availability of standards to determine the phases and the staff's prioritization of reviews created several concerns. Some members felt that the schedule for completion of Phase 3, which is, I remind you, December 31st of 2008, is hostage to the willingness of technical societies and the industry to cooperate in the development of these standards.

There was a letter sent to Dr. Travers by the ASME and the ANS where they state, "The schedule defined in the SRM seems rather ambitious." They point out that low power and shutdown standard will be released some time in 2005. The fire standard will not be balloted until at least in 2005. And there are no schedules right now for developing standards for

Level 2 and Level 3 PRAs.

The societies -- ANS and ASME -- propose to the staff that a committee be formed that will identify the need for additional standards and what these standards should be. And that, of course, will take time.

Another question that the subcommittee members raised was -- and it's related to my earlier comment regarding the willingness of societies and industry to cooperate in the development of the standards. What happens if you don't have such cooperation, and you don't have the standards produced as expected? What would the NRC staff do?

And then again, the issue of giving low priority to reviewing and analysis, because there is no standard. That is something that the subcommittee members did not like. And NEI sent a letter to the NRC on the 8th of April, and they expressed the same concern.

Now, some personal comments. What is missing from all of this discussion -- and I'm not trying to be negative here -- I'm going to stimulate discussion. What is missing is an assessment of what the impact of the various phases would be on the glorified integrated decisionmaking process, which is, of course, in Regulatory Guide 1.174 and everybody likes, including us.

On page 7 of the action plan, at least the version that I had, the plan says that all modes and initiating events that could change the regulatory decision substantially should be included. And it sends us to Section 3.1.4, where the word "substantially" presumably is explained. But, unfortunately, it's not explained clearly enough for me to understand it.

What benefits, besides prompt NRC reviews, would the licensee have if the licensee -- if we all moved to Phase 3? Would the decisionmaking process be more risk-based? To what extent would it be risk-based?

NEI says, of course -- and we agree -- that it will never be purely risk-based. And, again, the distinction between the baseline PRA and risk-informed decisionmaking elements is not clear to me, and I didn't see that distinction made in the action plan.

So what are we dealing with? Are we dealing with a baseline PRA, all of the PRA, or what?

Now, in Section 3.1.2, the draft action plan states that an objective is "for each application type to identify the role that PRA results make in the decision." And I was wondering whether it was a good idea to bury this objective in this section or give it much more prominence, because that's really a major issue that we are really dealing with here.

Okay. So the action plan is due to the Commission this coming July, and at the subcommittee -- and we are expected to discuss our views regarding the action plan when we meet with the Commission next month.

At the end of the subcommittee meeting, we discussed whether we should write a letter or not, and at that time the members felt -- present felt that maybe we didn't have enough to write a letter, and that we would create at this meeting three or four bullets that would be used when we met with the Commission.

I at least have changed my mind. I think we should write a letter at this meeting, after, of course, we hear what the staff has to say and we discuss among ourselves what the letter should say. That's a cleaner solution in my mind; we have enough to say. And then the presentation to the Commission will come naturally from the letter.

So with that, I will turn it over to the staff to tell us what they've done and where we're going.

Gareth?

MR. PARRY: Good morning. I'm Gareth Parry from NRR. With me at the table is Donnie Harrison from NRR, Mary Drouin from Research, and Stu Magruder from NRR. And at the side table we have Mike Tschiltz from NRR and Dave Lew from Research.

Okay. So what I will do is I will try and answer some of the questions that George has posed while going through this presentation. We have a lot of viewgraphs. I think we'll probably need to move through some of them fairly quickly. But, clearly, we need to go through what our description of the phases is, which I think is -- perhaps needs a little bit of clarification, and then we'll talk about the implementation issues.

I should also say that the draft plan that you have, which was issued a few weeks ago, is in a state of flux. We are changing it. We have -- in particular, we have changed the flow diagram that talks about our process for review when these phases are implemented. And I'll go through that when we get to that point.

There's no need for me to introduce the

idea of why we're here. As George said, we're here to give you a draft of the response to the SECY.

I will, though, go through our definition of PRA quality, because I think it may be worth keeping that in mind. The way we've defined PRA quality in the context of this draft plan is the same as it is in Reg. Guide 1.200, and also in Reg. Guide 1.174.

So we defined quality in the context of using a PRA, and it's defined by the appropriateness of -- there are different elements to it. One is the scope. What does the PRA cover? Does it cover internal and external initiating events? Does it cover the full power and low power and shutdown operating modes, for example?

There's another element that relates to level of detail, and the third element is technical acceptability, which is really what the standards are addressing.

VICE CHAIRMAN WALLIS: Doesn't it really mean that it's sufficient? If you added something, it wouldn't change your decision. You've got enough of a PRA that adding something -- there's nothing left out which would change your decision if you put it in. Isn't that your real definition of "quality"?

MR. PARRY: Well, I think you could change your decision in some ways, particularly if you think about applications like 50.69, which is associated with categorizing equipment according to safety significance. I think the more detailed and the more complete PRA the more you can recategorize components.

So, in that sense, that's a change of a decision. But I think in terms of whether you're allowing an extension to an AOT or not, you're right, because you want to take the PRA down to the level that you wouldn't want to change that application.

MEMBER APOSTOLAKIS: So, Gareth, the first question was, what do we do about this distinction between baseline and risk-informed elements? When you said in the previous slide --

MR. PARRY: Right.

MEMBER APOSTOLAKIS: -- PRA quality is this, are you referring to the totality of PRA analysis and arguments that will be used in making the decision, including the issue-specific elements?

MR. PARRY: I think what that refers to is -- I think we are dealing with the base PRA, the PRA, the decision of the risk from the plant. I think what the SRM is trying to say there is that -- they're trying to avoid the issue of, how do you change the model to address specific applications? Which may not be in the baseline PRA.

For example, how do you change the basic event probabilities to reflect the fact that you've changed your graded QA or your QA process? I think all it's doing is making the distinction between understanding the base risk picture of the plant versus changing that picture for a specific application, which is dealt with in other regulatory guides.

MEMBER APOSTOLAKIS: It is?

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: There is a guide that tells us how to change the probabilities of --

MR. PARRY: Well, actually, no, it doesn't. It doesn't do that. But it tells you you have to -- you have to have a reason for -- I mean, you have to have a rationale for why you're doing it. And, you know, there are some things which clearly we don't have a standard approach to yet.

MEMBER APOSTOLAKIS: Yes.

MR. PARRY: And those I think become part of the argument as to how you are changing the model, and why you are -- you think that change is adequate. And I think that's what the SRM is trying to do. It is trying to --

MEMBER APOSTOLAKIS: But you are not sure. I mean, that's reasonable -- what you're saying. I mean --

MR. PARRY: Well, that's certainly the premise that we've adopted in developing this plan is that the -- the guidance on how to change the PRA model to reflect the change that an application is requesting is -- is to be included in the regulatory guide that's associated with that application. And that's the way we've written the plan.

MEMBER APOSTOLAKIS: Well, the plan -- the version that I have is silent on it.

MR. PARRY: Well --

MEMBER APOSTOLAKIS: You should mention that.

MR. PARRY: I think it is in that.

MEMBER APOSTOLAKIS: It is?

MR. PARRY: Yes, I believe it is. We --

MEMBER APOSTOLAKIS: I didn't see it.

MR. PARRY: -- don't highlight it. I mean, we just say that -- specifically, we say that we have different elements of guidance, which is the guidance related to the quality of the base PRA and the guidance related to the applications. We'll make that clearer -- that that's where --

MEMBER APOSTOLAKIS: Yes, because --

MR. PARRY: -- the distinction is addressed.

MEMBER APOSTOLAKIS: So you are addressing the baseline.

MR. PARRY: Using the baseline in this, yes.

MS. DROUIN: Now, I've just made a note, George, that I think we need to go back at the beginning of the plan under the scope and make that clear.

MEMBER APOSTOLAKIS: Yes. I think that would be an excellent idea, because, you know, the other question that came to my mind is, when we -- the way -- maybe the SRM should have given an example, because the example you gave was very good -- how do you change the probabilities, you know, when --

MR. PARRY: Okay.

MEMBER APOSTOLAKIS: -- time available is from 42 to 39 minutes. I mean, it -- because what confused me is that later we say that in Phase 2 or 3 -- you know, 3, all -- we use the words "all currently envisioned applications."

MR. PARRY: Right.

MEMBER APOSTOLAKIS: I said, "Well, if you envision them, why don't you know what you need to do," and include that in the PRA.

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: I mean, in the quality discussion.

MR. PARRY: I think in a sense what that means is that any element of the PRA that you need to use to support the modification of the PRA that you will make for an application is included in the guidance. That's what really it means, which in fact probably means pretty much everything, once we've covered all our applications.

MEMBER APOSTOLAKIS: Right. Right. Because when you --

MR. PARRY: That's what the intention was.

MEMBER APOSTOLAKIS: For example --

MR. PARRY: That's not clear enough, okay.

MEMBER APOSTOLAKIS: -- in the technical issue that refers to human performance --

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: -- and you combine that with the model uncertainty issue, and so on, there should be sufficient quality there to allow you to make the changes that you mentioned earlier.

MR. PARRY: Right.

MEMBER APOSTOLAKIS: Although there are no standard rules how to do that.

MR. PARRY: Right, I agree. Yes. That I think is our vision of the case.

MEMBER APOSTOLAKIS: Okay. No, that makes sense to me.

MR. PARRY: Okay. And as George mentioned, the approach in the SRM is that we -- we should adopt a phased approach to achieving the appropriate quality for licensee PRAs.

And the nice thing about this SRM I think is it allows us -- in contrast to perhaps the message that was being given in the March SRM of last year, which called for an all modes, all -- all initiating events PRA that had been reviewed and approved by the staff, before we did any applications, we suggested that -- I think this allows us to move forward with the tools we have currently while progressing towards that aim.

Okay. I'll skip over that one.

Let me tell you the status of our plan so far. We have a small working group, all of which is actually here at the table and the side table. And we made this draft plan available on 3/15, specifically so that we could talk to you about it and we could talk also to our public stakeholders.

So we've had two public meetings, and we've had one meeting with the subcommittee. We're planning a third meeting. It's probably going to be on the 13th of May, not the 12th. And we have had, as George mentioned, a letter from the NEI and also a letter from joint ASME and ANS regarding future standards activities.

As George mentioned, the phases in the SRM we believe are differentiated by the availability of the guidance documents. And then, as I just explained, both for using the PRA in regulatory applications and for establishing that the PRAs are of sufficient quality.

So that the total suite of guidance documents includes industry consensus standards, industry guidance documents, and regulatory guides which may specific -- such like Reg. Guide 1.177, for example, which specifies a particular approach for doing one of the applications.

Our regulatory guides may, in fact, just endorse industry guidance documents, which is -- seems to be the way we are going with 50.69, for example. We will also need guidance documents that are internal to the staff on how to perform our reviews and how to allocate priorities to the various reviews, which is a subject we'll come back to shortly.

Okay. I'll go through the definition of the phases, because I think from what George said -- I don't think it's quite the way he said it. At least that's not our interpretation.

Phase 1 really in a sense represents the status quo, at least it's starting out as the status quo. And I think you'll see when I talk a little bit later that actually Phase 1 is in itself a transition phase to reach Phase 2.

And currently the way PRA quality is judged, it's really judged only in the context of -- I'm just talking about the base PRA now. It's really only judged in the context of what's needed for the application. So there's no requirement to review the whole thing.

But in accordance with the guidance and documents like Reg. Guide 1.174, when you make a risk-informed decision you have to look at all contributors to risk. However, what Reg. Guide 1.174 -- and those that developed from it -- allows is that contributors to risk that are not in the scope of the base PRA can be addressed in a number of other ways.

VICE CHAIRMAN WALLIS: Isn't this a bit awkward, this number 2? I mean, you have a core damage frequency of something which you quote for some application. You get another application, you have a different value, because you've included something else in the PRA. So what is the core damage frequency?

MR. PARRY: Well, the nice thing about -- if you like, the nice thing about Reg. Guide 1.174 is that it allowed you to make some decisions without knowing precisely what that was. Okay? As long as you could demonstrate that the change --

VICE CHAIRMAN WALLIS: It's all very logical to you, but how about the public and the public's --

MR. PARRY: Well --

VICE CHAIRMAN WALLIS: Different core damage frequencies quoted for different purposes. What is it?

MR. PARRY: I think that's the purpose, though, of this phased approach is to get us to that state where the PRAs are predictable, and, therefore -- and conform to standards, which would then give, I think, an increased public confidence and also an increased regulatory confidence in the use of the

PRAs.

MR. HARRISON: Can I add something?

MR. PARRY: Sure.

MR. HARRISON: On the base PRA, though, just to make it clear -- even when, say, two different applications come from a licensee on two different topics, it's not like they report a baseline CDF given one topic and a different baseline CDF for another topic. They should have the same baseline CDF value for both applications at the same time -- as long as they're at the same time.

What we do see is you have a baseline CDF on one application, and then a year or two goes by, the plant makes changes, updates their PRA, and then reports a new CDF in a new application a couple years later.

And that usually triggers us to go ask them what changed. So --

VICE CHAIRMAN WALLIS: So you have to make a distinction between this baseline and all of these other things, which affected a particular decision. That's part of George's issue, isn't it?

MR. HARRISON: Right. This gets at the point of when we judge -- in the context of the application, if I'm doing a diesel generator AOT, my review will focus on the electric power system. It won't necessarily go track down LOCA frequencies and look into those types of questions in the baseline PRA.

It will focus on the aspects of the PRA -- the review focus is focused on the application topic. But, again, the baseline PRA for two applications at the same time should be reporting the same CDF.

VICE CHAIRMAN WALLIS: Right.

MR. HARRISON: It's just the delta calculation they do will be for the application and will focus in on those areas.

MEMBER KRESS: Let me tell you what problem I have with this slide. If I'm going to use Reg. Guide 1.174 for my decision process, I need some sort of estimate of the full absolute value of CDF and LERF. Now, I can get that estimate by bounding analysis and other ways. But every time we get an application the question is: what do you do about fire contribution to the CDF? What do you do about shutdown low power risk? What do you do about the other missing elements? For example, if the seismic is treated in a qualitative way?

And in order to get some measure of what the real CDF and LERF are, I have to have some sort of bounding estimates for those things, and add them in. But it's never done. And you'll -- so you say Phase 1 represents the status quo, but the status quo does not really deal properly with the fourth bullet. And that's what bothers me about this slide.

MR. PARRY: Well, I think that's why the phased approach is being proposed. I mean, this is the way things are done currently. And I think a lot of them are done by restricting the scope of application, for example, so that you restrict it so that those elements of risk that you haven't modeled are not, in fact, changed.

But regardless, this is where we're at right now, and this is where we're trying to move forward from.

MEMBER KRESS: Well, I don't think it's where we're at, because I don't think we properly add in those risks to the absolute values.

MR. HARRISON: Right. And if you look at Reg. Guide 1.174, in there it has a discussion on seismic margin types or vulnerability type analyses that are used. If you get to a high enough -- it talks about if there's an indication that you might have a higher risk, then you would have to go back and look at more detail.

And there are some examples where we actually have, if you will, done an approximation of what the seismic risk might be using some seismic margin and some techniques to try to get at that, or in the fire area what we may do is we'll establish licensee commitments for fire watches and stuff like that to try to control the risk that we know from the fire analysis that may have been done.

So we try to either bound or control the base case risk in those situations.

MR. PARRY: Actually, I think what you try and do is bound and control the change, the delta.

MR. HARRISON: Yes, the delta that would occur.

MR. PARRY: And if the base case risk is -- if the delta is small enough, then Reg. Guide 1.174 does allow you -- or it does allow the fact that you do not have to assess the complete CDF, and I know that that's --

MEMBER KRESS: If you're down in that lower --

MR. PARRY: That's in the lower region, right.

MEMBER KRESS: -- lower regime you can forget about that.

MR. PARRY: Right. And I know that people have -- are uncomfortable with that. But -- but in any case, that is more or less what we do these days.

MEMBER POWERS: Let me ask you a question.

MEMBER KRESS: Yes, but that presupposes every one of these things will be in that lower regime, and they're not all --

MR. PARRY: Well, if they're not -- if they're not, though, as Donnie said, they will get -- they will get further scrutiny, and they become more complicated to process.

MEMBER POWERS: Let me ask you a question, Dr. Kress. You indicated as the slide indicates that we can use bounding arguments to assess those things that are missing from the scope of the PRA.

MEMBER KRESS: Well, that's the way I interpreted the bullet.

MR. PARRY: That's one approach.

MEMBER POWERS: And I'd like to understand that just a little better, because it seems to me that they're not bounding arguments, they are in fact plausibility arguments.

MEMBER KRESS: I would agree with that assessment, yes.

MEMBER POWERS: Because --

MEMBER KRESS: You know, we say that there have been some estimates of plausibility on fire. It says equal to the -- or greater than the parametric CDF or CDF without it. There have been guesses that the same thing applies to shutdown and low that's of that order. And those are plausibility arguments, and -- but they come out of some sort of assessments, but --

MEMBER POWERS: Well, I mean, at least a couple of these things I'm reasonably familiar with. For instance, if you frequently appeal to a scoping estimate that was done for the shutdown risk at Surry --

MEMBER KRESS: That's right.

MEMBER POWERS: -- I happen to know that that was done quite conservatively and that the operating procedures at Surry have changed since it was done.

MEMBER KRESS: Yes.

MEMBER POWERS: To where they do shut down and --

MEMBER KRESS: And unless they reevaluate that, I would have to be stuck with the original one as my bounding analysis, unless it's reevaluated to see what the effect of the changes are. If I'm going to be conservative about it, which I think bounding --

MEMBER POWERS: Well, I guess I'm not asking you to be conservative. I'm asking you to just be realistic and --

MEMBER KRESS: Well, if I'm going to be realistic, I have to have a good shutdown PRA to -- it will require a PRA that's realistic and has some certainties that --

VICE CHAIRMAN WALLIS: We've got qualitative arguments and plausibility guesses. This doesn't make me feel very confident.

MEMBER APOSTOLAKIS: Yes. I think there are two issues here. The first issue has to do with the fact that we -- the staff's presentation has to end by 9:45 or so, because NEI -- NEI will take the floor.

The second -- the purpose of today's meeting is to discuss the phases and how we move away from where we are now, not how good Phase 1 is, which I think some of the issues that you are raising --

VICE CHAIRMAN WALLIS: Hence the need for the other phases.

MR. PARRY: We've established --

MEMBER APOSTOLAKIS: Yes, and that's what Gareth keeps saying, that that's why we have the other phases.

MR. PARRY: Okay.

MEMBER APOSTOLAKIS: So let's see -- but the last bullet there -- keep going. Keep going.

MR. PARRY: Okay. All right. That sounds like the right approach.

Phase 2 is -- as George mentioned, in the SRM it's called an issue-specific approach. We've rechristened it, if you'd like, an application-type approach, which I think is more really appropriate. In which -- in this phase the base PRA quality is demonstrated by a comparison with an applicable consensus standard for those elements of the PRA that are required for the application.

And the -- again, as in Phase 1, we have to address all contributors to risk. But the distinction, as George pointed out, is that now all significant risk contributors should be included in the PRA scope. And significance is defined in the SRM as being determined whether -- by taking it into consideration you could change the decision substantially. That's a nice statement, but it's a little vague. We've recognized that, and one of the tasks in this plan is to define that more clearly.

MEMBER APOSTOLAKIS: Okay.

MR. PARRY: And we haven't done it yet. We will define it in the process of implementing the plan.

MEMBER APOSTOLAKIS: Gareth, would you say what is happening now with respect to risk-informed in-service inspection is a Phase 2 application? Even now?

MR. PARRY: Not yet, because --

MEMBER APOSTOLAKIS: Why not? Why not? What's missing?

MR. PARRY: Well, because the PRAs that are being used as the base have not yet been tested for quality against Reg. Guide 1.200, which, you remember, has only just been released for trial use.

MEMBER APOSTOLAKIS: But it's going through a peer review, right? I mean -- okay, 1.200 basically endorses --

MR. PARRY: Right.

MEMBER APOSTOLAKIS: -- the standard, so, I mean, it's not Phase 1, though. It may not be fully Phase 2, but it's not Phase 1 either.

MR. PARRY: Well --

MEMBER APOSTOLAKIS: And then --

MR. PARRY: But what you're saying is --

MEMBER APOSTOLAKIS: -- it's an

application type, isn't it?

MR. PARRY: It's an application type. I think what you're saying is that -- that the only PRA that you need to do ISI is an internal events PRA at full power. If you can make that statement --

MEMBER APOSTOLAKIS: Well, we are approving them, aren't we?

MR. PARRY: We are, but there are -- but, remember, there are other considerations. It's not just based on that. That's part of the input. We still have to consider the other applications. But if you can convince yourself that the low power and shutdown mode is not relevant, or that fires are not relevant for ISI, which is probably true --

MEMBER APOSTOLAKIS: Well, yes, we must have convinced ourselves, because we're approving them.

MR. PARRY: Yes. But, again, you're going back to what we're doing now. Okay.

MEMBER APOSTOLAKIS: But my question is -- or statement -- not everything we are doing now is necessarily Phase 1.

MR. PARRY: I think currently it really is.

MEMBER APOSTOLAKIS: Well --

MR. HARRISON: If I can --

MEMBER APOSTOLAKIS: -- let's suppose 1.200 was not used. I mean --

MR. HARRISON: If I can address the risk-informed ISI piece of that, though. One of the things that's missing is the reg. guide that goes along with risk-informed ISI at some point needs to be updated or revised to reflect what the requirements are for that scope.

In other words, if -- right now in all of the SEs there will be a paragraph that's written dealing with external events, saying why those aren't required. That logic needs to be put into the reg. guide. It's a technicality, if you will. Once that gets done and gets approved and gets, you know, cast in stone, then I think you're right. Then we do move into a phase 2 application immediately on that.

MR. PARRY: But we're not ready to say it as yet. So I think that --

MEMBER APOSTOLAKIS: But it's almost there.

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: Because basically the standard, which is the Westinghouse and the EPRI approaches, were reviewed and approved by you. And that's what people are implementing.

MR. PARRY: Okay. Right.

MEMBER APOSTOLAKIS: Okay.

MR. PARRY: Okay. So, and this actually gets to your point, really. To achieve Phase 2, then the guidance has to exist for, how do you use the PRA in making the decision? And this includes the definition of the scope of the PRA that you need to make that decision, and then the assessment of the quality of the base PRA for each item that you need.

Phase 3 is not so very different from Phase 2 in the sense -- in one sense. It's still based on having the guidance documents and standards to judge the quality of the PRAs. But what Phase 3 does -- it rolls everything up for all of the Phase 2 applications that you've -- to date, and it rolls them up into one framework.

So it would pull together all of the requirements, for example, on PRA quality for all the applications that -- I think what the -- the term that the SRM uses -- currently-envisioned applications -- but I think it's really what we currently do and what we anticipate to be doing in the near term rather than -- I currently envision it to be, as somebody pointed out last time, could be ---

MEMBER APOSTOLAKIS: Well, if you do --

MR. PARRY: -- it's infinite.

MEMBER APOSTOLAKIS: If you do 50.46, I mean --

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: -- you've done the big one.

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: Everything else will be nothing.

MR. PARRY: So, actually, tech spec 4B might be the big one that --

MEMBER APOSTOLAKIS: Good.

MR. PARRY: And the idea with Phase 3, it's scheduled to be completed by the end of 2008. Now, so I think the goal for the end of 2008 that we would have the regulatory framework in place -- the licensee to say that he's got a Phase 3 PRA, then he has to develop the PRA to meet that regulatory framework and -- which includes meeting the standards, getting it peer reviewed, etcetera.

VICE CHAIRMAN WALLIS: When you say Phase 3 is completed, do you mean that will then be the way in which you will do business?

MR. PARRY: We'll come to that in the

description of the flowchart.

MR. MAGRUDER: The policy issues.

MR. PARRY: There are some policy issues in there, right. Yes. At least the framework will be in place.

Phase 4 -- I don't think we should spend too much time on this, but it really is that stage -- that phase when the PRA has been developed to the state of the art. And I think we would define state of the art as being something like capability Category 3 of the ASME standard. It's beyond current good, accepted practice.

MEMBER ROSEN: Isn't that a moving target?

MR. PARRY: Well, yes. I think that's why it would be very difficult to -- to write guidance for Phase 4. Whereas, Phase 3 it might be -- I mean, Phase 3 guidance could -- it will also be a moving --

MEMBER ROSEN: By definition, if all plants are at Phase 4 and I am one plant and find my -- find a new use and improve my PRA in some way, everybody else falls back to Phase 3.

MEMBER APOSTOLAKIS: That's a good point.

MR. PARRY: Yes. For that application you fall back to Phase 1.

MEMBER APOSTOLAKIS: Because you move the state of the art.

(Laughter.)

MEMBER ROSEN: Phase 4 is an honorary degree.

MR. MAGRUDER: But there are other distinctions which we will get to about the staff review --

MR. PARRY: Yes.

MR. MAGRUDER: -- of the Phase 4 peer review.

MR. PARRY: So let me -- okay. Let me talk about the review of the base PRA. Now, this is a little different from what you saw last time. In Phase 1, currently what we do is the review of the base PRA is at the discretion of the reviewer. But what we're expecting is that while we're waiting for Phase 2 to be completed, which means getting all of the standards in place for a specific application, we will still have Reg. Guide 1.200 in place, which endorses currently the standards for internal events.

So we would expect that once the trial use is completed and we've modified Reg. Guide 1.200 that that would indeed be used to assess the quality of the phase -- of the base PRA even in Phase 1. So that explains my remark -- what I said earlier that Phase 1 is like a transitional phase, really.

So rather than -- as far as the staff review goes, the transition from having sort of ad hoc reviews like we do currently to a more systematic review based on Reg. Guide 1.200.

MEMBER APOSTOLAKIS: Is it only Regulatory Guide 1.200 that matters?

MR. PARRY: Well, that's where -- that's the document where we will endorse the standards. So in that sense --

MEMBER APOSTOLAKIS: Oh, so you will keep that in appendices.

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: Okay, okay. Okay, okay. So it's not in Phase 3 -- they want to handle it in Phase 3 is not the same as they want to handle it in Phase --

MR. PARRY: As it is now, right.

MEMBER APOSTOLAKIS: Ah. Maybe clarify that a little bit.

MR. PARRY: Yes. Yes. So in Phase 2, again, the review of the base PRA will be based primarily on 1.200 for all of the significant contributors to the application. And Phase 3, as I say, is similar to Phase 2.

Phase 4 is really different, because the way the SRM is written this requires staff review and approval of the base PRA, which really means getting into debt.

Okay. Now, this is the famous diagram, which usually takes a lot of explanation. This has changed a little bit since you saw it last, particularly on the left-hand side. I'll try and walk through it fairly quickly.

Okay. This -- we start off with box 1. It says the licensee has identified a specific application. Box 2 says, "Are we in Phase 3 yet?" We're going to assume for the moment that we're not. Well, we're not. So this is a futuristic box.

Box 3 asks, "What PRA scope is needed to support the identified application?" And that would be covered in the regulatory guides that address that application. Box 4 is the screening box that says, "Are we in Phase 2 or Phase 1 for that application?"

Okay. If we have the guidance in place to assess the quality of all the significant contributors that we think will be needed for that application, then we're in Phase 2, and we come out on the right-hand side of that diagram.

Box 2-1 asks, "Do the applicable portions of the base PRA conform to the existing standards for the risk-significant PRA scope?" In other words, are we consistent with the PRA requirements for that application type? If it's yes, we get kicked out to Box -- not kicked out, we go out to Box 2-2, which says you get a high priority review. We're going to have to work on these words. Really, it's a normal review.

If, on the other hand, not all the PRA -- if the PRA is not of sufficient scope for that application -- okay, so in other words, if the application required a fire PRA, then they don't have -- they have not satisfied the fire PRA standards. Then you come out of that box with a no.

No, if the risk-significant contributors, however, are still addressed, they get what we've called a low priority review, because it's going to be more resource-intensive. Okay. A lot of the decisions that we've got on this graph are based on review resources.

If, on the other hand, the licensee hasn't even addressed these risk-significant contributors, that gets rejected.

MEMBER APOSTOLAKIS: But it's not up to you. I mean, the SRM tells you to do this.

MR. PARRY: Well, yes, but when you actually go to the SRM -- well, this is a policy issue we've identified, and I'll --

MEMBER APOSTOLAKIS: Yes.

MR. PARRY: -- tell you why. I'll tell you why we've identified it. You could just reject it. Okay? The SRM actually says either --

MEMBER APOSTOLAKIS: Low priority.

MR. PARRY: -- they give it low priority or --

MEMBER APOSTOLAKIS: Which is what you have there, yes.

MR. PARRY: -- or reject.

MEMBER APOSTOLAKIS: Yes.

MR. PARRY: The reason we want to keep the low priority in here is really -- it's an optical one, because if we were to reject it outright it would sort of imply that what we've been doing up to date is not appropriate. And I don't think -- we don't believe that what we're doing now is inappropriate.

MEMBER APOSTOLAKIS: But you cannot disagree with the Commission's direction that you should give low priority or reject.

MR. PARRY: Or reject. And that's -- and we have that --

MEMBER APOSTOLAKIS: Yes.

MR. PARRY: -- that logic in here. Okay. So that's --

MEMBER APOSTOLAKIS: So you guys agree with this?

MR. PARRY: Yes. But -- yes.

MEMBER APOSTOLAKIS: Or you are doing it because you were directed to do it?

MR. PARRY: No, we agree with it also. Both, actually. We think it's a good idea. Okay.

MEMBER APOSTOLAKIS: Yesterday I had a guy from MIT presenting something about decision analysis. Okay? And he said -- or it had to do with maintenance. He said we screened the -- we have a priority. The top priority is if the president of the institute wants it, it's done.

(Laughter.)

For the rest, we use decision analysis. So this is a practical application. Okay.

MR. PARRY: Okay. Now, suppose we -- in the situation which we are in with a lot of applications, where we think we would need a fire PRA or a seismic PRA, but as yet we do not have the standards in place to judge them.

MEMBER APOSTOLAKIS: Right.

MR. PARRY: Okay. So that's Phase 1. So we come out to the left of this box.

Box 1-1 asks, "Do the applicable portions of the PRA conform to existing standards?" Does it mean those PRA -- the PRA that we've done, does it conform to Reg. Guide 1.200 guidance? If you say yes, okay, we come down to Box 1-2. This is the one that caused you a lot of -- well, you and industry a lot of heartache.

But what it asks is, does the application use a PRA scope that's beyond the current guidance to expand the scope of the application? Let's assume for now the answer is no. Okay. Then, this is a normal Phase 1 review, and it gets the normal priority review.

Now, let's go back to that box. What we really were looking for in that box was to say is -- if the expansion of the PRA is to purely -- is purely to get more from regulatory requirements, then we would say that that -- we're going to say that that should get a low priority review, based on the additional resources that we would have to spend to review that application, because we currently do not have the standards to judge that. So we would have to do a lot more ad hoc review.

An example of this, and the one we used last time, was 50.69. 50.69 -- the guidance for how to do the categorization -- is in NEI 0004. What NEI 0004 allows you to do is if you don't have a fire PRA, you don't have a seismic PRA, then what it tells you to do is then don't recategorize those components that you are relying on to deal with fire and seismic, that contribute to fire and seismic risk. You can only recategorize those things that are associated with internal events risk.

Okay. Now, that somewhat restricts the categorization. So if the licensee were to come in with a fire PRA to broaden the scope of 50.69 to increase the chances of recategorizing things as risk-free, that is the type of thing we're talking about here, because it's expanding the scope of the application of 50.69 by bringing in a PRA for which we do not yet have a standard. And that's the reason -- that's an example of why we put that box in there.

MEMBER APOSTOLAKIS: But you are looking at it from the point of view that the only benefit from this is to the licensee. The licensee wants to expand the scope.

MR. PARRY: Right.

MEMBER APOSTOLAKIS: But it seems to me if the licensee was willing to spend the resources necessary to do this extra work, that licensee is contributing to the advancement of the state of the art, which creates the foundation for developing the standards you want.

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: So by having the staff review it and, you know, making comments, and so on, you are contributing to this advancement. And that is a benefit that is not here.

MR. PARRY: Well, I think it will be in the sense that pilot applications -- for example, tech spec initiative 4B -- I think we would not apply that rule here, because clearly it's, if you like, a proof of principle of an approach, and that is certainly developing the state of the art for that application.

That would not be -- I don't think we'd give that -- well, clearly, we're not going to give that a low priority review for the application that we have, because it's part of the Reg. Guide 1.200 pilots. We understand that this appears to be a disincentive for some.

MEMBER APOSTOLAKIS: It is.

MR. PARRY: Well, not a disincentive.

MEMBER APOSTOLAKIS: To what degree, I

don't know. But there is a disincentive.

MR. PARRY: And that's why we have this as a policy issue.

MR. TSCHILTZ: We're trying -- this is Mike Tschiltz. We're trying to address that I think by saying that we would allow pilots before the standards are in place for certain applications.

But the problem we have is that if people proceed with using PRAs where there's no standards in existence, we're promoting ad hoc reviews, we're promoting resource-intensive reviews, and we're promoting non-standardization within the industry, whereas we're trying to harmonize things, so we're more consistent, and licensees are more consistent in their approaches to the development of standards.

MEMBER APOSTOLAKIS: And I agree with that. But, for example, one solution might be to break up this Box 1-5 into two boxes or three, and say that there may be other reasons that the staff may decide to give it a normal review.

MR. TSCHILTZ: Yes. And I think --

MEMBER APOSTOLAKIS: If it's of something very innovative -- I mean, the thing about the standards is you don't just declare, "I want a standard on XYZ by next December," without having the technical foundation to develop it, right? So this is where the technical foundation is developed, and you may choose certain things to say, "Boy, this is really new. Who is going to review it?"

MR. PARRY: I don't think that's what Mike was saying, that that's what we will --

MR. TSCHILTZ: We've discussed that, and we thought rather than putting it in the flowchart, which would maybe tend to get too complicated, you were going to address that in the text of the plan itself.

MEMBER APOSTOLAKIS: Well, it's attracting so much discussion, maybe it belongs --

MR. PARRY: Well, I think that -- well, if we make the viewgraph any more busy, though, I think we'll -- we'll make things even more complicated. I think this is really just a -- ultimately, we'll have to read the --

MEMBER APOSTOLAKIS: Put one or two words there to direct people somewhere else to --

MR. PARRY: Okay. All right.

MEMBER APOSTOLAKIS: Because right now it doesn't say that.

MR. PARRY: That's fine. We'll do that.

And what box -- let me go back up to Box

1.1, then. If the applicable portions of the PRA do not conform to existing standards, which means, for example, if a licensee comes in with an application that he has not done a -- he has not used Reg. Guide 1.200 to demonstrate quality of his PRA, then he would basically get a low priority review ultimately.

And this is a picture of when -- you had asked, George, I think through Mike, that we talk a little bit about the schedule. This is not going to take place immediately the guidance documents are established. Okay? There's a phase-in period for this.

For example, we've built in currently into the schedule a year after the guidance has been developed to allow licensees to meet that guidance. Now, the year is perhaps negotiable. I don't know. We haven't decided that that's definitely the date, but there has to be like a grace period to allow everybody to catch up to the guidance.

So moving on from this one, we have the second --

VICE CHAIRMAN WALLIS: How do you deal with these statements about risk-significant contributors are meeting current guidance? If you haven't put them in, how do you know if they are risk-significant or not?

MR. PARRY: I think it's a -- well, I think you can make a -- you can make a judgment as to whether the change you are trying to make with the application is going to affect the risk from fires or seismic.

MEMBER ROSEN: You say -- "could" is the word you used.

MR. PARRY: I said "could," yes.

MEMBER ROSEN: You say "could affect."

MR. PARRY: But I think --

MEMBER ROSEN: And I think that's flexible enough.

MR. PARRY: Yes. And I think we have to -- I think the general guidance will have to come out and make those statements. It will say, "To do this application, you need a fire PRA, you need a seismic PRA." That doesn't prevent a licensee from -- for his plant to come in and say, "Well, because I'm in this seismic region, I don't have to do a seismic PRA because my plant is not vulnerable at all."

VICE CHAIRMAN WALLIS: So these are plausible qualitative arguments that we got into before.

MR. PARRY: Well, they may be -- yes.

Well, they may be more than plausible and qualitative, but --

MEMBER POWERS: What I'm struggling with a little bit here is I sit here and say I'm interested in some component, and I have done a prior PRA. And so I come along and I make a plausibility argument that says, "Gee, the thing I worry about most in the case of fire is spurious operation of this -- operation badly."

If I can come up with some scenario with this component I'm interested in spuriously operating in some -- in an unusual fashion causes a problem, do I always end up in low priority review, then?

MR. PARRY: No. Well, it depends where we are with the standards. I mean, the low priority is -- first of all, the guidance for the application has to specify which -- what the scope of the PRA is you need.

Okay. If you -- currently, if it's a fire PRA you need, we don't have fire standards. That doesn't relegate you to low priority review. If after the fire PRA standards are in place you still come in without a fire PRA, that would.

MEMBER POWERS: I guess what I'm worried about is your significant contributors not being included.

MR. PARRY: Right.

MEMBER POWERS: And --

MR. PARRY: Well, let me, before you complete your question -- in this context, significant contributor, what I'm really talking about is the big contributor, like the type of initiating event and the type of operating mode.

The level of the -- the contributor at the level of the specific basic event is a function of the PRA, and that gets addressed when you do an application. You have to go through and find out which elements of the PRA are relevant to the answer. So I think you are talking at a somewhat deeper level than I was talking about here.

MEMBER POWERS: Okay.

MR. PARRY: And that won't be forgotten, but it will be addressed in the application-specific guidance.

MEMBER APOSTOLAKIS: You have five minutes.

MR. PARRY: Okay. Well --

MEMBER APOSTOLAKIS: Tony, how much time do you need?

MR. PIETRANGELO: I want my time allotted on the schedule.

MEMBER APOSTOLAKIS: You will have it.

MR. PARRY: I'm going to skip over this, because this is when the Phase 3 --

MEMBER APOSTOLAKIS: Yes.

MR. PARRY: -- this is sort of futuristic. The only -- okay. The policy issues that we've identified -- and I will focus I think primarily on the statement of the issue. We're still -- we had a meeting with our risk-informed licensing panel the other day, and they gave us some advice on how to perhaps restate some of the pros and cons in here. But I'll at least give you our rationale for why we're making the decision.

So the first issue was the one we discussed about in relation to that box. It's the use of the PRA scope greater than that for which standards exist, simply to increase the scope of relaxation requirements.

And we asked: should this submittal be given low priority? And our recommendation is yes, primarily on the basis that this is a very resource-intensive thing, and we really would -- and the reason it's resource-intensive is that we wouldn't have the standards to judge it.

The second policy issue is once a -- and this is related to the words that were in the SRM. If the licensee submits an application for which all of the applicable guidance documents are in place, which is Phase 2, but they don't conform to that guidance, should we give that application low priority? Or should it be rejected outright?

Our argument is that we should err towards the low priority, primarily because rejection would send a message that we haven't been doing the job properly up to date.

The issue 3 is when all of the guidance for all current and anticipated applications is in place -- Phase 3 -- should every licensee be required to conform to that guidance before submitting any risk-informed submittals?

Okay. Our recommendation here is no, because if the licensee is really only interested in one application, to develop a PRA that would cover all of them would be really, in a sense, an unnecessary burden.

The arguments against our proposed recommendation, really, is that without this there really is no forcing function to go to Phase 3.

MEMBER APOSTOLAKIS: You are going back to

Phase 1.

MR. PARRY: Well, no, there's another one. When all the guidance for Phase 3 is in place, if you followed our recommendation, then they would still be able to come in with Phase 2 applications. Okay? For specific application types.

And this policy issue says, okay, if they don't follow all the guidance for Phase 2 at this point, which means they're really coming in with a Phase 1, should we reject it outright? And our recommendation here is yes, because this would reinforce the Commission's view that we need to develop more complete PRAs.

There is maybe a -- this is also perhaps a little contradictory to what we said in policy issue 2. But we feel that when -- and this is why I think it has to be a policy decision, because the Commission has to weigh in on this -- because reg. guides typically tell you one way of doing things and not -- and we were allowing these applications in the past.

So the next policy issue, and the last one we've identified, is effective -- and that was brought up by Mr. Rosen last time. Actually, I think that he suggested this. If the SDOs decline to produce a standard considered necessary for an application, should the NRC develop its own guidance? And our recommendation here is yes.

And don't worry about the pros and cons. As I say, we're still working on those.

Okay. The activities that we need to do to implement this phased approach, we need to -- I haven't described the tasks here. And, in fact, they've changed a little bit from the version of the plan you have.

We need to continue supporting the development and the endorsement of PRA standards. We need to update regulatory guides, and that includes Regulatory Guide 1.200. We probably need to develop regulatory guides for new applications. These are anyway -- in any case being done.

We need to develop methods and supporting documents for the technical issues. As you mentioned earlier, George, there are three of the technical issues that were identified in the SRM that we need to address. And we also need to develop staff implementation guidelines, which include things like the standard review plan and office instructions. That's -- the office instructions is where we'll find the discussion of the priorities of review.

And the industry also has to do some things. Okay?

MEMBER APOSTOLAKIS: Let's look at the schedule itself.

MR. PARRY: Okay. We have I think a viewgraph that talks about the schedule. Again, this is not final. The reason I bring it up here is to show you that if you look at, for example -- look at the second group of two -- PRA quality, Reg. Guide 1.200 pilots. We are planning to finish those by December 30th, and then modify the reg. guide.

The implementation, which is when we would expect this guide to be used for all applications in the future that use internal events PRA, would be -- currently it's September 30, 2005. And these are tentative dates, but you will see that -- all throughout here that the implementation follows a year after the completion of the documents. And this is to build in that grace period.

MEMBER APOSTOLAKIS: Now, there is nothing on Level 2 on --

MR. PARRY: No. Because currently none of our applications really requires a Level 2 and a Level 3 PRA.

MEMBER APOSTOLAKIS: Doesn't the guide

talk about LERF -- I mean, 1.174?

MR. PARRY: It only talks about LERF. And the --

MEMBER APOSTOLAKIS: And we have guidance with LERF?

MR. PARRY: Yes. The ASME standard addresses LERF.

MEMBER APOSTOLAKIS: Which one?

MR. PARRY: The current one.

MEMBER APOSTOLAKIS: The existing one.

MR. PARRY: The existing one covers LERF, yes.

MEMBER APOSTOLAKIS: No, you're right.

CHAIRMAN BONACA: I had a question on the decisionmaking process that we discussed before -- at the beginning. You know, the presumption is that the delta CDF is independent of the baseline model. I mean, if you do have -- and I agree with that for the foreseeable changes.

I'm concerned about a major change like 50.46 with tentacles all over the place where you have -- you may have missed certain pieces -- power shutdown, other pieces there which are still affected by that. And, therefore, you're assuming some bounding examples based on similar plants, and so on and so forth.

My concern is that plant specificity is so critical in some of these evaluations -- I mean, in the model -- that, you know, the assumption of delta CDF independence may not be true. How do you get comfortable about reviewing it?

MR. PARRY: I don't think we can answer that question in this -- in this --

CHAIRMAN BONACA: I understand that. But we were discussing before the issue of, you know, Reg. Guide 1.174, and I understand that -- but that's an assumption that is always being made, and even is made in the SRM.

MR. PARRY: I think that sort of decision, though, will have to be made in any regulatory guide that's associated with 50.46 and the implementation of it. That will have to address what those issues are, and it will define --

CHAIRMAN BONACA: Okay.

MR. PARRY: -- what's needed for the application. And that will decide whether it's Phase 1, 2, or 3. Well, it won't be 3, that's for sure, and it may not be 2 --

CHAIRMAN BONACA: Yes.

MR. PARRY: -- for a while.

CHAIRMAN BONACA: Because, I mean, there is a widespread belief that that's always true. But in practical terms, when you do the modeling, and then you do certain assumptions, and then you call, you know, a comparable plant and you say, well, you know, this is -- well, you know, you discover you have a lot of differences in fact that you don't understand until you do the PRA.

MR. PARRY: Yes, I think you're right. But in a way this -- this draft plan is irrelevant if we don't have applications that are moving forward that require these different scopes I think.

MEMBER APOSTOLAKIS: The item there called alternate methods and treatment of uncertainties, that's the model uncertainty issue?

MR. PARRY: Yes.

MEMBER APOSTOLAKIS: And the human performance is somewhere else?

MR. PARRY: Yes. It's -- well, it's probably not on this. It's not on here, I don't believe.

MEMBER APOSTOLAKIS: But in the -- I don't know to what extent you have changed the plan itself. But the discussion of human performance there was not very convincing, and it was --

MR. PARRY: We have --

MEMBER APOSTOLAKIS: -- completely separated from the issue of model uncertainty. I mean, that issue in human performance is model uncertainty.

MR. PARRY: Right.

MEMBER APOSTOLAKIS: So it should be handled in some way. Developing guidance regarding accepted practices, or whatever way they put it, doesn't help.

MR. PARRY: Well, it helps I think that our review is to understand what's needed to meet the standard. But I agree with you. Those --

MEMBER APOSTOLAKIS: It doesn't appear -- you have it somewhere else, but not here.

MR. PARRY: Right. No.

MEMBER APOSTOLAKIS: Here the issue is if there are different views out there, different models, what should I do?

MR. PARRY: What should you do, yes. Yes. And, actually, to some extent that's already covered in some of the current reg. guides. To some extent.

Okay. But, yes, we need to -- we haven't really focused on that. We've been focusing more on the implementation, but we will revise that. We know that we have to do that.

MEMBER APOSTOLAKIS: Well, do you agree that the technical issues are important to all phases?

MR. PARRY: They're all important, yes. And I think what you -- but what it -- but, again, I think what that comes down to is that -- is that when you define your decisionmaking process, it has to be robust enough to recognize that these issues have not yet been resolved.

And, therefore, I think it has to be done in tandem with the decisionmaking process. It's not really -- this plan really is only to help develop the base PRAs. The model uncertainties will still be there.

MEMBER APOSTOLAKIS: Yes.

MR. PARRY: But they have to be addressed I think through the vehicle of the decisionmaking process, not through this guide, or through this plan I should say. And so --

MEMBER APOSTOLAKIS: So the only benefit -- the only benefit, then, that a licensee would have from the -- this whole process is the level of priority that they would get when they submit an application, in reviewing it.

MR. PARRY: But there may be other --

MEMBER APOSTOLAKIS: What else?

MR. PARRY: There may be other benefits, though.

MEMBER APOSTOLAKIS: Like?

MR. PARRY: Well, like, for example, if you have a Phase 3 PRA, then its use in resolving another phase -- Phase 3 SDP issues would be -- I think it would be of great benefit.

I also think that the development of the PRAs does allow the scope of things like 50.69 to be expanded.

MEMBER APOSTOLAKIS: But we could bring it up -- maybe it's most the obvious example, but --

MR. PARRY: It is an obvious example.

MEMBER APOSTOLAKIS: Anyway, you've handled your time very well.

MR. PARRY: Thank you.

MEMBER APOSTOLAKIS: Are there any comments or questions from the committee?

Well, thank you very much.

MR. PARRY: Thank you.

MEMBER APOSTOLAKIS: It was very enlightening.

So one last question. The plan that I have is not the plan that you have? Mine is dated?

MR. PARRY: Yes. I mean, it's in the process of flux.

MEMBER APOSTOLAKIS: So your view about the committee writing a letter is what?

MR. PARRY: Well, I think the --

MEMBER APOSTOLAKIS: Not what the letter should say.

MR. PARRY: No.

MEMBER APOSTOLAKIS: Should the committee write a letter now or wait until June or something, you know, when we review the final thing?

MR. PARRY: I think --

MEMBER APOSTOLAKIS: If we review it.

MR. PARRY: Yes. I think that probably my guess is that what you're more interested in is the overall philosophy rather than the detailed tasks -- task descriptions. And the -- I would suspect also the policy issues, doing a weigh-in on those.

I don't think those are going to change dramatically. I don't anticipate they will change dramatically. So if you feel you have enough to go on on those issues, then I think you could write the letter now.

MEMBER APOSTOLAKIS: Okay.

MR. PARRY: But if you wanted to see the

detailed task plans, which I'm not sure you -- I mean, well, I think we've identified the issues that we're going to address.

MEMBER APOSTOLAKIS: Very good. Thank you. That was very --

MR. PARRY: Thank you.

MEMBER APOSTOLAKIS: -- useful.

Okay. Mr. Pietrangelo.

MR. PIETRANGELO: Good morning. What I want to start with is where we were with the SRM March 31st of last year versus where we are now after the December 18th SRM.

From our perspective, what the Commission paid for and SRM put out in December was a vast improvement over the guidance and direction that was provided last March. And I think Gareth touched on this a little bit, but I wanted to underscore it.

The position put forward in that SRM -- the previous SRM was what we referred to as the all singing and dancing PRA to do any further applications, which was really a significant change from the way we were proceeding and the direction we were heading. It was a -- not only a step change, I call it a cliff change in approach. Okay?

Therefore, we view what the Commission put out in December, and the associated paper, as a significant improvement for the following reasons. The direction is to continue to evolve PRA technology, both the scope and technical adequacy and level of detail, while at the same time allowing practical uses of that technology in the regulatory process and to get more efficient as we go. I think we shouldn't forget that.

That's a key part of that SRM, and I think that's a lot of what's behind the staff's paper is to try to gain efficiency as we go forward. We want those efficiencies, too. A licensee pays the NRC for the review. If the review takes longer, you're already penalizing the NRC -- or the licensee, because he's paying for it. So we want efficiency in the regulatory process, both for the staff and for the licensee. So I think that there's a good balance there.

So we wholeheartedly agree with the overall thrust of the Commission's direction to allow progress as we move forward with evolving the scope and technical adequacy of PRAs.

You know, put all the rest of the mechanistic waste and the phases and how to proceed, that's the key part of this decision. And I think it's the right one from our perspective.

The other part I wanted to mention also is that we believe applications drive the evolution of PRA. If there's no good use for it, or cost benefit for it, it's going to be highly unlikely that a licensee is going to invest resources in it.

A lot of what's in the paper we sent to the staff last week talks about our current efforts, what we're doing this year, and it wasn't mentioned very much in the previous talk about the pilot plan we have on Reg. Guide 1.200 to use the ASME standard. That's a significant effort.

That standard alone took over four years to develop. The peer reviews for the Level 1 PRAs that are now a requirement in the standard, the industry started that before the standard was even developed. That took five years, and that's on the areas of PRA we know them most about.

The standard came out last year. It took another year to get a reg. guide that endorses it for trial use. It'll take another year at least for us to pilot that and specific applications. And I think per the staff's schedule, it will take about nine months to put out the revision of the reg. guide. So, and that's the thing we know the most about and have the most experience with.

When you get into these other areas with you know, fire and seismic and shutdown, there haven't -- there hasn't been one peer review, I don't think, in any of those areas yet. It took the industry five years to do the Level 1 peer reviews. So I think the paper -- this isn't the last time I think the Commission is going to weigh in on the direction for the evolution of PRA and scope of technology.

This is going to take a long time. I think what you heard in the ASME/ANS letter was that the schedule might be ambitious. We didn't even talk about schedule in our letter. Okay? We just want to make sure the arrow is pointing in the right direction. However long it takes it takes, and things always take longer than we think they're going to take up front.

VICE CHAIRMAN WALLIS: Now, this reluctance to proceed, is it due solely to economic forces? Or is it because you don't know how to do better? It seems to me you do know how to make better PRAs, but you just don't think it's worth it.

MR. PIETRANGELO: No, that's not it at all. In fact, you know, I'm going to disagree with the staff on the first policy issue. There are people that are making investments in scope enhancements to their PRA. Fire I think is the best example.

And also, I'm going to penalize somebody because there isn't a standard there? We disagree with the staff on that, as did the subcommittee. We think that sends the wrong message.

So it's not a reluctance. It's a tool.

VICE CHAIRMAN WALLIS: But it is an economic thing. You're reluctant to invest when you don't see a payoff.

MR. PIETRANGELO: Well, anyone would have that --

VICE CHAIRMAN WALLIS: Right. That is the reason -- that is what motivates your --

MEMBER APOSTOLAKIS: I believe, though, Graham, that comes back to a point I tried to make in my introduction.

Maybe you missed it, Tony. You'll have your time, Tony. Don't worry about that.

MR. PIETRANGELO: Okay.

MEMBER APOSTOLAKIS: Namely, the integrated decisionmaking process. The way it's done now, I'm not sure it encourages better PRAs, because you can get by with, you know, a PRA that's not as good as somebody else's. And that is not addressed in all of this, which is part of the philosophical approach that Gareth I think mentioned that a committee might want to look at.

That was a timeout. We'll start again with you.

MR. PIETRANGELO: Okay.

MEMBER APOSTOLAKIS: I don't want you to be anxious, Tony.

MR. PIETRANGELO: Okay. But I'll disagree to some extent with the point you just made.

MEMBER APOSTOLAKIS: Okay.

MR. PIETRANGELO: It's not the decisionmaking process that's not sending the right message to licensees. It's the applications. 50.69 is the best example. We mentioned that a lot in our paper.

MEMBER APOSTOLAKIS: I agree.

MR. PIETRANGELO: Okay. I can't -- as a licensee, I can't opt to do 50.69, unless I have a PRA that meets that ASME Level 1 standard. That's the incentive to get them to go further, and I can't expand the scope of that application to include more SSCs without expanding the scope of my PRA.

MEMBER APOSTOLAKIS: That's a very clear --

MR. PIETRANGELO: I'd be penalized for using that now. I think that's, again, the wrong message.

MEMBER APOSTOLAKIS: You're right. For 50.69, you are right.

MR. PIETRANGELO: Later on, the staff in the -- I think the Phase 3 part penalizes you for -- if you don't meet the standard and don't have a PRA.

MEMBER APOSTOLAKIS: Right.

MR. PIETRANGELO: Okay? So you're penalized if you have it in Phase 1, and then you're penalized again in Phase 3 if you don't have it. Okay? I just think that's wrong.

Phase 1 is Phase 1. It is where we are today. If they have the resources, they review it. I mean, we have a -- and I'm going to ping Mike Tschiltz a little bit on this. We've had an application in on containment ILRT on an industry perspective to go from 10 to 20 years that isn't being reviewed right now. It's been in there since December. It's a big industry activity.

The staff asked us to do it, but they don't have enough resources to do it right now. That's just a practical reality. I'd like to get them to get some resources on that, but I would assume that's got a low priority because nobody is reviewing it, and it's an industry initiative.

MEMBER POWERS: Tony, I guess I'm just a little puzzled. If a licensee comes in and he has been aggressive in developing PRA, and he has things for which -- in his PRA for which he -- there are no standards to review against, doesn't that ipso facto mean that it's going to take more review on the part of the NRC and, consequently, he is going to be penalized in dollar cost if nothing else?

MR. PIETRANGELO: Yes. But evidently, though, he wouldn't submit that application unless he thought that the benefit on the other end of that process was worth it.

All right. So it's already tough to do it, and I'm not disagreeing with the staff that that would be a more resource-intensive review. It would. But if somebody is willing to pay for it, it shouldn't automatically get a low priority. It's just going to be the reality that it takes more staff review, and that's the boat we're in now. And I think assigning priorities high and low based on that now --

MEMBER POWERS: So it's only --

MR. PIETRANGELO: -- inadvertently sends the wrong message I think.

MEMBER POWERS: So it's really the labeling that you're objecting to --

MR. PIETRANGELO: Yes.

MEMBER POWERS: -- not the conscientious attempt to reflect reality.

MR. PIETRANGELO: Yes, and inadvertently conveying the wrong message.

MEMBER POWERS: I agree with you that the -- it's an unfortunate choice of words. And I think the staff does, too. I mean, they kind of apologized when they presented it.

MR. PIETRANGELO: Let me move on here. Overall, we think the staff implementation plan is a reasonable response to what the Commission direction was. I mean, we agree with probably 98 percent of what's in there.

I've just shared with you the one where we do disagree on this kind of what we call penalizing the licensee for using a broader scope PRA than the standards available.

The other thing we mention in there is the terminology. If you're following this on a day-to-day basis like we do, you know, we understand the nuances in it. But it's not immediately apparent to people outside the process. We thought we were on a path where we weren't talking so much about PRA quality as much as -- more about PRA technical adequacy. I mean, that's the title of Reg. Guide 1.200 is the technical adequacy of PRAs to support applications.

Scope means, you know, Level 1, fire, shutdown, other external events, Level 2, Level 3. That's what we mean by scope. We reserve the term quality for a higher level, and that is the ultimate decision out of that risk-informed decisionmaking process. That, to me, is where we really want quality to be achieved.

All right. We want good, robust decisions. And you need technically adequate PRAs and -- with an appropriate scope to support that decision. So that's kind of our triangle -- quality, technical adequacy, and scope.

When you say PRA quality, and you use, let's say, a bounding method -- all right, it would -- things start getting mixed up while you're not using a quality PRA, and it just gets more confusing to communicate to people. So we think we ought to stick with a set and be consistent, and we've already got reg. guides out there that say that, so --

MEMBER APOSTOLAKIS: So what you're saying is that the PRA itself may not be of the highest quality, but the decision, though --

MR. PIETRANGELO: The decision has to be quality.

MEMBER APOSTOLAKIS: -- was -- yes.

MR. PIETRANGELO: The PRA has to be technically adequate.

MEMBER APOSTOLAKIS: That's an interesting distinction. Interesting distinction.

MR. PIETRANGELO: Okay. You were talking about the different phases. I think we're in a lot of -- in some respects, we're in Phase 1.5. Okay? We have been using the peer review results. It's somewhat analogous to -- you'll use the results of your assessment against the ASME standard. So it's not totally Phase 1, and it's not totally Phase 2. But we're about Phase 1-1/2. That's okay.

The other thing -- you know, standards are supposed to capture good practices. And this goes back to this other issue about penalizing somebody for having -- you know, how do you get the good practices if you're not incentivizing people to use the methods and improve them? Okay. Again, I think it's unfortunate.

The technical issue on uncertainty -- as an industry, we're trying to gather our forces into a single entity to develop some guidance on treatment of uncertainty. We've had some initial discussions with Mary and the staff on this, and I hope we'll get to a point later this year where we can share what that work is about, both with the staff and with the ACRS, because I know it's an important --

MEMBER APOSTOLAKIS: I understand EPRI is doing something for the industry, too.

MR. PIETRANGELO: Yes. But we're trying to make sure what we do -- EPRI and the owners groups -- that we --

MEMBER APOSTOLAKIS: Okay.

MR. PIETRANGELO: There's probably about four different efforts. We want one --

MEMBER APOSTOLAKIS: Okay.

MR. PIETRANGELO: -- that's supported by everybody.

Okay. I wanted to quickly go through the policy issues. I think we talked about one. The staff's recommendation is, yes, we don't agree. Okay.

On the second one --

MEMBER APOSTOLAKIS: You don't agree. Okay.

MR. PIETRANGELO: Yes, that's the penalizing thing we've talked about.

MEMBER APOSTOLAKIS: Yes.

MR. PIETRANGELO: And the second one -- if a licensee submits an application for which all of the applicable documents are in place, but does not conform to the guidance, should the application be given low priority?

We agree with the staff's recommendation, and it says it in our paper. If there is a standard out there, and you're using a PRA for that element, and you don't conform to it, then you ought to get a low priority. We don't disagree with that at all.

Okay. Policy issue 3 -- when all guidance for all current and anticipated applications is in place, should every licensee be required to conform to that guidance before submitting any risk-informed submittals?

The recommendation is no. This is -- I think it was explained before, for the licensee who doesn't want to do that whole suite of things, we shouldn't penalize that. So we agree with the staff's recommendation there.

Number 4 -- we disagree. This is on the -- if an application does not conform to the Phase 2 guidance, you reject it outright. And the staff I think appropriately captured our concern in the con here, and that there will still be -- and the Commission paper acknowledges this -- if you have a bounding analysis that was good enough before, all right, whether it restricts the scope of the decision or the application, appropriately restricts the application, it's not a resource issue anymore, because it's a bounding analysis. So that's not it.

This is just the -- we want you to have a greater scope PRA, and if you don't have it, you know, you can't come in. I think that's the wrong message to send. Not every -- it's going to be a cost-benefit decision. If you want to have everybody have the full suite, require it. Okay? If you can't -- I don't think the agency can even just reject things if there's an appropriate bounding analysis in there that's appropriate for the decision.

On number 5, I think this issue is moot. The NRC is paying the standards development organizations to develop standards. Okay? I mean, they're falling all over themselves trying to -- to hurry up and get these things done. So I don't even think this is an issue, and -- but I agree with the recommendation. If the staff thinks a standard is necessary and the SDOs don't want to do it, then go ahead, develop your own guidance.

MEMBER ROSEN: Isn't that a little bit simple, Tony? I mean, sure the NRC is paying the standards organization, and the standards organizations use participation across the whole industry.

MR. PIETRANGELO: That's true.

MEMBER ROSEN: And it is sometimes difficult to get the right people involved --

MR. PIETRANGELO: It is.

MEMBER ROSEN: -- and that -- and that takes a long time and may -- may or may not be available. So I think it's not entirely moot. I think there is a situation where we have -- I think we've used the word "hostage." I'm not sure that's exactly the right word, but I -- but it -- you know, we are going to have cases where we're not going to have the availability of consensus standards for one or more reasons.

And the question, really, then comes if we need a standard, well, yes, the NRC should develop its own guidance, and the industry and the standards organizations should just read it and weep, because they had their chance. The preference is for the standards organizations to do the job. If it's not -- isn't done and the agency feels it needs it and goes ahead, fine, that's the way it is, and that fully comports to the OMB Circular.

The OMB Circular just says use it if it's available. It doesn't say, you know, hold up with any regulatory action if -- until it's available.

MR. PIETRANGELO: Right. And the other point -- you mentioned about they're not -- there's nothing on the schedule for Level 2, Level 3, and so forth. And the proper -- I think the right response was given, "Well, there's no applications that use those elements now."

Well, the same can be said for shutdown. There's not one application, I don't think, that requires a shutdown PRA.

We think the order of the development of these standards is wrong. We think the fire one should be moved up. That's the one I think that has more -- we need to risk-inform the priorities of the standards development.

MEMBER ROSEN: That is a good point.

MR. PIETRANGELO: Fire is the one we think we're going to need sooner than the other ones.

MEMBER ROSEN: Yes. I agree with you on that, but I think that to -- the need for the low power and shutdown standard is incorrect, because it is important -- and it comes up frequently in the IDPs and elsewhere -- to do cycle risk optimization, where you're making a decision about when you should do online maintenance.

The question is often, well, it's going to -- we're going to take some risk, even in shutdown, by having this system out. Will we take more or less if we do it online? Well, you really don't know. I mean, you have some bounding analysis, and you have some qualitative arguments. But you really don't know unless you have a shutdown PRA.

MEMBER APOSTOLAKIS: Donnie?

MR. HARRISON: Tony is going to have to hold on to that thought, right? This is Donnie Harrison from the staff. I just wanted to back up to issue 4 real quick.

I think we probably need to clarify what our position is on issue 4. It wasn't to penalize a licensee that's using a bounding analysis. It's really to get out of the -- where we get qualitative arguments, or you don't do any analysis but you put on compensatory measures to try to control -- do fire watches.

And that's really the intent of stopping you from doing that. If you can do a bounding analysis to screen out a hazard, that would be acceptable and --

MEMBER APOSTOLAKIS: Yes. Because that can be as rigorous as anything.

MR. HARRISON: Right. So I think we need to clarify issue 4.

MR. PIETRANGELO: And then we agree.

MR. HARRISON: Yes. So I think that's --

MEMBER APOSTOLAKIS: But if it's a statement that -- to make it clear.

MR. SNODDERLY: Chairman Bonaca, I also wanted to make the committee and Tony aware of one other thing. Tony mentioned the importance of the Reg. Guide 1.200 pilot reviews. Next month in May at the full committee meeting Donnie Harrison is going to do an information briefing to the committee on the status of the pilot application, so we invite NEI to be aware of that.

MR. PIETRANGELO: Good. Okay. That's a very important effort. I want to leave you with one last thing.

MEMBER APOSTOLAKIS: Sure.

MR. PIETRANGELO: We are currently considering an effort to develop guidance on an enhanced decisionmaking process. Recall ancient history -- there was the EPRI PSA applications guide, and then the development of Reg. Guide 1.174 that this committee had a lot to do with. Okay?

It's been out there for several years. It has served us well. We're kind of entering this next phase now where we're going to have, you know, quantitative results, some qualitative things, some bounding analysis, some uncertainties, this and that.

And there's a thought on our side to saying maybe we need to have an enhanced decisionmaking framework to consider these different things. I think Dr. Kress raised the point about adding in, you know, the contributions from the other elements of scope. And, you know, obviously there's different levels of uncertainties with some of those other things, but is it appropriate to add it in? Or if it is appropriate, how do you do it? That kind of thing.

So we're seriously considering an effort on kind of an enhanced decisionmaking framework, probably akin to what we did on the applications guide, but more perhaps for the staff to endorse in a subsequent review relative to 1.174, or just as input to a revision to 1.174. That's still the motherhood document in Reg. Guide 1.200.

MEMBER ROSEN: Who has used that?

MR. PIETRANGELO: We developed it for ourselves I think first of all. I mean, the applications guide was for ourselves. I mean, there's a lot of risk-informed decisionmaking that doesn't -- is not submitted to the NRC. Okay?

So I think we have to be certain about how we're doing that and doing it appropriately. And if it works in the regulatory process, then that's even better.

MEMBER KRESS: Would that include a more substantive quantifiable definition of defense-in-depth, do you think?

MR. PIETRANGELO: Perhaps.

(Laughter.)

MEMBER KRESS: And safety margins.

MR. PIETRANGELO: I think we're kind of in the embryonic stage, but I think given that that's one of the elements in the decisionmaking framework and 1.174, I think yes.

MEMBER KRESS: Yes. Well, it would be quite interesting to see --

MEMBER APOSTOLAKIS: Well, the quantitative measure of defense-in-depth in fact is known as PRA I think.

MEMBER KRESS: Yes, but it's -- you can mess around with --

MEMBER POWERS: Only to a misguided rationalist.

(Laughter.)

MEMBER APOSTOLAKIS: Mr. Pietrangelo, do you have anything else that is much more --

MR. PIETRANGELO: No. Thank you for the time.

MEMBER APOSTOLAKIS: Okay. Thank you very much.

I hear no other comments. Back to you, Mr. Chairman.

CHAIRMAN BONACA: Okay.

MEMBER APOSTOLAKIS: Because I didn't ask for any, right?

CHAIRMAN BONACA: Let's take a break and get back at 10:30.

(Whereupon, the proceedings in the foregoing matter went off the record at 10:11 a.m. and went back on the record at 10:27 a.m.)

CHAIRMAN BONACA: Okay. Let's get back into session.

The next item on the agenda is SECY-04-

0037, issues related to proposed rulemaking to risk-inform requirements related to large break LOCA break size and plans for rulemaking on LOCA with coincident loss of off-site power.

And Dr. Shack is going to lead us through.

MEMBER SHACK: Okay. We had a subcommittee meeting on this in which we discussed essentially the status of the rulemaking in terms of some policy and technical issues that the staff had identified, and the status of the expert elicitation to define the frequency of large break LOCAs.

And we'll be reviewing those two items here today, and Eileen and Glenn are going to start off by going over the policy and technical issues that the staff has identified. And then we'll follow with a discussion of the frequency of the large break LOCA.

MS. McKENNA: Good morning. My name is Eileen McKenna. I'm currently a Section Chief in the Policy and Rulemaking Program in NRR, but I had been the Lead Project Manager on this effort during the development of the paper that we had sent up to the Commission.

With me is Glenn Kelly, Senior Reliability Risk Analyst in the Probabilistic Safety Assessment Branch in NRR. In the room we have other members of our working group who, you know, may be called upon if necessary for various topics.

We want to try to get to the technical issues for discussion as quickly as possible, so I'm going to kind of cover this one part fairly quickly -- typical agenda, the purpose, background, into the discussion of the issues, and then a wrap-up.

Our purpose at this point is -- was to inform the committee about what we've been doing since we got the SRM and to certainly obtain any feedback from the committee that they would like us to consider as we move forward in resolution of the technical issues and development of the rulemaking.

Briefly, in background, option 3, there had been previous discussions with the committee about risk-informing technical requirements in Part 50, and 50.46 was one of the candidate rules that was suggested as opportunity to consider the risk importance of various break sizes and how that relates to the requirements and make appropriate changes.

There was papers that went up to the Commission in '01 and '02, and that resulted in an SRM on March 31, 2003, that, among other things, tasked the staff to conduct two rulemakings -- one to prepare a proposed rule that allows for a risk-informed alternative to the present maximum LOCA break size, and, second, to prepare a proposed rule that would risk-inform the functional reliability requirements and thus relax the current requirement that for -- assuming large break LOCA with a coincident loss off off-site power.

The SRM had a number of specific statements about what they wanted the rulemaking to consider, and I just want to cover a few of those because they led to, in some respects, some of the issues that we're dealing with.

As I mentioned, the first one was to develop the risk-informed alternative maximum LOCA break size. The Commission suggested a change to the definition of LOCA to exclude some low-risk contribution. But, you know, they kind of left it open as to exactly how that might be accomplished.

It did state that the staff must establish the risk cutoff for defining the new maximum LOCA break size. And, again, they gave some examples of how that might be undertaken.

There was a statement in there that the Commission would not support changes to functional requirements unless they were fully risk-informed, and the Commission gave as an example that they did --

that they did not support changes to ECCS coolant flow rates or containment capabilities.

VICE CHAIRMAN WALLIS: Unless they are fully risk-informed.

MS. McKENNA: Well, the first sentence was -- the functional requirements, unless fully risk-informed. This was a separate sentence.

VICE CHAIRMAN WALLIS: Yes. So it wasn't clear to me whether it was dependent on the -- this being risk-informed or not. This is part of our discussion in the subcommittee.

MS. McKENNA: Well, yes. Exactly, right.

VICE CHAIRMAN WALLIS: It seems to be a bit up in the air.

MEMBER APOSTOLAKIS: And fully risk-informed means what?

MS. McKENNA: Well, this is one of the things that we spent a lot of time discussing in our working group as to -- we'll get into that in I think some of the issues that we are presenting.

MEMBER APOSTOLAKIS: Phase 3 or 4.

MS. McKENNA: There were three other statements I'll just touch on from the SRM. One about -- it's kind of using best estimate ECCS evaluation models. I won't spend a lot of time dwelling on it, just that that was part of it.

The next one I think leads directly to the point that was just made. The SRM had a statement that once the standards are in place, the PRA should be Level 2 internal and external initiating all modes. PRA subjected to peer review and submitted to and endorsed by the NRC.

Now, obviously, this SRM predated the December SRM on the action plan, but this was, you know, a statement in the SRM that we were responding to. And, finally, there was a statement that operational changes should be reversible if local frequency estimates, which are -- you know, as Rob will probably tell you, you know, there is a tasking to revisit the estimates every 10 years. And if we find that the frequency change is unacceptable in some sense that we might need to reverse what was implemented under this undertaking.

MEMBER FORD: Could you say something about the origin of the 10 years, and whether that's immutable? Given the fact that many of the degradation modes that become unfortunately unexpected.

MS. McKENNA: I think it came out of the Commission vote sheets in the SRM. There was a separate provision for a five-year look for new failure mechanisms. And I think, as Rob had mentioned at the subcommittee, this doesn't mean that we're going to be ignoring operating experience and information as time goes on. But it was more that the Commission wanted this periodic, you know, more in-depth perhaps consideration of the information and reassessment.

So that's how it kind of -- I don't know if there's any more magic to the 10, beyond just --

MEMBER FORD: So it's not immutable.

MS. McKENNA: I don't think -- I mean, just other than, you know, as I said, the Commission proposed it. But, you know, if there was some basis for us to say, you know, we really think we need to do it more often, or whatever, I'm sure, you know, the Commission would not, you know, say no on that -- in that sense if we had, you know, reason for that.

MEMBER KRESS: And PRA referred to in your second bullet --

MS. McKENNA: Yes.

MEMBER KRESS: -- that's -- if you change the rule, then the licensee comes in and wants to make changes to his plat based on risk information, that's the PRA you're talking about.

MS. McKENNA: That's correct. Because this is meant to be a voluntary alternative that a licensee could take and use, not that they'd be required to do that. And this would be, again, part of -- if you were making these changes, then we need to consider the impact on risk. And the Commission was looking for this level of PRA.

MEMBER KRESS: That looks like a Phase 3 PRA. What would you call it?

MS. McKENNA: I'm not an expert, but I think -- Glenn, maybe -- would you call it a Phase 3? Or Mark?

MR. KELLY: No. It's actually a Phase 4, because it has been reviewed by the NRC, and that doesn't happen until Phase 4.

MEMBER APOSTOLAKIS: But weren't we told earlier that there has been no application of Level 2 PRA to this day? And the letter from the -- from ANS and ASME says that there are no plans to issue a Level 2 standard. So when you say once standards are in place, that means now you are talking about several years in the future.

MS. McKENNA: Well, that was one of our considerations as we were working on this effort. And as I mentioned, I think the December SRM kind of gave another opportunity to revisit this point as to whether this level of PRA is necessary for the applications that might come out of this redefinition, which kind of leads into the paper and what the scope of the rulemaking might be.

MR. MARK RUBIN: Yes. This is Mark Rubin from the staff. The original SRM said reviewed and endorsed by the staff, and this is something, as Eileen said, that's being sort of revisited by the further work being done by the rulemaking. It will probably be subsumed by the phase quality initiative and be developed in more detail by the rulemaking and fleshed out by the detailed rulemaking.

MS. McKENNA: So, as I said, that was kind of the backdrop of where we were in the basically March/April timeframe last year, and just -- I'm going to go through a couple of bullets on what we -- you know, we did. As I mentioned, we had a working group that we brought together people from various groups that would be impacted and would need to contribute to this effort.

And we went through the SRM and some of the things like, what does fully risk-informed mean to us, and how would we carry that out, and we tried to understand, you know, that if we really did this in particular ways what would it mean and how would we do it.

We got some initial stakeholder input about, you know, what kind of applicants -- this was supposed to be voluntary alternative -- you know, candidate offered as a -- for potential burden reduction as -- that's suitably risk-informed. And so, you know, we get some -- so I had some discussion about what could be the scope and what should be required for implementation, and some idea of possible applications that industry might be interested in as a result of the redefinition.

We started looking at, okay, how might we write a rule? How would we do this? You know, should we redefine LOCA, and what's the implication if we did that? Or should we write it in a different way that was more focused on, you know, an application that you'd -- you know, you'd list particular applications or, you know, as a process like, you know, instead of saying here's the requirements that no longer apply, and here's the new requirements.

And we tried to look at various ways you might go about that, so that we did do it in a risk-informed way and made sure that we had the right requirements, that the changes that might occur to the plant would be appropriately looked at, that PRA scope would be suitable to what we're doing. And as we said in the last bullet, the lifetime aspects, you know, which gets you to the reversibility things of, you know, over time are we -- you know, are the changes going to continue to be acceptable?

As a result of those deliberations and discussions, we identified a number of issues that we thought needed development and resolution in order to move forward with the rulemaking. And we'll talk about these a little bit more shortly.

And we also did some -- initiated some research activities to look at some implications of some of these things -- that if you were to do, for example, uprates, what might be the kind of change in the thermal hydraulic response. You know, how might that affect risk on some candidate sample basis to, you know, give us an idea of what ballpark we might be in on some of these things?

We had a briefing for the Commission assistants in January, and kind of as a result of some of that discussion and our efforts to try to present these issues and how they were challenging us to complete the rulemaking, we ended up sending up the SECY-04-0037 paper. And what we tried to do is frame the issue.

The major issue we saw is that we needed to have a better understanding from the Commission of, really, how far they meant us to go. Were they really looking for a very specific set of a few small things that could be done that are support arising from the large break LOCA redefinition?

Or were they really looking for a broader, it's redefined, and take it where it leads you with some suitable set of acceptance criteria that, you know, are risk-informed, but these were very different kinds of rulemakings and approaches. And the complexity of solving the issues and the success of those would certainly vary.

So that's the major issue we framed to the Commission as policy of how -- do we go in a specific, narrow, or do we go more broad, comprehensive? And we also had some others in there, but this was the major topic.

And then, as I'll turn it over to Glenn in a moment, there were also a number of technical -- technical/regulatory we called them -- issues that we felt needed to be considered.

Let me turn to Glenn.

MR. KELLY: Hi. I'm Glenn Kelly with PRA

Branch in NRR. This morning I'd like to talk to you about some of the technical and regulatory issues that arose as we attempted to meet the guidance that was laid out in the SRM that the Commission gave us in March of 2003.

We found that there were -- some of these technical issues were potentially very challenging. The first one that I'd like to talk about is determining -- one of the things we felt we had to do was to determine what are the appropriate criteria that we needed to use to decide what would be the new maximum design basis LOCA.

And then, once we decided what that criteria was, how much confidence would we need to have in that particular criteria, or in the information that was going to be used to determine whether or not that criteria was met. And Rob Tregoning is going to be talking later to you about the elicitation -- expert elicitation that developed frequencies for these small and large break sizes.

VICE CHAIRMAN WALLIS: I don't know how you assess confidence when you ask experts.

MR. KELLY: Well, I think that that's one of the things that Rob is going to be talking about, and about the process that they use. And they have attempted to include the uncertainty among the experts, as well as just the inherent uncertainty in the results themselves. But they'll talk in more detail about that.

MEMBER KRESS: Will you talk about the -- what is the -- what you think is the appropriate criteria?

MR. KELLY: I'm sorry?

MEMBER KRESS: Well, you know, you talked about the issue is what is the appropriate criteria to use, redefining the LOCA. Are you going to talk about what you've decided at --

MR. KELLY: In our paper that we sent to the Commission on March 3rd, we identified a number of technical issues. And one of the ones that we said that we wanted to --

MEMBER KRESS: Well, you want feedback from the Commission on that. That's what you --

MR. KELLY: We were not seeking Commission feedback on that. We were indicating to the Commission that this was a technical issue that we were going to be working on.

MEMBER KRESS: I see.

MS. McKENNA: The paper we did kind of talk -- suggest that we thought a frequency of break size was part of this criteria for selection, rather than a risk number, for example. I think that -- but it's not something that we've picked a number and we're going with it, but it's kind of an approach that we had suggested in the paper.

MR. MARK RUBIN: This is Mark Rubin again from the staff. A frequency-based approach and an appropriate confidence about that are two I think of the challenges that, you know, we are faced with, that we have to develop. We are early in the process. We are certainly seeking guidance and consult in doing that, and I think Rob may have some --

MR. TREGONING: Yes, just a clarification. This is Rob Tregoning from the staff. We looked at uncertainties due to two -- two areas. One, we looked at the uncertainty within the responses for each panel member in the elicitation, but then -- so we captured that. We also captured the variability among the panel members, so we had two different measures that we used to capture each of those areas of uncertainty.

And we would propose that -- and one of the things we've talked about and we're still kicking around on the staff level -- and it goes to the heart of this issue -- how do you use both of these measures of uncertainty in a rigorous way when you go set the regulatory -- when you revise the regulatory framework.

So that's -- that's certainly a substantial technical issue that we're, as Mark said, still struggling with.

MR. KELLY: And one of the aspects that I think you'll find as I think we go through these technical issues is that potential resolution of one issue many times depends on how you're resolving something else, because, for example, one of the things that we'll talk about later here is about the retention and mitigation capability.

Having -- if you had no retention and mitigation capability, you might choose a different criteria than if you had very high confidence in having retained mitigation capability. So these are all things that have to be considered when we come up with our final recommendations.

MEMBER SHACK: Now, the elicitation scope, too, is only the degradation of piping systems, which is certainly not the only way that you can get LOCAs. And it wasn't clear how you were going to address essentially the other LOCA frequencies.

MR. KELLY: There are -- the elicitation has attempted to address other non-piping breaks, such as manway covers, things like that. It -- they have not, at this point, completed work on things such as the effect of seismic events on the piping, or water hammer, what -- and I don't believe that they're going to be dealing with heavy load drops. But they have covered things up through vessel rupture.

MR. TREGONING: Yes. Glenn, let me try to be clear. What we did in the elicitation -- and we're having a lot of the discussion that may best be postponed for when I'm up there. I don't want to take too much of your time here this morning. But the SRM was very clear in the direction that was really specifically to look at that -- those portions of LOCAs that were due to primarily normal operating loading due to passive system degradation.

As you've mentioned, you certainly get LOCAs from a variety of additional sources. One of the things that we've mentioned is an issue is when we do this rule revision we have to consider all of the sources of LOCA to make sure that we're fully risk-informed.

So in areas -- and, you know, so areas of crane drops, areas of seismic, areas of -- we considered water hammer, just not the rare water hammer -- the water hammer that would only occur -- we defined "normal loads" as loads that you'd expect over a 60-year plant life. So if it's the rare -- you know, the one in a 100-year water hammer, we didn't explicitly consider that.

So all of these things need to be also rolled in and considered as well. And we've looked at one piece. We obviously still need to go back -- and there's been a lot of work done over the years in these other pieces, and our plan is to go back and look at this work, dust it off, and see which of this -- which of this -- given what we want to do with the information, does this work still hold? You know, is it still valid, or do we need to update it in some sense?

There's been a lot of work done on seismic piping failure frequencies, and we don't want to reinvent the wheel so to speak. We just want to take what we've done, update it as we need to to try to make sure it's consistent with the intent of, again --

MEMBER SHACK: Well, I was more interested in Glenn's example for -- of the manway failures. Is that included, or isn't it included --

MR. TREGONING: Yes.

MEMBER SHACK: -- in your scope?

MR. TREGONING: Yes, that's included in

the scope.

MEMBER ROSEN: How about reactor coolant pump seal?

MR. TREGONING: Not pump seals. We defined -- we were very clear dealing with passive system metallic components. And we didn't deal with things like stuck open valves, pump seals. We defined those as active system LOCAs.

Now, we are -- we do have a corollary effort that's looking at updating those frequencies. Those frequencies have been studied pretty extensively throughout the years, and we've got a pretty good operating experience for those types of frequencies. So we are updating those numbers just to ensure that they are consistent with the latest numbers that we have for the passive system failures.

MEMBER KRESS: Do you envision this rule when it's written to be -- have a different form for application to new plants as opposed to an operating plant?

MR. KELLY: As we had talked about for the subcommittee, we've proposed that for future plants that the -- that we postpone the effort to define how LOCAs would work for them. And one of the reasons was that it's not clear what would constitute a design basis event for future plants.

And because what we're talking about here is modifying the design basis to exclude certain breaks above a certain size. It's just not -- I'm not sure how that would fit in with -- because it may be that a future application might be entirely risk-informed.

I'd like to move on to technical issue number 2, and that issue had to do with a better understanding of what is the practical effect if I actually take an event, such as breaks above a certain size, out of the design basis? What does that mean technically? What does that mean legally, for QA maintenance, reliability, all of these other things? How far do the tendrils of this go throughout the design? That's a very challenging question.

What can be changed under the rule if you change the design basis, if you take these events out of the design basis? Will I be able to have much larger power uprates than I was able to do before? I think that would be an expected consequence.

Would I be able to change my ECCS capabilities? Will I be optimizing my flow rates to handle small break LOCAs rather than large break LOCAs? Ultimate heat sink capacity might change. I could change boron concentration in the refueling water storage tank or in other places. EQ profile is going to change in containment, things like that.

So where if we go to a broader rule, where it's a process-oriented rule rather than a very defined list of changes to equipment, under a broad rule, where, if anywhere, do we want to say, okay, here is where you stop.

VICE CHAIRMAN WALLIS: But if the large break LOCA had never been there, all of these things would have been different.

MR. KELLY: That's correct.

MEMBER ROSEN: We have the great fortune in this industry of having a bunch of innovative and intelligent people running these plants. And you can be sure that if this rule goes into place they will scurry around and find all of the opportunities, even the ones you missed.

MR. KELLY: Right.

MEMBER ROSEN: Now, that leads me to my question, which is, are you using the industry's resources or asking the industry to help participate in these discussions? Because they will likely have ideas about ways this could be used that will go beyond what you might expect.

MR. KELLY: I'm sure that they have already been thinking about many ways that they can make use of this potential rule change. We have asked a number of times. We've gotten some responses back from the industry. I think one of the most complete responses was a white paper that they put together, gave us a draft in July of 2003 that describes some of what they wanted to do.

There was also some discussions that were held at an overseas conference where they talked in more detail about some of the potential changes that they might like to make. So we've had some discussions.

For various reasons, we've not had -- since -- when was the last time we had a public meeting?

MS. McKENNA: July, I think.

MR. KELLY: July of last year -- we've not had a public meeting, and it's in part because we were preparing to go forward to the Commission and explain where we were.

MS. McKENNA: We weren't sure of the Commission's receptiveness to some of the areas one way or the other. So, you know, it's kind of -- we could have discussion with the stakeholders externally and say, "Okay. Yes, it sounds like these are good candidates," and then but -- but, you know, the Commission said, "But we didn't want you to change ECCS flow rates." So, you know, is that one off the table?

So that was part of our difficulty with having too much discussion on possible -- I think we have an idea from the things that Glenn mentioned of some of the things that are in people's minds, and I -- you know, I think they are looking for, okay, well, what would be involved?

You know, what's the -- again, some of those -- am I going to have to do a full scope PRA in order to get these? You know, what else -- you know, are there some other tradeoffs? Things like that. And, you know, should we continue on these, or are they just going to be rejected?

MR. MARK RUBIN: But in direct answer, we will be actively soliciting industry participation. As part of the rulemaking we will be having numerous public meetings asking just those questions and incorporating in our rulemaking activities all stakeholder participation.

MEMBER ROSEN: Very good. Because as this comes into focus more and more in the industry, they will get -- more and more ideas will come forward that -- some of which will be challenging, and some of which will be no-brainers. But whatever, it takes -- what I want to do is encourage you to continue to do that, to continue to pulse it as you go forward, because it's not a one-shot kind of thing. People will think of new things as the process moves forward.

CHAIRMAN BONACA: The question I have regarding some of the examples here -- I mean, some of them would prevent the reversibility that the SRM is specific on. And why would you use them as examples? For example, I see using the excess capability of ECCS for doing many things. A reduction in ECCS capability -- are you speaking of qualification?

MS. McKENNA: Well, certainly some are more difficult to reverse than others. Absolutely.

CHAIRMAN BONACA: Or flow rates?

MS. McKENNA: Yes.

MR. KELLY: Part of the -- one of the things that we've talked about in reversibility is that there are two ways to do reversibility. One way would be to actually physically reverse the modification, whatever was made, in a sense of if I took out a pump, put the pump back in.

Another way of reversing it might be to --

changing how I operate the plant in some way to give me the same effect, in the sense of I might be saying what I'm really reversing is the increase in core damage frequency. And, therefore, if I can do other things that are going to change that increase in core damage frequency, that would be equivalent to making -- reversing that change. And that would be, you know, the way we're postulating it, where we would say that that's acceptable.

CHAIRMAN BONACA: Because, I mean, maybe I misunderstood it, but I read the SRM always as, in fact, not proposing to reduce the functional capability of the system, but to use it for other purposes. I mean, that to me is -- defines reversibility.

You know, if you talk about beginning to remove pumps and pipes, yes, I mean, to reverse it means pretty massive changes to the plant. I mean --

MS. McKENNA: Well, this was one of the issues we did pose back to the Commission to say, you know, could they give us any more insight of what they had in mind by reversibility, and were they open to the kind of reversibility that we were talking about of, you know, kind of an overall risk thing rather than saying, you know, this -- on a change-by-change basis, you have to undo it versus what Glenn was talking about of considering that it's a risk contribution, is there something else that offsets it.

MR. KELLY: In looking at the SRM, their SRM was put together from a number of vote sheets. And there are some places where we had some difficulty in interpreting exactly what was meant, and there are some places we felt it was requiring a very narrow rule. In other cases, it appeared to be applying in a much broader sense.

And so, again, that's one of the things that we've gone back to the Commission and said if you want a very specific, potentially a rule where we basically list, you know, the only changes that you can make, are you going to do it on a basis of broad changes?

CHAIRMAN BONACA: Yes, okay. That's great. Appreciate your bringing it up, because, I mean, I always presumed in my mind that reversibility meant something. And that combined with the reevaluation of the frequency of breaks every 10 years, so it seems to me that if you have that process -- but you are right, I mean, you could interpret it differently. And so --

MS. McKENNA: And it is a bit of a new

concept in regulation to say that, you know, you do something and then you reverse it later, you know, if particular -- on a case by case -- you know, there is always kind of the you revisit it if you get new information. But to specifically build into your process reversibility I think is a little unusual.

MEMBER ROSEN: Well, it's not entirely new, Eileen. I think in the exemption request, the graded QA thing for South Texas, there was a requirement to relook -- to look at whether the changes that had been made were, in fact, affecting the failure rates, and, if so, to consider whether the new failure rates that were being observed were large enough that you'd want to reverse the changes. So I would say there is some precedent.

MS. McKENNA: Okay. That's fair. I mean, again, we're getting more into the risk-informed applications, where I think it becomes more of a consideration.

CHAIRMAN BONACA: But to me, the SRM really meant controlling the interface between within design basis and beyond design basis, and be flexible about that -- flexible based on the information you do have regarding frequency of breaks. And so that, to me -- well, that's the way I interpret it.

MEMBER SIEBER: I think you have the other issue, too, of if you change the plant's design basis, and then you modify the plant -- for example, the sump screens -- if you say risk-informing that issue means leak before break or limiting the break size, that limits the debris accumulation which is what really sets the size of that screen. So that's not a reversible process. That's a tear out and replace process.

CHAIRMAN BONACA: See, that's what I mean. I think that, you know, I see a more narrow definition of reversibility -- I mean, something you can effect.

MEMBER SIEBER: Well, that goes a step further, too. You know, you really don't need to change 50.46 in order to apply that principle to that particular question. And I think that application, though, would have to be consistent with whatever it is you do in 50.46, you know, because you're relying on the same philosophical and theoretical --

MS. McKENNA: Absolutely.

MEMBER SIEBER: -- basis to make that change to the plant.

MS. McKENNA: I mean, this goes back to the comment I think that -- about what areas there is interest in the industry, and this one has come up as a potential candidate of, you know, is there room here?

I mean, I think there's recognition that some of these other issues that we talked about, like mitigation capability, would have to be dealt with in a manner consistent with what we're talking about here.

But this is one where there is, you know, a real application potentially, and people seeing -- you know, they're going to have to make a decision about what kind of upgrades to make on their screen potentially, and, you know, could that be done in the -- something other than consider the double-ended and treat it like, you know, we would normally do and, you know, take -- see where that takes you.

MEMBER SIEBER: Well, I think that without some kind of guidance, when licensees propose a modification to the plant to deal with that, you are going to get all -- a wide variety of approaches and a wide variety of assumptions. And it would be good if you are prepared for that when the time comes.

MS. McKENNA: Well, I think that's why, you know, we want to try to work through these issues, and those activities, you'll see in a later slide, you know, to try to get us to that point of having some consistent basis to make those kind of decisions from.

MEMBER SIEBER: Well, that will be your first challenge -- to come --

MS. McKENNA: No question.

MEMBER SIEBER: -- to come in the door before you even get to 50.46.

VICE CHAIRMAN WALLIS: It is very thoughtful on that, but it seems to me that you really ought to consider a broad -- what would you do if there were a broad interpretation of this? And then back off from that.

So, I mean, that's the biggest thing you'd have to face when you have very broad interpretation, and then you'd face all of these issues in spades. If you faced that and thought about that, then you might be able to argue about how you should back off from some of the implications of that.

MR. KELLY: Well, I think that's one of the things --

VICE CHAIRMAN WALLIS: You can't just whittle away at a problem by asking all of these questions. You may well have to interpret a broad change in the rule.

MR. KELLY: Well, I think most of these questions -- these issues came up with the thought that a broad rule might be the approach the Commission chose.

MS. McKENNA: Again, there were indications about, okay, if you really define the definitions -- the LOCA in the regulations and said -- you know, and carry it forward, you would do that broad thing.

And so then we started asking ourselves, well, you know, did the Commission really mean, would the -- did we think it would be appropriate to really use it in this way? Or, you know, does that mean that you can change this part of containment? Does that mean you can do this? Can you do that? And on what basis would you decide that?

You know, as Glenn said, are there things where we're saying, "No, we don't want to entertain changes in that area, because we think it would not be risk-informed"? And do you do that by writing criteria? Do you do it by fencing things off?

There's different ways you could approach it, but those are some of the considerations, because we were looking from the -- you know, if it really was broad, you know, just doing broad by itself, you know, we think is not sufficient. You would have to figure out, what is the box you build around it, so that when

-- the changes that actually get implemented are the right ones.

MR. KELLY: I think issue number 3 we've already talked about. So I'd like to jump on to issue number 4, and that has to do with mitigation capability. Technically, if one were to merely say, okay, I've taken break sizes, say, above six inches out of the design basis, that if one did that, then there would be no requirement that the design mitigate breaks above six inches.

And, therefore, there would be no requirement that a LOCA of six and a half inches would not go to core melt, would not go to early containment failure. There would be no requirement at all for that.

CHAIRMAN BONACA: Right.

MR. KELLY: Now, we -- and the industry has indicated their agreement, too, in meetings that they think that this -- some mitigation capability should be retained for these break sizes that are greater than up to the double-ended guillotine break.

But the question comes: what would this mitigation capability be? We've talked about that we wouldn't need as much assurance. For example, now we basically require for a design basis accident you can handle, you know, loss of off-site power or loss of one of the, you know, greatest single failure, and all of these other things that go along with it.

Maybe we would say, you know, you need only one train. We require -- we don't think that -- maybe we're going to let you go beyond 2,200 degrees F peak clad temperature. It's still -- we have some research work going looking into that, about what are the potentials for --

CHAIRMAN BONACA: Well, most likely they use best estimate.

MR. KELLY: That's correct. We would be using codes, especially once you're going beyond, you know, what -- your design basis would be looking for best estimate type -- those are realistic codes in this case.

MEMBER POWERS: Professor Bonaca, you raised this interesting issue of best estimate in connection with peak clad temperature. It seems to me that when we go look at what the intentions of peak clad temperatures were when they formulated the original versions of 50.46, you have to be careful we do not forget what the realities are today.

The realities today are that we're taking fuel to much higher levels of burnup than were ever envisaged at the time the original regulation was written. Yet we do these peak clad temperatures now both in -- in the DB analysis codes and even in the best estimate codes in this rather peculiar fashion where we're not looking at the peak temperature at any time of a particular location.

What you see in these plots is the temperature that's highest wherever it is in the core. And so we're looking at things that temperatures affect to see if that clad will rupture and release its fission product inventory.

But, in reality, if you take clads to high levels of burnup, you oxidize them more, you create an oxide layer, and they are susceptible to other things now than were ever envisaged at the time. For instance, thermal shock -- now it's not just the peak temperature, it's what the delta T that the clad experiences and it suddenly cools down, and what not, that becomes important.

So when we say we go to best estimates, I think we have to think about not best estimates in a stylized design, but best estimates of what's physically going on in the fuel.

CHAIRMAN BONACA: That's right. Because probably in this case, I mean, the concern would be, you know, coolability more, and so you relax the criteria which you are using. But you are still expecting some level of coolability of the fuel, and that would go -- that kind of evaluation.

MR. MARK RUBIN: Yes. Mark Rubin again. We certainly agree. We'll be working with our colleagues in the Office of Research to try to develop the appropriate approaches and methods to develop the criteria to arrive at the appropriate criteria as part of the rulemaking development.

MEMBER POWERS: I think your colleagues in the Office of Research are going to be very heavily stressed when you come and ask them this question --

(Laughter.)

-- because you're going to ask them, gee, what really happens in a core when I have a break, and they're going to have to admit that they don't have a whole lot of experimental data for these kinds of scenarios that you're looking at.

And they're going to give you plausibility arguments, and I hope you're skeptical enough that you will be able to see through plausibility arguments and say, "Where is your data?"

MR. KELLY: One or the other areas about the mitigation is once we decide -- once we decide whatever level of mitigation it is that we want, then we have to decide, is that something that we expect a licensee to justify that they've met that? Is that something that we're going to look at generically and try to do it? How is that actually going to happen? And, again, it will depend on whatever the mitigation was.

If it -- certainly, the further we go beyond 2,200 peak clad temperature design basis, and the further out we go, the more uncertainty we have, the more we're stressing the codes themselves, and whatever analytical tests or physical tests will be performed.

The fifth issue --

MEMBER APOSTOLAKIS: In the fourth, as I remember, in NUREG-1150 the conditional containment failure probability was essentially between zero and one. The uncertainty was huge.

(Laughter.)

MEMBER POWERS: Well, I don't think Professor Apostolakis is being facetious there. I believe that's what the result was.

MEMBER APOSTOLAKIS: Yes. So when you say, how will this be shown, uncertainty in core damage and severe accident would need to be addressed

-- are you going to do more than what 1150 did, or -- I mean --

MR. KELLY: I think -- when I say that, I think one of the things that we have to do is we have to take a very hard look at exactly what Dr. Powers has talked about, is what is the data that we have? You know, if we say that we're going to go beyond 2,200 degrees F, we're going out in these other areas, how are we going to -- I think it's important that we very carefully characterize our state of knowledge about how good these new numbers are, and then take that into account in our decisionmaking process.

MEMBER APOSTOLAKIS: But my point is, with the current state of the art, this uncertainty is huge.

MR. KELLY: Yes.

MEMBER APOSTOLAKIS: So now you are moving beyond the current state. The uncertainty is not going to go down, is it?

MR. KELLY: No, it's more huge.

(Laughter.)

MEMBER APOSTOLAKIS: Huger.

(Laughter.)

MR. MARK RUBIN: This is Mark Rubin again. We may move beyond. We may not. What we need to have is confidence in mitigative capability. And it really will be up to the utilities who want to voluntarily implement this approach what approaches and what criteria they want to use.

They may -- we've seen an initiative from the BWR Owners Group on an initiative for a LOCA/LOOP. They're going to use the current peak clad temperature in 50.46, and they have enough margin to do that using some best estimate and hydraulic codes. And they're going to stay with 2,200 degrees peak clad temperature.

They don't have to push beyond the current criteria. The PWRs may or may not have the ability to do that.

Whether people have to go into areas pushing the technology and having to look into some of the areas of greater uncertainty will be something we may have to look at or we may not have to look at. We don't know yet.

MEMBER ROSEN: The only thing I would quarrel with what you said, Mark, is you said you were going to have to have confidence, and I would say you need to have appropriate levels of confidence, given the circumstances beyond the new design basis --

MR. MARK RUBIN: Yes.

MEMBER ROSEN: -- break. And it would be -- it ought to be variable. Maybe you'll have less confidence if you are thinking about the full 36-inch break, the biggest break, let's say.

MS. McKENNA: I think that goes back to something Glenn said earlier about the interrelationship among things. Depending on where you select your break size, what you do, what kind of changes you make, the degree of mitigation and/or the confidence you have in it, they all have to be commensurate with each other, so that, you know, you support whatever you're doing.

CHAIRMAN BONACA: And the definition you put in about what happens beyond design basis will affect, for example, how many megawatts I can increase my power level by.

MS. McKENNA: Absolutely.

CHAIRMAN BONACA: I mean, you are, you know, potentially here considering the large span of breaks beyond six inches or eight inches, or whatever it might be. You know, you could conceivably raise your power level very much.

MEMBER POWERS: You were looking apparently at just changing break sizes. Have you looked at all at what the Germans have been doing about the double-ended guillotineness of the break?

MS. McKENNA: Do you mean in terms of the rate at which it --

MEMBER POWERS: No, just take it -- no, no.

MS. McKENNA: I'm not sure I understand what you --

MEMBER POWERS: They got rid of the double-ended guillotine, and they said, "Well, the thing will break, and it's an offset, and I have this much" -- and they changed the flow area.

MS. McKENNA: Okay.

MEMBER POWERS: On the -- for the flow based on a variety of arguments that I never really quite understand, but they have blacksmiths, too, and they make arguments that this is how pipes -- large pipes really break. And I believe their blacksmiths as much as I believe our American versions of that profession, which is totally without question.

(Laughter.)

MR. KELLY: Well, you'll have an opportunity to ask the blacksmiths a little later as they explain their numbers that they have for the break size frequencies. From our standpoint, we are -- you know, we will work with that information that we get.

And I would only assume based on the level of expertise that was amongst the 12 experts that were there that they are aware of -- or at least a number of them were certainly aware of that data, and Rob can talk to you more about some of the input that they gave to the experts to make sure they were all kind of on the same page.

MEMBER POWERS: You're asking blacksmiths to all speak from the same page. That's an impossible task.

MR. KELLY: To the extent possible.

(Laughter.)

VICE CHAIRMAN WALLIS: And as I said at the subcommittee, number 4 is very interesting to me, because it looks to me the beginning of a discussion of what one might do about a reactor where you didn't have a design basis accident spectrum, but you had to put far more preventative, mitigative, and all these other features in there as part of the design. But you didn't have the current design basis structure. So this looks like we are beginning to look at a regulation of that sort.

MR. KELLY: Right.

MEMBER RANSOM: It seems to me in making

some of these decisions you also have to decide what risks are acceptable. In other words, are there incredible accidents which provide a risk that you can't do anything about? And while pipe breaks are more probable than some of these more incredible events like vessel failure, vessel rupture, they don't provide -- because of the mitigating systems -- as much risk as those.

And so, really, it seems like the tradeoff here is in risk based between what risk -- do these contribute significant risk? And a lot of times the large breaks don't contribute significant risk because of the mitigating systems that you have. And if you take them out, they now become more significant from a consequence point of view.

And so that tradeoff, it seems to me, is there. And I wonder in a way if this isn't driven more by the intuitive idea that large breaks are less probable than small breaks, even though the -- and the consequences often times are less, too, because of the mitigating systems, you know, that you have accumulators and you can take care of them.

And, in fact, I think that's borne out by the advanced reactors in which they turn small breaks into large breaks, because they are easier to manage.

MR. KELLY: Well, I think, as we've talked about before, is that all of the risk assessments that I'm aware of have shown that the design basis accidents are "no, never minds" in risk space. They don't constitute a risk challenge to the plant. It's when you get additional failures that you run into problems. So --

MEMBER POWERS: Well, the design basis accidents, by definition, should contribute nothing at all to the risk.

MR. KELLY: Well, one would hope that, and it works out that the way that the plants are designed and operated that that is the reality as far as --

MEMBER POWERS: Kudos to the designers, because they did their job.

MS. McKENNA: But it's also why, you know, we were saying that once you get into consideration of particular changes that there would need to be some kind of risk assessment, because if you -- as a result of redefining your break you decide to change your mitigation, you need to see how that influences whatever events you have.

If you change something in your low pressure injection, that may deal with your large break LOCAs, but it may deal with other events where you ultimately have that as part of your success path as well. You need to think -- you know, consider that impact, too.

MEMBER ROSEN: You know, I'm troubled by a little bit of this discussion in the area of this constant refrain of when you take out the design -- the mitigating systems, when you remove the high pressure safety injection system.

Well, the reality of it is that I don't think anybody is going to do that. Now, of course, I'm guessing, too, about the future. But I don't think anybody is going to do that. I think it would be costly to do that and difficult, and would introduce all kinds of problems.

But what more likely will happen is someone might say, "Well, there are these requirements for the high pressure injection system -- for testing and maintenance and all of that -- and if one -- and I'll keep on doing those. But if one day I run into trouble and I can't quite do it exactly right, I might once in a while not do that."

And it's that kind of thing that's more likely, and I think we ought to be careful about leaving the impression that if this is ever passed that there's going to be a wholesale on 100 plants tearing out of the mitigating systems. I just don't think that's --

MR. MARK RUBIN: No, we're not -- of course not, and we're not suggesting that. My microphone just fell apart.

(Laughter.)

We're not suggesting that, of course, at all. But what we just wanted to point out is the current Part 50 regulatory structure, the way the design basis accidents are formulated, that's not precluded. The way the regulations are formed you do the design basis accidents. Those constrain what systems you need to respond to them.

And if you were designing a plant today, if you don't need it for a design basis accident, it doesn't have to be there. But the real issue is if you do change the limiting accident -- and for a number of the plants the large break LOCA is limiting -- you could -- if you had the thermal capability and the generator, and the steam generators in the case of the PWRs -- you could do a substantial power uprate to the degree that you maybe couldn't hack a double-ended guillotine break any more without significant core damage.

And so you could, in a sense, back into a scenario where you couldn't survive a large break LOCA anymore without a large amount of core damage. And we're just pointing that out.

MEMBER ROSEN: Okay. Well, that's -- I accept that. I agree with that. But let's be careful about the -- even referring to the idea that we're going to be taking out -- these systems out.

MR. MARK RUBIN: We didn't mean to suggest that.

MEMBER ROSEN: I think that's not likely.

MS. McKENNA: No.

MR. KELLY: The reality more is -- as you're saying is maybe that somebody is going to say, you know, I don't need these accumulators any longer. I can vote them out. Or I can have -- I have a train that -- where I needed it before, and I -- maybe I can have a six-month outage in this train now, because I really just don't seem to need it that much.

So that's the type of thing that would be the potential that's there.

The fifth issue is: how should adequate defense-in-depth be assured under this rule? And to what extent do the guidelines laid out in Reg. Guide 1.174 need expansion? I think there's two aspects to this.

Number one, Reg. Guide 1.174 provides an excellent -- in answers to George's comment, since he's not here -- the -- in risk-informing what we really -- when we talk about doing that and being fully risk-informed, we're really talking about following the process laid out in Reg. Guide 1.174.

And in Reg. Guide 1.174 there are a number of areas where it talks about defense-in-depth. And one of them is it gives a listing of seven different aspects that it feels if you meet -- if you follow these things, it's going to help give you adequate defense-in-depth.

And we've heard back from industry that even though these define that that maybe that they're not sufficiently well defined that it was too much of, you know, I'll know it when I see it, in a sense of the way the NRC has treated it. And they'd like maybe a little bit better definition.

We've said that -- told the Commission we will look at that and we will see whether we can do a better job of defining what -- you know, what those mean, if that's necessary. And the other area is that in Reg. Guide 1.174 it was designed as a way of changing the licensing basis. But it was not meant as a way of changing regulations.

One of the inherent assumptions in Reg. Guide 1.174 is that you would continue to meet all of the regulations. Now we're talking about having a process whereby we're going to be modifying the regulations based on a Reg. Guide 1.174 type process.

So we're also going to be looking at seeing whether there is any additional aspects to defense-in-depth that need to be added, not -- I'm not saying that we've identified anything at all, but we just want to look and see, is there anything else, since we're going to be changing, you know, the underlying pinnings of -- of how we've basically -- what we've used to design our plants, is there anything else that we need to think about to add to Reg. Guide 1.174 as an enhancement?

VICE CHAIRMAN WALLIS: Well, as we said at the subcommittee meeting, the large break LOCA is in the rules now because of defense-in-depth. If you're going to take it out, you have to give a proper argument in terms of defense-in-depth for taking it out and somehow negate the arguments which were then used to put it in the regulation.

It looks as if risk is going to be used to nibble away at defense-in-depth rather than defense-in-depth being used to trump risk arguments. I'm not quite sure which wins here.

MR. KELLY: Well, my understanding -- and I was not around when they originally did this. But my understanding is that the -- part of the concept of defense-in-depth was that it was designed to help protect against the unknown, the uncertainties that we have, the significant uncertainties.

And some of the things that would -- reasons that have been expressed about why we're even looking at changing these -- considering removing some of these larger breaks from the design basis is that we have more knowledge now about pipe break phenomena, about materials, and that we've had much more experience amongst the nuclear reactors.

And it is believed that there may be good reasons, therefore, to, based on that now increased knowledge, and, therefore, lesser uncertainty, that maybe now we can get rid of some of those things from the design basis.

VICE CHAIRMAN WALLIS: Okay.

MR. KELLY: Issue number 6 deals with a concern that -- and there's two parts to 6, so I just want to make sure I come back to two different parts. But 6 talks about cumulative increases in risk and about the need to limit that. And I think there's two areas to that.

One of them is as -- what we don't want to have is a plant coming in, let's say -- let's say that we said that, okay, the increase in risk that you could have under -- under the rule, say, was 10^{-5} core damage frequency per year, if we decided that that was the appropriate value.

And so this month I'd come in and I'd get that, and three months from now I come in and I'd say, "Ah, I have this other fix, and I want to increase that 10^{-5}." And six months later I have another 10^{-5}.

There's nothing in Reg. Guide 1.174 to preclude you from doing that. It does ask you to -- but we do say under Reg. Guide 1.174 that somebody is supposed to be tracking cumulative risk, and that cumulative risk is total cumulative risk, total risk on the plant. And they're also supposed to be tracking the total increases.

And I think what we're looking here is that some way we're deciding -- we want to decide how -- what's a good way to actually track the change in risk associated with whatever plant modifications are made under the rule.

CHAIRMAN BONACA: And limit.

MR. KELLY: Excuse me?

CHAIRMAN BONACA: And limit at some point.

MR. KELLY: Right. And have a limit. And then the question is: if we have a limit, is that limit only for changes made under the rule? Or what if I'm making other changes outside of the rule and they're affecting this, how does that count?

If my total core damage frequency is two times 10^{-5} per year, is it okay for me to continue to make changes that are going to be increasing my risk? Or do we decide that maybe we don't want to do that? That's one of the things that we believe needs to be discussed and addressed in the --

MEMBER APOSTOLAKIS: So what if I have a record of a bad safety culture, would you do the same?

MR. KELLY: If you can tell me how to quantify it, I would --

MEMBER APOSTOLAKIS: It's common knowledge that my safety culture has not been good the last 15 years. Would that play a role in anything?

MR. KELLY: We normally handle changes -- problems with safety -- we used to handle it in the -- in how we put plants on the watch list.

MEMBER APOSTOLAKIS: Yes. But you don't do that anymore.

MR. KELLY: We don't do that any longer.

I wouldn't know how to do that. Certainly, it's a consideration, but how you would address that in a rule I'm not sure.

MEMBER KRESS: It seems to me like Reg. Guide 1.174 already has built into it limits by way of the requirements on the various regions due to the absolute values of CDF and LERF. It seems to me like what you need to do is specify or -- or require some frequency of update of the PRA, so that it incorporates all of the changes that have been made as they are made, and also have some specification on the scope and quality of the PRA itself.

So, then, the Reg. Guide 1.174 processes automatically have limits in them and keep track of the cumulative changes in risk, it seems to me.

MR. KELLY: Dr. Kress, I -- it looks very simple on the surface, but it's not. And one of the reasons why it's not is historically what happens is when a utility makes an update to its PRA, it will not only update its PRA associated with whatever plant changes have been made in the period since the last time they had an update, but they'll also make modifications to the PRA itself to improve the PRA in some area. And those modifications --

MEMBER KRESS: Well, it seems to me that's all right, though.

MR. KELLY: Oh, it is. It's wonderful that the PRA is updated. But the -- as I modify my PRA, if I were to go back and look at modifications that I made under my PRA -- under my plant before, the changes to my PRA may, in turn, because I've improved my PRA, may change how much those changes to the plant increased or decreased the plant risk.

So over time as -- each time I change my PRA, potentially I have to go back and look at all of the plant changes, and it becomes very messy. We --

MEMBER KRESS: Yes. Well, that's what I mean by an update to the PRA. Just make sure it's always current.

MR. KELLY: That's fine. But what --

MEMBER APOSTOLAKIS: Phase 4.

(Laughter.)

MR. KELLY: But the problem comes with, then, just saying, "Okay. I'm just going to sum up all of my old changes and say that constitutes or equals the actual change that's been made."

CHAIRMAN BONACA: By the way, another point is, I mean, Reg. Guide 1.174 -- it gives you a limit, but that is not an end point.

MEMBER KRESS: Yes. I don't want you to

sum up all of the old changes. I think you just keep track of the status and condition of your plant, and calculate the new CDF and LERF. And it automatically incorporates all of the changes.

CHAIRMAN BONACA: Yes. No, but I'm saying that the -- you know, I mean, by saying that there is a limit there, I could creep to that limit, change -- through changes, and to me that is not right.

MEMBER KRESS: Well, I don't know why not.

CHAIRMAN BONACA: Well, perhaps we should discuss that.

MEMBER KRESS: I mean, you -- you creep up to the limit with more --

CHAIRMAN BONACA: Well, the fundamental principle in the regulation has always been that whenever the plant is, you stay there. I mean, so far as your licensing basis. And even if you have some margin, even though you can apply for it now that it's under 50.59, but it doesn't mean necessarily that you can push everything to your -- you know what I'm trying to say? Now, this is -- would be a different concept.

MEMBER KRESS: Well, as long as you are risk-informed and keeping your defense-in-depth, you should be able to do that.

CHAIRMAN BONACA: If you can creep to that limit, why can't you make a big change all the way to that limit?

MEMBER KRESS: I don't see why not, as long as you maintain defense-in-depth and keep within the limits.

MEMBER APOSTOLAKIS: No. The regulatory guide doesn't allow that.

MEMBER KRESS: The guide wouldn't allow you to do that, because it limits -- it limits the delta you can get within a region. But, you know, the cumulative -- it would allow you to creep up to it, and that should be all right.

CHAIRMAN BONACA: I mean, that's an issue that -- right now I agree with it.

MEMBER APOSTOLAKIS: Are you familiar with the phased approach that the Commission has proposed to reach --

MR. KELLY: I'm somewhat familiar, yes.

MEMBER APOSTOLAKIS: Could 50.46 be risk-informed with anything that is less than a Phase 4 PRA? I'm serious.

MR. KELLY: Could it be risk-informed?

MEMBER APOSTOLAKIS: Yes. I mean, could any of these issues that you are raising --

MR. KELLY: I think clearly it could be risk-informed at a Phase 3.

MEMBER APOSTOLAKIS: Why?

MR. KELLY: Because you would have addressed all of the -- you would have provided guidance for all of the major risk contributors, and that they would have addressed those, and that they would have followed that guidance.

Now, the question comes, would we, you know -- would their peer review be adequate for us?

MEMBER APOSTOLAKIS: Sure.

MR. KELLY: And if we felt that a peer review was adequate, I think we'd -- then we'd be okay.

MR. TSCHILTZ: This is Mike Tschiltz. I'd just like to say that I think we're not there yet. I think we need to define what 50.46 is going to allow before we define what the quality is going to be. So --

MEMBER APOSTOLAKIS: I mean, you have issues here like uncertainty, and core damage and severe accident analyses would need to be addressed. Okay? How should adequate defense-in-depth be assured under this rule? And there were all sorts of other statements regarding PRA and quality, and so on.

And it seems to me that if you don't have a Phase 4 PRA, you're not going to be able to answer it.

MEMBER ROSEN: The Phase 4 PRA is the state of the art.

MEMBER APOSTOLAKIS: State of the --

MEMBER ROSEN: And so it --

MEMBER APOSTOLAKIS: No, no, no. It's also NRC reviewed, right? Phase 3 is not --

MEMBER ROSEN: And approved and endorsed.

MEMBER APOSTOLAKIS: Endorsed, yes. Yes, this is endorsed. There is much more to it than just state of the art.

MS. McKENNA: I think Donnie wanted to --

MR. DINSMORE: Yes. Well, just a second. This is Steve Dinsmore from the staff. I think -- see, what we've been working with is that when you change the design basis LOCA sites, when you just do that without changing the plant, you're not really changing the risk. It's only when you start changing the plant that you're affecting the risk.

And so what we postulated is possible was -- yes, well, that's assuming that the --

MEMBER APOSTOLAKIS: How about the way I operate the plant?

MEMBER SHACK: It's still a change.

MEMBER APOSTOLAKIS: Oh. You consider that --

MS. McKENNA: Yes.

MR. DINSMORE: Yes. Well, if it's in your design basis, it's embedded in the design basis, so you'd have to change the design basis to credit -- to take credit for the change in the size. And the way we work now is if -- every time somebody comes in with a change we would evaluate the part of the PRA they need for that change.

So we could envision that -- if we set the limit on the delta CDF and the delta LERF like we do now, we can do that evaluation. And we can evaluate the part of the PRA which is needed to support that, using the current methodology as being approved by the phased approach.

So, in other words, if they -- they want to change something that's not in the PRA, which is a significant contributor, we'd say, "We can't do that." But it is possible to make some changes --

MEMBER APOSTOLAKIS: Are you referring to 50.46 now?

MR. DINSMORE: Yes.

MEMBER SHACK: It depends on what change

you want to make.

MS. McKENNA: Right. It's more narrow or broad, if you have specific changes that --

MR. TSCHILTZ: I think what he's saying, in effect, is you could be in Phase 1 for certain changes envisioned under 50.46.

MR. DINSMORE: Or at least that's the way we're kind of talking about it right now. It might get modified, but --

MR. HARRISON: This is Donnie Harrison. If I can jump in for a second, if I can just talk about the phases just briefly.

If you remember Phase 2, if we write the guidance for the application, and in that guidance it tells you what PRA quality you need or what scope of issues need to be addressed within that, so as part of the rulemaking there will be some type of guidance also developed that will need to address that area.

So you can enter Phase 2 and the PRA phase of -- quality phases for a 50.46 application when it's done -- once that guidance gets written and it tells you what you need from a PRA quality perspective, and then those standards are in place.

MEMBER APOSTOLAKIS: Are these statements consistent with what I keep hearing from our Chairman about the tentacles of 50.46 all over the place? Now you are telling me, oh, they can pick a little thing and do it, and no big deal. I thought 50.46 was everywhere.

MR. HARRISON: Well, again, I'm just talking about the phased approach, so that we don't --

MEMBER APOSTOLAKIS: But you can do this with Phase 1.

MS. McKENNA: I think this goes back to what you're actually -- what's the application, what are you really changing as a result -- you say, "I've redefined my break size," or "I've taken something out of the design basis," and then what do I really do? Am I changing my diesel start time? Am I, you know, doing some -- you know, how I operate one of my --

MEMBER APOSTOLAKIS: Well, the two major issues --

MEMBER SHACK: A major power uprate is very different from changing the diesel start time.

MS. McKENNA: Right. Right. True.

MEMBER SHACK: And the PRA level I need to support those two changes may, you know, be substantially different.

MR. MARK RUBIN: We'll be developing --

MEMBER APOSTOLAKIS: As a general

statement, that's correct.

(Laughter.)

MR. MARK RUBIN: We'll certainly be focusing on the PRA quality attributes explicitly as part of the rulemaking development. But we're going to be leveraging the phased quality initiative as part of it and trying to fit as much as we can directly into that.

VICE CHAIRMAN WALLIS: Well, we've had 20 percent power uprates without any magical, huge advance in PRA already. And we have had some questions about the PRA quality, but they haven't really led to any holdups in approving those power uprates.

MEMBER APOSTOLAKIS: Which comes back to my comment this morning. I mean, the heart of the matter is the decisionmaking process. As long as you can get all this stuff, with the present situation where presumably we are in 1.5 -- Phase 1.5, there is absolutely no incentive to move it. Anyway, okay.

MR. DINSMORE: Well, I guess this comes back a little bit to whether it's a broad or a narrow scope. If it's a broad scope, we'd have to be prepared for pretty much any changes, whereas Dr. Rosen said that they will be out there looking to see what they can change.

So we'd have to really deal with this directly, and we haven't quite figured out how to do it, which is why it's up there. Whereas, if it's a narrow scope, where it's defined beforehand, we can take a look at that, and then we could actually figure out what exactly the PRA quality requirements would be to support those allowable changes.

MR. KELLY: Issue number 7 is, what's the appropriate scope and quality of PRA, which we've already talked about here. And 8 is also the question about future reactors, which we've talked about. So let's move on to the next page.

The staff has seven activities outlined in the paper that we're going to -- we're going to talk -- we're going to determine the -- how we're going to choose the maximum break size, identify the level of mitigation required for the LOCAs beyond the new maximum break size.

We're going to develop criteria, including the metrics, for determining what would constitute an acceptable plant change. We're going to develop criteria for determining total CDF, maximum CDF, that would be -- we might use as saying, okay, if you're above this, we want to handle you differently than if you're below this.

We're going to look at the need for additional defense-in-depth criteria, if any. We're going to, as we mentioned, see if we need to improve on the guidance in Reg. Guide 1.174 on how you attain defense-in-depth.

We're going to develop criteria to demonstrate what it means to have adequate mitigation. And we're going to look at over time what kind of information the utility is going to have to retain or develop in order to assure that things are going okay.

And, of course, we're going to do this very quickly.

(Laughter.)

Research has ongoing work in thermal hydraulics and risk assessment, and we may be faced as we go along asking for additional work.

MEMBER APOSTOLAKIS: What does it mean?

MR. KELLY: Is Hossein here? There he is. Would you like to speak about what --

MEMBER APOSTOLAKIS: What does the first bullet mean, Hossein? You have to go to a microphone and speak with sufficient clarity and volume.

MR. HAMZAHEE: Yes. This is Hossein Hamzahee, Section Chief, PRA Branch in Research. I think what Glenn is saying under bullet one is that Research has already undertaken a number of activities to support this rulemaking, one of which is the thermal hydraulic calculations.

Mainly, we are trying to look at some of the postulated changes and then look at some of the potential changes in -- like peak cladding temperature or oxidation limits, and this is ongoing. And the other thing we are doing is we are trying to look at those and then do some risk assessment, trying to figure out what are the potential changes to some of the assumptions in the PRA models, and then making some of those changes, try to look at some selected plants and see how the risk profile would look like.

So these are the ongoing activities that Research has been working on.

MEMBER APOSTOLAKIS: So this doesn't mean that thermal hydraulics and risk assessment are trying to put together --

MS. McKENNA: No.

MEMBER APOSTOLAKIS: It's activities in risk assessment that --

MR. HAMZAHEE: That's correct. However, sometimes as -- what we get from the thermal hydraulics may help us in understanding what would be the potential impact on some of the PRA assumptions.

MEMBER APOSTOLAKIS: Well, it should.

MR. HAMZAHEE: It should.

MEMBER APOSTOLAKIS: It should.

MR. KELLY: Okay. And the last bullet involves LOCA/LOOP - the March 31st, 2003 SRM asked us to address looking at relaxing the requirements for LOCA/LOOP. We have BWR Owner's Group topical which we believe is going to be coming in shortly, which will be addressing that issue. We've asked the Commission if it's okay if we go ahead and review the topical, deal with that issue, and then go forward once we've gotten some experience and real-life exemption requests in this area.

MEMBER ROSEN: Do you think that the BWR's approach will be instructive for the pressurized water reactors, as well, or are they two separate issues on LOCA/LOOP?

MR. KELLY: My personal opinion is that it's going to be a little bit different for the boilers because they have significant thermal margin that may not be available for all PWRs. And the boilers are able to make modifications to the plant and still using realistic code runs show peak clad temperature below 2200 degrees F.

MEMBER ROSEN: Well, isn't your strategy a little unfair to most of the plants, that two-thirds of the plants are PWRs. And so if you're saying you're going to wait to work on the PWRs until later while you work on the BWRs, and not have any likelihood that what you'll learn from the BWR approach will be helpful to the PWRs, it seems a little unfair. Have you thought about that?

MR. KELLY: The boilers have done -- the BWR Owner's Group has done some work on developing rationale why the seven changes can be made, or combinations of these seven changes can be made and it be acceptable to the plant.

As far as we know, the pressurized water reactor plants have not gone ahead and done this work. We have already investigated looking at the issues such as developing a methodology to determine plant-specific conditional probability of loss of off-site power given a LOCA, which is very important because it's a very site-specific issue, where a plant even within -- if you have multiple plants on a site, can depend on different plants at the site.

This issue can be handled on a plant-specific basis. And what we're trying to do, and that would be available for reactors if they chose to come in that way. We prefer to be able to do it for a number of reasons, including resources to do it via topical report. I'm not sure if I'm really answering your question in part, but in essence the BWR Owner's Group has done a significant amount of work here. I mean we recognize that.

MEMBER ROSEN: You don't need to be specific to my point. Just be aware, I hope we've exchanged -- my feeling about that is that I'm not sure that's exactly fair to PWR to delay work on the PWR world while you consider the BWR LOOP/LOCA.

MR. RUBIN: This is Mark Rubin again from the staff. I don't think we're actually delaying the work. Any design would have to show thermal hydraulic success for delayed diesel start. And the BWRs happen to be showing that success through a TRACG calculation, still using 2200 peak clad temperature. A PWR may come in using RELAP or some other code. The general approach should be as applicable to a PWR. They don't have the same thermal margin. They may have a little tougher job in the T/H calculation, but the general analytical approach should be applicable, but they much not have as much pad in the delay of the diesel start. Instead of going to 80 seconds, they may only be able to delay to 22, 23, 32 seconds. But

I think we're going to learn a lot from the BWR Owner's Group approach, and I think it's going to be very efficient from a staff researcher's perspective, and I think the real expert is now standing at the microphone, and will be able to share his perspective. That's Mr. Lazevnick.

MR. LAZEVNICK: Yes. I'm Jim Lazevnick from the Electrical Branch in NRR, and Glen and Mark addressed the thermal hydraulic aspects which are, of course, different between the BWR and PWR. But the electrical aspects between a BWR and PWR are not based on thermal hydraulic issues. They're based on electrical design features, grid features and other things that are not necessarily specific to BWR and PWR. So we do expect to learn a good deal from the BWR approach in terms of the electrical areas that will carry-over directly to the PWR designs, as well.

MEMBER ROSEN: Well, I don't want to make too much of this.

MS. McKENNA: Well, we want to wrap up because we don't want to take all of Rob's time, so I think just quickly in summary that, as we've said, we want to be careful in doing a redefinition of the large break LOCA so that we don't lose the margins that exist as a result of the current designs as we move forward. I think this question about should it be narrow or broad, and what kind of changes could be forthcoming from the rule, we have to get to some meeting of the minds on that.

We sent the paper to the Commission. We asked for policy direction in certain areas. We are continuing to work on some of these technical issues, as was mentioned, while we're awaiting that kind of feedback. And as indicated, certainly any feedback from the Committee that you would like us to consider as we move forward, we get direction from the Commission as we try to shape the rule making. We'd certainly be very interested in that. Thank you.

MEMBER SHACK: I think we better move on because I think Rob will have a fair amount of material to cover in his time that he has available.

MEMBE POWERS: Well, despite his limited time, I have to say that I continue to be troubled primarily about some identified sites, and the paradoxes that you can get from there. I continue to worry whether PRA is the right technique to both design and assess these design-basis accidents. And I keep coming back to my structuralist biases, George, and say shouldn't -- if we're looking at 50.46, should we really be looking at what it was intended to do;

and that was to preserve barriers, that what would be intolerable in any design is a failure of the reactor coolant system that led to a concomitant failure of containment, and to assess that they took the biggest load that they could think of to put on containment. We now know that containments are much stronger than just their design levels, and so one can think about backing off. At the same time, we were worried about preserving the ability to cool the core, and they asked what's the fastest we get the water out of the system, and make it difficult to get the water back in, and so they came up with this doubled-ended guillotine pipe break. And they designed a system that can put water back in very quickly. We now know that that's not the only way to get to an incurable situation.

MEMBER ROSEN: It may not be the worst way either.

MEMBE POWERS: That's right, it may not be the worst way. And I keep wondering if we shouldn't -- if we are so enamored with this PRA that we're not looking at these barrier-type arguments as a way to approach redesigning 50.46. And that if the preservation of barriers isn't a better objective for 50.46, than risk. I mean, this comes inherently because of a disbelief in the omniscience of the PRA analysts. I simply don't believe they can think of everything that a plant can be asked to do.

MEMBER KRESS: I think I tend to agree with you, Dana, that we have to think of barrier presentation, so I think in this rule change you have to do something about preserving that type of defense-in-depth. But the fact is that this rule results in other things that have very little to do with barriers. And I think we can deal with these other things in risk-based, but I think -- I'm with you. I think I'm a structuralist defense-in-depth in this thing, and you have to maintain that part of it somehow.

MEMBER SIEBER: I'm a rationalist with structuralist tendencies, which I admit to. And so I think Dr. Powers has offered an important caution, that when we go forward we ought to be thinking about defense-in-depth. But I don't think these two approaches are exclusive, mutually exclusive. I think we're thinking about finding a balance.

CHAIRMAN BONACA:: Sure. And I think what we're saying is that these plants were built with margin we didn't realize we had when we built them. And now through PRA we measure the margin, it doesn't mean that you have to cash it all in. I mean, you can't.

MEMBE POWERS: Where I worry about self-identified sets is identify that margin, and then I use the PRA to take advantage of that margin. I will get into paradoxes. I worry about that a lot. And I think the consequences that Dr. Kress speaks of, people lose quickly, very quickly lost sight of what they were trying to accomplish in 50.46, and said this is the end in itself, and I think that was not the case. And I think the PRA is an excellent vehicle for showing you where those things resulted in unnecessary margin having been created. I mean, PRA clearly is the technique to show you where you have margin. I'm not sure that it's the technique they subsequently use to design something that's better, and I'm not sure it's the right technique to use to design something that's taken knowledge in neutral. I just offer that for my concerns.

MR. TREGONING: Okay. We want to follow-up the discussion we had on some of the regulatory concerns and issues that we're struggling with as an agency, and again we had a lot of good discussion and insight on today to talk about one piece of this. But it's sort of the first piece we've tackled of this revision exercise, so I'm going to be giving what hopefully will be very a condensed version of the presentation.

MEMBER SHACK: It will be a condensed version.

MR. TREGONING: I qualify it. I'm at the discretion of the ACRS here, so I trust in your judgment. I'm Art Tregoning, and Lee Abramson and I will be presenting the development of the passive system LOCA frequency that will be used as part of the technical basis to provide information to do a risk-informed revision of 10 CFR 50.46.

The objectives and scope of the elicitation, we touched on this a little bit earlier in regard to the questions that we had during the earlier presentations. I'm just doing these again to make sure that they're clear. I've gone over these a number of times at various ACRS meetings, but really the primary objective that we set out to do with this elicitation was to develop generic BWR and PWR piping and non-piping passive system LOCA frequency distributions as a function of both the break size - so obviously how big the break is, if it's a small, medium and large - and also, the operating time.

MEMBER ROSEN: Why do you say non-piping?

I thought we heard earlier that you only considered piping.

MR. TREGONING: No, only passive system, not active system. We looked at non-piping pressure system components, as well.

MEMBER ROSEN: For example?

MR. TREGONING: For example, pump bodies, valve bodies, the vessel itself.

MEMBER ROSEN: Okay.

MR. TREGONING: Manways, all of those - steam generator tubes which aren't historically considered as piping, even though they have many similarities. CRDM nozzles and tubes, things like that. Anything which could break due to degradation that could -- the break itself could lead to a LOCA, so not a consequential LOCA, but a primary LOCA in the primary system. And that's the first point, so we're looking at LOCAs which initiate in an isoluable portion of the RCS. These are primarily LOCAs that are related to passive component aging, but we just don't look at aging without considering mitigation, because we're just not letting the plant sit there, and we're doing something in many cases to try to combat aging, so for specific aging mechanisms, we tried to temper the effects by whatever mitigation measures are currently in place now.

I said that we did this as a function of break size. We looked at small, medium, and large break LOCAs. Even though the rule we've talked about -- we've talked about potentially redefining a break size which has more impact on --

VICE CHAIRMAN WALLIS: Well, you didn't look at this number 2 about the risk of someone over-tightening the bolts on a manway or something like that.

MR. TREGONING: We did consider --

VICE CHAIRMAN WALLIS: Is that passive component aging?

MR. TREGONING: Even though passive component aging was the primary thing, we did look at common cause failures for things like bolting.

VICE CHAIRMAN WALLIS: I thought you did.

MR. TREGONING: Yes, so that's true. So again, we looked at small, medium and large breaks, and we also looked at -- we further subdivided the large break category. Historically we looked at three LOCA sizes. We looked at six, so we broke the large break LOCAs into four separate regions. And the idea behind that is we wanted to try to get a more comprehensive look at the frequency spectrum -- at the frequencies over a spectrum of break sizes, and we wanted to go into bigger break sizes that may be of the level that we're looking at doing this redefinition. So we looked at large breaks and we categorized them to a much finer extent than we've ever done previously.

We looked at three different time frames. We provided fixed estimates at these different times. We provided estimates for the current day which we defined roughly as 25 years of average fleet operation. We looked at 40 years and 60 years. Why those two times? Well, 40 years and 60 years correspond roughly to the end of the original license period, and then the end of the license extension.

The 25 and 40 year estimates also coincided with direction that we got from the SRM that we need to consider LOCA frequencies which look forward 10 years, with the expectation that at a minimum in another 10 years we're going to have to go back and revisit those if -- again, assuming that something doesn't come up in the interim which calls into question the basis of the frequencies that we've developed to date. So that's why we picked these three different time periods, so we can give forward-looking estimates, and again also provide information that we could use to assess when we get to the point of redefinition in 10 years time how much change would be expected over this original set of estimates.

Primary focus as I mentioned were frequencies associated with normal operating loads and expected transients, and a major assumption here that I'd like to list to make sure people are clear about - we assume that there were no significant changes would occur in the future in the plant operating profiles, so that essentially -- why do we make that assumption? Well, we have a certain amount of service experience. We're essentially saying that we're not going to have such radical changes that the service experience is going to become moot at that point, so we're not going to do something which dramatically undermines the historical database that we've developed.

Of course, the database for big LOCAs are essentially zero LOCAs over thousands of years of reactor operating experience. But we do have an extensive database of precursor LOCA events, which would be things like cracks, leaks, things like that. And that's something that we've developed over the years fairly extensively, especially for piping. And that was really the primary basis that the various experts used to extend that to go from the precursor information to LOCA frequency. So we want to make sure, which is that final bullet or that final caveat, that we don't do anything that undermines that basis.

CHAIRMAN BONACA:: But if you use this margin to increase power level, there will be a significant change in the plant operating profiles.

MR. TREGONING: If the plant operating profiles would result in additional, I'll say additional precursors occurring, then that's obviously -- that would undermine the basis of the LOCA frequency, yes. It's very simple.

MEMBER FORD: But you're making the assumption there that the mitigation actions are going to counter the degradation due to, for instance, power uprates. It relates to Mario's question, that your presumption there is that mitigation actions will offset any increased degradation rate due to power uprates.

MR. TREGONING: With any of the aging mechanisms we looked at the effectiveness of mitigation, and tried to assess that. But just -- and this is why that 10 year window is so important. As we do changes, if we find things that change in -- the operating profiles have changed, that's changed the basis for these estimates, we have to very carefully evaluate them, and make sure that we are clear in saying hey, these no longer hold for this reason.

MR. RUBIN: This is Mark Rubin from NRR. The preliminary transmittal we got raised questions on whether significant power uprates would be covered by the evaluation that was done by the expert elicitation panel, so if we're going to be allowing significant power uprates based on the preliminary curves we got, it raises some questions on the validity of the application. So that's something that would need to be looked at before that was allowed.

MR. TREGONING: That's exactly correct. And that's why specifically I wanted to raise that caveat because that's a very obvious application that we need to be careful as we go forward with.

I just have a couple of summary slides here, and I've tried to boil down what I've presented a couple of weeks ago. And I've two slides which show qualitative insights that we got from the experts. This isn't comprehensive by any sense, and it's not even necessarily a consensus among the panel, but it is sort of many of the common themes that came out of this exercise, so I just wanted to summarize these quickly. We've gone over these much more in-depth at the Subcommittee meeting.

With BWR and PWR plants, we -- a number of different aging mechanisms were identified, and I've listed here some of the ones that the experts thought were most important. For BWRs, they thought thermal fatigue, ICSCC, mechanical fatigue, FAC were some of the major drivers. With BWRs a lot of the experts indicated that they do see increased operating transients compared to the Ps, i.e., greater likelihood of water hammer, and that's going to effect the frequencies that you would develop for Bs versus Ps.

Some interesting comments from the experts. A number of people had this, which I didn't expect going in, but they really look at the BWR community as being further up on the learning curve with dealing with aging mechanisms, and developing mitigative measures to effectively combat them based on the IGSCC experience that the BWRs lived through in the 70s and early 80s.

MEMBER SIEBER: That's a nice way to state that.

MR. TREGONING: Well, you know, you always evaluate your experiences and try to grow from them, both personally and professionally, so I think you have to look --

MEMBER SIEBER: I'm sure they have the greatest amount of growth.

MR. TREGONING: They've had growth certainly, because of that. The cautionary note is that when you look at service experience for BWRs, you have to be very careful because it's colored by a large extent to some of this pre-mitigative experience in IGSCC, so that was a challenge with the experts. We provided them operating experience data back to essentially the beginning of reactor time, you know, in the early 70s and 80s. I'll say the beginning of large scale commercial reactor time. So that was one of the things that they really had to do to make sure that they -- as they evaluated that data they accounted for the mitigative measures that have been put in place.

For PWR plants they really identified a lot of the same mechanisms, although certainly one was predominant, which is one that we started seeing greater frequency within the operating experience database recently, and that's primary water stress corrosion cracking. So this was one that probably dominated for most experts the answers that they gave us for PWR plants. But thermal fatigue and mechanical fatigue are important, as well.

We looked at both piping and non-piping passive system failures, so I just wanted to put a couple of insights that we got for each of those categories. And I don't know that there's -- there's no great revelations here, but I think they're worth stating, nonetheless.

With piping, with a bigger LOCA you can get -- or I'll say an intermediate LOCA, so something let's say an effective six inch break. You can get an effective six inch break by a complete break of a six inch pipe, or you can get it due to a partial failure of a much bigger, say a 30 inch pipe. So when you looked at these different LOCA categories, each expert had to make an assumption - well do I think the complete failure of the smaller pipe is more likely, or the partial failure of the bigger pipe?

Typically without fail, the experts tended to consider that the complete failures of the smaller piping was generally more likely than the partial failures of the larger piping, so this is a general truism that many of the experts expressed.

Interestingly, a lot of the experts felt both qualitatively and quantitatively that aging may have the greatest effect on intermediate size piping, and by intermediate size, I'm talking about breaks in

6 to 14 inch pipes, and 14 inch up to maybe the surge line for PWRs.

Why is that? That seems kind of odd at first. Well, the rationale is that the smallest piping we have a lot of experience with, not all of it good, but we've had failures in small piping. And we sort of have a good understanding of what the small pipe failure rate. And many experts expected that that would be relatively constant as we move forward into the future.

Consequently, larger piping up to the reactor coolant, the primary lube piping, that we have the biggest margin on for two reasons. One, we tend to have higher quality inspections of that piping. And secondly, the bigger the piping is, and the thicker it is, the more leak before break margin we have in that piping. So when you looked at the results, what you saw was if aging had an effect with given experts, it tended to occur in these 6 to 14 inch pipe break ranges.

MEMBER ROSEN: Before you go on, would you say that there's an operating experience database to support that first bullet, that complete failures of small piping are more likely than partial failures of large piping?

MR. TREGONING: If you take it to the extreme, yes. I mean, we have seen complete failures of like one inch, maybe even up to two inch pipes. Certainly if you include steam generators, we've seen a lot of complete failures of steam generator tubes.

MEMBER ROSEN: Well, if you left the steam generator tubes out --

MR. TREGONING: Even leaving them out of it, we have a lot of small pipes that are socket welded that we've seen complete failures of.

MEMBER ROSEN: The ones I think about all the time are things like, well, like the Surry failure, you know, big fish mouth and partial failure of a large pipe. Not a double-ended guillotine, a very astounding failure, but it wasn't --

MR. TREGONING: Pretty close, yes.

MEMBER ROSEN: It wasn't double-ended but, you know, I'm talking about the Summer case which was more of a leak.

MR. TREGONING: Right. And again, with small pipes you tend to have, especially the socket weld pipes you get into issues with small pipe where they mainly have one or two weld passes. And again you have increased -- you have a problem with one of the weld passes, and then all of a sudden you've got a crack in that pipe that may go completely around an essentially 50 percent through-wall, so I think there's a lot of operating experience, when you go to the very small pipe, the one and two inch pipe that does tend to support that assertion.

MEMBER FORD: Well, I'm having as I had the other day, great problems with these qualitative statements. They're undoubtedly true, but they are based on a very, very scattered database. There's a great deal of uncertainty, quantitative uncertainty, so how do you come up with quantitative conclusions from these observations? Are they supplemented by some sort of modeling or what? Real modeling, not field modeling.

MEMBER ROSEN: Not opinions.

MR. TREGONING: Again, as we developed this basis, as we developed what we call the base cases, those were actually physical models.

MEMBER FORD: Well, could you give me an example of a physical model?

MR. TREGONING: Yes. Probabalistic fracture-base models trying to model the evolution of let's say IGSCC within --

MEMBER FORD: Is this the PRAISE code?

MR. TREGONING: We used PRAISE, and we

also use the PRODIGAL code, yes. So you have -- certainly, you have limitations that are inherent in whatever code you're using, and that was certainly something that each expert had to consider. But we didn't model every piping system, but we picked four different piping systems that we tried to model, and four or five different degradation mechanisms that we tried to model, and that we also tried to model in other ways using service history data as the basis.

Service history data was the basis for all of these but we tried to predict LOCA size based on essentially statistical methods, as well. Markovian methods and sort of dosimetry analysis, so we had four different experts that looked at that precursor data and tried to, for those specific systems, make assessments as to the LOCA frequency. And as I've shown earlier, we got a quite wide variety of responses.

MEMBER FORD: You pointed out the BWRs I think correctly are more experienced at resolving some of these problems, understanding them for various reasons. And yet if you based your modeling solely on historical behavior for BWR pipes for instance, as you mentioned here, I fail to see how you could come to any conclusion based on historical piping failures.

MR. TREGONING: It depends on how you define historical. And again, that was the challenge with Bs, because we had to look at both pre and post mitigative service experience. And we really based it on -- redeveloped our idealized model of the IGSCC type of failure. We had -- even though we considered normal water chemistry, we applied a weld overlay. We applied one mitigative measure. We asked the experts, and we said okay, many plants have more than one mitigative measure, so how would that affect the failure rates in those particular plants.

MEMBER FORD: And there's a database so that they could say there's a factor of improvement of Yay.

MR. TREGONING: Yeah, we gave them data that looked at it. And we parsed it in many ways. We just did it on a calendar year, so that's sort of pre-19 versus post 1983. These were the failure frequencies - I don't want to say failure frequencies, but this was the rate of precursors versus --

MEMBER FORD: A group of experts had the same database and they made a conclusion based on that database.

MR. TREGONING: Yes. And we actually had several databases. We had two primary databases that we used, and why is that? Well, every database is slightly different. And we wanted to give the experts a sampling of some of the databases that were out there. I will say though that even though we gave them two primary databases, the general conclusions of the databases were similar, even though one was much more comprehensive than the other one.

With non-piping, as I'm trying to move along here, the - so I said allegedly it's going to be compressed. Non-piping, again estimation of non-piping failures is more challenging than piping. Why is that? Well, there's a number of very good reasons. One, we had widely varying operating requirements, design margins, materials and inspectability, i.e., you're looking at component failure and then also bolt failure, as we talked about with Dr. Wallis. So you have widely varying failure modes and scales. And with non-piping, you don't tend to have the same wealth of precursor information that you do with piping, just because it hasn't received historically as much study as the piping arena has.

However, the large non-piping components, and for the Ps we're talking the pressurizer valve bodies, pump bodies, they tend to have a bigger design margin compared to piping, but they tend to have decreased inspection quality and quantity. They tend to be large all static cast stainless steel components which as most people know are just generally a bear to inspect, and sometimes they're not even inspected at all, or very infrequently. So you have these sort of competing things. You have a bigger design margin, but then you also have reduced inspection quality.

And then with the smaller non-piping components, the steam generator tubes, the CRDM nozzles, things like that, I think in general the experts expected these components to benefit most from improved inspection methods and mitigation programs.

So these are the frequencies that we got, and this is sort of a simplified plot of the frequency. It doesn't show any of the panel variability. These only show -- these are essentially a consolidation of the mean predictions from the experts, and what this shows are the mean, and then the 95th percentile.

We asked each expert essentially what they thought their best guess was for these LOCA frequencies, and then we asked them to bound it above and below. We essentially said give us a guess that you think there's a 5 percent likelihood that the frequencies will be above the value that you give us, and then a 5 percent likelihood that the frequencies would be below that, so we tried to capture their uncertainty in that way.

MEMBER APOSTOLAKIS: Let me understand this. If I take say one of these dots, the first one on the left, the blue one. Okay. The top one says BWR 95^{th}. Right?

MR. TREGONING: Yes. That's the 95^{th} percentile.

MEMBER APOSTOLAKIS: And the other one is --

MR. TREGONING: Is the mean.

MEMBER APOSTOLAKIS: Whose percentile? You say the communities of experts that you elicited opinions from, or --

MR. TREGONING: This is the community. These are boiled down to community -- we asked each individual expert --

MEMBER APOSTOLAKIS: I understand that.

MR. TREGONING: -- for their individual estimates, but these are boiled down estimates. These are the mean and the --

MEMBER APOSTOLAKIS: And they processed somehow the individual --

MR. TREGONING: Yes. Yes.

MEMBER APOSTOLAKIS: This is very interesting.

MR. TREGONING: This particular -- we did this a number of different ways so I want to be careful. I believe this particular result is the median of all the community means that we got. I believe that to be the case. It may have been we looked at the median, we looked at taking the geometric mean and the trend geometric mean. There's essentially no difference, so I believe this one is the median, but --

MEMBER APOSTOLAKIS: But you didn't try to get the experts to reach consensus?

MR. TREGONING: No, we did not.

MEMBER APOSTOLAKIS: So if I look at the 95^{th} now, there were some experts that actually gave you a higher estimate.

MR. TREGONING: Of course. What I'm not showing --

MEMBER APOSTOLAKIS: And all experts are treated as having equal credibility.

MR. TREGONING: All experts are treated as equal credibility, except what we're recommending is that we use -- when we estimate these community distributions that we use the term geometric mean, which would essentially mean we'd be throwing out the highest and the lowest. That would be, I think, Lee's and my recommendation, so that would down weight --

MEMBER APOSTOLAKIS: If you use a geometric mean you are throwing away?

MR. TREGONING: A trend mean.

MR. ABRAMSON: It's Olympic-type scoring where you throw away the high and the low scores. That's the analogy.

MR. SNODDERLY: George, here's a plot that we can show you from the Subcommittee meeting that I think really showed the results for each individual expert, and then how they were combined to make this plot.

MEMBER APOSTOLAKIS: I'm going to need much more than that, Mike, given what plans Dr. Powers has for me. I'm going to need to understand this much better. Right?

MR. TREGONING: Right. But you're correct, there certainly is variability associated with each of these dots. And I haven't shown the confidence bounds associated with these dots. Just really only in the interest of time, and no other --

MEMBER APOSTOLAKIS: Isn't it remarkable though that you have experts -- I mean, is this plot sending the message that for this particular break diameter on the left which is, I guess, one-eighth of an inch or something - the community of experts - oh, but this is -- you have lots of data for this problem. Right?

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: So as you move to the right, you would expect to see --

MEMBER SHACK: Steam generator tubes you have a database.

MR. TREGONING: Right.

MEMBER APOSTOLAKIS: I mean, look --

MR. TREGONING: And with PWRs, that's what dominates there at the smallest break sizes.

MEMBER APOSTOLAKIS: Yeah, but even if I go to what, more than 10 inches, the uncertainty is not that great.

MR. TREGONING: But again, what this doesn't capture is the panel variability. That's what's not captured here through -- and that's captured through confidence bounds about either of these plots. What you see is the confidence bounds increased associated with any of these one data --

MEMBER APOSTOLAKIS: You have a confidence bound on the 95^{th} percentile?

MR. TREGONING: Yes, and also the mean.

MEMBER APOSTOLAKIS: Okay.

MR. ABRAMSON: What we got, as Rob said, is from -- the basic analysis was we took the results from every expert and we just propagated it through and got an answer, actually a median 95th percentile for each expert. And for BWRs, we had eight experts that we had enough information to get a total frequency, for PWRs we had nine. And then we took each of those data sets, and this is supposed data sets.

MEMBER APOSTOLAKIS: Right. But these results like this presumably would be used as input to what we heard earlier about PRA, you know, the Phase VI PRA. If you have 5th and 95th, and then a confidence interval of 5th, a mean and 95th, that is not consistent with the inputs of a standard PRA. A standard PRA would require a distribution of the frequency that you have there. So now you are giving me additional stuff which is confidence interval on the 95th percentile, and the PRA analysts will not know what to do with it.

MR. ABRAMSON: Well, the reason that this differs from a usual PRA is because we had a panel of experts here. Presumably one panel -- the usual PRA is based on one expert or one expert group. It's one answer that you get, including uncertainty. The point of departure here, of course, is that we use this expert elicitation based on a panel of experts. We did not try to get a consensus. We thought it was very important to let our analysis reflect the diversity of opinion, the variability among the panel members, and that's what we show.

How this is going to be used for regulatory purposes is something that we're working on, how you would use this diversity and variability among the panel members.

MEMBER KRESS: Would it be appropriate to assume that distribution is normal, and therefore you have all the information you need right there?

MR. ABRAMSON: Yes.

MEMBER APOSTOLAKIS: No. You see, that's --

MEMBER KRESS: If it's all normal, you have it all right there.

MEMBER APOSTOLAKIS: No, but that's what he's saying, that take any dot, there is a confidence interval.

MR. ABRAMSON: That's right.

MEMBER APOSTOLAKIS: That's what I'm

saying, that the PRA analysts will not know what to do with it.

MEMBER ROSEN: We don't give it to them.

MEMBER KRESS: We don't have that level.

MEMBER APOSTOLAKIS: What will you give?

MR. ABRAMSON: It's not the PRA analyst. It's the decision maker ultimately that's going to have to use this. The Commission, obviously, the Committee is going to have to use this in making the decisions.

MEMBER SHACK: We're going to have to wrap up in about five minutes.

MEMBER APOSTOLAKIS: Four. All this is documented some place, isn't it?

MR. ABRAMSON: Oh, yes.

MEMBER APOSTOLAKIS: Good.

MR. TREGONING: I'm going to skip the next slide, and just move onto the summary. Again, just to quickly summarize, we used a formal elicitation process to estimate generic P and BWR frequencies, function of flow rate and operating time, considering both piping and non-piping contributions. We developed quantitative estimates for these base cases that Dr. Ford and I discussed a little --

MEMBER APOSTOLAKIS: Oh. I'm sorry. I

got excited by the summary. That's very nice.

MR. TREGONING: Developed quantitative estimates for piping and non-piping, these base cases, which were these idealized set of conditions where we tried to analyze certain systems and certain degradation mechanisms using a variety of approaches. Panelists gave us quantitative estimates supported by qualitative rationale. They first had to determine important contributing factors, i.e., what important piping and non-piping systems were important for failure, what degradation mechanisms were important in terms of governing specific LOCA frequencies for each given break size. And then they provided relationships between these important contributing factors and the base cases.

The base cases were the only set of quantitative frequency numbers that we initially derived as part of this exercise, so each expert gave us qualitative or I'll say ratios between those factors and the base case frequencies.

On the results we had relatively good agreement among the experts about what factors are important, and which ones contribute to LOCAs in piping and non-piping system. We did have large uncertainty and variability in actually quantifying those frequencies associated with the contributing factors, but we certainly expected this going on.

There's a wide variety of approaches and opinions on how you take precursor data and assess the likelihood of LOCAs given that precursor data. So this was not unexpected, and this was one reason why we didn't want to get consensus, because we didn't want to suppress this uncertainty and variability in any way.

And the slide I didn't show is that the smaller break sizes were generally within the range of the NUREG/CR-57.50 estimates, and those were the last estimates that we did with LOCA frequencies. This is serendipitous because --

MEMBER APOSTOLAKIS: Tell me again what 57.50 was.

MR. TREGONING: That was a large study that was done in INEL which --

MEMBER APOSTOLAKIS: Oh.

MR. TREGONING: The initiative event frequency study.

MEMBER ROSEN: What year was that?

MR. TREGONING: `97 was when they did the pipe aspect of it. That was data up through `97.

MEMBER ROSEN: So they're looking at data up to `97.

MR. TREGONING: Right. But we used --

MEMBER APOSTOLAKIS: That's when we made the news that some of the initiating event frequencies were four times -- because they were using the PRAs, were four times greater than what the data would support. This is an important NUREG.

MR. TREGONING: And we used a totally different approach than what they used, the 57.50. So the fact that many of these estimates were somewhat comparable was a bit of a surprise. Again, when we tended to see -- we did see some elevation in the 57.50 estimates around the medium break LOCA regime, and that's consistent with the qualitative rationale that the experts felt that aging would affect. Again, the 6 to 14 inch pipes.

MEMBER APOSTOLAKIS: The surprise was what, that your estimates were close to 57.50.

MR. TREGONING: That was a surprise, yes.

MEMBER APOSTOLAKIS: Because you expected your estimates not to be close. 57.50 is databased, isn't it?

MR. TREGONING: Well, again, there's no -- they had to extrapolate precursor data, as well.

MEMBER APOSTOLAKIS: I'm sure.

MR. TREGONING: So they used a totally different methodology that was essentially one expert instead of a team of experts.

MEMBER APOSTOLAKIS: Did you make sure that your experts were not influenced by 57.50?

MR. TREGONING: I don't want to say not influenced. We told them what was done in 57.50 because we wanted them to have an understanding of that.

MEMBER APOSTOLAKIS: Somebody gave them a copy in the middle of the night.

MR. TREGONING: They all had copies of --

MEMBER APOSTOLAKIS: But then why are we surprised that the results are not that different?

MR. TREGONING: That wasn't the basis -- the 57.50 numbers was not the basis of this exercise. It was the data -- and we had a much -- the 57.50 looked at a database of leak events, which is incredibly small. We looked at this database of entire precursor events, part through-wall cracks, full leaks, and even pinhole leak sort of things, so 57.50 was really looking at data that just looked at bigger leaks, essentially. We did have one of the 57.50 authors on the expert panel, so he was likely biased by --

MEMBER ROSEN: By his prior work.

MR. TREGONING: Right. But that was one --

MEMBER APOSTOLAKIS: We have to be very careful with our words here.

MR. TREGONING: Right. So that was one of the team of 12 was 57.50 people, but we thought it was important to provide perspective as what was done in the past, because we're just revisiting and trying to update that study.

MEMBER APOSTOLAKIS: The reason why I'm saying is because in the early days of PRAs, this doesn't count against the five minutes, in the early days of PRAs, all sorts of people, consultants were coming from different directions. We have our own database. Everybody was copying Wash 1400. You know, instead of 5, 10 to the minus 3, they would make it 5 and a half. I have my own --

VICE CHAIRMAN WALLIS: George, are we out of the early days of PRA yet?

MEMBER SHACK: I think we're going to hear from NEI.

MEMBER APOSTOLAKIS: Okay. Great.

MEMBER ROSEN: In other words, this is entry.

MR. SNODDERLY: While NEI is coming up to the table, right now I think we need to consider how we want to review the final wrapping up of Rob's work, which is going to be in the form of a NUREG. What we've tentatively done is we scheduled a Subcommittee meeting for June 24th. Rob would have a draft of the NUREg ready by the end of May. That would give the Committee about three weeks to look at that, and then we could write a letter on the final NUREG at the July meeting.

MEMBER ROSEN: Which subcommittee?

MR. SNODDERLY: It's been under Dr. Shack's Regulatory Policies and Practices, and everyone is invited.

MEMBER ROSEN: Everybody is invited to submit themselves to Dr. Shack's tender ministrations.

MR. SNODDERLY: June 24th. We'll discuss it at the PM -- I just wanted you to consider that's the approach that -- so we've got to think about how we're going to wrap this up.

MEMBER APOSTOLAKIS: Are you going to change it?

MEMBER SHACK: We may.

MEMBER APOSTOLAKIS: In May, or you may?

MEMBER SHACK: We may change it.

MEMBER APOSTOLAKIS: Okay.

MEMBER SHACK: The problem is the Thermal Hydraulics Committee would value the whole week.

MEMBER APOSTOLAKIS: Only that week? Is it 15 minutes time, this time?

MR. PIETRANGELO: I know I'm between lunch, and I know I'm hungry, so I'm going to make this as brief as possible.

Okay. First of all, before I start this I want to say I have tremendous respect for the staff that worked on the SECY, the working group that's been working on this. I even like some of them personally as human beings. Okay? But the staff requirements memorandum from the Commission that they've been working to had a lot in it, and was subject to some interpretation.

Nevertheless, I would be less than candid if I said anything that we were extremely disappointed by what was in this SECY, and what went up to the Commission on this. I think it was noted earlier, we had two meetings, one last June, one last July. We sent the staff a white paper in September. There has been no dialogue since that time. I didn't hear anything this morning, and the issues that were teed up that were different from what we heard seven months ago. Okay? And that isn't even in a way just reopening some of the stuff that went into the 1174 decision making process.

It took them seven months to get another SECY up to the Commission to ask for direction less than one month from when the proposed rule was due, so when you have a lack of engagement like this, and you circle the wagons, and I don't know what the reasons for it internally at the NRC. When you stop dialogue, I think it's very destructive. We have people in the industry who are interested doing things on this, that are funding activities, and for the staff to just close -- you know, we call it the cone of silence in the industry. We never like when it's raised. And in this case, I thought we had productive dialogue early on but it's been stymied.

When we read the SECY, I'll be very honest with you. It was, to us, a lot of hand wringing about what licensees might do if we actually had an alternative break size in the regulation, and how do we know what the effects are going to be, and what if they do this, and what if they do that? Like we heard this morning, we're already doing research on what a power uprate might mean if we had an alternative break size.

I mean, we know there's going to be a lot -- there's no delusions about the technical work that's going to be necessary to do this. I think research has done an excellent job thus far. It's taken a long time. Okay? But we've got a good foundation to start with, and their efforts should be focused on getting a firm technical basis for an alternate break size for both a B and a P. Doing anything beyond that at this point I think is wasting their resources. Okay.

There's been no successful regulatory or form initiative that hasn't been preceded by some form of industry pilot or exemption-type request. And this effort is sorely in need of one. To be honest, I have no interest whatsoever in discussing some of those issues that were raised by the staff this morning in this abstract context.

This Committee has been discussing defense-in-depth since it has been formed. Okay. I mean, to what end is that going to take us? So we need specifics, we need a pilot here.

We're in total agreement with the staff recommendation on the LOOP/LOCA BWR pilot. You're going to get a submittal on that soon. It will have some good things for Ps in it too that are relevant.

But on the P side, what I think we're pushing at this point is to bring a risk-informed approach to GSI 191, the PWR sump issue. That's an issue of the day.

We think there's a net safety benefit in using a risk-informed approach on GSI 191. That was the other thing that bothered us about this SECY. There was no mention of any safety benefits or potential safety benefits in that entire SECY. It was all about inadvertent consequences, and all of this other stuff. And that's not what the intent of this effort is. And I think they just made it a lot more complicated than it has to be in terms of what we're trying to do.

Most of it's margin. It's operating margin for licensees. The double-ended guillotine break is used for things like valve opening times, and flows, and things like that. That's where most of the changes are going to come in. Do I have to overhaul a pump that's 5 gpm under its flow that was sized for the double-ended guillotine break? I mean, that's what we do now for tech specs. That's the kind of thing we're trying to get rid of.

There was a laundry list of --

VICE CHAIRMAN WALLIS: All things like that it's not large power uprates?

MR. PIETRANGELO: They were given a laundry list of things that might occur, and they took the most extreme ones in this thing. And they're even doing research on those now. I mean, there may be very legitimate reasons to not go forward with a power uprate. I think you already touched on them this morning. We didn't get to the application phase on this. It's too early. Okay.

We would have been better off with a very focused pilot, so that's what we're going to propose now. We have proposed it in GSI-191 space. I hope that all the staff that was working on this will help us in that effort, because we're going to need help in that effort, because we're under a very time constrained effort on this.

We will not be reducing ECCS capability when we risk-inform G-191. We will be changing it to be more risk-informed and response. It's not reducing ECCS capability. If we can make some changes that stem from an alternative break size, you can have a net safety benefit. You could even get small breaks which are the higher frequency ones that drive the risk of the sump issue out of scope for this issue because you'd never get to recirculation using the sump, so I think there's tremendous potential there.

And unless we get something accomplished that shows that there's a net safety benefit, then I don't see any future for this effort.

I mean, the Chairman has been pretty clear about that's why he's pushing this effort in all his talks on this, and I think that's what the Commission's expectation is. And to get a SECY back like that that had no mention of it, and that only spoke to the abstract discussion and all these -- how we have to do mitigation capability for beyond design basis events. We raised that issue eight months ago. We know we have to do that.

I mean, that's one of the things research could work on now, is what's appropriate acceptance criteria for those beyond design basis things. That would be at least a tangible thing we could use in this. But as was mentioned, for the BWRs they're probably going to use the existing acceptance criteria that's in 50.46.

For the GSI-191 we'll probably use net positive suction out at the stream. It's a lot more work to go develop these alternative acceptance criteria, and we understand that. And it probably does warrant a research effort, so it depends on the application and what you want to get out of it at the end as to what acceptance criteria you can settle for. If you need something that's less conservative, then you have to do more work to go get it.

Again, using more realistic methodology, we all knew we were going to do that for beyond design basis things. And GSI-191, maybe it's credit for containment back pressure, credit for non-safety related equipment, and less conservative assumptions that are used in our baseline methodology under regeneration and transport, and all that other stuff. So, I mean, this is not brain surgery to figure out more realistic methodology. But just to throw all those issues up, and they go back to the Commission and say - and there's three of them up there, and they have limited staff, all these technical and policy issues. I think the Commission has not been well-served on this issue.

I have no idea what they're going to do with that SECY, but again, we're just disappointed that it got to this point, and that the dialogue was stopped on this. So we're going to focus on pilots that can help demonstrate how these things would be done, because to try to discuss these in the abstract, at least from our perspective, leads nowhere.

VICE CHAIRMAN WALLIS: Now, Tony, I'm

puzzled because I thought when we had a discussion with you folks some time ago that you guys were going to make the case for changes in 50.46 rule. And now it seems to be that you're annoyed because the staff hasn't done it for you.

MR. PIETRANGELO: No, that's not it at all. Okay. We knew the research work was ongoing. That is going to be the basis for the alternative breaks. Ultimately, we're going to have to demonstrate the applicability to our plants of that, whatever number is come up with, and how you would control change using that. Okay.

Again, as I think was said before, just the placement of an alternative break size in the regulation or in the licensing basis of a plant changes nothing. It's what goes forward from that. You know, trying to discern in advance all the potential effects of all the changes that could stem from an alternative break size is a useless exercise. We don't have enough resources, time or money to do that.

MEMBER ROSEN: I think I understand your point, and I think I feel some of your pain. Now tell me what it is you're going to do on this pilot that will help. What is the pilot going to be?

MR. PIETRANGELO: I think at least on the BWR pilot, there are some defined changes in that topical report that stem from decoupling LOCA from LOOP. Okay. So that's very well defined. You can draw a nice box around it.

The same thing can be said for GSI-191. I'm not going to try to change the universe with an alternative break size. I'm going to use it for debris generation purposes, and I also may use it on containment spray operation set points.

MEMBER ROSEN: So you're going to get a plant, a PWR, obviously, for the sump issue.

MR. PIETRANGELO: Right.

MEMBER ROSEN: To actually do some calculations and vary the break size --

CHAIRMAN BONACA:: To show how it would be done.

MEMBER ROSEN: To show how it's going to be done, rather than rely on the NEI document?

MR. PIETRANGELO: We have to go forward. We had an effort ongoing on GSI-191 for quite some time, a baseline evaluation methodology. What we have right now is a deterministic approach and a risk-informed approach. The deterministic approach is what you think it is. Okay.

The risk-informed approach would be an alternative break size along with a beyond design basis, how do you mitigate the double-ended guillotine break, as we've been talking about, and for any kind of Option 3 activities.

MEMBER KRESS: Tony, there are a lot of possible changes that could be --

MR. PIETRANGELO: There are.

MEMBER KRESS: And I agree with you, it's not very progressive to try to figure out what all of those are, and to try to figure out their implications with respect to risk. It seems to me like the way to handle those is change them one at a time on a plant-specific basis, and using something like Reg. Guide 1.174, and some defense-in-depth considerations. And that would automatically allow the thing to be controlled and looked at.

MR. PIETRANGELO: That's precisely what we proposed last September, was an approach based on Reg. Guide 1.174.

MEMBER KRESS: Do you think the existing plant-specific PRAs are doing that for that type of --

MR. PIETRANGELO: It depends on the application.

MEMBER KRESS: But it seems to me like to handle those changes, plant by plant, each plant basis is the way to handle this.

MR. PIETRANGELO: The way we envisioned it going forward was that these specific applications would be identified to use the alternative break size. And then we would develop guidance on each of those applications, just like we have the last 10 years. And we get a lot of interaction with the staff, we get a lot of input from the industry that says here's the way to do that application. All right. And then plants would go in -- there's always been the understanding that even with a revised break size, it was an amendment request that was going to be needed to change it, so by getting the alternative break size -- this was kind of the enabling rule we petitioned on before.

By getting an alternative break size in the regulation, you enabled people to go out and do some things and then come in with amendment requests. You can't do that unless you're doing exemption requests if you don't have a change to the regulations.

I know I vented a little bit here and took more time than I wanted to, but --

CHAIRMAN BONACA:: No, that's valuable,

first of all, input to us. And second, examples would limit this genuine concern about all that could happen out there in the universe because of this. Okay. And it will make it more tangible and more specific.

MEMBER SHACK: Back to you, Mr. Chairman.

CHAIRMAN BONACA:: Thank you very much, appreciate it. And we want to get back in, let's see now, at 1:30 or do you want the full hour? Full hour, so quarter of 2.

(Whereupon, the proceedings in the above-entitled matter went off the record at 12:44:32 p.m. and went back on the record at 1:43:54 p.m.)

CHAIRMAN BONACA:: We're back in session.

MEMBER KRESS: You guys recall that with respect to licensing advance reactors or with respect to the technology neutral framework thing, the staff came up with a number of what we thought were excellent issues to the guidance, and they had options for the Commission to consider with preferred options, and we liked their issues, we liked their options, and they set the thing up. As usual, the Commission didn't agree with all of us, so they sent them back an SRM basically asking them to look at two things.

One of them was what the heck do we do about multi-module plants on a site with respect to integrating the overall risk.

MEMBE POWERS: You told us several times what to do on that. Did they listen to you?

MEMBER KRESS: They didn't listen, no. But we've got another chance here. The other thing has to do with non-light water reactor, where you have to deal with the question of maybe you don't want -- maybe you don't have to have a real containment like with leak-tight barium. Maybe you can have other types of arrangements, so the question is containment versus confinement is the way it's been capsulized, but it's more detailed.

MEMBE POWERS: If you're in that spectrum of containment to confinement, does the European vented filtered containment?

MEMBER KRESS: That's a good interesting question. That probably would be called real containment.

MEMBE POWERS: That's a containment.

MEMBER KRESS: Yes, I would call it that. But anyway, those are two issues that the staff was asked to reconsider or think about, and they've done that now. And they're going to tell us what their early thinking is on these issues, and get our feedback, I suppose. So with that, I'll turn it over to you, John.

MR. FLACK: All right. Thank you, Tom. My name is John Flack. I am the Branch Chief of the Advanced Reactors at Regulatory Effectiveness Branch in the Office of Research. To my left is Stu Rubin, who is a senior level advisor in the branch. To my right is Mary Drouin who is, I guess everybody knows, from the probabalistic risk assessment branch.

MEMBE POWERS: Is she qualified to --

MEMBER ROSEN: Is that Mary Drouin that was here this morning, or you have two of them?

MR. FLACK: No, same one.

MEMBER ROSEN: Or evil twin.

MEMBE POWERS: Hey, evil is not a word we associate with Mary.

MR. FLACK: And to her right is Tom King, a former director in Office of Research, who everyone knows.

What I'll do is I'll briefly go over what's in the SECY, some of the background that led up to that and the issues, and the messages we're sending.

Basically, first viewgraph, the objectives of our meeting here with the ACRS is to discuss the proposed response to the SRM we received from the

Commission last year. That SRM was in response to seven policy issues that stemmed from our review of Advanced Reactors, so we're here to discuss them, and then obtain a letter that would approve where we're headed. And in this context, integrate whatever comments you have with respect to the SECY.

The next viewgraph briefly goes over background.

MEMBER APOSTOLAKIS: When is your response due?

MR. FLACK: It is due April 23rd, so we have very little time on that.

Briefly going through the seven policy issues that were raised previously that are listed here on this viewgraph, the first two are basically over-arching policy issues, the first being expectations for safety, and generally the Commission agreed with the staff's position on that; with the exception of accounting for integrated risk and you'll hear more about that today.

The second was defense-in-depth, and again the Commission approved the Staff's approach. However, they provided additional guidance, and instead of basically coming up with a new policy, was to revisit some of the policies that we already had, specifically PRA policy statement and others, to see if they can be revised to reflect what we mean by defense-in-depth.

The third policy issue, use of International Consensus Codes and Standards, was not approved by the Commission. The staff was seeking to be proactive in that area, to get out in front, to seek to look at the international community for their codes and standards and their application to plans under review. However, the Commission guided the staff in its guidance, guided the staff to review only those there were applicable to a design under review, and that we should enhance our own codes, and not seek out International Codes to do that job.

On the fourth one, probabalistic licensing basis, this was generally to revisit the Commission on the fact that we're using PRA more today than when we first proposed this as a policy issue back in the early 90s, and they agree with the staff's position on that on the greater use of PRA, and picking events and identifying system structures and components that are important to safety.

On the fifth one, scenario specific licensing source term, that basically is consistent to where we were headed from earlier Commission's decisions on that, so we're consistent with using mechanistic source terms in our licensing decisions.

Containment versus confinement, number 6, is what you'll hear again today. The Commission did not approve of the staff's position in SECY and wanted to know a little bit more about it, wanted the staff to go off and look at potential options for containment performance requirements and so on, so you'll hear about that today from Stu.

And finally the last one was the emergency preparedness policy issue. And at the time, the staff recommended we do not change anything there, and the Commission agreed to that, no changes regarding emergency preparedness, or no reductions in EPZ.

Okay. And then the bottom there, I just summarize what has been approved and disapproved. And it's issues 1 and 6, which you'll be hearing about today.

On the next viewgraph we're just briefly looking at how the SECY was structured. It's structured around those issues, 1 and 6. And then there are four attachments to the SECY. The first attachment gives a summary and a basic status of the framework. Mary is prepared to address some questions on that, but basically, you'll be hearing a lot more about that throughout the year. It's not to provide anything new at this point, but only to say this is where we are.

Attachment 2 discusses and summarizes the basis for the recommendation that you'll hear on the integrated risk issue. Attachment 3 is the containment functional performance requirements and discussions, a discussion of that issue. And Attachment 4 summarizes the workshop we had, where we entertained the public and other stakeholders on that containment versus confinement issue. Again, the SECY is scheduled to be sent up to the EDO next Friday, which is April 23rd.

Okay. Specifically, with respect to the two issues, and I'm not going to get too far into this at this point because you'll hear a lot more about it, but basically, on Issue 1, we were to provide options for and impacts of requiring modular reactor designs to consider integrated risk from the use of multiple reactor modules, and that goes to the issue of putting on many smaller reactors that were equivalent to one larger one, and how to treat that probabalistically from a --

MEMBER KRESS: Now when they say risk, they mean both CDF and LERF.

MR. FLACK: That's right, front-end and back-end, both pieces.

MEMBE POWERS: John, two years ago the modular concepts were all the wild rage. I've heard less people being -- not so much enthusiasm about those in the last year and a half or so. Are they still considered a viable concept?

MR. FLACK: Well, there are advantages and disadvantages. I guess the plants seem to be getting bigger for some reason that they're building. And the advantage of building --

MEMBE POWERS: Yes. I know that the Finns just purchased a new reactor, and it's 1600 megawatt electrical. It doesn't look like it's moving -- it's definitely a module. It's a heck of a module. I believe it is. I think that's one of four they think they're going to buy. I'm just asking you with your pulse to the floor, do you see people pushing these modules the way they were, say two years ago, or have they just kind of fallen aside?

MR. KING: I think maybe Jerry Wilson ought to talk about what the early site permit folks are asking for.

MEMBE POWERS: Well, I know that the early site permits have these -- I mean up to 21 modules in one case. But there was two written like two years ago and conceived of two years ago. I'm asking what's the current - say the last six months. I just haven't seen people pushing modules so hard.

MR. FLACK: Yes. No, I think you're right. I think the only place we're seeing any action at this point is over in South Africa with the pebble-bed that they're proposing, but at this point in time there's uncertainty there as to when, and what, and how long, so I think at this point, you're correct in your observation. We do not have a module in, or someone that's interested in building a plant for that matter in this country that size.

MEMBE POWERS: I mean, even in the Gen-Four Program it seems to me that they have put any modular concepts on the back burner in favor of the more --

MEMBER KRESS: In any event, I think these conceptual issues apply to just multi-plant size.

MEMBE POWERS: Yes, multi-unit sites. It's a position that you've taken for as long as I've been doing this as a matter of fact, which we won't go into.

MR. FLACK: Well, the advantage there is, of course, you could build a number of them as you need them, and not just build one, and hold up all your resources in building one plant all at once, so I think that was the advantage that they promoted when the concept came out, that you can add to the site as needed.

MR. WILSON: This is Jerry Wilson of NRR, if I could amplify a little bit on that. WE're expecting two design certification applications next year, advanced CANDU reactor and ESBWR. And at the moment, both of them are optimizing their design to come up a little higher power, so you could see that as some indications that they're looking at higher power. But at the same time, we've recently received a letter from the pebble bed folks saying that they'd like to initiate a pre-application review on the pebble bed reactor next year with possible design certification down the road. And as you also observed, all three of the early site permit applications included the option of possibly building pebble bed reactors, so there's kind of votes on both sides of that issue.

MEMBE POWERS: Yeah, the siting permits - I mean, that's just prudence to include that in the range of possibilities. I mean, they also leave open the possibility of buying an EPR at 1600 megawatts a pop.

MR. FLACK: Okay. So those are the -- well, that was the first issue, was again modular issue. The second issue is the containment functional performance requirements and criteria, and the options and recommendations. So at this point, the SECY is basically intended to summarize the efforts developed for the risk-informed framework and defense-in-depth description. And Mary can talk about that, and inform the Commission of the relevance of the integrated risk issue to the early site permits reviews, are also part of the intent of the SECY.

Okay. Basically, the SECY recommends to the Commission two things. It seeks approval of the Staff's recommendation on the treatment of the integrated risk for the modular reactors. And secondly, it's seeking approval of the integration of the options on the containment functional performance requirements with policy recommendations on the frame work. So those are the two basically messages that the SECY is sending us at this particular time. Those are sort of the bottom lines on that, and that's where we're headed. So I'll turn it over now, if there's no further questions, first to Mary, and then that will be followed by Stu to address these two issues.

MS. DROUIN: I'm going to speak on the first technical issue of integrated risk, which is Attachment 2 of your SECY. And what we were asked to look at is should the risk, and we looked at it from a modular perspective, that when you look at the risk concerning modules, should they be considered on a unit, a per module basis, or should the risk be looked across all the modules? And we're only at this point with this issue is looking at it from the modular. We're not looking at it from the site. It does have implications for that, but the policy issue is very specific to address the modules.

In coming up with the options that we have --

MEMBER KRESS: When you're talking about risk here now, are you talking about both CDF and LERF?

MS. DROUIN: Yes. When we talk about the risk, we're going to be talking -- I would say right now we're going to use CDF and LERF as the examples.

MEMBER KRESS: As the examples.

MS. DROUIN: Because without knowing the exact design we have, CDF and LERF might not be the correct figures. But for illustrative purposes in the options that we've looked at, we're going to use CDF and LERF as our examples.

MEMBER KRESS: The proper definition for those for gas cooled reactors.

MS. DROUIN: Correct.

MEMBE POWERS: Why is this an issue? If I look at the safety goals, doesn't it answer that question?

MS. DROUIN: If you keep the question up at the safety goal level, but if you try to do it at a surrogate level, CDF and LERF are not always the correct surrogates.

MEMBE POWERS: I guess I'm puzzled. I mean, don't the safety goals say that the risk in the individual to nuclear activities will be no more, and it specifies the limits? It doesn't say anything about –– it's very clear, anything within the site boundary counts in that risk.

MS. DROUIN: At one time, we've got to go back a little bit historically. The safety goals were applied across the industry as an average. When we went into Reg. Guide 1.74, there was a reinterpretation of the safety goal, and then it was applied on a plant-specific basis.

MEMBE POWERS: I see now. It's because of that –– George let you get away with things in 1.174.

MS. DROUIN: But you are correct. I mean, if you go back 15 years ago --

MEMBER APOSTOLAKIS: I'm trying to be quiet here.

MEMBER KRESS: And I've complained about that interpretation in 1.74.

MEMBE POWERS: I know you did.

MEMBER KRESS: Umpteen dozen times.

MEMBE POWERS: And you got just as far as George did on his defense-in-depth philosophy statement. They didn't pay any more attention to you than they did to him.

MS. DROUIN: Anyway, the options that we have examined or evaluated and the one we finally ultimately recommended are based on three factors; based on risk guidelines looking at accident prevention mitigation, using CDF and LERF as our examples.

It's also looking at the number of potential modules you have at the site, and then the megawatt thermal size of each reactor. And we have identified three specific options.

Okay. The first option, where there's really not very much consideration of the integrated or the cumulative risk. And what we're saying on this one is that when you look at each module, we're evaluating each module separately and independently from each other. So, therefore, if you're using CDF and LERF, for example, as your risk matrix -- you're using CDF and LERF and you're using the 1E-4, and the 1E-5 respectively, then what we're saying is that each one of these modules has to meet each of those guidelines. So we're not looking at, for example, it doesn't matter whether you have one module or ten modules. It's not looking at the size of the reactor, so whether you have one module that's 100 megawatts thermal, and they're all 100 megawatts thermal, or you have five that's 100 megawatts thermal and another 20 that's 600 megawatts thermal, it's not making any difference.

MEMBER APOSTOLAKIS: Why would the power level matter? I can see the issue of modules --

MEMBER KRESS: It's because the LERF is defined in terms of the fixed fission product inventory.

MEMBE POWERS: Source term.

MEMBER APOSTOLAKIS: Because what?

MEMBER KRESS: LERF is defined and back-calculated based on a fixed fission product release inventory.

MEMBER APOSTOLAKIS: And the frequency we have as a goal for LERF is based on that.

MEMBER KRESS: Based on that, yeah.

MEMBER APOSTOLAKIS: So it's the definition that changes.

MEMBER KRESS: It's the actual LERF surrogate for a safety goal that changes.

MEMBE POWERS: But it could be recalculated because LERF is consistent with the safety goals.

MEMBER KRESS: Yes, it's consistent with it. It can be considerably higher for a smaller power reactor.

MEMBE POWERS: But you could back-calculate it and get the appropriate number for the surrogate straightforwardly. Whereas, the CDF would be not necessarily consistent.

MEMBER ROSEN: Now, George, you said something that a little puzzled me. You said for light water reactors, but I thought the QHOs were broader on that.

MEMBE POWERS: The light water reactors have different weight function than those from advanced --

MEMBER APOSTOLAKIS: No, the frequency

that we use now as a goal is for the current generation, because they're working backwards, they're evaluating backwards.

MEMBER KRESS: LERF is very specific for the current change in light water reactors.

MEMBER APOSTOLAKIS: But the change -- if you have a smaller reactor, what we call now a large early release may not be appropriate.

MEMBER ROSEN: But the quantitative health objective --

MEMBER APOSTOLAKIS: Same for everybody.

MEMBER KRESS: Yeah, they're technology neutral.

MEMBER APOSTOLAKIS: It's the surrogate that you have to be careful about.

MS. DROUIN: Even if your surrogate have changed, I mean, the size reactor could potentially make a difference.

MEMBER KRESS: But you still have a question there, even if the surrogate changes.

MS. DROUIN: Correct. And we're just saying at this option, all we're doing is staying with the current practice.

MEMBER KRESS: The operative words I think on this slide is that bottom bullet.

MS. DROUIN: Oh, yes. Sorry.

MEMBE POWERS: What, pre-decisional?

MEMBER KRESS: Yeah, that's the --

MS. DROUIN: No, is that we could be under-estimating the risk to the public, very much so.

MEMBER APOSTOLAKIS: By the way, is this by design to look that way, or it just xeroxed on the notebook on the left there.

MS. DROUIN: It's supposed to look like a notebook.

MEMBER APOSTOLAKIS: The spiral is what?

MEMBER KRESS: It's a notebook.

MS. DROUIN: It's pre-decisional so you're still in your notebook phase.

MEMBER KRESS: She just tore these out of her notebook and xeroxed them.

MS. DROUIN: Okay. On the second option, we are started to be a little bit integrated here, but we're only considering the frequency. And what we mean by that is that the risk from all the modules combined has to meet the guidelines. In addition, each module has to meet the guidelines equally.

MEMBER KRESS: Now let me ask you about this. Does that mean that you have 10 modules and your CDF goal were 1 times 2 to the minus 4, each module has to be one-tenth times 2 to the minus 4?

MS. DROUIN: That's correct. It's whatever your guideline is over N.

MEMBE POWERS: But why is that the case? I mean, does that mean that there is no common mode failure here?

MS. DROUIN: No, you could have common mode failures. It's just the option we've come up with that we're just going to split it equally. We're just going to look at the number, and not consider still at this time power, the megawatt thermal size of the reactor. We're just going to say you have to meet these guidelines, and the more you have, it's going to be tougher to meet them because we're going to split them up equally.

MEMBER KRESS: Does it also say each module must meet the LERF goal?

MS. DROUIN: Yes.

MEMBER KRESS: So one-tenth of the LERF goal for each module. Now that presupposes each module has some sort of separate containment.

MS. DROUIN: No.

MEMBER KRESS: Confinement, or that the LERF could all be taken out by the CDF.

MS. DROUIN: We're still treating these

each independently. You're looking at each module as its own little unit.

MEMBER KRESS: Just like it's a reactor sitting over by itself.

MS. DROUIN: Right.

MEMBER KRESS: And another reactor here, another reactor here.

MEMBER ROSEN: This would say that if the licensee thought he might build ten of these ultimately, but it was only going to build one to begin with, you need to be careful and make sure that first one was one-tenth of the LERF and the CDF if he wanted to preserve the option.

MS. DROUIN: That's right.

MEMBER ROSEN: To design one that ate up too much of the --

MEMBER KRESS: They're not going to recommend this option.

MEMBER ROSEN: Well, I don't know what they're going to recommend because I haven't heard anything.

MEMBER KRESS: Oh, okay.

MEMBER ROSEN: But I'm just saying, he'd have to be thinking ahead. He couldn't just plunge right on it and put anything he wants on the site first. He might chew up all his CDF and LERF.

MS. DROUIN: That's correct.

MEMBE POWERS: That would be good, Steve, because then when he built the next one it's going to be really incredibly safe, and we could shut down the first one, and --

MEMBER ROSEN: You might have to build the next one out of impervium, which is any way to build it.

MEMBE POWERS: Well, technological advances there.

MEMBER APOSTOLAKIS: The penultimate bullet confuses me a little bit. Recognize this accident provision is important regardless of megawatt power. You mean, so if I have 10 modules for CDF, I will have 10 to the minus 5, because --

MS. DROUIN: That's right, for each one.

MR. KING: The logic, George, is that preventing a core melt accident is important, regardless whether it's a small reactor or a big reactor.

MEMBER APOSTOLAKIS: But I would say that this would be true if you kept the 10 to the minus 4 forever. But to divide by 10, then that means that if you have a single unit which is 1000 plus megawatt, you're willing to tolerate a higher core damage frequency because it's only one unit. In which case, I don't know that you recognize that accident prevention is important.

MEMBER KRESS: Well, I think, George, you are exactly right. I think that 10 to the minus 4 is predicated on the fact that there's something like 100 reactors out there of a given size, and that that's an acceptable preventative role with the reactors. If you had 1000 reactors the same size, you might want to think about making that goal something smaller.

I think we've already said that for advance reactors, we would probably want to have a 10 to the minus 5 anyway.

MEMBER SHACK: Yes, but this would just make it 10 to the minus 6.

MEMBER KRESS: Yeah, but I can't see the logic to that. I think you want 10 to the minus 5 for each reactor, because that still gives you the same concept that you're using now for the 10 to the minus 4.

MEMBER APOSTOLAKIS: If you build tomorrow 900 reactors, and you have a total of 1,000 - you can't really apply these only to the 900. You have to go back and apply it to all 1,000.

MEMBER KRESS: That's right. That's exactly right.

MEMBE POWERS: I have never understood this argument. And if I am in Connecticut, I am not threatened at all by the San Onofre reactor.

MEMBER APOSTOLAKIS: The Commission was thinking, at least in my interpretation, in terms of the risks nuclear power imposing on the nation.

MEMBE POWERS: They may well have thought about that, but they didn't write that.

MEMBER KRESS: They never used a CDF, actually used it in the safety goals.

MEMBER SHACK: And expectations.

MEMBE POWERS: I remain confused by this sentiment, because I read the explicit words, and they talk about an individual. And an individual in Connecticut is never going to be affected by the San Onofre reactors.

MEMBER KRESS: I think they will be, and I'll tell you why. You have one more reactor accident, you're going to shut down all --

MEMBE POWERS: He may have a code, but he's not going to be affected by the radioactivity --

MEMBER KRESS: But I think the idea is you just don't want to have a core melt. And the probability of having one has to do with the frequency times the time, times the number of --

MEMBE POWERS: This may be a belief on your part, because there is nothing in policy that says that we don't want to have a core melt.

MEMBER APOSTOLAKIS: The policy says nuclear power should not contribute more than one-tenth of one percent to the accident rate. It didn't say in Connecticut or in Oklahoma.

MEMBE POWERS: Yes, in individual.

MEMBER APOSTOLAKIS: How do you interpret that?

MEMBER KRESS: I don't think you would interpret that part of the safety goal in terms of this.

MEMBER APOSTOLAKIS: Living in the country. It didn't consider spatial distribution of individuals.

MR. KING: It talks about individuals around a reactor site.

MEMBE POWERS: Yes, it talks about individuals around the reactor. I don't think any --

MEMBER KRESS: I don't think you can use the QHOs to arrive at this 10 to the minus 4, or 10 to the minus 5 at all. I think it's a good issue. It has to do with we don't want to have a reactor accident.

MEMBER APOSTOLAKIS: Yeah, I think that's --

MEMBE POWERS: I know they don't want to have a reactor accident, but that's not what their explicit QHO says.

MEMBER KRESS: I don't think this has anything to do with the QHOs. It's an input into the final thing. I think the reason for having 10 to the minus 4 is another reason in the QHOs. You could have the QHOs with lots of CDFs.

MEMBE POWERS: I think the answer to that in debating this issue is to quite referencing yourself to this surrogate, go back to explicitly what you're trying to achieve.

MEMBER KRESS: Oh, I wouldn't be against that, but LERFs have been very useful things, I think.

MEMBE POWERS: Well, LERF I will agree with you is a useful thing, because it's indifferent to the QHOs. It is CDF that causes the problem, and that's because we don't know exactly how they got CDF.

MEMBER KRESS: But I still say the QHOs cannot be used to back derive this CDF, unless you somehow think you can use the CDF as a surrogate --

MEMBE POWERS: What I'm telling you is quit using CDF to adjudicate this decision, and go to the QHOs.

MEMBER KRESS: Yeah, but what I'm saying there is the QHOs are incomplete in terms of the expectations. The expectations are also that you won't have a core melt accident. You don't get that out of the QHOs.

MEMBE POWERS: That may well be your belief.

MEMBER KRESS: Oh, okay.

MEMBE POWERS: And we all know that the beliefs in Tennessee are unusual. The explicit words don't say that.

MEMBER APOSTOLAKIS: Wasn't there a commissioner who --

MEMBE POWERS: Yes, Balinski did all the back calculations --

MEMBER APOSTOLAKIS: And he considered 100 reactor --

MEMBE POWERS: He came up with a different number, yes. But that's not what got written down. The fact that somebody did an analysis at one time doesn't carry any weight. What counts is what's written down.

MEMBER APOSTOLAKIS: The fundamental problem is, and you touched upon it, is that we have goals that are in terms of per unit something, per reactor here, per reactor here basically; whereas, it should have been the total risk. Then you are covered. If you have total risk, then everything flows naturally. The moment you say the individual around the reactor, the reactor here should be the thing, then you run into problems like this. You can't do it on a per unit basis theoretically. In practice, it works if you have a stable fleet of 100 and some reactors more or less of the same power level and so on.

MEMBER KRESS: Very much what we've got.

MEMBER APOSTOLAKIS: That's why it's important. I'm not saying this to you, but it's important to understand why certain mathematical theories are formulated the way they are. If you go to decision analysis you'll never see anything on a per unit thing, unless there is convincing evidence of doing it on a per unit time, or per unit something doesn't affect anything, that it's constant no matter what you do. It should be the total impact. And I think the total impact is on the nation, not the -- maybe the goals are not stated well. You're right, stated for individual basis, but I think what they had in mind was the nation.

MEMBER KRESS: But still, with respect to CDF --

MEMBER APOSTOLAKIS: That's why --

MEMBE POWERS: George, your outrageous beliefs are on better in Boston than they are in Tennessee. It's what is explicitly written down that --

MEMBER APOSTOLAKIS: No, but the staff though -- if you work backwards like you did with LERF for CDF, you remember you come up with something like 10 to the minus 3. The staff says no, we don't want any accidents, 10 to the minus 4. Okay. And everybody said fine.

Now when they said we don't want any accidents, it seems to me they meant anywhere in the country.

MEMBER KRESS: That's what I --

MEMBER APOSTOLAKIS: They didn't mean no accidents in San Onofre, but it's okay to have in northern --

MEMBE POWERS: George, again your beliefs are fine.

MEMBER APOSTOLAKIS: It's not a matter of belief.

MEMBE POWERS: It's the explicit words that count here.

MEMBER APOSTOLAKIS: And, Dana, you cannot be as literal as you usually are when --

MEMBE POWERS: I am perfectly capable of being as literal as --

MEMBER APOSTOLAKIS: Your level of comment is the same level as your earlier comment, the last word, predecision. You're going literally.

MR. KING: But remember, the Commission did write down the 10 to the minus 4 CDF. They wrote it down in a June 15th, 1990 SRM that told us how to implement the safety goal policy, so they sort of supplemented the safety goal policy with that SRM. It was like a six or eight page SRM. It didn't get into the modular plant issue, it did say core damage prevention is important, and use a 10 to the minus 4 CDF as a guideline for assessing --

MEMBER KRESS: I remember that, and in their expectations for an increased level of safety for advanced reactors they said drop that down to 10 minus 5.

MR. KING: Well, they said don't do that. The staff recommended drop it down to 10 minus 5, but the Commission said no, keep it the same, today's plants, future plants the same.

MEMBER APOSTOLAKIS: Yes, that was a different issue.

MEMBER KRESS: Right. That's right.

MEMBER APOSTOLAKIS: And with the expectation --

MR. KING: That's an issue we're wrestling with on the framework --

MEMBE POWERS: Well, then you say with the expectation. How does that figure? That the future plants will be safer, right?

MR. KING: They've come out qualitatively and said in a policy statement we expect future plants to be safer, but they never put a number on that.

MEMBER KRESS: That true, but they said use the same procedure and thinking you did with the evolutionary plants, and those were 10 to the minus 5. Now I guess that's where I assume that 10 to the minus 5 was the operative number. I could be wrong.

MEMBER APOSTOLAKIS: It's the intent that matters.

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: Right?

MR. KING: Expectation.

MEMBER KRESS: But still, if you have three units on a multi-unit site, you wouldn't ask each one of them to have -- going forward of the CDF goal, and in the modular place just the same thing. You ask each reactor to meet the goal on CDF, not a one --

MS. DROUIN: That was option one.

MR. KING: I mean, that's the fundamental question of how to interpret the safety goal policy, on a per reactor or per site basis. If it's a per reactor basis, you're exactly right.

MEMBER KRESS: Well, I'm ambidextrous on that. If it's CDF, it's per reactor. If it's LERF, it's per site.

MEMBER APOSTOLAKIS: Yeah. I thought that was what you were proposing.

MEMBER KRESS: That's not what you're proposing.

MEMBER APOSTOLAKIS: Oh.

MR. KING: Well we'll go through, and we'll come back --

MS. DROUIN: Why don't we get to Option 3.

MEMBER APOSTOLAKIS: Yes, just get to Option 3.

MS. DROUIN: In Option 3, what we're

saying is that when you look at the risk guidelines, when you look at CDF, that all the modules have to individually meet the CDF.

MEMBER APOSTOLAKIS: And what will that be now? Can you give me the numbers because I don't want to have to divide.

MS. DROUIN: 1E minus 4.

MEMBER APOSTOLAKIS: Each module meets the 10 to the minus 4.

MS. DROUIN: If it turns out that the risk guidelines for the advanced reactors is a CDF of 1E minus 4, that's what we're saying. And each module would have to meet the 1E minus 4.

MEMBER APOSTOLAKIS: Okay. All right. Good. Next.

MS. DROUIN: Now for LERF, if it turns out the risk guideline is the 1E minus 5, what we're saying is that each module has to meet it, and the combined has to meet it.

MEMBER APOSTOLAKIS: But isn't that what Tom and I just said, and you guys said no?

MS. DROUIN: No.

MEMBER APOSTOLAKIS: That's what we just said.

MEMBER KRESS: No, no. I'm saying --

MR. KING: If Option 3 is -- if the overall goal is 10 to the minus 4 for CDF for a plant, for a modular plant, if it's 10 modules it would be one-tenth of that, because when you add up --

MEMBER APOSTOLAKIS: That's not what Mary said.

MR. KING: I know that's not what Mary said.

MEMBER SHACK: That's what the paper says though.

MR. KING: That's what the paper says.

MS. DROUIN: I don't think they said on the accident prevention they had to each meet it equally.

MEMBE POWERS: No, not equally.

MR. KING: The paper says --

MEMBER ROSEN: Do you guys want to have a caucus?

MR. KING: Yes, we may want a caucus here. But the intent of the paper is that each one has to meet one-tenth of the CDF goal, the overall CDF goal.

MEMBER ROSEN: We can always take a break.

MR. FLACK: I think that's right. The idea is not to allow modules to float up to what a CDF would be for a large plant, recognizing that you have

10 modules equivalent to one plant. So you would want any one of those modules to have a lower frequency of core damage, so that when the 10 of them are running, the integrative risk of all 10 running would be no more or less than one large unit running. I mean, I think that's the intent of it at the front-end.

MEMBER APOSTOLAKIS: Yes, but again, John, if I think in terms of accident prevention period, the accident prevention is important, I just don't want any accident.

MR. FLACK: Right. That's the intent. It's front-end loaded.

MEMBER APOSTOLAKIS: Because you have a larger number now.

MR. FLACK: That's right. It's front-end loaded. It's leaning towards the preventive side. Now in the mitigation side --

MEMBER APOSTOLAKIS: But it's not power. It's because -- it's the number. I don't care. No, it's important. Because you have many more now, you want a lower CDF.

MR. FLACK: Right. A lower likelihood of getting --

MEMBER APOSTOLAKIS: Whether it's 100 megawatt or 1,000, you really don't care, because what matters is not to have an accident.

MS. DROUIN: Right.

MR. FLACK: Right.

MEMBER SHACK: WE're in perfect agreement, George.

MEMBER KRESS: No, we're not.

MEMBER SHACK: Well, you and I are. You're not.

MEMBER APOSTOLAKIS: You and I what?

MEMBER SHACK: We're in agreement.

MEMBER KRESS: I'm saying each one of them, each reactor ought to be treated the same.

MR. FLACK: Reactor or module? The module --

MEMBER KRESS: Module is a reactor in my --

MR. FLACK: Okay.

MEMBER KRESS: So when you impose the CDF, you don't take the 10 to the minus 4 and divide it by the number of modules.

MR. FLACK: Why not?

MEMBER KRESS: Because I'm interested in not having an accident happen nationwide, and that's equal to the frequency, the CDF times the number of plants, times the time they're operating. That's the probability of having one, and that's what I'm trying to prevent. But now when I go to protect the people around the site from having a -- I use the QHOs. So then I say well, I've got to add up all of the LERFs on this site, and the summation has to meet the QFOs, so I take care of protecting the site people by my LERF. My CDF is a different animal.

MEMBE POWERS: Yes. But, Tom, in this case, it seems to me when you go to add up those LERFs, you're really adding up a tenth of the inventories. In other words, you're going to add them all up, but you're going to have divided the numbers by 10 automatically, because --

MEMBER KRESS: I eventually am, yes.

MEMBE POWERS: So the number is going to come out the same. It's still going to be 10 to the minus 5^{th} for the site as a whole, because the inventories are divided.

MEMBER KRESS: But now that imposes CDF on each one of them though, that I should not have imposed.

MEMBE POWERS: I mean, that's George's hangup, George and Shack are the ones that are going to be shaft them on the CDF.

MEMBER KRESS: No, but I don't want to do that. I don't want to shaft them on the CDF, but I want to make sure they meet the LERF.

MEMBE POWERS: The LERF is okay because the inventory is --

MEMBER SHACK: This is what you're trying to do. You're trying to prevent a reactor accident. If you've got ten of them, you divide by ten to avoid the accident. Your goal of avoiding a small core melt, you know, you have a strong desire to avoid that. And it's --

MEMBER ROSEN: We can argue, and we will, each of the members' opinion, but I'd like to know what the staff thinks. And so, John, will you --

MS. DROUIN: I don't have a problem with that.

MR. FLACK: All right. She has the option on the next slide. The recommendation for --

MS. DROUIN: Our recommendation is Option 3.

VICE CHAIRMAN WALLIS: And is it your version or Tom King's version?

MS. DROUIN: No, it's both our versions.

VICE CHAIRMAN WALLIS: Which is?

MEMBER ROSEN: CDF divided by ten because you have ten modules.

MS. DROUIN: Right.

MEMBER ROSEN: And LERF --

MS. DROUIN: And LERF, they each have to meet it, and the combined has to meet it.

MEMBER KRESS: Doesn't the combined suppose that each would meet it? I mean, they have to be lower. I mean, you don't have to have both statements, just the combined --

MS. DROUIN: But it is more, but if you have a combination of modules - and what I mean by that, say you have a mixture where they're not all the same size.

MR. KING: Or they're not all the same condition. One can be in refueling, and one can be operating.

MEMBER KRESS: Yes, but --

MR. KING: The idea was to allow some variation among the modules.

MEMBER KRESS: Yes, but that's all taken care of by saying the combined LERF has to meet it. LERF should have taken into consideration that --

VICE CHAIRMAN WALLIS: But doesn't this depend on the megawatts per module?

MEMBER KRESS: It should.

MS. DROUIN: Yes.

MEMBER KRESS: It should, and instead of saying LERF, maybe we ought to say QHOs.

MR. KING: Yes. Perhaps we could just talk about the combined effect, and that would take care of everything. But the idea is --

MEMBER KRESS: I think you don't have to say each one of them.

MR. KING: Yes. The real key point is that it is the combined effect that we're interested in. But our view is it's the same thing for CDF.

MEMBER KRESS: Yes, but I think we're wrong on that.

MEMBER APOSTOLAKIS: I think there is a problem with it, because again, you have to have a point of view. Okay. The point of view you have now is that a 10 to the minus 4 CDF refers to a site. So if I have 10 modules there, I have to divide by 10. That's a point of view. It's not in the goals.

My point of view, and I think that's what Tom was arguing also here, is that I don't care how many you have on the site. It's the total in the nation. So if I have -- if you take each site and put 10 reactors there, then I go on the order of 1,000 reactors, then I should divide --

MEMBER KRESS: But shouldn't the --

MEMBER APOSTOLAKIS: But just because I did the grand site, it's a perturbation.

VICE CHAIRMAN WALLIS: George, I disagree. It's all risk benefit. If you get more megawatts, then you can tolerate more risk. It must be. It's balancing risk versus --

MEMBER APOSTOLAKIS: Not when it comes to prevention. Preventing nuclear accidents is a fundamental objective by itself, regardless of the power you get out of it.

VICE CHAIRMAN WALLIS: If you have a reactor that produces no power --

MEMBER APOSTOLAKIS: It's the LERF that depends on that.

MEMBER KRESS: Yes.

MEMBE POWERS: Well, let's just pursue something a little further. Suppose I have ten reactors on this site, each reactor is so small that it can never violate the 10 CFR Part 100 siting criteria. Okay. Then I should be willing to tolerate all kinds of accidents there.

MEMBER APOSTOLAKIS: And I'm saying no, because even a small accident, people don't care. It's the same thing with security, for heaven sake. If you hit the fence, all you're going to see on CCN is nuclear plant was attacked.

VICE CHAIRMAN WALLIS: How do you know?

MEMBER APOSTOLAKIS: The fact that -- well, how do I know, because I live here. Don't you know that anything that starts with N has a problem, so I think the prevention policy is not to find yourself in that situation. It has nothing to do with whether you produce 1,000 megawatt or 100. You just don't want anything that is called nuclear accident, and that's why we even tolerate the 10 to the minus 4 instead of 10 to the minus 3, which would be consistent with the goal.

MEMBER KRESS: That's exactly right.

MEMBER APOSTOLAKIS: Yes. It's a different objective, it's a fundamental objective independently of the risk.

MEMBER KRESS: Absolutely. That's why you can't get it out of the QHOs.

VICE CHAIRMAN WALLIS: George, you're going against all the principles of PRA, were you look at consequences, say no accident whatsoever. If the accident has more consequences, you're more careful about preventing it. Right?

MR. KING: Having an accident to begin with is a consequence, forget the amount of radiation.

MEMBER KRESS: That's part of defense-in-depth and --

MEMBE POWERS: Psychological, financial.

MEMBER APOSTOLAKIS: The goals of Mary's -- the project that Mary is -- K minus 1 project, on the goals it says -- defense-in-depth says that for core damage frequency you have 10 to the minus 4, and therefore, use 10 to the minus 5. And there is a not so subtle assumption there that prevention is a thousand times more important than mitigation, 10 to the minus 4, 10 to the minus 5, something like that. So I think it's a fundamental objective not to have an accident, period. I don't care how much power you've got --

VICE CHAIRMAN WALLIS: Then you should make it 10 to the minus 10 or something.

MEMBER APOSTOLAKIS: You could, if you could.

MEMBER KRESS: It's a policy statement, and there's no technical reason for it. It's what people think is realistically achievable, and acceptable to the general public.

VICE CHAIRMAN WALLIS: Then you better ask the public and not this group of people here.

MEMBER APOSTOLAKIS: The public is the

five commissioners. That's what the public is.

MR. KING: It's clearly a policy decision, and that's why it's gone to the Commission.

MEMBER APOSTOLAKIS: Good.

MEMBER KRESS: It's policy.

MEMBER APOSTOLAKIS: So do I understand where you stand, and the gentleman stands.

VICE CHAIRMAN WALLIS: Yes. I'd like the rationale from the staff. I haven't heard much rationale yet that I believe, so is there some believable rationale that you have that you can persuade us with?

CHAIRMAN BONACA:: Yes, we heard the other rationales.

VICE CHAIRMAN WALLIS: The staff's thought about it much more than we have perhaps, so maybe you could give us a convincing argument.

MR. KING: Well, the rationale is that prevention of an accident is important regardless of the reactor size. And when you're adding a group of modules all at one time to a site or over some period of time to a site, you don't want the likelihood of a core melt accident on that site to all of a sudden jump up.

VICE CHAIRMAN WALLIS: It says megawatt

thermal of modules considered in one line. In the next line it says it's regardless of power, so I don't understand this slide.

MEMBER APOSTOLAKIS: Eleven?

VICE CHAIRMAN WALLIS: You weren't considering megawatts at all.

MEMBER APOSTOLAKIS: Eleven.

VICE CHAIRMAN WALLIS: If you're not considering megawatts, that's a false statement.

MEMBER APOSTOLAKIS: That's exactly what it said.

MR. KING: One is talking about accident prevention.

VICE CHAIRMAN WALLIS: It says megawatts considered, and then two lines down it says regardless of megawatts.

MEMBER APOSTOLAKIS: This is mitigation, the other is LERF.

MS. DROUIN: Action is important.

MR. KING: Yes, regardless of plant size.

MEMBER KRESS: Megawatts will be considered because when you calculate CDF, it enters into the calculation. But you're not explicitly putting it in the acceptance criteria.

MR. KING: Right. But accident mitigation does have dependence upon source term, which is dependent upon plant size, so we're allowing the analysis to give credit for that.

CHAIRMAN BONACA:: Yes, and this slide is confusing because it doesn't specify that the statements relate to LERF.

MR. KING: Yes, that last one doesn't. You're right. Well, it says accident mitigation the last two words.

MEMBER APOSTOLAKIS: Yes, you have to know that.

VICE CHAIRMAN WALLIS: I don't understand this at all. You've got three conflicting statements about megawatt thermal. Are you considering megawatt thermal or not? Are you giving credit for --

MR. KING: For accident prevention, no. For accident mitigation, yes.

VICE CHAIRMAN WALLIS: Well, that's not stated. I mean, it's just three -- it's not spelled out in this slide anyway.

MEMBER KRESS: That's what they mean.

MEMBER APOSTOLAKIS: I guess the only minor disagreement in I think Tom's and my point of view and your's, is that you take the number of reactors or modules at the site, and you divide the goal by that. I would take a broader view and say the total number in the country should be the number you divide the 10 to the minus 4 by. Now you might say well, I don't know what it is, and so on. But if you -- yes. Yes, the total number in the country, not on that site.

MEMBER KRESS: Absolutely, George. You're absolutely right.

MEMBER APOSTOLAKIS: You could disagree, maybe, but don't --

MEMBER KRESS: Well, from what I hear, I may be adding comments to --

MEMBER APOSTOLAKIS: I'm not sure that's a critical point though. Do you think it's a critical point? Well, it is --

MEMBER KRESS: I think it is because --

MEMBER APOSTOLAKIS: Because they assumed there would be 1,000 reactors.

MEMBER KRESS: But I think the industry would be up in arms over that.

MEMBER APOSTOLAKIS: I think everybody meets that, 10 to the minus 5. Now one of them, who was it, IG or First Energy -- these guys are going to have a problem.

CHAIRMAN BONACA:: I understand where

you're coming from, but you can go to the limit, assuming you have your module on that site. Okay. And then you say each one of them is 10 to the minus 4 because -- well, you know, we're making the likelihood of core damage on that site very high.

MEMBER APOSTOLAKIS: No, no, no. That's not what we're saying. We're not saying you keep the 10 to the minus 4. We're saying you take the 10 to the minus 4 and divide by the total number of modules in the country.

MEMBER KRESS: That's exactly what I --

MEMBER APOSTOLAKIS: Not on one site.

MEMBER KRESS: If 10 to the minus 4 is acceptable for 100 reactors, you've got the right show, what you need right there.

MEMBER SHACK: Back to the reactors, every time you add a new --

MEMBER APOSTOLAKIS: It's a problem.

MEMBER KRESS: Well, no, that's a problem. So what you do is you make for advance reactors, you make it 10 to the minus 5 and say now when you step up to 1,000 reactors, which we're never going to get, so we're taking care of the problem. That's the way you deal with the fact that you change it every time.

MEMBER APOSTOLAKIS: And then you can say the existing reactors are grandfathered.

MEMBER KRESS: Yes. Exactly right. You don't have to backfit.

MEMBER APOSTOLAKIS: Look, I don't think this is more stranger than what they're proposing.

VICE CHAIRMAN WALLIS: Well, could you explain to me --

MEMBER KRESS: I think it's the right thing. It makes a lot of logic and technical sense, and properly I think interprets the --

MEMBER APOSTOLAKIS: It could be an Option 4.

VICE CHAIRMAN WALLIS: So if I put 100 modules on a site --

MEMBER KRESS: Each one of them has a 10 to the minus 5.

VICE CHAIRMAN WALLIS: Each one produces --

MEMBER APOSTOLAKIS: Ten to the minus 6 now.

VICE CHAIRMAN WALLIS: -- ten megawatts. Each of them has to have a 10 to the minus 6 CDF?

MEMBER KRESS: Sure.

VICE CHAIRMAN WALLIS: So the group of them is equivalent to one.

MEMBER KRESS: Yeah.

MEMBER ROSEN: Right.

VICE CHAIRMAN WALLIS: And then how about LERF, same thing?

MEMBER KRESS: No, no, no. That's what they're saying, not George and I. I said each one of them has to have 10 to the minus 5. That's what George and I are saying.

MEMBER APOSTOLAKIS: They're saying that rather than dividing by the group, you divide by the number in the country.

MS. DROUIN: We're looking at in a site, not across the country.

MEMBER APOSTOLAKIS: They're looking at it on a site basis, we're looking at it on a nation basis.

VICE CHAIRMAN WALLIS: But if you put 100 modules on a site, does the public believe you are now doubling the risk of reactor accidents?

MEMBER KRESS: You take care of that with your LERF. You protect them with your LERF. You have to add up all of the LERFs.

MEMBER APOSTOLAKIS: Yeah, the LERFs will --

MEMBER KRESS: That takes care of

protecting the people around the site. The CDF --

VICE CHAIRMAN WALLIS: So safety has to do with LERF, and sometimes psychological --

MEMBER KRESS: Except there is this question with balance in your LERF calculation. You still have to balance CDF properly, but we've already decided what that's going to be.

MEMBER APOSTOLAKIS: I mean, they're not independent. It could be another interpretation.

MEMBER KRESS: I mean, when we calculate this --

CHAIRMAN BONACA:: That's more a practical approach, however.

MEMBER KRESS: When you take 10 modules, each one of them with the same CDF and calculate the LERF, you don't just take that one CDF. You use the 10 times that CDF, times some sort of way you can fail their containments, whatever it says, so you do add up the CDFs when you calculate the LERF.

MEMBER SHACK: But you're going to have a hard time explaining to the guy that he's 10 times more likely to have a nuclear accident in his neighborhood than the guy over there is, even though you tell him the LERF is going to be the same.

MEMBER KRESS: Well, we do what's right,

not what has appearances of --

MEMBER SHACK: The people have certain expectations.

MR. KING: Accident prevention is right. I don't see how you can say that's not right.

MEMBER KRESS: Well, we're preventing it by --

VICE CHAIRMAN WALLIS: What's right is what he thinks is right, not what you think is right for him.

MEMBER ROSEN: And that's democracy.

MEMBER APOSTOLAKIS: How do you know what he thinks?

CHAIRMAN BONACA:: Well, I think instinctively he believes more in prevention than --

MEMBER APOSTOLAKIS: I don't think you guys should -- I mean, I don't understand this argument he thinks this individual. These people are represented by the five commissioners, period. All you have to do is convince the commissioners.

MEMBER KRESS: That's right.

MEMBER APOSTOLAKIS: We don't have to go out on the street and start asking people what do you think. That's the way the system works. The people are the commissioners, so if the commissioners approve this, then it's fine. I mean, let's not talk about -- there is no end to this.

VICE CHAIRMAN WALLIS: And you've got to give them a good rationale.

MEMBER APOSTOLAKIS: And that's what this meeting is all about.

CHAIRMAN BONACA:: All right. I think --

MEMBER SHACK: This inspires confidence, I'll tell you.

MEMBER APOSTOLAKIS: What the staff is proposing is similar to what Tom and I think is right, if you assume that you will have 1,000 of those. Right? Because they divide by 10. And in that sense, they are saying the 100 --

MEMBER SHACK: You're sharing the risk out over all the reactors.

MEMBER APOSTOLAKIS: Yes.

MEMBER SHACK: These guys are really keeping the site --

MEMBER APOSTOLAKIS: It's the same thing. It's exactly the same thing.

MEMBER SHACK: No, it's not the same thing.

MEMBER APOSTOLAKIS: Because then the next step would be okay, I have 100 units and now they're a little higher, I can give an argument that I don't have to worry about them. I don't want to backfit. Okay. Of course, some of them are above 10 to the minus 4, but we don't --

CHAIRMAN BONACA:: But the other plants all exist already, but this guy here wants to put 20 modules on his location. I can do something about it. Okay.

MEMBER APOSTOLAKIS: Yeah, but that something has to have some basis.

MS. DROUIN: George, I mean if you've got two different sites and each site has 10 modules, we are saying that they have to meet it -- each module at each site has to meet it at 1E minus 5.

MEMBER APOSTOLAKIS: Yes.

MS. DROUIN: Because we're looking at it on a site basis. If I understand what you're saying, then they'd have to meet at 5E minus 6, because you're saying you want to take it across everything, which would be a total of 20 --

MEMBER APOSTOLAKIS: No.

MS. DROUIN: Well, that's what it sounded like you were saying.

MEMBER APOSTOLAKIS: Now you will be higher than the minus 5, because in my case I'll divide by the total.

MEMBER RANSOM: All sites.

MEMBER APOSTOLAKIS: All sites, 140. You divide by 10, but I would divide by 100 and whatever.

MS. DROUIN: Okay. But we are not looking at the current set. We are just answering -- the question posed to us by the Commission was what do we do with the modules. It does have implications. That's a separate policy issue if you want to now bring in the current set of plants. But we were just asked to look at the integrated risk across the set of modules, and we answered it in that very narrow context.

Now if you want to extend that to the site where you have current plants, that's a separate issue, and we don't have a recommendation for that.

MEMBER APOSTOLAKIS: Let me give you my thinking on --

MEMBER KRESS: When you do this, and you have say 10 modules on one site, and you take one-tenth CDF for each one of them, and somebody at another site builds three identical sets of these modules, now you're going to have one-third of the CDF for each.

MS. DROUIN: Correct.

MEMBER KRESS: It doesn't make sense.

VICE CHAIRMAN WALLIS: It does to the guy who's living there.

MEMBER KRESS: No, it doesn't. He's smarter than that.

VICE CHAIRMAN WALLIS: No. If you're going to put 100 modules, he's going to see 100 reactors in my backyard, and --

MEMBER KRESS: Well, he's going to ask what risk am I being put to, and you're going to tell him the LERF value.

MEMBER APOSTOLAKIS: He's never heard of LERF.

MEMBER KRESS: LERF in terms of .1 percent of his chances of dying some other way.

MEMBE POWERS: Tom, you're absolutely correct. It's not going to take long for that guy to realize that he's getting three times the core banding frequency that his neighbor down the road is being subjected to per module.

MEMBER KRESS: That's right. He's the guy that's going to complain.

MEMBE POWERS: He's going to complain like crazy.

MEMBER KRESS: Yes.

MEMBE POWERS: And if George --

MEMBER KRESS: It works both ways.

MEMBE POWERS: And since George is worried about the headlines in the "Boston Globe", this guy is going to get headlines in the "Boston Globe" as big as the --

MEMBER KRESS: Absolutely. And so you pick out a number and you apply it to all of it, and it would be justified on the basis of total number and expectations for increased safety. My guess would be that would be 10 to the minus 5 for every CDF for every module, because I've not used 10 to the minus 4 because there is an expectation of increased safety for new plants. And you're planning on increasing these, so I would choose 10 to the minus 5, and say that's what our recommendation is.

MEMBER APOSTOLAKIS: Or even higher. It could be higher because --

MEMBER KRESS: It could be higher, you know. It could still be 10 to the minus 4.

MEMBER APOSTOLAKIS: Let me give you this line of thinking. We want to prevent accident anywhere. Right now it's 10 to the minus 4 per reactor. We have 100 units. That implies that per year we want the probability of 1 percent or less of an accident anywhere.

MEMBER KRESS: That's right.

MEMBER APOSTOLAKIS: And that's independent of the number of units. So if now my number of units become 1,000, then on a per unit basis, it should be 10 to the minus 5, to preserve the 1 percent. If I have 500, it would be whatever it is, to 10 to the minus 5.

MEMBER KRESS: Yes. And my point was that the 1 percent, I think rethinking that and having second thoughts about it, it ought to be better than that for new reactors, so let's make it 10 to the minus 5.

MEMBER APOSTOLAKIS: No, I preserve the 1 percent.

MEMBER KRESS: No, what I'm saying is you really shouldn't because the Commission is having second thoughts about that being appropriate.

MEMBER APOSTOLAKIS: The 1 percent is anywhere, from any reactor.

MEMBER KRESS: I know, but they're having second thoughts about that, so let's make the new reactors 10 to the minus 5.

MEMBER APOSTOLAKIS: Oh. And that's a factor of 2.

MEMBER KRESS: Yes.

MEMBE POWERS: Let just inject a comment that Mr. Wallis would likely make. You guys can't pull these numbers out of the air. They have economic consequences. I mean, you can't just grab at some number and say let's make it this.

MEMBER APOSTOLAKIS: No, I'm just inferring from what the policy of the agency is right now. I'm not grabbing anything. I'm saying you have a 10 to the minus 4 goal, 100 reactors. That tells me that on a per year basis, it's 1 in 100. You are working with that. That has been the policy for 40 years. Now if you want to go to 500 reactors, or 1,000 reactors, I want to preserve it 10 to the minus 2 per year, so I have divide by --

MEMBE POWERS: Who said that you wanted to preserve the 1 percent? I mean, where is that written?

MEMBER APOSTOLAKIS: Make some assumption, okay. I don't want to increase it.

VICE CHAIRMAN WALLIS: But, George, here's one of the most important decisions you can make for people living near a plant. You're making it just by pulling 1 percent, or a factor of 10 here.

MEMBER APOSTOLAKIS: I'm amazed that you

say that, because I'm not making any decision. I'm just trying to analyze the implications of the recommendations, and the five Americans who represent the public will make the decision.

MR. FLACK: But getting back to the option, there's a global issue and there's a local issue, you might say. We're looking at the local issue in this paper; the integrated risk when you build a number of modules at a site. And how do you address that risk as coming forward with a licensing application for that site, for that plant that now consists of X number of modules? How do you integrate that risk to come up with criteria, and that's the option that's being chosen.

MEMBER APOSTOLAKIS: I think there is a misunderstanding around the table, at least on my part. I know Tom has his own views. I'm not saying this is wrong. All I'm saying is there is an equally plausible, or perhaps a little more plausible interpretation of the goals and the policies, the existing policies, that could lead to an Option 4 according to what we've been arguing. I'm not criticizing this. There is a big difference.

MR. FLACK: I understand, but --

MEMBER APOSTOLAKIS: I mean, you gave

Option 1. Now come on, what was Option 1? Option 1, as I recall is --

MR. FLACK: Let's treat them all like we do today with regular plants, and --

MEMBER RANSOM: Well, what do you today if you have like four plants on --

MEMBER APOSTOLAKIS: Nothing.

MR. FLACK: Well, we have three plants at a site, Paolo Verde -- and I think it was an option to build two more, correct me if I'm wrong, so we would just look at each plant.

MEMBER RANSOM: It's per plant, not per site.

MR. FLACK: And we'd consider that in the context of the safety goals, and recognizing that if the plant is meeting the safety goals in every one of those plants, it's safe enough, basically is the way we do business. That's in the context of a policy. It's not a requirement now, it's a policy. We look for the --

MEMBER RANSOM: Well, it's a little hard to see the difference between that and say multiple modules.

MR. FLACK: Well, the only thing with multiple modules is that you could have many more of those that generate the same quantity of electricity. So the question is okay, now instead of coming forward with one large plant, you come forward with 10 smaller ones. What is the integration of that risk of 10 smaller ones, and how should we perceive that risk if we're going to take that and break it down to each module? And I think that was the question at hand, how are we going to deal with that issue.

MEMBER RANSOM: I understand that, but --

MR. FLACK: And that's what this is about. Now if we talk about other plants across the nation, that's a bigger issue.

MEMBER APOSTOLAKIS: Okay. Let me ask another question. I said that this is not wrong, nothing is wrong in this case. This is a different kind of argument. Are you saying that what Tom and I are proposing is wrong?

MR. FLACK: Oh, no. I'm just trying to say there's a difference between what we're moving forward with here.

MEMBER APOSTOLAKIS: Right, there is a difference.

MR. FLACK: And this option that you propose.

MEMBER APOSTOLAKIS: So what would be the impediment to putting it as an Option 4, the fact that we don't have time.

MR. FLACK: Well, it expands the scope to something more than just modules.

MEMBER APOSTOLAKIS: It's that you don't have time, John.

MR. FLACK: Well, that's what I mean, expanding the scope --

MEMBER APOSTOLAKIS: Because you don't just sit down and write an extra section. I mean, it has to be reviewed by N plus 1 people.

MR. FLACK: Yes. Of course.

MEMBE POWERS: John, let me ask you this question. You're dealing with a local question. Why are you dealing with it in terms of CDF? Why don't you just go to BRISK?

MR. FLACK: I would say in the -- although it's a sort of -- I mean, you might call it a cop-out. It's a lot easier to deal with it as an engineering, the engineering aspect is easy to deal with at that type of consideration, and provided it's consistent with that goal. I'm not trying to say that we're moving away from that goal. We understand that goal is there, but it's a much more difficult goal to work with when you're doing a review of a plant.

MEMBE POWERS: But what I'm thinking is -- my thinking would go this way. With the risk, looking at the QHO and trying to deal with that, I can get a consistent answer. And then from that, I can figure out a way to calculate the CDF that I want to use. I think CDF is getting you in trouble because this doesn't have any logical connection -- any quantitative, easy to understand connection with QHO. It has a connection with things that George has been talking about, the time, the reactors in the nation times the number of years they operate. And that's fine if you were working on the global issue. But since you're working on the local issue, I think you have to come back to the QHO. Once you get that answer from the QHO, then calculate what the appropriate CDF is.

MEMBER APOSTOLAKIS: But I would not -- risk is not the only fundamental objection.

MEMBE POWERS: I don't argue with that, but his ground rule is he wants to work the local issue.

MEMBER APOSTOLAKIS: I understand that.

MEMBE POWERS: Okay. And I think where you run into logical traps is working a parameter that's based on the global issue and trying to apply it in the local issue. It gets around that if you would just go and work the QHO approach, and then once he gets that answer, say what does that imply about the CDF, because I know kind of how they got to it. And you could do preservations of some point --

MEMBER APOSTOLAKIS: We do this for LWRs, as you remember, Sherrie did that for us, because he went back to 11.50 and other standards, and found that the contribution of the containment, for example, was a certain number. Okay. So you can work backwards now from the QHOs to the large release, and then he looked again and said well, you know, from core damage to release there is a factor of X, and work backwards. With the new designs you don't have --

MEMBER KRESS: You don't have that containment.

MEMBER APOSTOLAKIS: You haven't done the PRAs, you don't know what the factor will be. It will be difficult to work backwards as we did --

MEMBE POWERS: But the QHO, you can come back and you get a LERF. Okay?

MEMBER APOSTOLAKIS: If you know how much you buy from the containment.

MEMBE POWERS: No, no. I can get a LERF.

Okay. So then I can say okay, well the LERF is typically a tenth of the CDF --

MEMBER KRESS: That's an assumption.

MEMBER APOSTOLAKIS: See, that's an assumption for LWRs.

MEMBE POWERS: That is a way of doing it. Okay. And you can make your judgment on what CDF is, but you come up with a LERF. It's quantitatively related to the QHO.

MEMBER APOSTOLAKIS: You're right.

MS. DROUIN: Okay. If you remember on our slides --

MEMBER APOSTOLAKIS: We did that for LWRs. It was 10 to the minus 3, and then they reduced it by 10. Sherrie did it for us.

VICE CHAIRMAN WALLIS: The LERF is a local thing. It's the guy who's actually living near the plant. And what you're doing here is you're balancing the whole nuclear game, is this is risk/benefit - whose risk, whose benefit? Are you going to look at it as a nationwide thing, or are you going to look at it --

MEMBER APOSTOLAKIS: You must because the person, the guy --

VICE CHAIRMAN WALLIS: Well, I don't know.

You have to enunciate some principles. I'm telling you, the safety of the person living next to the plant is paramount. Therefore, we will decide on LERF. Or it's a risk benefit spread over the whole nation. Therefore, we going to have some other principle --

MEMBER KRESS: The risk benefit has already been done.

MEMBER APOSTOLAKIS: I'm not introducing any new principles.

CHAIRMAN BONACA:: Well, it seems to me that we understand the differences of a plant, and there is another -- I mean, we have little more than half an hour left. I think we should move on, because I see that --

MS. DROUIN: The thing I'd like to make clear is that we were using CDF and LERF as examples of our accident prevention in mitigation.

MEMBER KRESS: Yes, we understand that.

MS. DROUIN: And if you go through the paper, you don't see the words CDF and LERF there, and they weren't on our slides.

MEMBER KRESS: That's right.

MS. DROUIN: And as we point out on this last slide here, there's guidance that's going to have to be developed. What we're trying to say with Option

3 is that in Option 3, that we want to focus in on accident prevention, because we think it's important. We want to prevent accidents. I think that's a goal you can't go away from. And when we look at accident mitigation, we want to take into account on the accident mitigation the size of the reactor. And that's the recommendation we're making conceptually. And there's going to have to be details worked out.

MEMBER KRESS: When somebody comes in and says I want to build a modular reactor system on this site, are you going to require him to tell you what the maximum number of modules he's going to have on there?

MS. DROUIN: This is a detail that would have to be worked out.

MEMBER KRESS: That's one detail because that fixes the number of the CDF and the LERF --

MR. KING: I think the way the ESPs are now, they put down the maximum number of megawatts thermal, and then you can divide into that however big your module is. That'll tell you how many modules you can have. I think that's the way they're coming in. Jerry is shaking his head yes over there. So they don't say number of modules, they say total number of megawatts thermal.

MEMBER KRESS: Say they're going to build two modules this year, add two more at the end of five years, and add two more five years from now, and we've accounted for the risk of all of those starting today, which doesn't seem like it's developed consistent to me.

MEMBER APOSTOLAKIS: So the pebble bed reactor will have a particular design, which may turn out to be okay to be licensed at Site X, but not Site Y. That's what you're saying, because at Site Y they may want to put more. That doesn't make sense to me.

MEMBER KRESS: That doesn't make sense.

MEMBER APOSTOLAKIS: It doesn't make sense. It has to be nationwide.

MEMBER KRESS: Absolutely.

MEMBER APOSTOLAKIS: Anyway, I think I've said my peace.

MEMBER KRESS: I think it's maybe two against I don't know how many.

MEMBER APOSTOLAKIS: Galileo was right.

MEMBER SHACK: Burning is fun.

MR. KING: Okay. Are we ready to move on to the next one? Okay.

MEMBER APOSTOLAKIS: I still want to emphasize that these are matters for interpretation.

I'm not saying that what you're doing is wrong. It's just another way of interpreting.

MR. FLACK: Okay. We recognize that.

MEMBER APOSTOLAKIS: You think what I'm saying is wrong?

MR. FLACK: Okay. Are ready to move on?

MR. RUBIN: Okay. Fortunately this next topic is a lot less controversial than the one we're leaving. I'm Stuart Rubin. I'm with the Office of Research Advanced Reactors. This next topic is essentially a status report on the work of the staff to develop options, as was mentioned, in the area of non-light water reactor containment and functional performance requirements and criteria. It's been referred to as confinement versus containment but the Commission has kind of broadened that to be a more functional look at containment requirements. This is the third meeting, I believe, with the ACRS on this subject. Next slide.

MEMBER APOSTOLAKIS: What am I missing here? The feedback is verbal.

MR. RUBIN: Well, because we are --

MEMBE POWERS: George, how do you get feedback other than verbally?

MR. RUBIN: Well, I mean as opposed to in writing in your letter.

MEMBER APOSTOLAKIS: No, no, no. He's right.

MEMBE POWERS: You meant oral.

MEMBER APOSTOLAKIS: Don't you know you have a Mr. Literal over there.

MR. RUBIN: And I thought this would be no controversial. I was wrong.

MEMBER ROSEN: Maybe you could get here on Saturday morning when things go smoother.

MEMBER APOSTOLAKIS: No, no. John was about to say --

MR. RUBIN: The letter is really -- what it's requesting is on the integrated risk part. Okay. Let's go to the next slide. I think we covered that.

Again, just by way of background, the staff in the last SECY paper proposed two options. One would have required a conventional type containment for non-light water reactors. The other option was to allow the possibility of other kinds of containments provided that there were performance requirements and criteria that would be established and would be met.

VICE CHAIRMAN WALLIS: Why is it retained pressure rather than the content, they're assigned to retain the fission products.

MR. RUBIN: Yes.

VICE CHAIRMAN WALLIS: There's nothing magical about pressure. Pressure doesn't hurt anybody.

MR. RUBIN: Yes. I wouldn't disagree with that, and so --

MEMBER KRESS: That's differentiated from containment, as you will maybe filter and vent.

MR. RUBIN: Right, to just bottle it up.

MEMBER KRESS: But, you know, the idea is --

MR. RUBIN: Right. Bottle up everything that might be released from the reactors. The staff recommended the latter option which it had done in previous years, and requested a policy decision, as well as requested permission to proceed to actually develop those requirements and criteria.

Basically, this Commission did not agree with either path. They basically felt there wasn't enough information for them to make a decision, and they really weren't sure whether or not if Option 2, if it led to a confinement-type building for an ACGR, whether or not that would be acceptable. So the staff was asked by the SRM to give options, options for functional performance requirements for the containment of non-light water reactors, and certainly ACGRs within that.

They specifically asked that we consider the fuel, and core cooling systems in our analysis, and we interact with industry and other stakeholders in developing these options.

MEMBE POWERS: Didn't the Commission recognize that the largest reactors this country has ever built had confinements?

MEMBER KRESS: That's the N reactor.

MEMBE POWERS: N reactor and C reactor.

MEMBER KRESS: C reactor.

MEMBE POWERS: And that those confinements were in the case of C reactor, were designed to withstand the over-pressure from a nuclear blast.

VICE CHAIRMAN WALLIS: From outside.

MEMBE POWERS: Yes. And the other thing I wondered, does the Commission understand that a substantial fraction of the plants in Europe are the vented filtered containment design; that is, they're design to act as containments up to a point, and then they vent through a filtration system?

MR. RUBIN: I wouldn't want to venture a guess as to this particular Commission. The intent is in the final SECY paper to apprize them of these kinds of facts and information.

MR. FLACK: Again, these policy issues are for non-light water reactors, but recognizing that there are also existing situations --

MEMBE POWERS: I'm not sure that a containment really cares what's inside of it.

MR. FLACK: That's true.

MR. RUBIN: And I do have a slide that takes somewhat of a survey, perhaps not including the reactors you mentioned, of plants worldwide, non-light water reactors, either existing or proposed, and the kinds of containments that they have.

In terms of where we've gone so far, since the SECY we've tried to collect documents relevant to this, documents of the reactors that you just spoke. We weren't successful, in fact, in retrieving those documents, but we did get many more in other plants. We discussed this with our senior management staff to get their views. We've had a couple of public meetings well attended by the nuclear industry and design folks involved today in designing these plants. And we've prepared a SECY and you have seen a draft of that. And we've also included what stakeholder comments, predominantly from the industry, views on requirements for containments.

MEMBE POWERS: You speak of the industry, and I'm sure that what you're speaking of is the U.S. industry, both reactor operators and NPBS suppliers. Do you try to include the views of say the designers of the EPR, which has a double containment, and a core retention device?

MR. RUBIN: We haven't specifically targeted them. We've certainly announced our meetings. Perhaps the title of the meetings as being non-light water reactors has caused them not to show an interest, but at this point we have certainly gotten the attention of the HTGR folks, both in South Africa, General Atomics, and DOE, and we've gotten participation from Liquid Metal Mold Salt Reactor Design --

MEMBE POWERS: Those are good. Unfortunately, none of those particular vendors have sold a plant; whereas, the designers of the EPR have, and their design is double containment core retention device. It seems to me that that must surely carry some weight. I mean, if this is the kind of plant that the public in the western world is willing to buy, maybe that's one that ought to be put in front of the Commission so that they're aware of it. It may be telling you something.

MR. RUBIN: Let me just kind of jump ahead a little bit. In terms of the functional areas that containments serve, there's clearly first and foremost the containment, retention, reduction of fission product release function, the mitigative function. There are other functions, including protective functions in terms of external events, tornado, missiles, aircraft, and the like.

The focus of this particular paper at this time is on the function of mitigation of fission product release. Now I'm not familiar with this double containment, but in terms of fission product release, the idea of a conventional leak-type containment is kind of -- probably the extreme case that we're considering.

Now when you consider the external events, there may be other kinds of things you want to do to your containment building system, per se - other kinds of shells within a shell, let's say. But the focus right now is on what are the performance requirements for fission product retention, containment, mitigation. That's the focus of this paper at this time, and we will look at the other functions to see what may flesh out when we look at that.

Now the industry has said that the way of designing these plants, they start out with a let's say top level objectives of meeting health and safety criteria or expectations, and then from that they develop you might say reactor safety requirements, things like shutting the plant down, containing fission products, removing heat. Some may be technology-specific reactor safety requirements, such as for an ACGR, avoiding chemical attack which doesn't show up as a reactor safety function on light water reactors, per se. So you have some variation right there in one of the top level reactor safety functions from technology. Then from there --

MEMBE POWERS: My friends in the metallurgical profession say yes, definitely the light water people have not looked at chemical attack.

MR. RUBIN: Okay. From there, they then try to optimize their designs in meeting those reactor safety functions. And the containment may or may not show up in some of those key functions. For example, shutting the plant down, maybe the plant sub-critical, it may not show up there. It could show up in removing accident heated. It certainly will show up in containing fission products and so forth.

VICE CHAIRMAN WALLIS: If you could show, really convince me that the fission products could never get out of the fuel which is made so that they can never get out in any conceivable event, then you wouldn't need any containment presumably, because there's no function to be performed.

MR. RUBIN: Well, what then comes in is the issue of defense-in-depth.

VICE CHAIRMAN WALLIS: Okay. As a performance --

MR. RUBIN: There's two major pieces here to the containment functional performance criteria, in terms of mitigating fission products.

VICE CHAIRMAN WALLIS: It's other function is a kind of public confidence booster, that you put it there to make people happier.

MR. RUBIN: Well, there has to be a balance between prevention and mitigation. If for some reason you fail to prevent that release from the fuel, should there be some sort of a --

VICE CHAIRMAN WALLIS: So you're just saying if you're not sure that it's going to be retained.

MR. RUBIN: -- defense-in-depth beyond a confinement, which may not have the same functional capability to retain fission products that the fuel was designed to have. It has a role in terms of attenuating the concentrations, but it's not as absolute as the fuel was intended to, so there's an issue of how much defense-in-depth you want in your containment. And that's really, in essence, where the decision lies among the options in terms of fission product release, in terms of picking an option.

Do you believe just what you said and say if we rely solely on the fuel, you would in principle say hey, the containment in terms of a confinement-type concept would reduce fission product sufficiently to meet the dose criteria. I'm done. Where's your defense in depth in terms of if fuel were not as effective as you had assumed, that particular concept may not give you additional mitigation capability to compensate for that, so you may want to factor in additional capability beyond what the dose criteria requirements would be.

And just to jump ahead, the staff is working on a description of defense-in-depth as it was described earlier, and that description of defense-in-depth is expected this summer, and it will be -- I'm sure it will have as a key feature in there the issue of defense-in-depth of mitigation and fission product retention specifically. We plan to use that particular description when it's developed as a yardstick to look at our options.

VICE CHAIRMAN WALLIS: Are you going to have measures of this defense-in-depth so it's not just a philosophical thing, and argue about it.

MR. RUBIN: Well, the paper lays out qualitatively the kinds of --

VICE CHAIRMAN WALLIS: Well, that's the problem, isn't it?

MR. RUBIN: -- defense-in-depth.

VICE CHAIRMAN WALLIS: When you get fuel which is better, and better, and better at retaining fission products, you can't just go and say well, it's all irrelevant because we've got to have defense-in-depth.

MR. RUBIN: Well, I mean --

VICE CHAIRMAN WALLIS: We'll have a measure of these things so you can decide when it's good enough.

MS. DROUIN: We have a subcommittee meeting scheduled in July, I think it's all day, where we're going to go through the technology neutral framework, and a large part of that is the defense-in-depth. And it's going to get into a lot of these issues.

MEMBER APOSTOLAKIS: We have? July when?

MS. DROUIN: I don't remember the exact date in July.

MEMBE POWERS: There was a -- following the accident at Chernobyl, Energy Secretary Harrington became very concerned about the energy production reactors, the Department of Energy's production reactors. I mean, they're the biggest reactors that have ever been built in this country, and the public perception that they did not have containments because they deliberately had confinements - when the justification of why the confinement design came up, I think at both of the sites, but especially Savannah River, the design philosophy was well articulated, in which they said they had a peculiar advantage at these sites, that they had control of the population to a much greater extent that you ever do for a commercial reactor. And the advantage of a confinement design is they knew where the fission products would go, and they could just clear that path. And it was just going to contaminate their own site, and it was not going to get beyond it.

That always struck me as a peculiarly strong feature of these confinement designs, given that they were strong enough to also serve the other requirement of tanks. Meteorites I think would bounce off some of these confinements. Are you articulating that kind of advantage of the confinement-type concepts that you avoid a pressurized release of fission products when you go to a confinement. And that if you have a confinement with a filtration system, you have even greater control over things?

MR. RUBIN: Well, you're jumping ahead to the options. In the options we do go through exactly those points. In the case of if one were to place a traditional containment around a HTGR and one were to have a loss of coolant, you would have some downside to that on safety, in the sense that you might make some of the heat removal systems less reliable. And you also would retain a mode of force for the release of fission products once those fission products were released, a day or two later let's say when the core heated up, whereas a confinement you would release all that energy. You would not pressurize the confinement, and then when fuel were to fail in very some limited manner, let's say, a couple of days later, there would not be mode of force to carry that away, so there is definitely advantage. That is described in the paper, that's described in these charts.

I don't know if you want me to keep moving, but that was one of the criteria for evaluating the various options; that being, is the option such that it could have a negative impact on safety in some way? Okay. I won't go through that. We've been talking a lot about what are the considerations. This lists some of what I'll call the generic policy guides that the Commission has set out to -- that has guided our development and assessment of the various options. I won't go into those. We're all familiar with those.

And then what I have is another list of what I'll call Commission policy decisions that are more specifically directed at non-light water reactor licensing. And several of these came out in the recent policy decisions on the SECY on light water reactors, that being that risk should be considered to a greater extent, and identifying events to be considered in the design-basis of containment, things like using scenario-specific source terms rather than bounding ones.

In the past, prior Commissions have indicated that the containment requirements should not be so stated as to discourage accident prevention and innovation in advanced reactor designs. They should not be so excessive, so to speak. And past Commissions have also indicated, at least for ACGRs, a desire for the staff to take a look specifically at air ingress and core oxidation, and the benefits that might be derived in terms of prevention from the containment itself in preventing that kind of an event. So these are some of the things that we've had as kind of guide posts for assessment.

As was pointed out earlier, there is a relationship between what the work here and the work on the framework. The intent is that the requirements at least that we are developing for containment, the options, they be technology-neutral risk-informed and performance-based.

Once one gets down to criteria, there's been an argument within the industry, and I think we tend to agree with that. Once you get down to the specific criteria, you need to consider the specific technology and how the criteria for it makes sense.

And also, defense-in-depth, as we mentioned earlier, that's going to become a kind of a measure of evaluating each of the options, because this option seemed to optimize the application of defense-in-depth compared to another one. And that will be coming this summer. We'll be able to do that, hopefully.

The outcome will have two possibilities. One is, of course, to put into the framework the Commission policy decisions in terms of developing actual regulations, and also will be of use in making decisions on COL and design certification applications on a plant-specific basis.

This lists some of the background documentation we looked at. There certainly was a lot. I would point out that we also looked at foreign plants, and operating plants, as well as concepts, things like the HTTR in Japan, the HTR-10 which is a pebble bed reactor in China. We looked at some of the concept plants that are being developed in Japan, and the containments that are applied in each case. And also, the DOE reactors that comprise several different technologies.

Let's just go to the next slide. This then again is basically the list of six functional areas that a containment can serve in reactor safety. Again, not all these functions are necessarily required of a containment. Some of these functional areas are let's say a collateral benefit of containment, because it was put there for reasons of let's say mitigation of fission product release. They certainly have come to be very important in terms of prevention of damage of bio-equipment due to external events, external sabotage, security incidents and the like. So this is a list that I think the industry would support.

I will say on bullet number 2, bullet number 2, the idea being there that the containment, at least in terms of some HTGRs, in terms of preventing or limiting air ingress has a vital role to limit the amount of air that would be available for air ingress. If you were to read the safety evaluation for the HTTR in their concept plants, the Japanese view the containment's primary purpose for being there is to limit the amount of air, and to a lesser extent to mitigate fission product release. Okay. So on that basis, I wanted to make it more prominent in terms of its importance.

And also, in other systems, such as liquid metal reactors, the containment provides kind of a way of containing the loss of coolant in a reactor coolant pressure boundary so that it doesn't go away and it's still there to cover the core, so it prevents core damage in that sense. And certainly, on light water reactors, there are some core damage prevention factors involved.

I put the first one in italics because that is the one that we're really focusing on now in this preliminary paper.

VICE CHAIRMAN WALLIS: Is all this going to become more specific, such as limit to some value rather than just reduce --

MR. RUBIN: Yes. Well, I'm going to get to that. This is kind of a generalized statement. We'll get more specific. Okay.

MEMBER APOSTOLAKIS: When you say potential safety function, so that follows a column, says containment building system. So shouldn't these six bullets refer to the containment?

MR. RUBIN: That's the intent. In other words, once you --

MEMBER APOSTOLAKIS: The second doesn't.

MR. RUBIN: The second bullet?

MEMBER APOSTOLAKIS: Core damage.

MR. RUBIN: Yes, it does. Well, I thought I gave you an example. I talked to you about HTGRs as an example. In fact, I'll just mention it now. Let's go to the next page, and I'll give you an example of that.

If you go into the advanced HTGR group, and I think you might find this one interesting, the last bullet is the GTHTR-300. Okay. This is a plant on the drawing boards in Japan which is intended to be the power reactor concept for the next generation. Let me put this one up. They call that a double confinement. Okay. You have an HTGR system on the lower part of the drawing below grade, and above it you have another volume, and the two are connected by - you can see a vent valve. And the upper containment has a secondary vent valve. Okay.

The idea being, that if you have a break in the reactor cooling system, those valves open much as would a confinement-type space to relieve that pressure and to relieve that coolant and fission products that might be the prompt release of fission products, but then following the depressurization, those valves close. The reason being is they want to limit the amount of volume that's available for air to interact with the core graphite. That's the principal reason for that design. And, of course, it still would have the functionality of play-out fission products due to slow heat-up and releases that would occur in a delayed fission product release sense. Okay. The purpose of this design is to prevent core damage.

VICE CHAIRMAN WALLIS: How is this thing

cooled following an event? How is the K heat removed?

MR. RUBIN: Well, as in any modular HTGR, it's through natural --

VICE CHAIRMAN WALLIS: It just sits there.

MR. RUBIN: It just sits there in like a cup of tea, you know, cooling off.

VICE CHAIRMAN WALLIS: So part of the purpose of this thing is also to confine the heat.

MR. RUBIN: Oh, yes. Those are the other functions. The reason I threw this up and explained it was to try to point out the function of prevent or limit core damage. This was an example of that second bullet. That's the basis for this design, is to limit the amount of air.

VICE CHAIRMAN WALLIS: And it shouldn't be so insulated that it let's it heat up too much. It's got to --

MR. RUBIN: Oh, yes. It still has to remove heat and all the other functions.

MEMBER APOSTOLAKIS: But would they still have to show here that the release frequency of radioactivity is 10 to the minus 5 or less, with one-tenth of that due to the confinement?

MR. RUBIN: The confinement would be taking credit for it in terms of the mechanistic source term would then be used to calculate the releases --

MEMBER APOSTOLAKIS: In other words, I thought the goals that Mary is developing will give credit to prevention, but up to a limit. You still want something for the confinement, so that's why I question that bullet. But now you've explained it, I understand it better.

MR. RUBIN: Okay.

MEMBER APOSTOLAKIS: Prevent or limit potential core damage. We still need something though.

MR. RUBIN: Yes. I think that's consistent with --

CHAIRMAN BONACA:: But that bullet still is reduce radioactivity release to the environment, so how is that --

MR. RUBIN: It has really two functions.

CHAIRMAN BONACA:: What are the functional requirements of that?

MEMBER APOSTOLAKIS: It's a matter of interpreting the slide. All right.

MR. RUBIN: Okay. So anyway, the point I'm trying to make here is among the non-light water reactors we see a range of containment choices, ranging from the traditional confinement vented low pressure containment in the first two, a traditional containment in the HTGR, a double confinement which is a variation to prevent core damage to the air ingress, moving down to the small liquid metal reactors what we see there is the 4S reactor from I think Toshiba, and the STAR, and SSTAR both leak-type pressure retaining-type reactors. And we believe that the Molten Salt reactors are going to be much the same as a traditional-type containment in terms of bottling up fission products.

MEMBER KRESS: That Molten Salt reactor, that's a Molten Salt cooled reactor?

MEMBE POWERS: Yes.

MR. RUBIN: Right.

MEMBER KRESS: Not the traditional Molten Salt reactor.

MEMBER ROSEN: No, it's not with integral for fuel.

MEMBE POWERS: I didn't know anybody gave any credence to the traditional one.

MEMBER KRESS: At least one person does.

MEMBE POWERS: One person does.

MR. RUBIN: The question was asked well, what are the requirements ultimately on containment, and the key first requirement in all the options, and I'll like to just introduce to you now what they are, and these are preliminary subject to refinement, change, et cetera, is that the on-site and off-site radionuclide dose acceptance criteria for the event categories, and the framework is developing curves that will kind of set some context for that.

In the first case, the events that would be considered in the containment design basis would go down to let's say the traditional cutoff of 10 to the minus 5th or 10 to the minus 6th, a level that is indicative of -- that does not lead to severe core damage in light water reactors. That would be the cutoff for those kinds of events.

The second option is the same as the first option, except that the designer would be forced to include events of lower probability into his design-basis analysis; the idea there being that those additional lower probability events would in some cases have higher consequences in terms of source term, and would challenge the containment design more. And might, in fact, result in additional containment fission product mitigation capabilities.

MEMBER KRESS: I read those two as saying they're going to now use the whole spectrum of events as the design-basis?

MR. RUBIN: Yes. Essentially.

MEMBER KRESS: Okay.

MR. RUBIN: Okay. So these are kind of a rationalist spectrum. We're now moving into a structuralist option in item 3, the idea being there the requirement again would be you'd have to meet the dose criteria for the event categories. In this particular item 3, we would go back to the more traditional cutoff of frequency. But the containment would also have to have a capability to handle source terms that were unexpectedly higher than what would be predicted from the mechanistic source term analysis. And we could argue about well, how much higher, and how much additional mitigation capability. Are we talking about a couple of decades of additional mitigative capability to reduce fission products, and that's TBD. But there would be some additional requirement there.

And a key within this particular option is that some have called it a hybrid containment design, is that you have the capability to button-up or seal, or make low leakage a containment that was initially a high leakage-type containment. So if there is an unexpected increase down the road a couple of days later of fission products, you will have already taken action to seal it up in a way. Okay.

The fourth option is again the traditional conventional containment. Now we tried to establish some measures to how to compare each of these options to one another, and so we developed some valuation metrics, and other considerations.

This next page lists what we think are really important considerations from a safety regulator's point of view.

MEMBER KRESS: Now when you say dose, are you incorporating some thought of emergency response there, or is this once fission product radioactivity gets to a given point at the site boundary or something?

MR. FLACK: I'm assuming this is the Part 100 you're talking about at this point.

MEMBER KRESS: So that doesn't have anything to do with emergency response.

MR. RUBIN: No, no, no. The folks who are working on the framework are trying to develop a consequence versus frequency curve. Okay. And then there is going to be some frequency bands that correspond to abnormal occurrences, design-basis, and then you have emergency planning-basis events. Okay.

And so the idea would be the containment needs to -- for the various events in those bands needs to meet the consequence criteria that you've established. And we're trying to do it on a technology-neutral basis, and specific plants have proposed specific curves for their plant designs, based on a light water reactor dose requirements Part 100 and the like. But that's the idea.

MR. FLACK: TBD.

MR. RUBIN: TBD on that. Getting back to Dana's point, would there be any adverse effect on safety functions. Some of these could have adverse effects, and we really don't want to get into that situation.

Would the containment option be such that it could undermine the designer's interest in preventing accidents or even being innovative? Could it be so onerous that there'd be no interest in creating fuel that never fails?

The next bullet is much like we talked about are there features that would come out in the wash, so to speak, of the containment design that would serve to prevent or limit core damage simply by this particular criteria that we would impose. And you will see some do and some don't.

Is the requirement performance-based and risk-informed, which is the intent of this exercise. And would the requirement provide flexibility in the way it's stated.

The other considerations which are perhaps not from a safety regulation point of view, as important, but we believe should be brought to the attention of the Commission, are things like is this a technology-neutral type of requirement because we certainly want it to fit within the plans to incorporate into our new framework. Is it something that seems to be in consonance with what the designers are working against now, and have put a lot of design finalization into, or is this something that's going to totally create a new requirement for that containment? Not that that would be all that critical to a safety regulator, but I think they would be interested in knowing about that.

We give the increased costs associated with those differences, and would they be commensurate with the safety benefits that one would perhaps get out of it? And do we see the various options as detracting from or adding to public confidence by the nature of that mitigation capability?

With that, I'd like to just quickly go

through each of those four options in terms of how they would be implemented.

MR. FLACK: Well, at this point we should probably have about 10 minutes left.

MR. RUBIN: Okay.

MR. FLACK: Can you go through them in 10 minutes? It's a lot more detailed as you move into each of these options, and maybe we should just leave it up to the Committee whether they want to hear that.

MR. RUBIN: Yes. Well, I'm just throwing it open now. I mean, you can see from the slides, they're pretty self-explanatory. The first option again --

CHAIRMAN BONACA:: Maybe if there's anything that you want to emphasize in particular, without going over them one by one?

MR. RUBIN: Well, I mean the options speak for themselves. I think what we really need to see ultimately is what level of defense-in-depth do we want as a regulatory agency in that containment in terms of a backstop for the uncertainties, the unknowns that we haven't considered in these designs. And that defense-in-depth measure will then drive you toward which option is going to be most optimal.

MEMBE POWERS: Let me ask you a question

of a philosophical nature concerning your options. In several cases, you say that we're going to use some deterministic engineering judgment to evaluate some of these concepts. And we probably will not have prototypic experimental data on any new containment design. In other words, you're going to have to rely on pure analysis for that judgment. Well, I think for instance, suppose that we just wanted to know how the radioactive aerosols behaved in a containment or a confinement design, and we have a lot of codes that purport to do that, but they have never been tested against real radioactive aerosol. And so there's a leap of faith going on there when we do those analyses. So there presumably has to be a margin above and beyond these -- I mean, there is no engineering judgment here because no one has ever seen radioactive aerosol in a reactor containment. I mean there's no experience with this. There's just approximation of codes, so you have to have some sort of margin beyond what you get from some deterministic calculation. Is that kind of thinking built into the development of these options?

MR. RUBIN: Well, yes. That was the intent of the last bullet on each of these slides. The staff will recommend enhancements to address potential areas of high uncertainty, and would be subject to Commission endorsement. And so that really is kind of a caveat to all of these. And in the previous advance reactor designs I do believe there were staff recommended enhancements. I'm not sure they affected the containment, per se. They may or may not. I'm not that familiar with it, and they were endorsed by the Commission, and they became part of the certification of those designs. So that bullet is part of the process.

I can't tell you how it's going to turn out. I don't know what kind of technology program they have. They may address it by the time they come in, but it probably won't.

MEMBE POWERS: I think you answered my question. And I think you'd be remiss if you tried to go more detailed than this because you don't know what these guys are going to come up with.

MR. RUBIN: And the reason I put that bullet on there is to make clear that there is a trap door in a way to even though you start out with a vented low pressure containment, there may be some reason even in entertaining that design where you want to add some additional features or capabilities like sealing down the road in an event that would be awed by that process. But I can't say we will or will not get to enhancement, but the process allows for it based on the uncertainties.

MR. KING: Spray system in AP-600. That's the example of what you're talking about.

MEMBE POWERS: I mean at that point it was imposed strictly because of overall uncertainty in what the analyses were. As we move into these confinement designs, I worry about things -- I worry about people being over-enamored in our ability to predict these things. For instance, a great deal of stir was created recently over the subject of iodine formation and the effect of silver. And then all of a sudden they find out in subsequent experiments they didn't get all the silver where it's needed to control the iodine. If you've done analyses in-between these two, you might get very different confinement designs. I mean, we're still discovering things because we can't test it full-scale with full prototypicity. You know, you're going to discover these things kind of one at a time, and you have to recognize sometimes there are substantial changes in your understanding.

MR. RUBIN: Well, that's really the issue of defense-in-depth. You can only solve so much at the time you're asked to sign on the dotted line, and you want to have something in your back pocket, and the guidance will give us an indication of what that needs to be.

MEMBE POWERS: I couldn't have said it better myself.

MR. RUBIN: Right. Are there any other questions?

MR. FLACK: So you want to skip the options and go to the end.

MR. RUBIN: Okay. Let me just tell you where we're headed under the milestones. Following this meeting, we plan to have another public meeting in August, and there the industry wants very much to provide much more substantive presentations on their bases for the various containment options. And we will present where we are too.

Again, the defense-in-depth description will be in place in August, and that will give us a good yardstick to then measure the various options. We would like to meet one more time on the final options with the public around the October time frame. We would then come back to the ACRS with what might be viewed as the final options and recommendation. And we will also combine that with a framework. It may take a whole day, but it will be combined with the framework. And then we'll put it in a SECY paper by the end of the year with those proposed options, the pros and cons, and the recommendations.

In summary then, we're at a point where we have pushed the assessment to a point where we have some preliminary options that range from you might say totally rationalist to structuralist. The options at this point are focused on reducing radioactivity release to the environment, that particular mitigative function. We're going to look at the merits of developing requirements for the other five functional areas, that's appropriate. And we'll develop those options again as it makes sense.

And again, by the end of the year we'll have those final options for your review and the Commission's review. And, hopefully, we will be able to get a policy decision, at least on the mitigative aspect of it. Let me just stop there.

MR. FLACK: Okay. And that, I guess, concludes our presentation.

MEMBER SIEBER: You didn't do your last slide.

MR. RUBIN: Oh, yes.

MS. DROUIN: Sorry. We'll go right to the very end.

MR. FLACK: All right. Agreement of staff, send letters and form staff recommendations.

MEMBE POWERS: Well, I mean the agreement here is -- certainly leads you to be confident that this will be the outcome.

MR. FLACK: Well, we appreciate that.

MEMBER ROSEN: I think there would probably be 10 plus 1 opinions.

MS. DROUIN: We are trying to finish a draft of the framework in time to get it to the ACRS in June. We have a time set for a subcommittee meeting in July. I believe we have it all day. We have a public workshop scheduled in August. I think it's a two-day workshop, I think the 17^{th} and 18^{th}. I might have the dates wrong. We'd like to then come back in the November and December time frame to the Full Committee, where we will be asking for a letter, and to send the framework up to the Commission in December, where we would be releasing it for formal public review and comment. And that's just quickly --

MR. FLACK: Things to come.

MS. DROUIN: Things to come.

MEMBER KRESS: We look forward to it. I turn the session back to you, Mr. Chairman.

CHAIRMAN BONACA:: I thank you for the

presentations. We'll take a break until 5 after 4. Please be back at 5 after 4. We're really running out of time. We have a lot of work.

(Whereupon, the proceedings in the above-entitled matter went off the record at 3:43 p.m.)