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Phenomena, and Reliability and Probabilistic
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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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JOINT MEETING OF THE ACRS SUBCOMMITTEES ON MATERIALS AND METALLURGY, THERMAL-HYDRAULIC PHENOMENA, AND RELIABILITY AND PROBABILISTIC RISK ASSESSMENT

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FRIDAY,

MARCH 16, 2001

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T-2B3, 11545 Rockville Pike, at 8:30 a.m., William J. Shack, Chairman of the Materials and Metallurgy Subcommittee, presiding.

COMMITTEE MEMBERS:

WILLIAM J. SHACK, Chairman, Materials and Metallurgy Subcommittee

COMMITTEE MEMBERS: (cont'd)

GRAHAM B. WALLIS, Chairman, Thermal-Hydraulic Phenomena Subcommittee

GEORGE APOSTOLAKIS, Chairman, Reliability and Probability Risk Assessment Subcommittee

MARIO V. BONACA, Member

THOMAS S. KRESS, Member

JOHN D. SIEBER, Member

I-N-D-E-X

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

(8:29 a.m.)

CHAIRMAN SHACK: The meeting will now come to order.

This is a joint meeting of the Advisory Committee on Reactor Safeguards, Subcommittees on Materials and Metallurgy, Thermal-Hydraulic Phenomena, and Reliability and Probabilistic Risk Assessment.

I am William Shack, Chairman of the Subcommittee on Materials and Metallurgy. Graham Wallis is Chairman of the Subcommittee on Thermal-Hydraulic Phenomena. And George Apostolakis is Chairman of the Subcommittee on Reliability and PRA.

Subcommittee members in attendance are Mario Bonaca, Thomas Kress, and Jack Sieber.

The purpose of this meeting is to discuss the status of risk-informed revisions to the technical requirements of 10 CFR 50.46 for emergency core cooling systems. The subcommittees will also discuss the proposed final report on the NRC Safety Research Program. The subcommittees will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full committee.

Michael T. Markley is the cognizant ACRS

staff engineer for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on March 1, 2001, and later amended to provide for discussion of the report on the NRC Safety Research Program.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. It is requested that speakers first identify themselves and speak with sufficient clarity and volume so they can be readily heard.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's meeting.

For those who came to attend the 50.46, we will be taking about an hour. That will -- we'll start the discussion of 50.46 at about 9:35.

At the moment, I'll turn it over to George Apostolakis to discuss the Safety Research Report.

MEMBER APOSTOLAKIS: Thank you, Bill.

As the members know, we have a new version of the report to the NRC on the Reactor Safety Research Program, and we would like to discuss some of the outstanding issues today and possibly vote on it.

So, Dr. Kress, would you lead us, please, through this?

MEMBER KRESS: Yes. Members should have a handout, the new draft version, which fortunately now has page numbers on it. And there are a number of items of disagreement or contention, and what I'm proposing we do is you have a sheet -- I think you should have a sheet that looks like this. These are the page numbers where those items are.

There's only really a few of them, but some of them are more contentious than others. And my proposal is that we take up the two most contentious ones first, and see if we can discuss it and come to some sort of agreement. That would be pages 11, 12, 13, and 15.

MEMBER APOSTOLAKIS: Okay. So you are skipping the others?

MEMBER KRESS: Well, not yet. But we'll come back to them.

MEMBER APOSTOLAKIS: Oh, okay.

MEMBER KRESS: I just want to start with these --

MEMBER APOSTOLAKIS: All right.

MEMBER KRESS: -- because I think the others are probably relatively easy.

MEMBER APOSTOLAKIS: Okay. So you're saying 11?

MEMBER KRESS: Pages 11, 12, 13, and shut down --

MEMBER APOSTOLAKIS: Okay.

CHAIRMAN SHACK: This whole thing? We have two versions.

MEMBER APOSTOLAKIS: It is an alternate to what. To the previous paragraph? The one on page 10?

MR. EL-ZEFTAWY: The one on 12 was a recommendation to scratch the whole section of the standard for PRA.

MEMBER APOSTOLAKIS: Oh, oh, wait a minute. Wait a minute. So up to page 10, line 198, there is nothing, there is no change.

MR. EL-ZEFTAWY: Right.

MEMBER APOSTOLAKIS: So then you have one paragraph versus the standard for the PRA.

MR. EL-ZEFTAWY: Right. The one that's starting in -- on page 11, that's a new paragraph.

MEMBER APOSTOLAKIS: So line 199, line 220, those would be the alternatives.

MR. EL-ZEFTAWY: Right. And then you have to decide if you're going to scratch from 220 all the way to 236.

MEMBER APOSTOLAKIS: Yes, and adopt 199 through 218.

MR. EL-ZEFTAWY: Correct.

MEMBER KRESS: That's the issue.

MEMBER APOSTOLAKIS: Okay. Okay.

MEMBER KRESS: Now, should we let members have time to read both of these first and then discuss them?

MEMBER WALLIS: Well, what's that page? It seems to be the one from --

MEMBER KRESS: That's the problem. The alternate has a much different thought process and much different than the other one.

CHAIRMAN SHACK: Well, actually, what I proposed for the alternate was it would replace the lines from 184, starting on the risk management tools used by industry, through 198, so it's --

MEMBER APOSTOLAKIS: See, that's what I thought.

CHAIRMAN SHACK: It's an alternate that replaces a fair chunk of that paragraph, rather than an addition.

MEMBER KRESS: So that replaces 184 through 198.

MEMBER WALLIS: Well, that makes some

sense but that really changed the subject.

MEMBER APOSTOLAKIS: Yes. I thought the issue of standards for PRAs is an entirely different --

CHAIRMAN SHACK: That's a different -- yes, it just happens to come together here, but --

MEMBER APOSTOLAKIS: Oh, okay. So the alternate, then, in our report would replace the risk management tools. Because I thought when I saw the e-mail that this was really a rephrasing of that --

CHAIRMAN SHACK: Right. It's a rephrasing of the 184 to 198 section.

MEMBER APOSTOLAKIS: Well, I'm for the alternate.

CHAIRMAN SHACK: I would also just suggest that from reading last night the 177/179, I would take out the "It can be argued that licensees are adequately managing risk during planned outages." And just go directly to "The nuclear industry has made substantial efforts."

MEMBER APOSTOLAKIS: Wait a minute.

MEMBER KRESS: I think I would support that.

MEMBER APOSTOLAKIS: Where is that?

CHAIRMAN SHACK: It's on 177.

MEMBER KRESS: Now, let me tell you --

MEMBER APOSTOLAKIS: And then you would go directly to where?

CHAIRMAN SHACK: I would take that sentence out and then take off the introductory phrase, "It is certainly true that," and just say, "The nuclear industry has made substantial" --

MEMBER KRESS: And start there. But let me -- now, I was against this change.

CHAIRMAN SHACK: Completely.

MEMBER KRESS: Completely. That was the word. And let me tell you why. The major message in these lines 184 down can be found in lines 184 and 185 and 186 and part of 187. And that major message has been done away with, and that's a message I think needs to be said because it -- to me, it is the -- it highlights the major difference between what the industry does and needs and what the regulatory agency does and needs.

So I didn't want to lose that message, which the alternate -- the alternate proposal loses that.

CHAIRMAN SHACK: Deliberately.

MEMBER KRESS: Deliberately, of course.

MEMBER WALLIS: Why did you want to lose

it?

CHAIRMAN SHACK: Because I personally think that, you know, we've made that argument in our '99 letter, that there was this distinction between what the NRC was interested in and what the licensee was interested in. I think that's a false distinction. You know, if we're out here to just -- to computer this number, I don't think that's important.

MEMBER KRESS: It's not a false distinction, because there are two reasons for having shutdown risk assessments. One of them is to manage that shutdown risk, as it is ongoing, and that -- the tools for that are what the industry uses and they're good tools. NRC needs to know about those tools and needs to be able to do that also.

But that doesn't help them at all when they go to risk-inform the regulations. Those tools tell them nothing. It just gives them a little -- a few insights. This tells them nothing about the risk contribution of shutdown. That's the problem.

And if you want the risk contribution due to shutdown to factor in to your risk-informing the regulations, you have to have this difference. And it's a different animal. It's not easy to do. And

that's the reason it hasn't been done; it's not easy. And that's why some research is needed.

But that's my whole problem. If you want to risk-inform the regulations, you have to have this component in there. And that's my problem.

CHAIRMAN SHACK: I mean, I will argue that the reason I want to do shutdown risk studies is I want to be able to make the statement that we made that there are unlikely to be any major contributors to risk that have not been identified that we can make about normal operations. I don't think we can make that statement about shutdown risk. I don't think we can make it about fire risk.

MEMBER KRESS: I don't mind making that statement also. I just don't want to lose this distinction, though, because to me it's the major distinction. I wouldn't mind adding --

CHAIRMAN SHACK: Being the major one is, in fact, that you want the assurance that you've identified to measure the contributors to this.

MEMBER KRESS: Well, I think this is equally important. I think they have equal importance.

CHAIRMAN SHACK: That's why we completely disagree.

MEMBER WALLIS: I don't understand really why there's so much disagreement. Can't you retain the sentence -- two sentences that Tom would like to retain? Is there something offensive about them?

CHAIRMAN SHACK: What's offensive about it, of course, is it was stuffed the last time we sent it up.

MEMBER KRESS: Well, you know, that shouldn't be any reason why we -- we shouldn't give good advice.

CHAIRMAN SHACK: I think it puts the wrong emphasis on why you're doing it.

MEMBER APOSTOLAKIS: I don't see the two points of view being very different, and I don't see why you would have to say which one is more important than the other, although I tend to agree with Bill. I think, you know, if there is a question of not knowing of some vulnerability, that is really the most important thing you would like to know about it.

But why do we have to say what's more important?

MEMBER KRESS: Well, I don't think you have to. I would be in favor of keeping both sentences. I just don't want to lose this thought.

MEMBER WALLIS: I think you could keep one

of these, you can just take it on the end of that section. It's not incompatible, is it?

MEMBER KRESS: That would suit me.

MEMBER APOSTOLAKIS: Okay. So somebody will do that?

MEMBER WALLIS: Tom will do that. Tom has dictatorial authority.

MEMBER APOSTOLAKIS: Editorial or dictatorial?

MEMBER WALLIS: It's one of those Latin terms that you would have to -- the concept is probably unknown in --

MEMBER KRESS: Okay. Now, that sort of gets us on the road for maybe resolving that one. The next one is this section on -- starting on line 219. And I think the proposal there was to just zap that section all together. That's the question. Do we want to zap that section?

MEMBER APOSTOLAKIS: Well, since I proposed that, it's not that I'm against the agency spending resources to support the development of standards for PRA. It's just that I thought that this is something that the agency has committed to do. It's something that they will do. And I don't view that as research. So I didn't think it belonged

there, but I didn't really --

CHAIRMAN SHACK: Well, there is research in lines 231, 232, 233, where you essentially define necessary features of PRAs.

MEMBER APOSTOLAKIS: Well, but that's part of this activity. This is not where we talk about necessary and sufficient, is it?

MEMBER KRESS: No. We'll get to that.

MEMBER WALLIS: I thought we ought to retain it, because this is a major issue with the -- it's on the Commission's radar screen. They are worried about PRA quality and how to respond to critics. The quality is so lousy you can't use it, and --

MEMBER BONACA: We can put in a statement, George, that affects your point of view. This has already been dealt with in large part. We recognize that. But it's as important --

MEMBER KRESS: Well, let me tell you what my take is on this. My take is is the industry and the agency are on divergent courses. Industry is going out to -- through a certification process to certify the plant-specific PRAs. And the agency is going forth with this development of standards.

And I see the two as somewhat similar but

not completely compatible. And what I think will happen is the agency will have this set of standards to look at, but the industry will come in for some request for an exemption or a change or rule -- rulemaking or whatever, and the plant that comes in will bring his certified PRA certified by the industry process.

And the staff will be sitting there with another whole set of standards. And they will have to somehow reconcile the two, and that's what I'm asking for here is to give some thought to how they're going to reconcile the two and see if there is some relationship between the standards and the certification, and maybe even adopt one or the other or both of them, show how they're related to each other.

So I thought we needed a section on standards to deal with what I see as an upcoming issue. And that's why I didn't want to zap this section.

CHAIRMAN SHACK: But I thought they already had a program in place to --

MEMBER KRESS: Yes, they have --

CHAIRMAN SHACK: -- at how good -- you know, whether the peer review was a grade 3 -- is

adequate for Option --

MEMBER KRESS: Well, I'm sorry, I didn't see --

MEMBER APOSTOLAKIS: And also, didn't the staff also report some time ago where they had the necessary features? That was really nice, where they also had Appendix B and we recommended that they expand the --

MEMBER KRESS: They had necessary but not sufficient.

MEMBER APOSTOLAKIS: But it's not sufficient here either. In fact, it says sufficiency is very difficulty. So all of these things either have been done or are in the process of being completed. That's all.

MEMBER KRESS: Well, you know, everything we talk about is -- I don't know why this one should be different.

MEMBER WALLIS: They don't want to --

MEMBER APOSTOLAKIS: I don't see it as research. But, anyway, I'm not going to --

MEMBER KRESS: Well, research is a good -- has got a broad envelope in this agency.

MEMBER APOSTOLAKIS: All right. Well, that's fine with me. We can keep it. I didn't feel

strongly about it. It's just that I thought it was something that was being done anyway.

But this also is nice because it says clearly that you cannot define "sufficiency" requirements, which we will remember a little bit later.

MR. EL-ZEFTAWY: That word has been taken out, the 242 -- line 242. When it comes to sufficient, we took the word "sufficiency" --

MEMBER APOSTOLAKIS: Where is 242? That's on -- what do you mean?

MR. EL-ZEFTAWY: But, I mean, originally we had "sufficient and necessary," and we took the word "sufficient" out.

CHAIRMAN SHACK: On 242, it was "necessary and sufficient features of probabilistic risk assessment" once upon a time. That -- we nailed that --

MEMBER APOSTOLAKIS: Okay. So that's an old letter.

CHAIRMAN SHACK: Yes.

MEMBER WALLIS: So as long as the PRA methods are insufficient, that would be okay?

CHAIRMAN SHACK: Yes.

MEMBER APOSTOLAKIS: Okay. So we could --

so we keep that.

MEMBER KRESS: So we keep this, and that resolves that issue. Well, we're making headway. These other things I think --

CHAIRMAN SHACK: Well, I think there's a question why George wants SPAR out.

MEMBER KRESS: Yes, that's on 13.

MEMBER APOSTOLAKIS: Because it's -- really, the whole thing addresses the issue of codes. SPAR is a model. I mean, they are taking the IPs and putting them on SAPPHIRE, right? Is that what SPAR is, essentially? No?

MR. KING: Well, it's not taking the IPs. It's taking our own models, which in many cases are better than what the IPs had.

MEMBER APOSTOLAKIS: Right. Right.

MEMBER KRESS: But they are in a sense PRAs. They're very --

MR. KING: No, plant-specific now. We've got -- we're developing SPAR models for each plant.

MEMBER KRESS: But they could not --

MEMBER APOSTOLAKIS: But the whole point of this paragraph was to address the need to peer review the fundamental tool of SAPPHIRE. Now, whether you use SAPPHIRE to do other things, I mean, I would

--

CHAIRMAN SHACK: Well, I thought it was more risk assessment tools. I was going to suggest changing lines 241 and 242 to read, "An agency effort to define the kinds of risk assessment tools needed to support regulatory processes might well provide the agency" --

MEMBER APOSTOLAKIS: In my mind, the important recommendation is 244. The SAPPHIRE code has reached a stage of development that the public deserves to see a comprehensive peer review of this code. This is the message here.

MEMBER KRESS: Yes.

CHAIRMAN SHACK: But I think Dana has been adamant that they need better risk assessment tools, and so I think he would look at both the --

MEMBER APOSTOLAKIS: But we say that somewhere else. This is not the place. This is -- he doesn't discuss SPAR. He just mentions them in passing.

MEMBER KRESS: That's the only place in here we say anything about SPAR.

CHAIRMAN SHACK: Well, I mean, you might say we ought to say more about SPAR, but I'm not sure we should argue we should say less.

MEMBER BONACA: I agree with that.

MEMBER APOSTOLAKIS: Look at the first sentence. "The NRC risk assessment codes and models continue to undergo development, and the vision of this code" --

CHAIRMAN SHACK: These codes and models.

MEMBER KRESS: I think it's --

MEMBER APOSTOLAKIS: I think it dilutes it. I think it really is the SAPPHIRE thing that needs the review.

MEMBER KRESS: Do you want to take us --

MEMBER APOSTOLAKIS: I mean, we're asking them to do a peer review of a SPAR model?

CHAIRMAN SHACK: No. No, no. All we're saying is they should continue the development, and we'd just like a little better, more organized picture of what they really intend to get to with the SPAR models. How good do they need to be? How good are they? How good --

MEMBER APOSTOLAKIS: Where does it say that? It doesn't say that?

CHAIRMAN SHACK: Well, it's -- if we say an agency -- you have to define the kinds of risk assessment tools needed to support regulatory process -- might well provide the agency with a more scrutable

strategy for the development of these models and codes.

MEMBER KRESS: Yes, I wouldn't be against that.

CHAIRMAN SHACK: You know, changing the words a little bit.

MEMBER APOSTOLAKIS: Sometimes asking for too much means you are getting nothing back. I think if you have a specific recommendation, take this code and peer review it. It's very hard to say, "There are ways around it." Developing better models, yes, we are development better models. What do you want? I think it dilutes the message. The message is breaks of power are so important to have some sort of peer review to -- I don't care about the --

MEMBER KRESS: Let's take the -- the proposal is to remove the word "SPAR" from here and just have this paragraph focus specifically on SAPPHIRE. Those in favor of that, please raise your right hand. Those opposed? So it passed three to two to -- so we're going to remove that "and SPAR," and this paragraph is just going to --

MEMBER APOSTOLAKIS: Now, what are we going to do about line 241? The necessary features of probabilistic risk assessment support -- are you still

leaving that there? I think it's okay to leave it. I mean --

MEMBER WALLIS: Let's leave it.

MEMBER APOSTOLAKIS: -- it's sort of a model for --

MEMBER KRESS: Let's leave it. Let's leave it.

MEMBER APOSTOLAKIS: Okay.

MEMBER BONACA: It's mentioned as part of the -- from your report?

CHAIRMAN SHACK: I believe so.

MR. EL-ZEFTAWY: So it's even from line 237.

MEMBER APOSTOLAKIS: Yes, the SAPPHIRE code.

MR. EL-ZEFTAWY: Okay.

MEMBER APOSTOLAKIS: Right.

MEMBER KRESS: Okay. That takes care of that problem. Now, where should we go? Let's see what's on page 25. Let's look at 15. That's the next one. That's the next contentious issue. That's the quantification of uncertainties.

MEMBER APOSTOLAKIS: I was the one getting kind of --

MEMBER WALLIS: No, it's very important

that we do that.

MEMBER APOSTOLAKIS: Well, my point was that this is also too dilute. Let's --

MEMBER WALLIS: Be stronger about it?

MEMBER APOSTOLAKIS: We worry about uncertainty, and so on. I think our message is that in the context of these new thermal-hydraulic codes, we'd like to see statement of model uncertainty.

MEMBER KRESS: This had to do with PRA.

MEMBER WALLIS: We'd like uncertainty evaluated everywhere, including PRA, as a separate --

MEMBER APOSTOLAKIS: Well, I mean, if you do that there, that's PRA.

MEMBER WALLIS: Yes, well, this is a PRA. We're talking about PRA.

MEMBER APOSTOLAKIS: And what they say in the PRA context, "Please address the issue of uncertainties and quantify them," again, is a motherhood statement. Because PRA is supposed to do that. If you don't do an uncertainty calculation, you are not doing a PRA. So I thought the message was clearer in the other sections.

MEMBER KRESS: Yes. But what this makes a point is that the uncertainty development in PRAs is mostly epistemic and they don't deal with the

aleatory --

MEMBER APOSTOLAKIS: And they don't know that?

MEMBER KRESS: Well, we're saying here the only place you have both of those combined is in the NUREG 1150. And you need to somehow separate the two out and use some generic measure of the aleatory and let the codes go ahead and develop the epistemic. But at the end you add the two together some way.

You have to deal with both uncertainties some way in your development. Either -- either you do it in your -- how you make your decision using the results, or you make an assessment of them some way. But it says you need to deal better with uncertainties.

And it also makes an interesting point that -- to be careful somewhat with the Bayesian process because it knocks off details. And that's an important message, too.

MEMBER APOSTOLAKIS: I wrote that.

MEMBER KRESS: You wrote that?

MEMBER APOSTOLAKIS: But I'm proposing to eliminate it, because I think it's --

MEMBER KRESS: No, no, it's an important message.

MEMBER WALLIS: George, it's not as if they don't know it. If they know it, we're simply reinforcing it. And the fact that we wrote it in our report will help them. So --

MEMBER KRESS: The staff probably knows 99 percent of everything that --

MEMBER APOSTOLAKIS: Can we get -- well, it's not a matter of that. Well, one thing we don't do right now is send the reader to other sections where similar things are discussed. Like here I think it would be very appropriate on line 301 if we actually send them to the thermal-hydraulic section.

MEMBER WALLIS: That would be fine. That would be fine.

MEMBER APOSTOLAKIS: That would make me happy.

MEMBER WALLIS: That would be fine.

MEMBER KRESS: I wouldn't be opposed to that.

MEMBER APOSTOLAKIS: Yes. I mean, this thing about -- as you know, we sent many e-mails to Dana back and forth. When I discussed this issue of updating the distributions it was in a very different context.

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: So I thought it was a little bit out of the blue. But it's okay. I mean --

MEMBER KRESS: Well, it fits you. I guess the word fits. So we'll retain this, and maybe add a sentence at the end that refers to the thermal-hydraulic section that deals with this same issue.

MEMBER APOSTOLAKIS: Now, if we retain it, look at 294. "Uncertainness in the models used for the analysis are seldom discussed." Is that correct? I don't think it's correct.

MEMBER KRESS: That one we might want to change.

MEMBER APOSTOLAKIS: They may not be quantified.

MEMBER WALLIS: We should take that out.

MEMBER APOSTOLAKIS: But they are certainly discussed. So let's take that out.

MEMBER KRESS: I thought we could deal with those kinds of things later. Well --

MEMBER APOSTOLAKIS: Also, on 293, of propagating parameter uncertainties, we don't need the word "epistemic" there.

MEMBER KRESS: 293? Yes, you're right. It's redundant.

MEMBER APOSTOLAKIS: Now --

MEMBER KRESS: Besides, anywhere I can mark out the words "epistemic" and "aleatory" I am willing to do --

(Laughter.)

MEMBER APOSTOLAKIS: 291. Yet careful quantification of the -- it's not -- there's a typo there.

MEMBER KRESS: Yes, there are a couple of typos.

MEMBER APOSTOLAKIS: Yes. Of uncertainties seldom appears in risk-informed regulatory discussions. Do we all agree with that?

MEMBER KRESS: Well --

MEMBER APOSTOLAKIS: Quantification. Yes, probably right. Quantification is correct. The discussion was incorrect.

Okay. So just make sure that at the end we put "see also Section 6." Go to the end of the paragraph, and --

MEMBER WALLIS: Is it only in Section 6 that we want to --

MEMBER APOSTOLAKIS: Well, that's where the thermal-hydraulic is. Is there another place? I think that's the main place.

MEMBER KRESS: I think that's the main place it's in here.

MEMBER APOSTOLAKIS: See Section Roman II.6. Thank you. Okay. Let's keep it.

MEMBER KRESS: Good. Let's go to page 25. That's another simple one. Oh. The suggestion was to delete that -- what should be the -- at the end of that. I oppose that suggestion because --

MEMBER APOSTOLAKIS: Well, isn't the second bullet -- sub-bullet -- where is it? Oh. Asking the same thing? When is human performance at the nuclear plant good enough? In fact, I prefer that than what it should be, and that was what dictating -- the human error contribution should be 30 percent. So that's why I proposed to take it out. Personally --

MEMBER KRESS: I think you're right, George.

MEMBER BONACA: I think so.

MEMBER KRESS: I think you're right. Let's zap that.

MEMBER APOSTOLAKIS: You win a few, you lose a few.

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: You lose a lot, you win a few.

(Laughter.)

No, no. No. Delete, "What should they be?" The red.

MEMBER KRESS: Okay.

MEMBER APOSTOLAKIS: Then, you want us to go to 33?

MEMBER KRESS: Yes, we might as well go right down the line here. Then we'll get back to six, eight, and nine.

MEMBER APOSTOLAKIS: So this is alternate now to what again?

CHAIRMAN SHACK: Hold on a second.

MEMBER APOSTOLAKIS: To all the bullets?

CHAIRMAN SHACK: Yes. Yes.

MR. EL-ZEFTAWY: Yes. It's all the --

MEMBER KRESS: The suggestion was to zap out all of --

MR. EL-ZEFTAWY: Actually, it's line 631.

MEMBER KRESS: Yes, and replace it with this tiny little sentence. Yes. And I think Bill Shack could -- could discuss why he thinks this is a good idea maybe.

CHAIRMAN SHACK: Okay. I just felt that basically you had better -- there were better points made in the discussion of the specific topics than

there were here. I mean, these bullets didn't really -- couldn't even make the case. You know, whether the model is -- doesn't have the technical sophistication that you have at NIST is not really the question. The question is, is it good enough?

I don't know that it's, you know, specialized activities that can't be done by the regional staff and require -- you know, it does -- this didn't strike me as very forceful arguments for why I needed research. I had much more forceful statements I thought in the discussion of the specific tools. And so I thought it actually strengthened the argument to get on with it.

MEMBER KRESS: And my feeling was that these are relatively true statements, all of them -- the bullets. So it didn't hurt much to leave them in to set in -- give a context for the -- it didn't hurt to leave them in. And Dana -- they were close to Dana's heart, and so my feeling was it -- if it didn't hurt to leave them in, why not just leave them in?

CHAIRMAN SHACK: Well, for example, in 631, this his what -- you know, we argue about when the staff should be doing things and when the industry should be doing things. It's not at all clear to me that this is a -- you know, that it's something that

shouldn't be done by the industry, for example.

MEMBER KRESS: Well, if you're going to risk-inform it -- the process, then it's something that the agency ought to do.

CHAIRMAN SHACK: I think the industry should be -- you know, required to analyze consequences of the accidents.

MEMBER KRESS: Maybe what you -- how you risk-perform it is --

CHAIRMAN SHACK: Well, to facilitate the circuit analysis sounds to me like a licensee --

MEMBER BONACA: You know, I don't think, though, the bullets here are created equal. I think we should look one by one, because some of them, for example, I agree to retain. That first one -- it's an important observation. I think the fact that, you know, the NRC to have the technical sophistication of -- developed by -- it's an observation of --

MEMBER KRESS: I think we've used up our hour. Should we defer this to --

CHAIRMAN SHACK: No, we've got until 9:30. We've got half an hour.

MEMBER KRESS: Oh, do we?

MEMBER BONACA: Yes.

MEMBER KRESS: Okay. Thank you.

CHAIRMAN SHACK: We're doing good.

MEMBER BONACA: Yes. The second bullet, for example, I could do without. I mean, so what's the problem? If you need to obtain a specialist for the important stuff, I mean --

MEMBER KRESS: I wouldn't want to be without that second bullet.

MEMBER BONACA: What?

MEMBER KRESS: I wouldn't want to be without that second bullet. Neither would Dana.

MEMBER SIEBER: Neither would I.

MEMBER KRESS: I've got two votes. If I raise my left hand, it's Dana. If I raise my right hand, it's --

MEMBER BONACA: No. I mean, I think we should walk through the bullets now and discuss --

MEMBER KRESS: Yes.

MEMBER BONACA: -- them all. I think some of them I agree with and some of them I don't agree with.

MEMBER KRESS: Well, I certainly wouldn't want to get rid of bullet number three. I might be willing to get rid of bullet number four.

CHAIRMAN SHACK: Okay.

MEMBER KRESS: And five. I would like to

retain the first three bullets and get rid of --

MEMBER BONACA: I can go with that.

MEMBER APOSTOLAKIS: How many?

MEMBER KRESS: The first three.

MEMBER APOSTOLAKIS: The first two?

MEMBER KRESS: The first three.

MEMBER APOSTOLAKIS: And replace them by the alternate or just --

MEMBER KRESS: Well, the alternate might be something we'd want to replace them with. No, no, the alternate would -- we said that to some extent in the --

MEMBER APOSTOLAKIS: Right. So eliminate the first three bullets.

MEMBER KRESS: Yes. No, the last two.

(Laughter.)

MEMBER APOSTOLAKIS: Wait a minute. Wait a minute. You are eliminating --

CHAIRMAN SHACK: The last two.

MEMBER APOSTOLAKIS: The significance of the termination process?

MEMBER KRESS: Yes. But read the whole thing, George. I mean, what -- I mean, I don't think that's very helpful to the --

MEMBER APOSTOLAKIS: Right, right, right.

MEMBER KRESS: You know, the important --

MEMBER APOSTOLAKIS: I would say it is based on evaluations that are not at all transparent to the public.

MEMBER KRESS: Well, I would probably agree with leaving it in if you --

MEMBER APOSTOLAKIS: Yes.

CHAIRMAN SHACK: Transparency to the public is --

MEMBER APOSTOLAKIS: Or transparent, period.

CHAIRMAN SHACK: Until we've gone through the STP, I'm -- you know, that's sort of my thing, is that we --

MEMBER KRESS: We haven't really reviewed the --

CHAIRMAN SHACK: -- we haven't reviewed this.

MEMBER APOSTOLAKIS: Well, but in that spirit, have you really reviewed the NIST code? And do you know that it's much better than --

CHAIRMAN SHACK: Hey, I voted for eliminating all of the bullets myself.

(Laughter.)

MEMBER APOSTOLAKIS: I think something

about the STP is important. I mean, you can say they are not at all transparent, but, you know --

CHAIRMAN SHACK: It would be helpful if I had read it and I knew what it was.

MEMBER APOSTOLAKIS: It would have been helpful, yes.

MEMBER WALLIS: I think Dana has read it.

CHAIRMAN SHACK: Yes. But my comment was that I think Dana may be the only one that has read it. And, you know, this is a committee position.

MEMBER BONACA: This could be a true statement and transparent -- and much of the regulations are transparent to the public.

CHAIRMAN SHACK: right.

MEMBER APOSTOLAKIS: So why would we say "not at all transparent to the public"? But it doesn't matter? Because the other regulations are the same way.

MEMBER KRESS: Yes, that's my point. I don't think it has to be transparent.

MEMBER WALLIS: Well, I'd be happy to remove it. We don't really seem to be certain that we want to say --

MEMBER KRESS: Let's zap those two.

MEMBER APOSTOLAKIS: Yes.

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: I'm not sure about the first bullet.

MEMBER KRESS: Okay. Let's go back to --

MEMBER APOSTOLAKIS: Is it the case of the grass being greener on the other side?

MEMBER KRESS: Well, I think it's a case of --

CHAIRMAN SHACK: But even if it's not, it doesn't -- you know, I'm sure there are lots more technical sophisticated ways to do lots of things. The question is, you know, is it good enough?

MEMBER APOSTOLAKIS: And I'll submit the overall fire risk assessment methodology that is used by the fire community is not as sophisticated as ours. Maybe individual tools are a little better.

MEMBER BONACA: But given the significance of fire risk, okay, given the significance of fire risk, I think that, you know, that's a statement that says we have expectations that the NRC had the better -- had these available, acknowledge that it's not being used right now.

MEMBER APOSTOLAKIS: Well, really, the message should be that the technical sophistication of our tools is behind that of the state of the art.

That is more accurate I think.

MEMBER KRESS: Yes, why don't we say that.

MEMBER APOSTOLAKIS: But to compare now with NIST and --

MEMBER KRESS: Yes, I think you're right, George. Let's do it that way.

MEMBER APOSTOLAKIS: Okay.

MEMBER KRESS: Give her the --

MEMBER APOSTOLAKIS: Huh?

MEMBER KRESS: Give her what that --

CHAIRMAN SHACK: We'll work on it later, and we'll -- just move on.

MEMBER APOSTOLAKIS: The technical sophistication of models that appear in the literature --

MEMBER KRESS: I think we're going to zap the red part of it.

MEMBER APOSTOLAKIS: We're zapping what?

MEMBER KRESS: This.

MEMBER BONACA: The alternate?

MEMBER APOSTOLAKIS: Oh, the alternate. Yes, that goes.

MEMBER KRESS: Okay. We will work on that bullet.

MEMBER APOSTOLAKIS: Okay. And we're

keeping everything else? What?

CHAIRMAN SHACK: Did you take out -- the last two bullets went.

MEMBER APOSTOLAKIS: Oh, the significance --

CHAIRMAN SHACK: The significance of termination and --

MEMBER SIEBER: And the first one gets rewritten.

MR. DURAISWAMY: Hey, Tom, excuse me. You just took out the last two bullets? The last one, too?

MEMBER KRESS: Yes.

MR. DURAISWAMY: But the last one I think, you know, they've got some problems between the industry and the staff.

MEMBER KRESS: But that's why --

MR. DURAISWAMY: I don't think you should take it out.

MEMBER APOSTOLAKIS: No. But I agree with Bill here. It's not obvious to me that there are computational methods that could be developed to facilitate it. Have we ever investigated that? Is it obvious to everybody else?

MR. DURAISWAMY: Well, that's why I think

we've got to set up a subcommittee to --

MEMBER APOSTOLAKIS: Yes.

MR. DURAISWAMY: -- talk about that and --

MEMBER APOSTOLAKIS: I cannot say right now that obvious computational methods could be --

CHAIRMAN SHACK: The "obvious" has to go, if nothing else goes.

MEMBER WALLIS: If you're going to say this, I would have a period after "fires," and cut out this and simply start, "Computational methods should be developed to" --

MEMBER APOSTOLAKIS: That makes me much happier.

MEMBER KRESS: Well, do we want to put --

MEMBER APOSTOLAKIS: Take out "when obvious." And capitalize "computational."

MEMBER WALLIS: But a period here, too.

MEMBER APOSTOLAKIS: Where are you now?

MEMBER WALLIS: No, no, no.

MEMBER APOSTOLAKIS: We zapped it.

MEMBER KRESS: Let's put it back in.

MR. EL-ZEFTAWY: So you're just taking out one "obvious"? Is that the only thing you're going to take out?

MEMBER WALLIS: "Computational methods

should be developed." Should instead of could.

MR. EL-ZEFTAWY: And there's a period after "developed."

MEMBER WALLIS: To facilitate the -- analysis, risk-inform the--

MR. EL-ZEFTAWY: Okay.

MEMBER KRESS: I would put a statement when --

MEMBER APOSTOLAKIS: Is it really a controversy with the licensees?

MEMBER WALLIS: Yes, I think you might want to change that, too. I would say something -- "Staff finds itself disagreeing with licensees" or something like that.

MEMBER APOSTOLAKIS: Yes.

MEMBER WALLIS: Or in disagreement with --

MEMBER APOSTOLAKIS: Yes, finds itself in disagreement.

MEMBER WALLIS: Or it simply disagrees. Do we need to "find itself in disagreement"?

MEMBER APOSTOLAKIS: Disagrees. That's --

MEMBER KRESS: Get rid of "finds" in that sentence.

MEMBER APOSTOLAKIS: So you go to fires, put a period, on the second line?

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: Delete "when obvious" and capitalize C.

MEMBER WALLIS: And then have "should" instead of "could."

CHAIRMAN SHACK: And we'll leave it to the highly paid arbitrator to straighten out the constructions of the other bullets.

MEMBER KRESS: Yes, Sam can do that.

MR. DURAISWAMY: Not highly paid, but --

(Laughter.)

MEMBER KRESS: Let's go to 36. This is a --

MEMBER APOSTOLAKIS: Oh, you're going to another page? Oh, I had a question on line 640.

MEMBER KRESS: 640?

MEMBER APOSTOLAKIS: Yes. The ACRS has reviewed the plan and the concurs with the research program -- that the plan sets forth. When did --

MEMBER KRESS: Oh, we did that. Yes, that was -- we did that a couple of weeks -- months ago. That was --

MEMBER APOSTOLAKIS: A couple of months ago we wrote a letter?

MEMBER KRESS: Steve Arntz.

MEMBER APOSTOLAKIS: The fire protection --

MEMBER KRESS: No, it wasn't.

MEMBER APOSTOLAKIS: Yes, that was --

MEMBER WALLIS: Wasn't this a Jack Sieber thing or --

MEMBER KRESS: Yes, that was --

MEMBER SIEBER: We all got copies of the --

MEMBER WALLIS: Did we actually agree on it. There's a huge fat thing that came out and --

MEMBER SIEBER: Yes, three-eighths of an inch thick.

MR. DURAISWAMY: Did you write a letter, Jack?

MEMBER SIEBER: Pardon?

MR. DURAISWAMY: Did you write a letter?

MEMBER SIEBER: No.

MR. DURAISWAMY: So then you can't say ACRS completed the --

MEMBER SIEBER: We never got it officially.

MEMBER APOSTOLAKIS: Okay. Why don't we delete the sentence?

MEMBER KRESS: Just zap the last sentence.

Thank you, Sam.

MEMBER APOSTOLAKIS: Keep going. Keep going. Is it longer or shorter now?

MEMBER KRESS: Keep going to the -- whoa.

MEMBER APOSTOLAKIS: Wait. No, no, no, no. We are in the next section now. Go back. Well, it's not 640 anymore. Go back more.

MEMBER KRESS: Okay. There it is. 641. No, it's --

MEMBER APOSTOLAKIS: Go back some more.

MEMBER KRESS: Okay. Thank you.

Now, let's look at page 136. George, I think this is a debate between you and Mario.

MEMBER BONACA: Yes. I would say that the statement we had before that says "would surely" is too strong. I agree with that. The words I had originally was "is likely to."

MEMBER APOSTOLAKIS: Sorry? What were the words?

MEMBER BONACA: "Is likely to." It might. So I would change "would surely" to "is likely to" and Bill is proposing "could." I just wanted to make sure it wouldn't be too --

MEMBER APOSTOLAKIS: I would say "could" is more neutral, isn't it?

MEMBER KRESS: Yes. "Is likely to" means it is likely to. "Could" means there's --

MEMBER BONACA: That's my judgment. At this stage it's a judgment. Certainly, if it is just a might --

MEMBER APOSTOLAKIS: No, the "might" I think is too weak.

CHAIRMAN SHACK: "Could" is stronger than "might" and weaker than "is likely to."

MEMBER KRESS: "Could" is so weak that it always applies. "Could" is about as weak as you can get.

MEMBER APOSTOLAKIS: Replace "might" by "could."

MEMBER BONACA: I don't know.

MEMBER APOSTOLAKIS: No?

MEMBER BONACA: Are you sure? You don't think about "is likely to"? I understand that we're implementing a regulation and that affects -- therefore, you know, PRA, you may have --

MEMBER WALLIS: Well, I sort of support Mario that this is old, and surely something has changed.

MEMBER BONACA: If you make it too weak, the whole section becomes into question. Why have a

full section proposing something if you're really making a statement that is so weak that says "so what?" I mean, if really aging is not an issue, and you can have this plant at 600 years of age, I mean, why propose --

MEMBER KRESS: Well, we could say results could show increases in risk metrics. That's almost certain. I don't think they're going to go down.

MEMBER WALLIS: It implies that we think it's likely.

MEMBER KRESS: Yes. But even if it's likely, this doesn't address the question of whether George's statement that it's already so low that an increase doesn't make much difference gets lost in the noise. I think that's a significant statement.

MEMBER BONACA: I think George was focusing mostly on main components for the vessel rather -- I'm thinking about total -- I'm thinking about those nozzles that we saw cracked, and the UT failed to detect it.

MEMBER WALLIS: Well, I suggest no word at all. PRA that could account for aging of structures, systems, and components. Oh, I see. I'm sorry. I screwed up on that.

MEMBER BONACA: I agree that, you know,

the statement "would surely" was too strong. But I think that -- I think I believe it's likely to show some -- I think it surely would --

MEMBER APOSTOLAKIS: The end part program of several years ago did not find any significant failures due to aging. It found partial degradation, things like that, but, hence, to see the impact of aging on failure rates have reached no conclusions. There is no evidence that the failure rates increase.

When we did the small study at MIT, again, we were hard pressed to really find a significant change in probabilities of core damage, and so on. That's why I'm reluctant to be very positive that, yes, we will find an impact. On the other hand, I'm not ready to say, no, there will be no impact. So, I mean, what --

MEMBER BONACA: So this is -- I've been thinking about the experience we had from industrial facilities other than LOCA, is that when it reaches end of life, even with the proper maintenance it becomes so troublesome that they get shut down just for economic reasons.

Now, here the implication is that those kinds of, you know, compounding failures you see more leaks here and there, some problems, are not going to

create a problem from a safety standpoint. It will only create a problem from an economic standpoint, so the plants would be retired. That's really the conclusions we are reaching.

Well, I think it's a stretch to reach just a conclusion. There is complexity that says, you know, common sense is telling me that it could affect those there. If I use "might" -- a section of this size, it would be --

MEMBER APOSTOLAKIS: I am with you on the "might," but do you disagree on using "could"? Is that too weak?

MEMBER BONACA: "Could" is a little weak. I mean, I -- you know, I thought that -- I really believe it is likely to show, but I have never made it -- we are assuming that --

CHAIRMAN SHACK: But you have Tom's problem -- is that surely there are increases. The question is whether they're significant or not.

MEMBER BONACA: Yes, I understand. Well, whatever it says, we believe in fact that they are not insignificant because of the --

MEMBER WALLIS: I have a different way of putting it. A PRA that could account for aging of structures would provide measures of increases in --

MEMBER BONACA: That's not the meaning of this. What we intended to say is that we would see some increase due to the fact that you have increased failure rates of some type, and then the discussion of how you would contribute to those increases.

MEMBER WALLIS: But I think your colleagues object to the distinction that there are going to be increases.

CHAIRMAN SHACK: Graham gets us around that problem. I think his says --

MEMBER WALLIS: Yes, I had a time where there's going to be increases or not.

MEMBER BONACA: Could you repeat your --

MEMBER WALLIS: I said -- well, take what we've got. A PRA that could account for aging structures, systems, and components, would provide measures of increases in risk metrics, such as core damage frequency. We don't even need to say "increase."

MEMBER APOSTOLAKIS: It's a neutral statement.

MEMBER BONACA: I agree.

MEMBER APOSTOLAKIS: It's more neutral.

MEMBER BONACA: I agree.

MEMBER APOSTOLAKIS: It says we want to

know.

MEMBER BONACA: Right. I agree. And that's important for the --

MEMBER WALLIS: Without trying to guess if it's going to be --

MEMBER BONACA: I agree with that.

MEMBER APOSTOLAKIS: All right. So will you tell Sheri what to do there?

MEMBER WALLIS: Where are we? Take out all the red. Take out the "might." Take out the red stuff. Okay. And then take out "show." Would provide measures of --

MEMBER APOSTOLAKIS: No, "would surely" goes.

MEMBER WALLIS: Would provide -- instead of "increases," which occur -- okay. Take that out. Okay. Would provide measures of -- a long sentence. Increases in -- has aged.

MEMBER APOSTOLAKIS: And I would put a period there and say, "These increases are due to" --

CHAIRMAN SHACK: Yes, the sentence is too long.

MEMBER APOSTOLAKIS: Go back. Not right there. You want to put it after "operations" comma. As aged from 40 years to 60 years of operation. And

then this increase would be expected due to increases -- there are too many "expecteds."

MEMBER WALLIS: Just take out the second "expected."

MEMBER APOSTOLAKIS: Yes.

MEMBER WALLIS: The second "expected." Well, due to a higher failure probability.

CHAIRMAN SHACK: An increase in failure probability along with components. Good enough. That's okay. Is that --

MEMBER WALLIS: Should we leave up to the "highly" --

CHAIRMAN SHACK: Yes.

MEMBER APOSTOLAKIS: So, essentially, what we're saying is that even though the plants meet the requirements of the license renewal rule, the risk will increase as they're allowed to operate from 40 to 60 years.

MEMBER WALLIS: And we want to know. And we want to -- they should find out.

CHAIRMAN SHACK: But George has a comment on page 37 about some -- you know, the -- we didn't say anything that, you know, people are trying to manage this.

MEMBER BONACA: But the statement before

says the risk increase is found to be small because of the implementation of requirements which are --

MEMBER APOSTOLAKIS: Where is that?

MEMBER BONACA: The statement right before that. It gives credit to -- like 137. I mean -- has extensive modeling programs in place. That's implicit in that statement that --

MEMBER APOSTOLAKIS: Where is that sentence that it says --

CHAIRMAN SHACK: 137.

MEMBER APOSTOLAKIS: I know the page, the line.

CHAIRMAN SHACK: The line is 2536 on your printed copy.

MEMBER KRESS: 538.

MEMBER APOSTOLAKIS: The risk increase is small because implementation reserves regulatory margins. Where does it say about --

CHAIRMAN SHACK: Well, I was going to change that line to read, "The risk increase may well be found to be -- may well be found small because the license renewal process is intended to provide insurance that aging management programs preserve regulatory margins," duh, duh, duh, duh, duh, duh, duh.

MEMBER APOSTOLAKIS: Good. That's what -- sounds good. That's good.

MEMBER BONACA: So give it to Sheri?

CHAIRMAN SHACK: I'll just give it -- while we're on that page, too, I thought Tom -- we focus on the other metrics for power uprates. That sentence on 137 that starts at 2544, I was going to suggest changing to, "Assessments of the increases in risk associated with license and renewal and power uprates may need to consider risk metrics other than CDF and LERF."

MEMBER KRESS: Oh, great. I love that.

MEMBER BONACA: What is the line?

CHAIRMAN SHACK: It's this line. We just focused it purely on power uprates, and I think Tom would say that you really need to look at that in a broader sense.

MR. EL-ZEFTAWY: If we were to leave the last one -- if you look at page 139, line 2579, can you tell me if you agree on that change?

MEMBER APOSTOLAKIS: Where?

MR. EL-ZEFTAWY: Page 139.

MEMBER APOSTOLAKIS: Yes, it was approved, I thought.

MEMBER KRESS: Yes.

MR. EL-ZEFTAWY: So that's approved?

MEMBER APOSTOLAKIS: Yes.

MR. EL-ZEFTAWY: The e-mail exchange. All right.

MEMBER APOSTOLAKIS: Yes, I have no problem with that.

MEMBER KRESS: Okay. Now, I suggest we look at --

MEMBER APOSTOLAKIS: Any corrections?

MEMBER KRESS: No, not yet. We'll save that to last. But look on pages 8 and 9, and let's deal with those. I think Bill's suggestion was to move some of this around and delete some of it. He wanted to delete the lines highlighted in 140 and 141 and move lines 152, 153, and 154 up to replace them -- I think was the suggestion, wasn't it, Bill?

MEMBER WALLIS: What we have is actually the new 140/141. That's an addition to -- the highlighted 140/141 is an addition. It comes from 152, which has been --

MEMBER KRESS: That's just -- you're right. And my suggestion was to not do that.

MEMBER WALLIS: Okay.

MEMBER KRESS: Is to -- is to delete that line 140/141 and retain 152 and --

CHAIRMAN SHACK: Right. Yes. I wanted to insert that line up there, but I didn't know where to put it is all.

MEMBER KRESS: Yes. My feeling was that that sentence doesn't belong up there, because it's an entirely different subject matter than the rest of the paragraph.

CHAIRMAN SHACK: Yes, but read the sentence before that, starting on 137, and then look at the sentence that starts on 152. "One would expect that the Commission would -- would have available comprehensive state-of-the-art assessment tools. One would expect that site-specific risk information would be readily available to line organizations implementing risk assessment process." To me they're saying exactly the same thing.

MEMBER WALLIS: Yes, it is. I think you're right. I thought this was okay, sort of a compression of the idea.

MEMBER KRESS: Yes, but I would want to -- I'd still want to get rid of that statement that risk assessment remains an activity that --

MEMBER WALLIS: Do you want to remove it all together?

MEMBER KRESS: Yes, that part of it I'd

like to get rid of.

CHAIRMAN SHACK: But would you then retain any part of 152 and 154, or that just all goes?

MEMBER KRESS: I would get rid of all of it, yes.

CHAIRMAN SHACK: Less is more.

MEMBER KRESS: Yes. Now, on page 9, Bill had added in the shaded part, and I suggested that we not add it in. And his reasoning I think was that this is something we're leaving out of the statement that's of use, but I -- my feeling was that these limited numbers of shutdowns are not useful at all to shutdown risk. I don't even want to refer to them, because I think they're useless.

CHAIRMAN SHACK: For your purposes, they're useless. You know, if you're looking for insight, I think they are useful. You know, they don't allow you to compute the average lifetime risk.

MEMBER KRESS: I think they're -- I think the statement that they're -- I mean, I think it's overly strong to say that you've got scoping assessments of shutdown risk at two representative plants. Period.

MEMBER WALLIS: I think they need more than that. They used more information than that.

CHAIRMAN SHACK: That, to me, is just, you know, a -- we didn't do it; therefore, we ain't going to look at it.

MEMBER KRESS: Well, I'm not strong about -- you're right. I can go along with leaving it in. It doesn't hurt to say this.

MEMBER WALLIS: It's not a lie, is it?

MEMBER KRESS: No. Well, it's a very limited --

CHAIRMAN SHACK: Put in a very --

MEMBER APOSTOLAKIS: Let's leave it in.

MEMBER WALLIS: They did use this information. I mean, it --

MEMBER KRESS: Yes, let's leave it in.

Okay. Now, I didn't have a chance to send everybody the suggestions that Graham Wallis had on what to do with the --

MEMBER WALLIS: I sent them to all of the ACRS --

MEMBER KRESS: So you got some suggestions from Graham on what to do with the -- with some things that may be wrong with the introduction. And what I did was you have before you something that looks like this.

MEMBER APOSTOLAKIS: Oh, this is Graham's?

MEMBER KRESS: No. This is my response to Graham's suggestions.

MEMBER APOSTOLAKIS: Oh.

MEMBER KRESS: Before you look at it, I want to make one correction. Under two on page 2, there's supposed to be an introductory sentence that says the examinations of the research programs by the ACRS then did not focus on the initial need for the research results. Instead, the exemptions focused on the questions. And then --

MEMBER APOSTOLAKIS: Right. That's fine.

MEMBER KRESS: That's supposed to be --

MEMBER APOSTOLAKIS: That's fine.

MEMBER KRESS: But this is my -- what I've done is just rearranged things.

CHAIRMAN SHACK: Well, you've wiped out the whole user needs stuff.

MEMBER KRESS: No, it's supposed to be in there.

CHAIRMAN SHACK: Did it move somewhere?

MEMBER WALLIS: It wasn't supposed to.

MEMBER KRESS: It just moved.

MEMBER WALLIS: It should be removed because --

MEMBER KRESS: Well --

MEMBER WALLIS: -- as it was.

MEMBER SIEBER: Well, I just moved it because I wanted you to look at this and see how it read and then make a decision whether to black out the --

MEMBER WALLIS: Well, you put it in now with your added sentence under two. You said we didn't refer to the user needs. We used these other criteria, and that clarifies it. I don't think we need to talk about user needs again, do we? Because we sort of take a swipe at them which isn't justified.

MEMBER KRESS: Where is the user needs part in here?

MEMBER WALLIS: On page 5. Nevertheless, motivation -- did not -- we could remove that because we've already said that.

MEMBER KRESS: Yes, that's the question. Do we want to leave that in or --

MEMBER WALLIS: Let's take that out because it sort of takes a swipe at something we never expand upon in any way.

MR. EL-ZEFTAWY: You're talking page 5, line -- the paragraph at the top?

MEMBER KRESS: Paragraph in the middle on page 5.

MR. EL-ZEFTAWY: Yes.

MEMBER WALLIS: Actually, we're talking about concerns about using the process at the top of page 5.

CHAIRMAN SHACK: Right. It's the first paragraph 5.

MEMBER WALLIS: I would like to remove both of those paragraphs.

CHAIRMAN SHACK: Yes, I don't think it helps.

MEMBER WALLIS: It says -- it sort of says the user needs process is in place, but we've ignored it completely because we think it's pretty lousy. I don't think that's what we want to say.

CHAIRMAN SHACK: I'm sure that's what Dana wants to say.

MEMBER WALLIS: Is it? But I'm not sure that's what we want to say, is it?

MR. LARKINS: I think Dana's point was that, you know, all of the research shouldn't be driven by the user need requests, that it should be some portion or percentage of the work that's done outside of this process, research on its own.

MEMBER KRESS: I suspect everybody would agree with this statement. So I don't know why we

don't --

CHAIRMAN SHACK: But I thought it was cryptic enough as it was written.

MEMBER KRESS: Yes, it is pretty cryptic, isn't it?

CHAIRMAN SHACK: I mean, I had a rewrite of the paragraph that says, "As now constituted, the user needs process may lead to an overemphasis on short-term work to support immediate needs and not result in adequate support for research needed to improve line organization capabilities."

MEMBER KRESS: Is that a rewrite of the first paragraph?

CHAIRMAN SHACK: Yes, that's a rewrite of that first paragraph.

MEMBER WALLIS: You need something like that.

MEMBER KRESS: Yes, that sounds pretty good.

MEMBER WALLIS: I would support that and keep the first paragraph. I'd support that. And then the second paragraph I'm not sure we need that because they've already said that in the sentence that you added earlier.

MEMBER KRESS: I would go along with both

of those suggestions, Bill's rewrite of the first paragraph and --

MEMBER WALLIS: And removing the second one on page 5?

MEMBER KRESS: Yes.

MEMBER WALLIS: Okay. So, Bill, are you going to --

CHAIRMAN SHACK: I'll give you some words, and you can figure out how to work them in.

MEMBER APOSTOLAKIS: So you all agree with the third bullet here on this page, too?

MEMBER KRESS: Oh, yes, that's another question.

MEMBER APOSTOLAKIS: That was the ACRS approach?

CHAIRMAN SHACK: Well, I think we did try to consider that.

MEMBER APOSTOLAKIS: Some place.

CHAIRMAN SHACK: Some place.

MEMBER APOSTOLAKIS: Not really -- it was not a uniform --

CHAIRMAN SHACK: Nothing is ever uniform. We have no criteria, George, no process. We --

MEMBER KRESS: No privatization.

CHAIRMAN SHACK: In fact, I had a

paragraph if you'll look on the back of that, that says we -- can you give me that thing back?

MEMBER KRESS: No.

(Laughter.)

CHAIRMAN SHACK: I was going to put -- following the three bullets, I was going to add something like, "In previous reports, we have argued that processes and criteria need to be developed to address such questions. These have not been developed, and our current assessment is based on our own intuitive judgments."

(Laughter.)

Get into the Jocelyn-Graham job there.

MEMBER WALLIS: I'd like to remove the "intuitive."

MEMBER APOSTOLAKIS: Isn't it true that the whole risk-informed revision of the regulations really should be done by the licensees? Who is benefitting from all of that? Why do we have to do it?

MEMBER KRESS: What did you say?

MEMBER APOSTOLAKIS: Yes. Why do we have to do it? Why do we have to develop performance indicators?

MEMBER KRESS: That's the job of the

agency.

MEMBER APOSTOLAKIS: Why? Who is benefitting from it? I would argue that the licensees are benefitting and we --

CHAIRMAN SHACK: We all benefit, George. Benefit is not -- benefit is not the criteria. That may be one of the elements of the thing.

MEMBER APOSTOLAKIS: I don't know. Is this work that needs to be done independently by the NRC? Why is the revised oversight process something that we need to do? They should propose all -- we review and approve.

CHAIRMAN SHACK: That's why we need criteria and judgment for doing that.

MEMBER APOSTOLAKIS: But that's not what it says. It says that we actually use this.

CHAIRMAN SHACK: We tried to think our way through that based on our own judgment of when things needed to be done independently, and when we could just review the license --

MEMBER APOSTOLAKIS: I think it was done in a very awkward way.

CHAIRMAN SHACK: Of course. Of course it was.

MEMBER APOSTOLAKIS: We could put it front

up here that -- I mean, I understand the first two bullets. I mean, that we really did.

MEMBER KRESS: I think we've exceeded our one hour now. So we can put it on the agenda --

MEMBER WALLIS: Well, I do want to make some resolution about this question of by what criteria is this decided.

MEMBER APOSTOLAKIS: Yes. And that is something that bothers me, too. I mean, the only thing we didn't put are those little angels around the --

MEMBER KRESS: Well, I think we would just indent it and not bold it.

MEMBER APOSTOLAKIS: Huh?

MEMBER KRESS: I think we would just indent it and not bold it and --

CHAIRMAN SHACK: We already have it as one of the three bullets. Why repeat it again? Is sort of my theory. You know, it's the same as this -- this work that needs to be done independently by the NRC rather than depending on information supplied by the licensee. We've said it once. We don't have to say it again.

MEMBER WALLIS: Well, it's said again in response to this tension and competition. I want to

--

CHAIRMAN SHACK: Well, it's mentioned in

--

MEMBER WALLIS: Why don't we black that whole thing about tension and competition?

MEMBER APOSTOLAKIS: Although the identification? This paragraph? This paragraph?

MEMBER KRESS: I might be in favor of that, particularly because there is something in the wind and we may want to add some more to this in --

MEMBER APOSTOLAKIS: You're talking about the paragraph that starts, "Although there are" --

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: Oh, that would make me very happy to take that out.

MEMBER WALLIS: That until the end or the whole thing?

MEMBER APOSTOLAKIS: Until the end, the present end.

MEMBER WALLIS: The present.

MEMBER APOSTOLAKIS: There would be another end.

MEMBER WALLIS: There would be another end?

MEMBER APOSTOLAKIS: Yes.

MEMBER WALLIS: You're rewriting the end of the story?

MEMBER APOSTOLAKIS: Shall we move on now and --

CHAIRMAN SHACK: We have to move on now. We have --

MEMBER APOSTOLAKIS: I think we have to take action here and vote. But the thought occurred to us earlier that perhaps we should add a few paragraphs to this as to where the agency -- what are the challenges in the future, in particular with new reactors. We have some of that in Roman 3, but we should move it up maybe from last year.

So what I would propose is that Tom and Dana -- Dana will be back on Monday -- add a few paragraphs and circulate them by e-mail, but we take a vote today, subject to that condition.

Tom, is that correct?

MEMBER KRESS: Yes. I was under --

MEMBER WALLIS: I think it would be very appropriate if we can do it well. I think it should be in this report. We're not going to --

MEMBER APOSTOLAKIS: Okay. So that's why we are assigning Tom to do it.

MEMBER KRESS: It says I have to do it

well.

MEMBER APOSTOLAKIS: Yes.

MEMBER KRESS: I didn't agree to that.

(Laughter.)

MEMBER APOSTOLAKIS: I move that this report be accepted by the committee, subject to this condition that Dr. Kress will supply a few paragraphs to be added to the introduction regarding future challenges.

MEMBER BONACA: And the last paragraph? The introduction is scratched?

MEMBER APOSTOLAKIS: That has been a --

MEMBER KRESS: And I also met something that -- if you'll let me raise this with --

MEMBER APOSTOLAKIS: That's part of the motion.

CHAIRMAN SHACK: Yes. Dr. Kress has full power to do the cleanup work.

MEMBER KRESS: Okay. Good.

CHAIRMAN SHACK: He's the cleanup man.

MEMBER APOSTOLAKIS: Yes.

CHAIRMAN SHACK: Second.

MEMBER APOSTOLAKIS: So there is a motion on the table and it has been seconded. Any discussion? Hearing none, those in favor of the

motion raise your hand, please. The research report is approved.

CHAIRMAN SHACK: We're running a little bit late. I think I still want to take a five-minute break.

MEMBER APOSTOLAKIS: Yes. Maybe we can shorten the lunch break. Okay? So we will be back when, at quarter of?

CHAIRMAN SHACK: Quarter of.

(Whereupon, the proceedings in the foregoing matter went off the record at 9:36 a.m. and went back on the record at 9:45 a.m.)

CHAIRMAN SHACK: We'd like to come to order now and begin our discussion of the 50.46. And I believe we'll start with the industry presentation by Mr. Heymer, assorted support from a wide variety of people.

MR. HEYMER: Good morning. My name is Adrian Heymer. I'm a project manager at NEI dealing with risk-informed regulation under Tony Petrangelo, who's our director, and I've been following the option three as well as some of the option two activities.

This morning what we're going to talk to you about is 50.46, and specifically what we believe

the most important element to look at in 50.46. And the one with the highest priority from a safety enhancement as well as a resource benefit is redefining the large break LOCA.

And I have with me here Lewis Ward from Southern Nuclear; Bob Osterrieder, Westinghouse Owners Group; Dave Bajumpaa, Millstone and the CEOG; and Terry Rieck from Excelon and representing the BWR Owners Groups.

We did have another representative from the B&W Owners Group, but something happened and he couldn't make it this morning. Otherwise, we would have had the complete spectrum of the owners groups here.

And I think one of the messages we want to provide today, that this is an industry-wide activity. The owners groups are on board, and I'm going to go over some of those issues and the industry structure and background as we move forward with this presentation.

So what we are really focusing on today is redefining the large break LOCA. I will go over some background information how we got here and the general approach that the industry sees to improving this aspect of the regulation. Then, the Westinghouse

Owners Group will talk about a specific approach and some of their activities.

And then we'll have an example from the CEOG of what we call an application, what flows from redefining the large break LOCA to give you an idea of where the benefits are, and then Terry Rieck will say a few words on behalf of the BWR Owners Group.

I guess where we started off on risk-inform in the regulations was several years ago with SECY98-300, and at that time we were using this slide of what we believe is the important aspect of risk-informing NRC technical requirements, which was the improved efficiency and effectiveness of the NRC regulatory regime, to provide an increased focus on those issues that are safety significant while reducing unnecessary burden.

And that's the sort of fundamental element that we've looked at as we've moved forward. And, obviously, to do that, you've got to look just not at the regulations but also at the guidance documents and at the industry codes and standards activities.

MEMBER WALLIS: Well, there's another one of their objectives which is maintain safety.

MR. HEYMER: Well, yes, but I --

MEMBER WALLIS: Remember, that's one of

the constraints.

MR. HEYMER: Yes. Yes. I mean, increasing the focus on safety-significant issues should -- we believe should enhance safety.

And I guess as we went through this, following the Commission's SRM on 98-300, we went through and we looked at the technical requirements and we came up with a list, and there was an NRC workshop and we discussed some of those things with the NRC. And we went out to the industry with a survey, and we included the list of regulations but we said, "What do you, the industry, think that we should focus on to improve our focus, focus on the safety-significant issues, and provide some benefit?"

And we got a list back from the industry, and we provided that list to -- the results of that survey to the Commission in January of 2000. And in that, there were three specific areas. One was -- the first priority was focus your activities on finishing what you've already started, which was things like the oversight process, fire protection, and the technical specifications, and then look at 50.46 and 50.44.

And the reason why they put 50.44 up there was that they felt with the amount of work that had gone on on 50.44 that was something that we could move

forward fairly expeditiously. But on 50.46, there was a number of issues why we came up with 50.46, and it just wasn't really associated with financial issues.

The initial 50.46, it has a large number of tentacles that go out. Throughout the regulations, there's a number of issues that are linked to 50.46, and it was felt that if we could identify some of the items that perhaps don't have the same degree -- high degree of safety significance and where we perhaps could better focus our activities, we could make improvements both in safety and in -- and in the financial profile of the plant by looking at 50.46.

MEMBER WALLIS: Are you going to enhance safety as well as try to reduce burden by removing the focus on low-risk significant events, but you can actually also look at the other side of the coin, that there are other things that are more important where you can enhance safety?

MR. HEYMER: Other things that are more important that we should place greater emphasis and resources --

MEMBER WALLIS: There's going to be a tradeoff. It's not going to be all just reducing burden. It's going to be actually --

MR. HEYMER: Well, as has been said on

many occasions, there's two sides to this equation, and we accept that. And if there's things that come up that are required for safety --

MEMBER WALLIS: I think for public reassurance, there's sort of -- there's a big drama associated with the large break LOCA. And if you sort of want to -- not that the agency should back off on that. There's going to be some good arguments that your -- because now your attention is focused on something else, you are actually improving safety. Otherwise, it looks as if you're -- the agency is just backing off. I don't think that's very good for public confidence.

MR. HEYMER: No. And I think that's the reason why we're couching it the way we do. And I think if you look at the -- the large break LOCA, if you just look at some of the studies that have been done out there, it is a relatively low probability event.

And if you take that on as, we believe, negligible public risk, and -- and but we're not intending to sort of just throw everything away associated with that. I think we've developed, through risk-informed ISI, a much better process of looking at what inspections we need to do on those

activities. We still have detection. We're still going to carry out inspections in that regard.

Now, as I said, the effect from a safety perspective associated with redefining the large break LOCA is -- we think is very significant. As I said, it's an essential element in the regulatory structure. And if you can redefine what the break size is, then the follow-on activities and your resources can be adjusted to focus on the more probable activities and those matters that are of safety significance.

And you'll see as we go through the presentations here today some of the activities that we get involved in link specifically to the large break LOCA, which if you take a more realistic approach to it we wouldn't have to be expending resources in that area. So we hope to --

MEMBER WALLIS: The fact that it is a central and controlling element, the way you've identified it here, means that in the past it was assessed as being important enough to have this role of being a central and important controlling element.

MR. HEYMER: That is true. But I think as -- and as we started out the regulations, there was a very conservative approach to say it's the double-ended guillotine break of the largest pipe. And

that's why we're emphasizing it's the redefining. It's not the elimination of the large break LOCA. We're redefining it.

MEMBER WALLIS: So it's not, though, as if you're asking to simply redefine something of low-risk significance. You're asking to redefine something which is a central and controlling element. It's a major step.

MR. HEYMER: It is a significant step. But on the other hand, it has, we believe, significant benefit, both in terms of safety and finance. Having determined it was 50.46 and perhaps it should be redefining large break LOCA, Westinghouse Owners Group already had an activity underway and have already done some extensive evaluations of redefining the large break.

And through those activities, we pulled the other owners groups together, and I think we've developed over the past 18 months sort of an industry approach, which I'll go into and which we've described in several meetings and workshops with the NRC staff as we've moved through and discussed the options of what to look at first, because 50.46 is a very large and complex regulation. And we think if you're going to look at 50.46 you need to focus on what is really

going to provide the benefit, and to us that is redefining the large break LOCA.

We've listed some of the -- some of the safety enhancements that we see from here. I think on a number of unnecessary plant transients it gets back into how many times you can sort of begin to run up against the limits in the technical specifications that are linked back to the large break LOCA. And so if you don't have to have a power train, you shouldn't be imposing one, not only from a financial perspective, but also from a plant safety perspective.

MEMBER WALLIS: Can you explain that a bit more? You say "unnecessary plant transients." You mean deliberate transients. You have to run the plant through some transient under the regulations.

MR. HEYMER: Because of the regulation.

MEMBER WALLIS: It means you have to test things or something?

MR. HEYMER: On a testings or come down in power or shut down or come to a halt -- shut down while you fix something, or even go to a cold shutdown. So the number of times you exercise -- move through those -- those plant states --

MEMBER WALLIS: Is all motivated because of the large break LOCA?

MR. HEYMER: Or linked to requirements and technical specifications or other -- that are linked into the large break LOCA.

MEMBER WALLIS: It would be nice if you could have some numbers associated with that, and let us know what's the number and the cost or something.

MR. HEYMER: Yes, we can get back in subsequent presentations on that.

MR. OSTERRIEDER: We do have a couple of examples later in the presentation.

MR. HEYMER: Yes. We'll speak to that.

We speak here about improved worker safety profile, and I guess the potential to rebalance the ECCS system so that we -- we focus on more probable events, such as the small break LOCA or the breaks of a smaller size, intermediate and small, I think that once you come up with whatever the new break size would be and you start running that through the PRA, your safety assessments and your PRA assessments become even more meaningful and just improves the general process. So --

MEMBER WALLIS: So you're claiming that because of the focus on large break LOCA we have some requirements for ECCS that may actually be detrimental in the case of other kinds of LOCA?

MR. WARD: Yes, sir.

MEMBER WALLIS: Yes?

MR. WARD: The particular example that we've discussed several times is the balancing of the ECCS system so that when you have a large break LOCA all of the water does not go to the broken loop, that there is a certain amount of it that goes into the intact loops and then goes to the core. And those -- we put orifices in typically to do that and balance them to prevent runout on the pumps in that condition.

But what that does is if we had, for example, a smaller loss of coolant accident or a small leak, that -- those orifices are still in place and it throttles back the amount of water that would be delivered to the loops in that condition.

If we were designed to some intermediate-sized break, then you could decide -- you could open up the orifices, provide more flow to the core for the small break than we do now, because you would not have the pump runout concerns on the high end. That's one example that we thought about.

MR. HEYMER: Our overall approach for redefining the large break LOCA takes into account that we have varying designs out there and varying designs -- we have boilers, we have pressurized water

reactors, we have CEABB plants, we have Westinghouse plants, we have B&W plants.

And, therefore, what our approach is is a relatively straightforward rule change. At the moment, the regulations say that you will analyze with the double-ended guillotine break of the largest pipe. And we think the add-on would be you would just add a phrase "or alternative break sites as approved by the Commission."

And to the extent of the rule change, there would be some other conforming changes where in other parts of the regulations, perhaps the general design criteria, you'd define what a loss of coolant accident is, so that there would be some conforming changes there.

And having done that, and having started to progress with the rulemaking, each owners group would develop and submit what they believe would be the justification for redefining the break size for their particular designs. And that would be an owners group specific activity.

But just redefining the break size alone doesn't really get you there, and so you start looking at applications. And so once there is a good understanding on what the break size would be as we

begin to focus down and reach an understanding with the staff on what the break size would be, you can then start looking at the specific applications, be it diesel generator start times, balancing ECCS that we spoke about.

And they would be done, again, on an owners group basis, generic as much as we could for each owners group, so that when the licensee came along they could just submit a license amendment based on the topical reports that have already been approved by the staff. And we think that would be the most efficient use of resources of moving through this.

So it's really simple that the initial step is -- is to move forward with a rule change that would say -- as I've said, allow an alternative break site as approved by the Commission, but don't define that break size and leave that from the -- for the technical interactions between the owners group and the staff to come to some conclusion on what that break size is.

MEMBER WALLIS: Wouldn't you still have to analyze the large break LOCA anyway in order to show that it's not significant? You have to do something with it. You can't just ignore it.

MR. HEYMER: Well, no, you just don't

ignore it. That's some of the issues that we're going to be --

MEMBER WALLIS: But you'd still have to do an analysis and convince the Commission that this break is not important or something.

MR. HEYMER: Well, as we --

MEMBER WALLIS: Wouldn't that just be a risk analysis? Or would that be a technical analysis?

MR. HEYMER: Well, we will continue --

MEMBER APOSTOLAKIS: Mechanistic, you mean.

MR. OSTERRIEDER: We would continue with large break LOCA in the risk models for the plants. But, you know, so that -- it wouldn't be taken out, so --

MEMBER WALLIS: So it would still be in the risk models, but it wouldn't be in the sort of technical requirements.

MR. OSTERRIEDER: Right. It's like other things in the risk models that aren't necessarily part of your design basis.

MEMBER WALLIS: Yes. But in order to do the risk model, you have to do a thermal-hydraulic type analysis and everything. You have to look at consequences and all that.

MR. OSTERRIEDER: Right. You need to do appropriate success criteria analysis.

MEMBER WALLIS: So it wouldn't go away. You'd have --

MR. OSTERRIEDER: That's correct.

MEMBER SIEBER: Well, it's an interesting thing. If you enlarge the size of the orifice, which you said was going to be an advantage to having a smaller break size, then if you actually did have the large break the pumps would run out, and the outcome would be different than you currently have now. So the risk numbers and consequences would go up. Is that not true?

MR. OSTERRIEDER: Right. Yes, they would --

MEMBER SIEBER: In other words, you could not handle the --

MR. OSTERRIEDER: Right. The risk of that occurring would be assessed into the plant's risk model, since it --

MEMBER SIEBER: That's right. But if it did occur, whatever the probability, the ECCS couldn't handle it.

MR. OSTERRIEDER: That's right.

MEMBER SIEBER: Under those circumstances.

MR. OSTERRIEDER: Well, we'd assess with the success criteria -- certainly more likely less success probability, certainly.

MR. HEYMER: And as we get into the discussions here, I think you'll also hear that our emphasis isn't necessarily doing extensive modifications based on this, but allowing for operational margin to -- for us to operate with that margin so you don't have to get involved in some of these evaluations and activities that Dave here will talk about from the CE perspective -- so perhaps ultimately the sink calculations, containment, heat removal.

So we're not talking about ripping out pumps and replacing pumps. What we're talking about is, okay, we don't have to -- perhaps the engineering specification is going to be the same, but the actual licensing and technical specification may be a little bit different.

MEMBER KRESS: Why shouldn't I view this from the perspective of Reg. Guide 1.174 and say here's a suggested change in the licensing basis for lots of plants, not just one. That will result in these changes to specific plants, the listed changes. I suspect you have those. And then that will change

the risk status of each of these plants by this much, and looking at the guides in 1.174 say whether that's acceptable or not. Why isn't -- I don't see a perspective -- well, it seems like we're viewing this strictly from the design basis accident space and not --

MR. HEYMER: Well, I mean, the initial step coming out of this isn't to say, well, we want to redefine the large break LOCA because we want to have a different pump size there. But on the other hand, if somebody then wanted to go and implement a modification, they would then use the 1.174 as the guideline. And the guideline and the baseline for the plant would be adjusted based on whatever the new break size came out to be.

So, I mean, I think what you're saying is that, yes, okay, once you've redefined it, you may some stage down the road want to perform a modification, and, yes, you would use 1.174.

MEMBER KRESS: I see. So that would come in at the point where the plant decided -- a specific plant decided that --

MR. HEYMER: Yes.

MEMBER KRESS: -- take advantage of the new definition and make some changes.

MR. HEYMER: That's right. Within the confines of 1.174 and the new rule and the guidelines and the technical documents, but not as a direct --

MEMBER KRESS: Why couldn't they do that already?

MR. OSTERRIEDER: I think it's more simple than that. We are planning to use the 1.174 framework and assess the risk significance of large break LOCA. So I think the answer is simply, yes, we are intending to do what you're suggesting that we should be doing.

MEMBER KRESS: Yes.

MR. OSTERRIEDER: As you'll see it in my summary of what we've been able to do. I think we're doing that.

MEMBER KRESS: Maybe I should wait until we hear that.

MR. OSTERRIEDER: Or tell me if we're not answering the question, certainly.

MEMBER WALLIS: Adrian, you talk about alternative break size. This is really in the old deterministic world where you have sort of specified things you have to consider. But in a risk-informed world, you really ought to look at all break sizes, including large break LOCA.

MR. OSTERRIEDER: We do. And we will --

MEMBER WALLIS: Make an assessment --

MR. OSTERRIEDER: Yes, we do.

MEMBER WALLIS: -- and if you change your orificing, then your consequences change and your risk assessment changes for all of them.

MR. OSTERRIEDER: That's correct.

MEMBER WALLIS: And you don't -- there's no real change. You have to look at the complete spectrum of breaks.

MEMBER KRESS: There's only a change if they make modifications to the plans and procedures.

MEMBER WALLIS: Right.

MEMBER KRESS: I think that's what you have to look at.

MEMBER BONACA: Probably to do that I think they only leave -- they can assign a very low probability to that event. So, no, that -- so they are going to consider that.

MEMBER KRESS: Well, that's almost irrelevant. I think what the relevant thing is is what modifications and what changes will result from the change in the definition.

MEMBER BONACA: Yes.

MEMBER KRESS: It doesn't matter how low the probability is. It's what --

MEMBER BONACA: What I'm saying is that they're not going to eliminate the possibility. They're going to consider it still. They're only saying that the likelihood of the large break LOCA, the way he's --

MEMBER KRESS: It may still not contribute much to risk --

MEMBER BONACA: That's right. They're saying --

MEMBER KRESS: -- for that sequence, but the changes to the plant that result from the change -- you see, the tentacles of design basis accident go beyond a specific sequence you look at or --

MEMBER BONACA: That's obvious. But I'm saying that -- that they are not neglecting that. That's all I'm saying. I'm only saying that since it is assuming low probability most likely, then it should not be the design basis event you are designing it for. And then there are tentacles we have to look at. I agree with that.

MR. HEYMER: And, in fact, what we're getting into here is some of the more detailed discussions, and I think it's a good point at which we can hand over to the Westinghouse group to get into some of the more specifics of the technical approach.

And I'll ask Lewis Ward to lead off on that.

MR. WARD: Yes. I'm Lewis Ward with the Southern Nuclear Operating Company of Bogle, Farley and Hatch. I'm the Chairman of the Westinghouse Large Break LOCA working group.

This project started off within the Westinghouse Owners Group a little over two years ago. We had an invitation from Commissioner Diaz to each identify the most single important program that we could work on that would help our fleet of plants. And the WOG identified large break LOCA elimination, I believe is the way it was phrased at that time.

Shortly after that we put together a steering committee to start through the process of following up with that letter to Commissioner Diaz, and really deciding what approach we would take on going about a rule change. We looked at the rules themselves as very simple. There's about three places in Appendix K and Appendix -- in 50.46 and Appendix A that, you know, we need one sentence basically.

But as we realized right off, there is much, much more to it than that. There are numerous Reg. Guides and other documents below that that spin off from that. So we internally worked for about a year to try to put together a framework within our

owners group on how we would get our owners to fund such a program, realizing it was going to take a big commitment of resources on our part to even launch off into that.

About a year ago we also got all three of the other owners group involved with us, and NEI started doing a coordination role with us. And right now, all four of the owners groups representing all of the plants in this country are on board with us on this project.

What we have done is tried to think through many of the questions that you're asking and -- and put some thought behind how we would go about addressing those issues.

One of the program approaches that we've put together in our framework is that we really need an implementation plan that would be exactly what you're asking about, so that, you know, once we get a rule change, what do we -- what do I as a licensee -- how do I go about implementing a particular change on a particular system or component or design basis with my plant?

And the approach that we are looking at is to come up with an implementation guideline that is an industry-wide guideline. Each of our owners groups

feels like, you know, we would put together a guideline, have it reviewed and agreed to by the staff, and possibly endorsed by a Reg. Guide, and probably have a predefined list of the things that we could go about doing once we got the rule change.

Now, there may be many, many other things that we did not think about as we went through that we'd then follow up with the normal licensing process, either under 1.174 tech spec submittals and that kind of thing.

That's the general approach we've been working on. Over the last year, we have had numerous internal meetings with all of the owners groups to get this plan more or less laid out. We've started gathering data to support the specific analysis for the Westinghouse fleet. And we have proceeded forward, and we -- we've kept the staff fully informed.

I believe we've met six times with the staff over the period of the last year or two, to lay out our game plan and to get staff's feedback.

The safety benefits -- I'll go over part of this and Bob will go over part of it. The safety benefit -- I think all of us recognize that safety has to be our first priority. We, as owners, investors,

and operators, and citizens who live next door to nuclear power plants, do not -- did not want to go down any path that we did not feel like was right from safety. And so that has been our first focus.

We believe that doing this process will allow us to put our limited resources on other activities that have greater risk significance. Right now, we spend a lot of engineering time, we spend our highest level of engineering expertise on areas such as large break LOCA. Our training staff spent a lot of time on large break LOCA. If you're a licensed operator, which I had an SRO license at Farley, you can expect a large break LOCA on one of your requal drills on the simulator.

As we've seen an event within the last year not having to do with LOCA, there are more subtle accidents that are more realistic that the operators need to learn to deal with more than the "here's the big one," "I know how to deal with this one," and we go on.

Surveillance testing -- we do a tremendous amount of surveillance testing for tech spec surveillance requirements that are directly hinged to large break LOCA, such things as accumulator level transmitters in containment, very, very tight

tolerance bands, extremely time-consuming dose activities that would go away or be extensively broadened.

There's a considerable amount of maintenance. We do fast starts on diesel generators every month or more often. It puts wear and tear on diesel generators; we have to tear them down, overhaul them, and keep them in shape so they will pass the surveillance over and over again in the event that they are needed for the LOCA with a station blackout.

There are design issues that we have to resolve. We work on design issues every day. There's a current issue on containment sumps that all of you are aware of. There are other issues that we have to deal with on a design basis every day in the plants to try to get resolved for this very unlikely event.

MEMBER KRESS: Now, if I had two categories and one of them was safety benefits and burden reduction, it seems to me like most of those things you just talked about would fall under burden reduction.

MR. WARD: They are burden reductions which, recognizing we have limited resources in terms of technical expertise --

MEMBER KRESS: Is this a zero-sum

activity? So those resources -- the money and activities actually go into other things?

MR. WARD: Yes.

MEMBER KRESS: You save money that way.

MR. WARD: No. We don't -- I don't envision any of us laying any people off. I think it would allow the people that are doing these activities to focus on something else.

MEMBER WALLIS: I think he's saying that the operators would be better trained if they were trained to face up to real events and not have so much emphasis on LOCAs. Actually, the plant would be better. It's not just reducing burden. It's better use of people and resources.

MEMBER KRESS: I'm not so sure that redefining the large break LOCA has anything to do with the training process.

MEMBER WALLIS: Well, I think that's what you're saying is you have a lot of people spending time on something which is just very unlikely to happen.

MR. WARD: Yes, that's correct. And that was my point.

MEMBER KRESS: You shouldn't do that. I mean, I don't see that that has anything to do with

this definition.

MEMBER BONACA: But isn't the bigger issue that -- from what I've seen is that the requirements of the large break LOCA on equipment are forcing a very tight margin on equipment. I mean, simply there isn't time on diesels to wait. You have to start them and you have to test them cold. And so that's because you have such a strict requirement coming from the largest demand, which is the LOCA.

That's true of HVAC systems. They would have to be reconfigured in -- with them in, like the clock or -- isn't that issue of marginality of the equipment that is really the bigger driving issue? You're bumping limits, you're bumping the tech specs, you have to find out because you are so marginal in that your -- the demand is maximum for this, isn't it?

MR. WARD: Yes, that's correct. So when we hit one of those limits, the -- our expertise works on that problem, not something else. And that's the -- it's a zero net sum, I think, but it's -- where do you want to put the focus? On something that's most likely never going to happen or something that is likely to happen.

MEMBER BONACA: Yes. From my experience, I mean, the problem is always that the plant is just

barely making those requirements of the LOCA. Therefore, it's easy to bump into, you know -- the diesel start is 10 and a half seconds, and the diesel is not starting in -- it starts in 10.6 seconds. And that one-tenth of a second is just killing you if you have to do all kinds of jumping around to show that you can come out. That's really where I see a significant impact. I mean, from the requirement you are making. Okay? Just the equipment barely makes it today.

MEMBER KRESS: So that's one change. And there must be a list of these changes. And the question I have is: do those particular changes have any significance in maintaining the risk profile of plants to an acceptable level? Somehow I haven't seen that case made yet, but I --

MEMBER BONACA: I agree totally with you. That's my thought process, too. I would like to see at some point in all these presentations the list of the benefits and what they mean.

MEMBER KRESS: Yes. You know, I --

MEMBER BONACA: And then I could decide --

MEMBER KRESS: Well, it's clear that there would be some benefits with this. And it's not exactly as clear that the -- that this thing doesn't

have safety significance. But, you know, it looks -- I mean, the implications is that it doesn't, but I haven't really seen the case made yet. I've seen, you know, assertions to it.

MR. WARD: There is a list of benefits on toward the back of the page that we'll get to in a little while, and there are many that are -- that's just a partial list. But I think what we wrestled with for the qual was the -- it's going to take quite a bit of effort on all of our parts to work through this program to develop the list of benefits and the approach on how we could benefit or how we can achieve those benefits with the rule change.

And that's why we've been working real closely with the staff on a -- you know, before we go commit all of our resources and put together a 100 percent complete package, and then no assurance that -- that anybody is going to listen to it, you know, that's why we've been having a continuing dialogue with the hopes of moving forward on that basis.

But we do have a list, and Bob will go over them a little while later.

Another point is the consistency within the regulations. Right now, leak before break is an approved methodology for certain actions --

elimination of whip restraints, baffle -- reactor vessel internal -- it's a baffle bolt issue. So it's been recognized by the Commission for 15 years that this is approved technology for certain uses.

And it presents us a problem by having one set of requirements for one application and a different set of requirements for different applications. And what we are proposing is something that would clean up that inconsistency within the regulations.

Okay. Bob, I'm going to turn it over at this point to Bob Osterrieder with Westinghouse, who is our lead manager.

MR. OSTERRIEDER: Okay. What I'm going to do is try to briefly summarize what our approach is in redefining the large break LOCA, and then we'll move on, after I talk about that a little bit, to some of the example applications that you're asking about.

Essentially, you know, we view this as a risk-informed initiative based on SECY98-300, Option 3, and as part of that we're envisioning this to be an optional implementation where you could return your current licensing basis in regard to large break LOCA.

Adrian already mentioned that there is essentially three key places where the definition of

LOCA is in the regulations, that it has to be a double-ended -- if they analyze up to a double-ended rupture of the largest primary piping, and we're envisioning changing that in these three places -- Appendix K, Appendix A, and 50.46.

What we intend to do is redefine the maximum size and the attendant consequences while maintaining an acceptable margin of safety.

MEMBER APOSTOLAKIS: But let me understand here -- the issue -- the question was asked earlier regarding 1.174, and now we have Option 3. I mean, how do these things play against each other?

Tom, you raised the question of 1.174. I mean -- yes, go ahead. I'm sorry.

MR. OSTERRIEDER: I was going to say, we're going to be -- you'll see on the next slide we're actually looking at 1.174. That's just part of the Option 3 approach. I think they're all --

MEMBER APOSTOLAKIS: Okay. Well, if you come to it later, we'll wait until then.

MEMBER KRESS: One of the places where the double-ended rupture shows up is in the general -- in the design basis accident, the containment. You know, that doesn't affect -- hey, guys, you're going to go in and weaken your containment just because of this

change in rule.

But it might affect future plants if we did something like this. You know, a future plant could have a new -- are we going to exempt containment, or are we going to keep that -- give the -- make a new design basis for containment? Is that --

MR. OSTERRIEDER: Well, what we've discussed to date is, as you indicated, not changing the actual physical containment but allowing some operational flexibility. You know, you may be able to change some --

MEMBER KRESS: You can change your leak range measurement --

MR. OSTERRIEDER: Yes. And --

MEMBER KRESS: -- for one thing. I see where that --

MR. OSTERRIEDER: Right.

MR. HEYMER: The CE Owners Group is going to -- the specific application where they talk about containment -- and I think that they will be able to really get into that situation. With regard to new plants, we think that Option 3 should be kept separate from new plants. And if you're going to go forward with new plant regulations and thinking about a

framework for the regulatory regime --

MEMBER KRESS: Try to do --

MR. HEYMER: -- you need --

MEMBER KRESS: -- another -- Option 4 maybe or --

MR. HEYMER: You'll have a totally framework and you're going to start off with a clean sheet of paper and really -- really go through it.

MEMBER KRESS: I agree with that. An Option 4 type thing.

MR. HEYMER: Yes.

MEMBER KRESS: Okay.

MR. OSTERRIEDER: Again, the approach we're looking at is on the technical justification slide. We will be using risk-informed technology to show the low-risk significance of the large break LOCA. Utilizing Reg. Guide 1.174, we're going to be assessing the likelihood and the consequences of large break LOCAs to demonstrate that they're of low-risk significance and that these --

MEMBER APOSTOLAKIS: And, again, 1.174 utilizes the current CDF and LERF, right? I mean, and the delta CDF and delta LERF. Are you going to do this in a generic way? And if you do, what kind of CDF are you going to use?

MR. OSTERRIEDER: We're doing some generic work. Each of the owners groups is looking at the risk significance of large LOCA. We, in fact, have calculated some new initiating event frequencies for large LOCA, but even if we hadn't what we are intending to do in assessing the risk significance is look at all of the plants, the importance of large break LOCA, and --

MEMBER APOSTOLAKIS: For each plant.

MR. OSTERRIEDER: For each plant.

MEMBER APOSTOLAKIS: Oh.

MR. OSTERRIEDER: And we're containing that in a -- at least for the Westinghouse Owners Group, we're going to put that into one risk significance document that's going to explain how risk significant is large break LOCA in terms of core damage frequency and large early release frequency, and then addressing the -- the five principles of 1.174. That's what our plan is, and we intend to submit that for review.

MEMBER KRESS: Well, let me ask you a question about that. I could envision that -- that this change would allow you to go to a higher leak rate from the containment, possibly, because, you know, you're holding the pressure down lower. And so

for you applying this -- the source term that you have to apply, you could end up with a lower leak rate.

That implies to me that for other accidents, other sequences, that it's possible, then, that in the -- if you shift now to the PRA, that the frequency which you exceed certain releases of activity in the low level for -- you don't break containment. You don't have a LERF. But you still have core damage of some sort.

Those frequencies are going to increase, although you wouldn't see that at all in CDF, and you wouldn't see it in LERF. And it seems to me that those things are of interest at least. They are to me. And how would that be dealt with in a 1.174 sense?

MR. OSTERRIEDER: Well, I'm not sure about in the 1.174 sense, but we will be looking at the effects of any plant changes. If we do do a change to the leak rate parameters, then we need to assess does that affect the calculated dose rates for other events that use those parameters in the analysis.

MEMBER KRESS: Yes. But that would be in the deterministic space, in the Chapter 15 space.

MR. OSTERRIEDER: Right. It would --

MEMBER KRESS: Which doesn't, you know --

you have to meet those surely, but -- but it doesn't show up in 1.174 anywhere, which wouldn't -- you know, the only place it shows up in 1.174 is a little sentence that says, "You will also meet the rest of the requirements, the rest of the regulation."

But I'm worried that CDF and LERF doesn't capture small releases and doesn't capture late releases and doesn't deal with things like injuries to workers and injuries to the population, that there are less deaths. I worry about those things that it seems to me like 1.174 doesn't properly capture.

MEMBER SIEBER: Well, there's other requirements besides 1.174. You have 50.2 that has a dose-limited defense line, and 50.35, and other general design criteria which you have to meet anyway. And that's in a deterministic and absolute sense.

MR. HEYMER: Yes. I mean, at the moment, we're just focusing on 50.46 and redefining the large break LOCA. And I agree that those -- those requirements are still in place, and we would still have to show that we meet those requirements.

MEMBER SIEBER: That's right.

MR. HEYMER: And the same for OSHA and other worker safety requirements that -- that are there. We have to meet those. So we're not looking

at changing those, and so that's what we would still be governed by, regardless of what you might be --

MEMBER KRESS: Yes. The problem I have is those other requirements are not necessarily risk-informed. And we're trying now to go to a risk-informed process.

MR. OSTERRIEDER: Okay.

MEMBER KRESS: But, anyway, that's a personal problem I have. I don't want to --

MR. OSTERRIEDER: One other --

MEMBER KRESS: -- dwell on it.

MR. OSTERRIEDER: One other point. There's no guarantee that you can reduce your leak rate testing because a lot of plants are governed by steam line break pressures for --

MEMBER KRESS: Yes, that's right.

MR. OSTERRIEDER: You know, so if you have to look at the entire picture for your plant and decide --

MEMBER KRESS: So it'll be plant-specific.

MR. OSTERRIEDER: Sure. You need to holistically evaluate any potential plant changes.

Okay. The second part of -- after we evaluate the risk significance, and demonstrate how risk significant the event is, then we'll also be

relying on a deterministic piece of looking at leak before break analysis to justify the break size that we'll be submitting to the staff for approval as the new maximum break size.

And then we'd have to do further analysis to evaluate real plant changes as a result of the rule change.

MEMBER KRESS: That's what I want to see.

MR. OSTERRIEDER: And just to kind of follow up on what we mentioned before, we're already allowed to use leak before break and not analyze certain aspects of the plant for the full double-ended guillotine break. And that is, GDC4 allows for application of leak before break to high energy piping to -- involved with the evaluation of the dynamic effects.

And a number of plants have applied this for main coolant piping, pressurizer surge line, and a few other examples here.

MEMBER KRESS: Has leak before break been approved for the big-sized pipes that we're talking about?

MR. OSTERRIEDER: We've had leak before break approved for certain applications down to and including I believe we even have a six-inch approved

for the plants.

MEMBER SIEBER: But that's just for Westinghouse, the combustion plants, right, and B&W? But not for --

MR. OSTERRIEDER: Well, it's not a generic approval. Each plant may have different --

MEMBER SIEBER: Right. Gets it on its own, right.

MR. OSTERRIEDER: Right. And submitted their own, you know, work and gotten it approved for that particular plant.

Okay. What we intend to do is take the existing leak before break work that's already been accepted for certain applications and extend that to other applications beyond the dynamic effects. And what we have envisioned was using the same methodology that was used in those cases.

And then what we would do, depending on the maximum size that the -- that you're looking to put as the largest LOCA size you must analyze, we'd perform -- potentially perform leak before break on additional lines, if you hadn't already covered those lines with your existing leak before break work.

And we're intending to consolidate and make more efficient the review by justifying one

maximum size, at least for the owners -- Westinghouse Owners Group, and each owners group is going to decide, you know, how do they want to approach that.

MEMBER KRESS: I guess implied in that approach, then, is if you can just -- if you can invoke leak before break, that that renders the frequency of failure of those pipes that you invoke it for to a low enough value that they wouldn't show up significantly in the risk profile? Is that the

MR. OSTERRIEDER: Not -- I believe it's slightly different than that. I believe it's more the -- the leak before break is a -- a demonstration that you will detect this before you get large LOCAs, and the large LOCA may never --

MEMBER KRESS: Plus, you reduce the frequency way down, because you're going to detect it in the --

MR. OSTERRIEDER: Well, because it's based on frequencies and propagation of cracks and to potential leaks, and then the leak detection capabilities of the plant. But the frequency itself that you would use in your PRA, we have recalculated frequencies using fracture mechanics. But you wouldn't have to do that.

I mean, the main purpose of the leak

before break analysis is to support the idea that we show that large LOCAs are not risk significant, and then we show that we have some mechanism to evaluate the actual plant and that we will not have a large break before you would detect it.

It sounds like I'm not answering your question.

MEMBER KRESS: Well, it sounds like you answered it -- yes, to what I said, but I guess --

CHAIRMAN SHACK: But I think you will end up essentially calculating a frequency of rupture as a function of pipe -- that will -- that will go into your PRA evaluations of delta CDF and delta LERF.

MEMBER KRESS: My question is if that number is below, say, 10^{-6}, then you say, "Well, we won't worry about that pipe." If it gets above -- around 10^{-6}, we'll say, "Okay. That may be the size we're dealing with for large break LOCA." I was wondering if that was the rationale.

MR. OSTERRIEDER: Well, that's part of the approach that we've done in the Westinghouse Owners Group and we're going to be submitting is looking at the probability of all these different pipes in the plant leaking above a certain amount, which, you know, that will define the size. And we're looking at all

the pipes and, yes, that's exactly what we're doing.

MEMBER KRESS: Okay. That was the nature of my question.

MR. OSTERRIEDER: Okay. Again, one aspect that, you know, we've talked about, if -- if you change your maximum LOCA break size, the question has come up, "Do we need to identify other events that we possibly don't analyze now?" And we believe that you should currently be analyzing all of the significant events for different plant systems, but we do need to make sure if we lower the maximum size that we haven't in the past said we don't need to analyze a certain event because it's bounded by this.

We need to make sure that we don't now have that resurface, and then we -- you know, so we may end up having to do additional analysis. That we're looking to do that as part of our comprehensive program.

Adrian already mentioned that following the rule change plant-specific changes to the maximum size would require a submittal and approval of the NRC. So you'd start with the rule change, allowing you to change the maximum, and then you would have to get approval from the NRC to --

MEMBER KRESS: So the rule wouldn't

specify the size.

MR. OSTERRIEDER: That's correct. We're envisioning a broad rule, and each owners group would need to decide on what size is appropriate based on their designs.

MEMBER KRESS: So this could be a plant-specific size, depending on --

MR. OSTERRIEDER: Yes. We'd envision each plant submitting with a certain size, and we would envision a lot of plants may submit with the same size. But it depends on the plant design and the --

MR. WARD: Really, we're looking at fleet size, the Westinghouse fleet. We would -- we are doing a scoping study now, just have one size for the whole Westinghouse fleet.

MEMBER KRESS: One size fits all Westinghouse.

MR. WARD: Yes. And that is --

MEMBER KRESS: One size for --

MEMBER WALLIS: Can we talk about what you mean by "size" now? If you say -- say, a six-inch break, do you mean a six-inch pipe break, or do you mean a break of an area in a bigger pipe, or what kind of thing are you thinking of?

MR. OSTERRIEDER: We are envisioning a --

we pick a certain break flow rate, and then we would analyze any leaks in any piping sizes to begin --

MEMBER WALLIS: It ought to say that you've sort of got a six-inch pipe breaking and snapping off or something. It's the same thing as the equivalent area somehow opening up mysteriously in an 18-inch pipe or whatever, 30-something-inch pipe or --

MEMBER KRESS: It seems --

MEMBER WALLIS: They seem to be completely different beasts.

MEMBER KRESS: Well, it seems like the -- the concept ought to be leak -- how fast you leak.

MEMBER SIEBER: Yes.

MR. OSTERRIEDER: Right. And I think I was trying to say that. We're looking at how much your leakage rate is. In fact, if you look at double-ended guillotine ruptures, the risk significance is really low, really low, for the double-ended ruptures of any -- the initiating event frequencies are orders of magnitude lower.

When you look at the leakage rates, at a certain leakage rate for all of the different sizes, then it does raise the frequency up. So that's what we're looking at -- that, not just the double-ended rupture of all of this piping.

MEMBER KRESS: Yes. It seems to me like you ought to get away from that concept, and the rule ought to specify a limiting leak rate, or something like that.

MR. OSTERRIEDER: Right. Although we think the rule should specify that you're allowed to justify and determine what the leak rate is based on your design.

MEMBER KRESS: Based on the design. Yes, that's --

MR. OSTERRIEDER: I mean, we really wouldn't want to have the leak rate in the rule directly.

MEMBER KRESS: Yes, that's what I had in mind.

MEMBER WALLIS: It matters where the leak is.

MEMBER KRESS: Well, it certainly would, yes. But that would be part of the rule, too. Somehow that would be captured as --

CHAIRMAN SHACK: It's part of their justification for the size that they pick, yes.

MR. OSTERRIEDER: That's correct. Where we think the breaks are, and so forth. That's correct.

MEMBER KRESS: Your justification would have to be in terms of risk some way.

MR. OSTERRIEDER: Well, we're doing a justification based on the risk, and then we're supporting it with the leak before break deterministic work.

Okay. Once you would have a specific size approved for your plant, the licensee then -- any additional plant changes or benefits they would go to, and we're going to give a few examples here in a minute, would follow the appropriate plant change control processes, because we've had a discussion, you know, do the plants -- do the licensees need to submit future changes? And we believe that the processes in place should dictate that.

And if you're falling -- say you want to change something in the technical specification, certainly you need to submit that or a current guideline. So you may be able to allow the change in technical specification, and I'll show -- well, we might as well just go to the examples on the following page.

Many of these are technical specification numbers. So approving the rule change and even accepting the new break size for that plant does not

mean the plant can go in and just make these changes. They still have to follow all of the rules.

And we've talked about increased diesel generator start time. You know, that's typically in the tech specs, and this would allow you --

MEMBER KRESS: Explain to me, once again, why they can't already do that.

MR. OSTERRIEDER: Because there's a limit. They have to show that they're meeting the design basis requirements, which includes large break LOCA, which that's the event driving the quick diesel start time.

MEMBER KRESS: I mean, could it -- when they come in for a change to the licensing basis, couldn't they -- couldn't that be part of the change request?

MR. OSTERRIEDER: It could if they had a basis. But if you have to analyze large break LOCA, depending on which methodology you're using, you may not be able to justify much longer start times.

MR. WARD: Right. And I have to get flow to the core in 40 seconds, or whatever, to meet a large break LOCA, which means diesel has got to start at 10, the pump has got to sequence on in the next five, come up --

MEMBER KRESS: And what I was saying, you come in for -- request to increase that start time, and your justification is not that it meets the requirements, the justification is I don't need it because of these risk considerations. And 1.174 plus the other --

MR. OSTERRIEDER: Well --

MEMBER KRESS: -- it seems like that's a perfectly legitimate thing to do under the --

MR. OSTERRIEDER: Well, we felt in assessing the different options that the rule change was a more holistic approach that would also consolidate review times, etcetera. We could come in with a bunch of exemption requests.

MEMBER KRESS: Okay. Now that, to me, is a different reason and probably a valid one. It gives everybody a start on the same page.

MR. OSTERRIEDER: Right.

MEMBER KRESS: So that's --

MR. OSTERRIEDER: Right.

MEMBER KRESS: Okay.

MR. OSTERRIEDER: Again, I'll just --

MEMBER APOSTOLAKIS: Didn't we just say, though, that they would still get to come back and request changes on individual units?

MEMBER KRESS: Yes. But at least it gives them all sort of a systematic and consistent approach to it, I think.

MR. WARD: I would have to come in and get an application for my unit to apply the new rule as my design basis. Now, as part of that, if -- if I could change my diesel start time, and if it was in the tech spec, I would have to have that in as the tech spec submittal.

If I had already taken that specific number out because I had adopted the approved tech spec, and the specific number is not in the tech spec but it's in the bases, then I would not have to come in for that specific approval after I got the design basis approval. That's how we envision it.

MEMBER APOSTOLAKIS: And I guess a lot of the generic technical work will be done by the owners group rather than individual --

MR. WARD: Yes.

MEMBER APOSTOLAKIS: -- licensees. That's really a great benefit.

MR. WARD: Right.

MEMBER APOSTOLAKIS: I mean, in principle, one could use 1.174 to come and request all of these changes. But then each application would have to go

through a reevaluation of the large break LOCA essentially. That's what you're saying.

MR. OSTERRIEDER: Right. That's right. And there is justification, and I'm not sure if you'd need an exemption request each time or not. You would. You would, I guess, versus allowing you in the rule.

MEMBER SIEBER: You would need a very extensive exemption request because of all these other deterministic rules that are out there as part of your license conditions or, you know, if you have a -- well, a 104-type license, you have that, and so that would not be a simple thing.

MR. OSTERRIEDER: I really -- I'll just point to a couple of examples here. I guess in the interest of time I won't go through them all unless you have specific questions.

The third item on here -- we've talked about the second item, which is flow balancing. We've talked about -- you know, this list of some of the things that we were looking at that plants may do or desire to do after this rule changes.

And in the area of accumulators, for instance, we're looking at potentially some relaxation in the tech specs where now if you're outside of a

spec on boron concentration or -- or water volume, you may have to shut the plant down and do a plant transient, whereas it's not a risk-significant event. These are essentially relied on for the large break LOCA.

So we're looking at some, again, relaxation of operating parameters to avoid potentially plant shutdowns, which -- obvious economic benefit, but we believe there's a safety benefit of -- of the thermal cycling on the plant when -- when it's not a risk-significant reason to be shutting down.

MEMBER SIEBER: Is that a real phenomenon? I can't ever remember a plant shutting down because accumulators were out of spec.

MR. WARD: The shut down is not such a big risk as the startup.

MEMBER SIEBER: Well, you have to fiddle -- you have to fiddle on startup to get it right.

MR. WARD: On one of my units we had a two-day delay on startup last year with one transmitter, trying to get it within a quarter of an inch.

MEMBER SIEBER: Yes, it's pretty tough. On the other hand, I can't remember a plant being shut down because of that. Of course, I don't -- I don't

know every event that has happened in the last 30 or 40 years either.

MR. OSTERRIEDER: But even if they don't shut down, there may be a lot of work spent at the plant if they're on the edge as far as, you know, the volume spec. You know, you certainly need to meet their specs, but they may be doing -- spending effort in dealing with the idea that they're close.

MEMBER SIEBER: My point is your slide is sort of misleading to me.

MR. OSTERRIEDER: Well, the intent of the slide really is just to give you some idea of the things we're looking at. These -- you know, we need to assess these down the road, and I agree with you. I don't want to mislead you, but I don't want to mislead you and not put something like an accumulator spec change and then have you come back later and say, "Geez, if he was thinking about that, we should have put it on the list."

So we just -- we're trying to get it on here to give you some examples. And, really, I guess I wasn't planning on talking any specifics on this anymore unless you have a specific example you'd like us to talk about because I think we're going to get into some more examples.

MEMBER WALLIS: But if the large break LOCA went away, would the fan cooler water hammer problem go away?

MR. OSTERRIEDER: We would have to assess the fan cooler water hammer problem. We would have to assess what's driving some of these issues and whether or not they're prudent --

MEMBER WALLIS: You haven't gotten that far yet to reach a conclusion?

MR. WARD: I think there's a high likelihood that one may go away or get -- get better anyway. We've added a number of relief valves on containment penetrations for that reason. That could have been avoided.

MEMBER KRESS: When the agency was redefining the source term for use with the design basis accidents, what they did was speculated on what possible changes might result if a plant opted for the new source survey. And then they took those changes and calculated the risk impact of those, and then made the decision whether or not that risk impact was significant enough to do or allow a new source survey. This sounds like it's very similar to that.

MR. OSTERRIEDER: It's the same thing. What you don't see here is part of our activities

throughout this program is to identify and assess, from a risk perspective and from a deterministic perspective, some of these changes that we have on this list. We fully intend to do that as part of our demonstration analysis, but we --

MEMBER KRESS: That's down the road some.

MR. OSTERRIEDER: Well, we need to get endorsement that we think that the -- that the philosophy of the rule change makes sense. We believe it fully does, and we're hoping to get endorsement so that we could go ahead and proceed with that work. But, you know, we have to evaluate the risk, but that's what is currently planned in our activities.

MR. HEYMER: I'd also like to point out, as Bob said before, that there are specific control requirements imposed on licensees for making changes today, and that if you move forward with the large break LOCA, then want to go and do a change, you have to meet those control requirements which may or may not require you to go to the NRC staff to seek prior review and approval.

And under the current process, you've got 1.174 from the plant-specific basis that would govern that, so --

MEMBER KRESS: And we've got 50.59, of

course, so --

MR. HEYMER: So I think you're covered as regards, can you overstep demand?

MR. OSTERRIEDER: Right. And just to kind of try to bring this to closure here, our part, the safety margin area, we've talked about most of these items. As part of the risk-informed approach, 1.174 Reg. Guide, I mean, you're assessing defense in depth. So that's going to maintain defense in depth.

And what we're doing, we've already mentioned that, you know, we're going to be looking at the CDF, the LERF, the effects on the health and safety of the public. From that perspective, we're not eliminating LOCA from these designs; we're looking at, you know, retaining LOCA, just defining what the maximum size is allowable.

And we believe that other design basis accidents continue to maintain adequate margin. You know, the idea of, do we need to look for additional accidents? I mean, these accidents should already be on the table, and that's what we're going back to look at and make sure that we're not increasing the importance of some event that we said was bounded before.

And, again, we feel this focuses our

resources on greater risk-significant activities.

MR. WARD: So just to quickly wrap up our part of it, we believe that this approach will maintain the typical margins of safety. We do believe this will bring consistency within the regulations. It will help -- if we can follow this approach, it will help reduce the amount of resources that the staff and us have to spend on Option 3. And that helps our efficiency, our manpower efficiency, and effectiveness of the regulatory process.

We believe large break LOCA redefinition is the preferred industry approach on Option 3. We have looked at the other options that have been floated around, and large break LOCA is the only one that really makes sense to us to approve. And we do have industry consensus on this one, on this one. This is one we would like to move forward with.

But like Bob said, we need some assurance that before we do another two years of work and invest a tremendous amount of money in it that we're going to have a success path to get there.

MEMBER WALLIS: Well, it seems to me you read some -- I mean, this sounds reasonable, but then I haven't seen the numbers. And it may be that some of the gains may turn out to be small, other ones may

be bigger than you thought, and so on. Until we really get an evaluation of them, it's hard to make the decision.

MR. WARD: They put so many tentacles into everything that I don't think any of us can envision what all it may impact down the road. We'd like to lay out a framework on how to use it.

MR. OSTERRIEDER: But we are doing the quantitative work regarding risk significance. This, in the near term -- we're currently scheduled for a July submittal of the risk-significant arguments, at least from the Westinghouse Owners Group.

MR. HEYMER: Okay. With that, we get on to a presentation from the Combustion Engineering Owners Group. Dave Bajumpaa from Millstone will go over some of the --

MEMBER APOSTOLAKIS: Adrian, just a second. Are we going to go until 12:00 with the meeting with industry?

CHAIRMAN SHACK: Yes.

MEMBER APOSTOLAKIS: I thought maybe we should take a break, then.

CHAIRMAN SHACK: Yes. I think there seems to be a groundswell for a five-minute break here -- a 10-minute break.

(Whereupon, the proceedings in the foregoing matter went off the record at 10:56 a.m. and went back on the record at 11:06 a.m.)

MR. BAJUMPAA: Good morning. I'm Dave Bajumpaa. I'm a Senior Engineer in the Nuclear Fuel and Safety Analysis Group at Northeast Nuclear Energy Company, Millstone Nuclear Power Station.

I'm here this morning to -- actually, I work in the deterministic thermal-hydraulic analysis area, which includes the FSAR Chapters 14 and 15 accident analyses. I'm here this morning to present the CEOG position on large break LOCA definition.

And as we talked about earlier, large break LOCA -- by "large break LOCA" redefinition we mean to -- we mean the use of leak before break technology to really define a maximum mechanistic break size that we need to analyze in a design basis space, and then continue to analyze the spectrum of LOCAs up to and including that maximum break size.

As we've talked about already this morning, and as you well know, GDC4 currently allows for the application of leak before break analyses to eliminate dynamic effects associated with the large break LOCA. And as part of risk-informing 10 CFR Part

50, we would -- we endorse extending this science to the remainder of the 10 CFR Part 50 regulations.

As we talked, GDC4 doesn't specify a specific break size. It generically -- essentially allows a -- it's a generic statement to the effect of essentially having the individual licensees justify a maximum break size that needs to be analyzed.

We at the CEOG support the consistent application of this large break LOCA redefinition through both the Appendix K and the containment-related analyses.

Adrian, Lewis, and Bob talked this morning about -- identified I think some of the safety benefits and the programmatic approach for the large break LOCA redefinition. The CEOG approach that we would take would be very similar to what -- the WOG approach as has been discussed previously already. We would continue to use risk-informed technology to show the low risk of large break LOCA, use leak before break analysis to justify a maximum break size, and then continue to analyze the spectrum of LOCAs up to this maximum break size.

The next slide, please.

There's, again, two major areas where we see extending the application in this redefinition of

large break LOCA to 10 CFR 50.46, the ECCS performance analysis, and then to the containment-related analyses that offshoot from the 10 CFR Part 50 regulations.

And this morning I'd like to just present -- for the remainder of my presentation, I'd like to just discuss -- focus a little more on the containment area, as those areas tend at times to be a little more subtle.

Next slide, please.

I think the first two bullets on this slide are pretty obvious to -- the most obvious here is that we look at containment-related LOCA design limits. We're looking from the perspective of peak containment pressure and inside containment EQ temperature profiles.

The next few bullets there are dealing with the -- a more subtle analysis that we have to do. We analyze -- as for peak containment pressure, we'll analyze to maximize containment pressure and temperature. But we also have to perform an analysis, a separate LOCA analysis, that looks to maximize the close cooling water system temperatures.

It's a similar kind of containment LOCA analysis, except that we'll -- instead of using a fouled set of CAR coolers to maximize the containment

temperature and pressure consequences, we'll actually use clean CAR coolers to put as much energy into our closed cooling water systems as possible. And you continue to use a fouled heat exchanger on our closed cooling water to service water; that's our ultimate heat sink.

So we do two distinctly different large break LOCA containment-related analyses. The analyses that we do to maximize the RBCCW -- I'm sorry, I use RBCCW because that's reactor-building, closed cooling water system. That's what I call it in my plant, so I apologize if I stumble through that.

Some of the key parameters we analyzed, design limits we analyzed for peak RBCCW temperature-related effects are the -- our containment -- our safeguards rooms, our ECCS and containment spray pump temperature profiles. They're for the room temperature profiles that are in a building, and that's going to affect the EQ of our HPSI/LPSI containment spray pumps -- safety injection and containment spray pumps.

Other design limits that we have to analyze with this peak -- related to this peak RBCCW analysis are closed cooling water inlet and outlet temperatures at the different components in the closed

cooling water system at the containment air recirc coolers, the shutdown cooling heat exchangers, and the spent fuel pool cooling heat exchangers.

Again, it was brought up a little earlier, the generic -- other issues related to containment design limits, issues related to the Generic Letter 96-06, potential water hammer loads associated with the LOCA with the concurrent LMP, and the potential for voiding in the car coolers. And then, once you resequence your closed cooling water pumps on, you will get some significant hydrodynamic loads in the CAR coolers.

Some of the other components -- the subcompartment pressurization analysis. That's a traditional design basis analysis where we looked at the double-ended guillotine, and we looked to apply this large break LOCA redefinition effort in order to -- to limit the maximum break size we analyze.

Another issue -- the last bullet on that slide is I've got a relatively significant issue that's still out in the Generic -- I guess it's Generic Safety Issue 191 dealing with debris generation in the transport over to the -- with regards to the containment sump screens and our containment sump design verification.

We believe that the application of large break LOCA redefinition is appropriate in this arena as well as the rest of the containment design areas and 50.46.

Looking at the next slide, the -- if we're looking at the containment-related design limits, we typically have very little analytical margins of these design limits. What I will calculate for a peak RBCCW temperature, say at the outlet of my CAR cooler, is the actual limit that our CAR cooler piping can handle.

I don't have any margin in many of the -- related to many of these design limits. Changing these design limits is costly. For example, the CAR cooler outlet temperature, if I have to increase that containment temperature, I have many, many, many calculations of structural supports and many stress-related calculations that have to be redundant.

It's very expensive to us, so it's -- analytic margin is a very good thing to have. So if we have increase analytic margin, we can accommodate some unforseen plant problems that we run into on a day-to-day basis at our plants.

And looking at -- you know, trying to quantify some of the margin, you know, if we look at

the containment pressure design limit, the containment pressure, we'd expect a reduction if we're allowed to limit our -- apply -- redefine our large break LOCA. We'd expect about a 10 percent increase or a 10 percent reduction in containment pressure, which would increase our analytic margin by that 10 percent.

We wouldn't look to change any of the design -- containment design, you know, thicknesses or any kind of structural integrity of the containment. But we'd use it for -- use it to get that and establish the analytic margin.

Next slide.

I'd like to look at a little more detail on containment design pressure here, just to show you what typically is out there. This is actually related to my plant at Millstone. These specific numbers are related to my plant at Millstone but are very similar to the rest of the CEOG fleet.

The containment design pressure I have is a 54-pound containment design. My peak calculated containment pressure falling in my LOCA is 52.9 psi. Peak calculated pressure falling in the main steam line break is 53.8. So I'm actually steam line break limited at Millstone, at this point -- Millstone II at this point.

So redefinition of large break LOCA is not going to directly gain the --

MEMBER KRESS: Do you consider those two numbers significantly different?

MR. BAJUMPAA: No, I do not.

MEMBER KRESS: Okay. So both of them limit the --

MR. BAJUMPAA: Right. Right. But we would certainly advocate the redefinition of large break LOCA to get more margin for the LOCA. If we can get that extra 10 percent or so margin, it would certainly simplify our design change process to -- to perhaps allow us to do -- right now, if I had proposed a design change, because I'm so close to the limits, I have to look at both accidents. If I had more analytic -- and I have to look at both accidents quantitatively.

If I was able to get a little more margin, analytic margin for my LOCA, perhaps I could look at that one qualitatively. But I would still have to look quantitatively at the steam line break.

So there's not a different benefit on containment pressure here, but it is certainly -- it does simplify my life in the -- maintaining my plant's configuration and our design change process.

Some of the other -- next slide, please.

Some of the other areas -- the inside containment EQ profile. Again, increased analytic margin between the post-accident calculated temperature profile and the EQ temperature envelope of equipment inside containment, that's -- again, we're going to get some increased analytic margin here if we are allowed to redefine the large break LOCA.

Similarly, the ECCS room temperature profiles, if I have a -- if I am able to limit my break size, for example, to something as large as branch line break, up to something like that, that would get me some additional temperature margin, so that I could -- so it's just an increase in margin there as well.

And the same thing between the CCW temperature when it might have increased analytic margin between what I calculate post-LOCA with clean CAR coolers versus my coolant CCW temperature when it's in my design limits right now.

MEMBER SIEBER: With respect to the EQ limits on electrical equipment, how does that benefit you since you already have the equipment qualified to the original profile? Is it in replacement parts or aging life, or how does that come up in -- in some

cases, you may be able to recall.

MR. BAJUMPAA: Yes, there is some equipment that actually has -- I have in my plant right now that -- it's definitely an aging issue.

MEMBER SIEBER: Okay.

MR. BAJUMPAA: It also comes from the perspective of showing the long-term LOCA profile compared to the test profile and actually analytically proving that the test profile that the equipment is tested to bounds the actual predicted LOCA profiles.

I actually have some equipment that is very marginal that we have to do a pretty sophisticated analysis internally to demonstrate that with the double-ended guillotine LOCA that our equipment would survive that for the 30-day time of the accident and including them in a four-year life. So there would be some equipment potentially that we could avoid having to replace.

MEMBER SIEBER: I think I'll ask no more questions about that.

MR. BAJUMPAA: Okay.

MEMBER SIEBER: Thank you.

MR. BAJUMPAA: Sure. So I've sort of established to this point, hopefully, that what we're trying to do here is increase the analytic margins to

our design limits. Now, what would we do with that analytic margin? And this next slide sort of leads into some of the areas in the containment-related design benefits that we would get here.

One area, we would look to relax perhaps the CCW flow limits through our CAR coolers. Right now at my plant I have a very, very small window in which I can set my CAR cooler flow outlet valves to get the proper flows. I have to make sure that I have enough minimum flow through the CAR coolers, so that I am assured to pull off enough heat removal so that I don't exceed my containment design pressure when I'm looking to maximize my containment design pressure.

But I also to make sure that I don't have too much CCW flow going through my CAR coolers. If I start having too much flow, I might -- with a clean CAR cooler, then I might actually increase my peak calculated RBCCW temperature following the LOCA. And so I actually have a very tight constraint right now that I have at my plant to maintain a minimum flow that ensures the containment pressure is met and a maximum flow that ensures that I don't exceed the peak CCW temperature limits.

MEMBER SIEBER: Do you have service water temperature limits?

MR. BAJUMPAA: Yes. We do have service water temperature limits. Primarily, with the containment-related analysis, that comes in from the ultimate heat sink, the --

MEMBER SIEBER: Okay.

MR. BAJUMPAA: -- sound temperatures, yes.

MEMBER SIEBER: And do you also have RWST temperature limits?

MR. BAJUMPAA: That is correct.

MEMBER SIEBER: Which often is hard to meet in the summertime?

MR. BAJUMPAA: That is -- yes, that is correct.

MEMBER SIEBER: Okay. And those would be relaxed if you had a smaller break size?

MR. BAJUMPAA: That would -- it would certainly -- it would help.

MEMBER SIEBER: Okay.

MR. BAJUMPAA: I'm not sure on the RB we have to look, you know, in an integrated fashion through all of the -- but, yes, that would certainly help the containment.

MEMBER SIEBER: I know that Farley had those problems, correct?

MR. BAJUMPAA: Right.

MEMBER SIEBER: Okay.

MR. BAJUMPAA: Right. So I should have a bigger window as far as CCW temperature to flow -- to set a bigger window in my plant right now. I think I've only got a 25 gpm target window to set through a CAR cooler, so that I don't have a minimum flow. When I take the minimum flow, I also have to drop off to account for pump degradation and instrument uncertainty.

So I have a very tight window. It's only like 25, 30 gpm that I can set my CAR cooler outlet valves within, which is a bit of a challenge and we do have to fiddle with the valves from time to time to make those -- to maintain our configuration management.

MEMBER WALLIS: Fiddling with the valves, is that done remotely?

MR. BAJUMPAA: No. These are actually manual.

MEMBER WALLIS: Someone has to go in there and turn them?

MR. BAJUMPAA: Yes. Somebody would go in there and turn them, not during an accident, but during the refueling outages and stuff when -- or whenever we do anything that might change the

configuration of our CCW system we'd have to go back and do a flow balance.

MEMBER SIEBER: Well, you end up having a range of adjustments because as you operate the plant the CAR coolers become fouled and flow goes down.

MR. BAJUMPAA: Yes. We typically --

MEMBER SIEBER: To some extent.

MR. BAJUMPAA: To some extent, that is true I guess perhaps for some plants. But on our plant we currently do cool our CAR coolers with a closed cooling water system and maintain pretty decent chemistry there.

MEMBER SIEBER: So you're better off.

MR. BAJUMPAA: We typically don't have issues with car cooling, fouling.

MEMBER SIEBER: Okay.

MR. BAJUMPAA: Yes. Other potential applications that we use for this increased analytic margin we'd get with our potential large break LOCA redefinition here, I might be able to increase my tube plugging limits that I have to maintain in my configuration right now on my CCW to service water heat exchangers, my shutdown cooling heat exchangers, and the CAR coolers.

The service water areas, being a raw water

system, that's probably the area where I'd be most sensitive about tube plugging. Other areas -- as alluded to a little earlier, I have actually made submittals on our docket, and we just received a license amendment regarding the increase in our ultimate heat sink temperature limits. Actually, it's more of an issue there that I just went through on my plant.

Another potential area of use for this increased margin would be to accommodate any future potential power upgrades. Because I'm so close right now with the LOCA on containment pressure, increasing the power, that event turns out to -- that may actually put the LOCA containment calculated pressures higher than the design pressure containment.

If I were to do a power upgrade in the future with a double-ended guillotine steam line break there, even though it's up there right up and close, that's actually limited by my zero power case by the additional water inventory and the steam generators.

I guess the next slide -- this next slide really is a summary of actually when Millstone was going through its 54(F) configuration management related outages, this is a listing of the areas where we had analytic problems that we had to straighten out

our configuration. And that resulted in us having to reanalyze our containment pressurization analysis associated with the large break LOCA.

We had increased safety injection. We had to increase our safety injection pump flows. We had to increase the spent fuel pool cooling heat loads that were assumed in the analysis. We had increased containment spray header fill times when we looked at in more detail.

Small -- very, very small issue here obviously, the containment paint thickness, but that does play into -- I have to -- I have a maximum paint thickness that I have to assume on my passive heat structures inside containment. And during the 54(F) outage we identified that the paint micrometer was thicker than what we had assumed in the analysis.

So that was another contributor to making us reanalyze that event and in the increased refueling water storage tank temperature. That's -- those are things that we had to deal with during our 54(F) outage, and now we have a solid configuration in our running well.

Another area where we just wanted to make one point with this slide, that we really feel -- the CEOG feels that we should consistently redefine the

large break LOCA across the entire spectrum of the 10 CFR Part 50 requirements. We think that is the way to go. It's currently acceptable to use LOCA redefinition for GDC4, and to extend that application through both the 50.46 and the containment-related areas, we think that will allow us to take advantage of some of the potential safety benefits.

I throw up as an example on this slide the emergency diesel generator start times to -- to try to enhance the diesel reliability. But that diesel generator start time is driven by a lot of things. It's driven by the 10 CFR 50.46 ECCS performance analysis, where we are looking at getting our high head and low head safety injection pumps up to speed in the adequate time to combat the double-ended guillotine LOCA.

But I also have to have my CAR fans start my closed cooling water pumps for the containment-related areas. They need to sequence on the diesel generator and start to accommodate these double-ended guillotine LOCAs.

If I am going to increase this diesel start time, it's a major effort on behalf of my plant from a design change perspective. I have to look to make sure that my steam line break containment

performance does not now become more limiting than the LOCA with regards to maximizing the water hammer loads on the CAR coolers, the RB temperatures, and things like that.

So it's -- to -- to -- right now, on Millstone, my diesel start is tied in right now to -- in order to prevent too many -- too large hydrodynamic loads on my CAR coolers, I need to start my diesel in the same -- I can't relax that directly right now unless I get -- unless I'm able to redefine the LOCA. Then I will not be able to increase my start time, if I just apply it to the -- if I apply LOCA redefinition to the 50.46 area only.

So it's got to be an integrated overlook, and I've got to look at not only the containment-related LOCA analysis, I've got to look at the ECCS analysis, and I've got to look at all the rest of the Chapter 14/Chapter 15 accident analyses to make sure I'm not affecting aux feedwater start times for my loss of normal feed analysis in Chapter 14. So it's got to be a big integrated look to get this increased diesel start time and yet still maintain the proper configuration at my plant.

And I guess the last slide is just a summary that the CEOG -- as I have indicated and

alluded to in earlier slides, the CEOG does support the consistent application of the large break LOCA redefinition throughout the entire 10 CFR Part 50 regulation.

CHAIRMAN SHACK: Let me catch up one thing back to Mr. Ward. Something slipped through that I'd sort of like to understand. Although we're doing this under Option 3, is your selection of the maximum pipe size going to be basically a deterministic argument based on the 1061 kind of arguments, that you're going to have some margin to leak and then some margin on crack size? Or are you going to go through and look at the risk significance of various leak sizes?

MR. OSTERRIEDER: It's a combination. We're considering the risk significance and the deterministic piece.

CHAIRMAN SHACK: Okay.

MR. WARD: Yes. And, historically, we had started this before Option 3 became a program. We wanted to get into redefining the LOCA. So I guess we have been doing this in conjunction or in support of the staff's effort to come up with some options under Option 3.

MR. HEYMER: Terry Rieck from Excelon will talk to you about the BWR perspective. He's

representing the BWR Owners Group.

Terry?

MR. RIECK: Good morning. For those of you who don't know who Excelon is, we're now in the merged organization of Con Ed and PECO, so -- I know a lot of you don't know how much we're changing out there in the industry.

But I'm here representing the BWR Owners Group. Excelon does own 10 BWR units, and so we are a big part of that owners group.

We formed a committee recently, a technical committee, to look into Option 3 risk-informing Part 50, the technical requirements. Frankly, we were behind on where the PWRs were, PWRs having started a year and a half ago or so to look into this. We are behind because we saw we had some margin in large break LOCA, and we saw where the PWRs were going and -- and didn't jump in right away.

But within the last few months, we felt we needed to get more involved to see where the benefits might be for us. And we formed this technical committee. We've now met a couple of times, and we started talking about the same things that the PWRs were doing.

Very quickly, we got into determining that

redefining the large break LOCA should be our highest priority. As I said, we kind of dismissed that a year ago or so, but once we started talking about it we saw that it met the criteria, the framework, that the Commission was talking about in terms of Option 3. That is, there was some significant safety enhancements that could be made on our plants, but also have a burden reduction for us, and there was some cost that we had to incur to get there.

So when you looked at it, when we looked at it in terms of the PWR approach, we saw the same safety enhancements that the PWR saw. We talked about diesel generators starting in 30 seconds instead of 15 seconds, and what would that mean to the reliability of the diesels to the reliability of the electrical system.

And we saw that our CDF for our large break LOCA was way down in the weeds, very low, and our small break LOCA was higher and other -- other actions that relied on loss of -- relied on offsite power were higher, and, thus, the diesels are very important.

So we ended up with the same safety benefits and felt we didn't meet the safety of the plant significantly. And, you know, as we talked more

and more about it, the members of our committee from the various utilities said, "Well, of course, you know, the setting up of valves in certain ways and the ECCS pumps would all enhance the small break LOCA." And the large break LOCA was so low in CDF, you know, it might, as mentioned here, increase its CDF. But it was so low it was an insignificant increase.

We very quickly said, "Yes, we can gain the safety benefit, and the burden reduction could also be significant." The same thing is talked about on the PWR side.

As I mentioned, we do have more margin in the large break LOCA, so it kept us from getting in as quickly. And we realized also that we haven't delved in as much into fracture mechanics probability and leak before break like the PWRs, so our cost might be more to get into this than the PWRs.

But what that meant is we would incur a larger cost for the burden reduction, but it might also mean an alternate break size, as we may not be able to justify as small of a break size as the PWRs. And as each of the owners groups talked about here today, that's part of our industry proposal is that each vendor would have to propose their own break size based on what they could justify. So we realize we

may not be able to get the same break size.

So, again, just to summarize, we felt the -- that large break LOCA redefinition was our most beneficial path to go down. But we did make this a committee that looked at other options, because the other owners groups had already done that. But we hadn't had the chance to look and see what might be our highest priority, and, thus, we did look at other options and came up with half a dozen other options that we ought to pursue. So we are looking other places.

So we see large break LOCA as a high priority. We see a benefit for that as well as working with the Commission and the owners groups in terms of -- of the framework and how it might be further development through this process in the large break LOCA.

So our follow-on activities on the second slide here are to continue in the large break LOCA arena, better define the safety benefits as well as our burden reduction, essentially do the cost-benefit analysis, but also assess the various approaches on fracture mechanics and leak before break.

So we've got a lot of work ahead of us to catch up to where the PWR is. But, again, I want to

emphasize that is our top priority in the working group, but we are also looking at other options. And we're playing in -- or we're working in this arena to get more experience in that and know where our cost benefit might be for other options down the road.

CHAIRMAN SHACK: Would you be looking at changes in GDC4 on the requirements that you can't apply leak before break, for example, to piping within a granular stress corrosion cracking?

MR. RIECK: We have -- the BWRs have had IGSCC problems, and we have also done some mitigation to those problems over the years. And so, in our discussions, we felt that we'd have to do a lot of justification to show that we have improved on the BWR pipes. And the smaller pipe size may not be justified, but the larger pipe size, where we may not have seen that, we might be able to justify that. So that's the path that we have taken.

That's all I have to present. I'd be repeating a lot of what the PWR said, but I made the points. We are moving down this path.

MR. HEYMER: The B&W Owners Group couldn't be here today, but they have a similar program underway. They are supporting this activity. They support this approach, and they believe, looking at

50.46, that redefining the large break LOCA is the priority that we should be looking at in this activity.

And so I guess, in summary, what we've tried to do today is explain to you -- give you some background of how we reached our conclusions on 50.46 and redefining the large break LOCA. All owners groups have evaluated this and have continued to look at it as we've interacted with the staff over the last 15 months or so and explained our positions and thoughts to the staff on where we think the emphasis needs to be placed in improving 50.46.

You heard today some discussion on the benefits as regards to margin, the operational margin, scheduling of work activities, the priority of work activities, and consistency in the regulation. And we believe that by going down this path of redefining the large break LOCA we can more effectively focus our resources on those issues that are safety significant which will ultimately enhance the overall safety profile of the plants.

So that's what we came with today. We're looking to go to the next step, and you heard Westinghouse talk about evaluations that are underway. As I said, owners groups have provided funding because

we saw recognition that if we're not going to go down the large break LOCA path that we need to hear about that, because we do really believe that it is the priority and the one that we should be looking at to get the maximum benefit, both from a resource and a safety perspective.

And before these folks go off and spend a lot more money, I think we've got to come to a resolution of the direction in which we're going.

MEMBER WALLIS: So what are you hoping for from the ACRS at this point?

MR. HEYMER: Well, we understand that this was really a familiarization discussion with you to explain our position, and we look forward to hearing what the staff is going to say on the matter. And we understand that there are some papers going up to the Commission, because as you rightly said this is -- this is a significant step and they want Commission involvement.

And we hope that it's -- it's the decision that supports what we've explained to you this morning, because we think that is the right thing to do.

MEMBER WALLIS: We have to listen to the staff and then -- I don't know what the staff will

say. If the staff agrees with you, then it would seem we don't have much to do. If the staff disagrees with you, maybe we need to get involved and --

MR. HEYMER: Well, I mean --

MEMBER WALLIS: -- try to sort things out.

MEMBER KRESS: I think it's a question of whether we agree or not, not whether the staff does.

MEMBER WALLIS: Yes, but we haven't seen that much. And we've seen sort of the perspective of you're about to go down this path, and there may be some nice country to discover if you take the path. But we haven't really seen much in the way of numbers or technical analysis or -- I mean, there's hopes that if you did this you might be able to get something here. I think we need something a little more substantial in order to give a solid yes or no or evaluation.

MR. HEYMER: And I think that what we're looking for from an industry side is the fact that, yes, okay, it's worth progressing, and, yes, we can continue to go down this path, and we will do the analysis. And we can come back once we've done those detailed analyses and provide you a further -- a much more detailed description of what we're finding and where we're going.

But we feel we should be confident that we can do that, and we can achieve --

MEMBER WALLIS: Before you plan the expedition to climb this mountain, you want to know if there's going to be some taboo or something that says you can't go there anyway.

MR. HEYMER: Well, yes. And if someone says that whether you -- you can do what you want but you're wasting your time, and, you know --

MEMBER WALLIS: Right.

MR. HEYMER: -- then we're going to have to take a look at doing risk-informed, and are we actually risk-informing the regulation, because we think this is a central element and it -- it does send a very clear signal that this is what we want to move towards, improving the process.

MR. OSTERRIEDER: Right. In all the discussions we've had to date, we haven't heard of any issues brought up that we didn't feel were -- that were insurmountable. We thought that all of the issues that were identified to us thus far are issues we can deal with. And this continues to make sense and the most sense, but, you know, we just need to understand if there are issues there and get them on the table and move forward.

CHAIRMAN SHACK: Well, I think perhaps this -- we really do need to hear from the staff. That's the next step. And we'll be doing that at 12:30. We'd like to take a break for lunch now. Come back at 12:30.

(Whereupon, at 11:42 a.m., the proceedings in the foregoing matter went off the record for a lunch break.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(12:32 p.m.)

CHAIRMAN SHACK: We're ready to restart the meeting, and we'll have the staff presentation. I guess we're going to have an overview from Tom King, Mary Drouin, and Mike Mayfield, among others -- the usual suspects.

MR. KING: My name is Tom King. I'm with NRC's Office of Research. With me at the table is Mike Mayfield, Division Director, Division of Engineering Technology and Research; Mary Drouin from the PRA Branch; and Alan Kuritzky from the PRA Branch.

If I could have the second slide.

What we want to talk about today is give you a status report on where we stand on looking at 50.46. We haven't sent you anything in advance. We're not asking for a letter. This is work in progress, but I think we've reached a point where it's worthwhile having some interactions, and at least informally getting your reactions, your feedback. And we'll get to a schedule slide later on, and we will be back several times before this is all done.

This is sort of an initial overview of what we've done, sort of some general conclusions we've reached, and some additional work things,

follow-up things we're still working on. And like I said, we'll be back later to talk about further progress in this area.

I'm going to give a little introduction and overview of where we stand. Mike is going to talk about in more detail redefining the large break LOCA. And then Alan Kuritzky is going to talk about where we stand in terms of some near-term conclusions or recommendations that we're thinking of proceeding with and the longer term aspects of 50.46. If I could have the third slide, please.

As you recall, this is work being done under what we call Option 3, and Option 3 was basically an effort to go in and look at the regulations, technical aspects of the regulations, try and identify what the -- from a technical standpoint what things were candidates to be changed based upon risk insights. And those changes could go either way. They could fill gaps in the current regulations that risk insights say need to be filled, or they could remove some unnecessary burden that risk insights say are not very risk significant.

Our plan in Option 3 is to do what we call a feasibility study. That is, go to the Commission, do enough work to go to the Commission and say, "Hey,

here are some things that are feasible to change." Not give them a rulemaking, but get them to buy in up front that, yes, we've done enough work to establish certain changes are feasible, and then the rulemaking would actually get into the details and the exact wording of the changes, and go through the normal process which is usually about a two-year process.

The rulemaking process involves a lot of public interaction, but we've also tried to have with -- to work under Option 3 public interaction as well. And you heard this morning we've had a number of meetings with the owners groups, and they've all been public meetings. We had a workshop to try and get as broad input as we could on this activity, and we'll continue to do that as we proceed.

MEMBER WALLIS: Are you getting what I would call real public input?

MR. KING: We have not gotten much from outside the industry, no. We've invited people, and some of them attended, but we haven't gotten much in terms of feedback.

MEMBER WALLIS: I think this is an issue where, you know, I would really be interested in what the sensible, informed public would think of about this sort of change, and not people who have something

to gain by it one way or another but those who -- you know, whose interests you are trying to protect.

MR. KING: I'd like that feedback as well. I'm not sure exactly how to get it other than you keep asking for it and hope it comes in.

MS. DROUIN: We have had at the public meetings real public. They have come to some of the meetings.

MR. KING: Yes, but they haven't said much.

MS. DROUIN: They haven't said much.

MEMBER APOSTOLAKIS: I don't understand why they are part of -- they use different names, means --

(Laughter.)

MR. KING: Non-industry.

MEMBER APOSTOLAKIS: Okay. Non-industry. Much more factual. In fact, to protect the sort of public that's sitting in front of us. Let's not forget that. The public has safety.

MR. KING: We're following in all of these Option 3 activities what we call this framework document, which we've discussed with the committee before. It sort of lays out the ground rules as how we go through and look at regulations and what the

guidelines are for making judgments on whether we'd make a change or not make a change, and it involves defense in depth, safety margins considerations, as well as some risk guidelines.

And the question came up this morning, well, why not use Reg. Guide 1.174? In theory, any licensee today could come in with 1.174 and propose a change to the large break LOCA for their plant, go through all the analysis it would require as to staff review and approval.

Option 3 is really trying to make some generic changes, not require plant-specific stuff in every case. And that's why the framework in Option 3 is a little different than what's in 1.174. 1.174 is delta CDFs, delta LERFs. You're making changes from the current plant risk profile.

MEMBER APOSTOLAKIS: Let me understand that a little better, Tom, because it's something I have on my mind. When you change a rule, you can still use the idea of delta CDF and delta LERF to evaluate the change you're about to make. In other words, you are using the idea behind the 1.174, even though you are not changing the licensing basis of a specific unit.

MR. KING: When you change a rule,

particularly when it's mandatory on everybody, and you go through the backfit analysis, you have to show that the incremental improvement in safety is substantial. And there are guidelines in the reg. analysis guidelines, delta CDF, for example, that's used to do that.

MEMBER APOSTOLAKIS: But in addition to those, though, shouldn't delta CDF be small? Or do you think that's covered already by the regulatory analysis?

MR. KING: If we're imposing a new requirement, we want to make sure that the improvement in safety is not minuscule, that it has some substantial improvement in safety. So there's a delta CDF guideline in the reg. analysis guidelines.

MEMBER APOSTOLAKIS: I guess now I'm a bit more -- when you are imposing a requirement, that means that the delta CDF is negative, is it not? And that's why the regulatory analysis applies.

MR. KING: But the change is an improvement in CDF, and CDF goes down.

MEMBER APOSTOLAKIS: Okay.

MR. KING: Yes.

MEMBER APOSTOLAKIS: If, on the other hand, you change a rule in a way that, really, there

is only relief, then I would expect a positive delta CDF. So there shouldn't be a question of regulatory analysis. But there should be a question of whether the delta CDF, which is not positive, is acceptable.

MR. KING: Yes.

MEMBER APOSTOLAKIS: Which brings into this 1.174 what I feel the idea is behind 1.174.

MR. KING: Right. Right.

MEMBER APOSTOLAKIS: So that would be one where you're doing it. But then, this morning -- again, I'm trying to understand how this works -- we said that, yes, even if you change the rule, then each licensee will have to come to you with a request to actually be allowed to change it for their facility. And that's not clear to me.

MR. KING: Well --

MEMBER APOSTOLAKIS: Why do they have to do that?

MR. KING: It depends on the rule change that's made. I guess in an ideal situation, you'd make a generic rule change, specify a new break size, and maybe people now would have to submit on their reload analysis to conform to that new break size. But they wouldn't have to come in and justify that break size.

I think what we've kicked around is there is -- you know, it's not clear we can define a generic break size for everybody -- a new one.

MEMBER APOSTOLAKIS: Okay.

MR. KING: Perhaps its class of plant-specific or vendor-specific -- or perhaps it's plant-specific, in which case you -- I think you heard this morning that if it's plant-specific, maybe each licensee -- what the rule change would do, it would open the door for each licensee to come in and propose for his plant the new break size that makes sense based upon his risk assessment, his plant design. That's one option.

And what this rule change would do, basically, then, would eliminate having to have an exemption to the current regulation to do that.

MEMBER APOSTOLAKIS: So they wouldn't need to concern themselves with Regulatory Guide 1.174 at all, because that's in the rule.

MR. KING: What we would have to do in that case is put out a new Reg. Guide that says, okay, if you're going to come in under this new rule that opens the door, here's the analysis we'd want to see and here's the acceptance criteria.

MEMBER APOSTOLAKIS: So you might repeat

some of the requirements of 1.174 --

MR. KING: Yes.

MEMBER APOSTOLAKIS: -- if it is appropriate.

MR. KING: If people -- right, exactly.

MEMBER APOSTOLAKIS: In other words, you may request a risk assessment, an evaluation of delta CDF.

MR. KING: But today, if somebody wants to come in under 1.174, in this particular case, they're going to have to ask for an exemption to 50.46. And, you know, the Commission has told us in pretty clear terms that if -- if you're starting to make a lot of exemptions in a certain area, you ought to start thinking about a rule change. And that's one reason for not just saying, "Go use 1.174" on something generically.

MEMBER KRESS: That's the best reason -- explanation that I've heard so far. That's helpful.

MR. KING: Okay. Next, side 4.

Where we stand -- within the past four or five months, we've pretty much been in an information-gathering mode, gathering information from the industry, from the owners groups you heard this morning, in terms of what their thoughts are, what

work they've done looking at this issue, and we've been doing our own work in-house looking at various options and the technical basis for those options, using our framework and looking at the risk information associated with those options and how it stacks up against the framework.

And we're now at the point where we've gathered enough information where I think we're settling in on some at least preliminary conclusions and preliminary approaches, and that's what we're going to talk about today.

We're going to talk about what we consider is feasible to go forward with in the short term. By the "short term" I mean with a paper to the Commission in June, and then some things that we think are potential longer term improvements, but we need some more time to work on those. So you'll hear about both of those.

If I can have the next slide we'll talk schedule a minute.

This is sort of the first time we've come forward in a public setting and talked about what these preliminary conclusions are and what we want to pursue. So we think, clearly, we want to have at least another public meeting before June to talk about

these in more detail and get some feedback from others besides this committee. So that is factored into our schedule.

I think we want to come back to the committee after that and, you know, tell you where we stand, having factored in input from that public meeting and additional work we're doing. We would intend to get you a draft Commission paper to look at in mid-May, and then we would want to come back to the committee at your June full committee and ask for a letter on this before we actually send the paper to the Commission the end of June.

MEMBER APOSTOLAKIS: So the subcommittee meeting will follow the SECY paper. We'll have an opportunity to read the SECY paper before the meeting, right? Or is that after?

MR. KING: We are proposing another subcommittee before you actually get the paper, and then give you the draft paper before the June full committee.

MEMBER APOSTOLAKIS: The reason being?

MR. KING: The reason being that I thought it might be useful before we actually take the time to write this stuff down in a SECY paper to have some more discussion. If, you know, the committee has

different views and you want to adjust that schedule, we're certainly open to discussing it. So we can come back to that maybe at the end of the day today.

MEMBER APOSTOLAKIS: But isn't it typically too short a time? If the subcommittee makes comments, I mean, May -- mid-May sounds like too short a time for any real changes in the document. Should the subcommittee meeting be perhaps late April or -- my feeling is with you guys that two weeks means nothing.

(Laughter.)

And I'm learning from --

MR. KING: Is that a compliment or is that a --

(Laughter.)

MEMBER APOSTOLAKIS: I'm not saying that, you know, blaming you for anything. But I realize that, you know, there are reviews to be made and various offices to concur, and all that. And two weeks is not enough.

MR. KING: I don't think it's worth getting back together until we have our next public meeting. I think after that would be the right time to get together.

MEMBER APOSTOLAKIS: So, in essence, what

you're saying is that this June letter might not be real. It could be a July letter.

MR. KING: That's always an option. We send our paper forward and you follow up in July with a letter. That's an option also. But what we -- ideally, we'd like to have a letter before our paper goes up so we can reference it in our paper. And the steps to get to that point are negotiable, but I think we'd like to have our public meeting first and then get back and have some further interaction.

MEMBER APOSTOLAKIS: Well, anyway, if you don't think it's a problem, that's fine. But I thought it would be a problem. You know, May -- mid-May, early June, I mean, it sounds like things are happening with lightning speed there.

Now, you are committed to give something to the Commission by June 29th?

MR. KING: Yes.

MEMBER APOSTOLAKIS: Okay.

MR. KING: That's our current commitment date, due date, to the Commission.

MEMBER APOSTOLAKIS: And what is it that says that the public meeting cannot be in early April?

MR. KING: There's nothing that says that, other than getting everybody's calendars coordinated

and picking a time and scheduling it.

MEMBER APOSTOLAKIS: Well, that would make everything else much easier.

MR. KING: Yes. And Mary Drouin will be setting that up.

(Laughter.)

MEMBER APOSTOLAKIS: So if it's not early April, we know whose fault it is.

(Laughter.)

MS. DROUIN: Alan's.

(Laughter.)

MR. KING: Okay. Slide 6. As I said, we're going to talk basically about two things. We're going to talk about the work we've done looking at risk-informing the definition of the large break LOCA, and then we're going to talk about other things that are on -- that we've considered beyond just redefining the large break LOCA. And, again, these are going to break down into some near term and some longer term changes.

And with that, I'm going to turn it over to Mike, who is going to talk about the large break LOCA redefinition area.

MR. KURITZKY: Actually, before Mike takes over the large break LOCA redefinition, I just wanted

to mention something up here which I hope after Tom has clarified things for you this isn't going to further confuse them. But we had -- under this Option 3 we had come up with a number of various options for risk-informing the technical requirements of 50.46 and the large break LOCA and associated GDCs, etcetera.

And we have about three of those options for various takes on redefining large break LOCA, and then another seven or so involve actual changes to just the technical -- the various technical requirements.

These three right here are the three that we have that all fall into the category of redefining large break LOCA. And when I explain the difference between the three, hopefully that will further clarify what Tom was saying and not further muddy it up.

But in the first -- when we were going to redefine the large break LOCA by plant, you know, except what we do there is a plant would then be permitted to define its own maximum design basis LOCA using leak before break and probabilistic fracture mechanics analyses. It's very similar to what Westinghouse or NEI industry was discussing earlier today.

MEMBER KRESS: Tell me, how would they do

that? That sounds like a task that I see has no relevance to this issue.

MR. KURITZKY: Well, this one is focused on -- would be focused on the frequency of the break.

MEMBER KRESS: Yes, but that's just a PRA issue.

MR. KURITZKY: No, it's actually even before that. It's -- well, actually, the next thing I'm going to tell you about, actually bring more of the -- the carrying the risk. This one would be on the frequency, and this --

MEMBER KRESS: Well, what you're doing is using leak before break technology to -- to refine the frequencies of certain leak sizes, to the PRA issue. I don't see its relevance to this issue of defining a design basis large break LOCA. I mean, unless you're going to say something which I think is the wrong thing to do, that -- if that frequency turns out to be below 10^{-6} or some magic number, then we -- then we've screened all pipes or leakages bigger than that, which is -- which sounds like what it sounds like.

But I think that's the wrong way to go, because the issue is really if I change this design basis LOCA definition, what changes will I expect to see in the plants? And are those changes acceptable

from a risk standpoint?

That really has nothing -- very little to do with the actual frequency of it.

MR. MAYFIELD: But don't changes in the plant hinge on what size break you go --

MEMBER KRESS: Oh, absolutely. But that -- what I'm saying is you -- you make your rules say you will -- your large break LOCA will be a leak size specification that doesn't allow your plant to exceed these risk acceptance criteria, something like that 1.174 but not exactly.

And then, they say -- all right. And then use the leak before break technology to translate that leak size into a pipe size, but that's -- you know, that's sort of a detail. And it doesn't have anything to do with the rule.

MR. MAYFIELD: But it's a sticky detail to get to.

MEMBER KRESS: Yes, it's not easy. It's not easy. I didn't mean to say that. But it doesn't have anything to do with the rule, I don't think. That's my point. Other than if that helps define the frequency that goes into a PRA to do your calculations for risk. It's useful there, too, but, you know, presumably we've already got that in the PRA to some

extent.

But that's my point. I don't see how leak before break really plays much of a role here except in translating your leak size into pipe size.

MR. MAYFIELD: I think that's -- why don't we go and then -- why don't we go ahead and walk through this, and then come back to it, Tom, if we don't address your issue.

We spent some time -- slide 8. We spent some time thinking about what would go into the analysis, the probabilistic fracture mechanics analysis that might support this kind of change, whether you go at it to determine what would be an acceptable frequency or the analysis that you'd have to have to work backwards from at leak size to pipe sizes.

We spent some time thinking about what should go into that, what kinds of things would have to be considered. First of all, we think service experience is the right place to start. We'll talk a little bit about that. Some analysis to predict piping failure frequency -- and, again, it's the same basic analysis, whichever direction you're going.

And the other one is to look at what kinds of failures -- other failures where the large break is

currently a surrogate to cover those, and we'll talk a little bit about that.

We've had some prior analyses that have addressed these same kinds of subjects; it's probabilistic fracture mechanics kind of stuff. Those have been presented to the committee going back to 1985, '86, the changes to general design criterion 4; more recently, the risk-informed, in-service inspection programs.

Neither of those approaches were sufficiently rigorous to support the kind of rule change we're talking about here. And I'll talk a little bit more about why we believe that. We think that the analysis to support this kind of rule change -- and, again, whether it's going to the frequency or backing from leak size to pipe size -- that level of analysis ought to be at least as rigorous as what we're going through on the PPS rule change.

We think that's beginning to set a standard for the level of rigor that we think should be in the analyses to support these fundamental type of rule changes.

Can we have slide 9?

The prior staff study that, interestingly, was referenced this morning was NUREG CR-5750,

estimated large break LOCA frequencies. For the PWRs, that was a five times 10^{-6} kind of frequency, with a 90 percent confidence interval running from 10^{-7} to 10^{-5} per year.

The recent experience at V.C. Summer, while it certainly wasn't a large break LOCA, did contribute to the same kinds of cracking that was looked at. That would increase the best estimate that the staff has looked at to something on the order of seven times 10^{-6}, which is certainly within the band that came out of the earlier study.

We think that overall these numbers are conservative, and then it gets to be a challenge of, well, how conservative are they? And there are a lot of assumptions. If the committee wants to go there, we've got the staff here that can talk to them. But I think the point that I wanted to make is that the numbers aren't low enough that just out of hand you say the large break LOCA can be dismissed. So it requires a little more looking than that.

MEMBER KRESS: Where is that?

MR. MAYFIELD: Sir?

MEMBER KRESS: Where is that level?

MR. MAYFIELD: I'm not going to try and pick it. But when you're in the mid 10^{-6}s --

MEMBER KRESS: You know you're not there.

MR. MAYFIELD: -- we think we're not there. It may be one of these things where, collectively, the Commission would decide, well this is -- you know, some number is low enough; I don't think we have that target today.

CHAIRMAN SHACK: It's okay for vessels to fail at that rate but not pipes?

MR. MAYFIELD: Absolutely.

MR. KING: Remember, the framework document had laid out initiating events, sort of in a frequency -- by frequency category. And when it got down to rare events, then it had, you know, basically collectively we want rare events not to add up to be more frequent than 10^{-6} per year. And any individual one ought to be substantially less than that.

We sort of proposed a rule of thumb of, you know, at least a factor of 10 lower than the 10^{-5}, which would say, really, to exclude something you've got to be below 10^{-6} per year frequency. It's sort of the guideline we've been using in the framework document.

MR. MAYFIELD: Slide 10, Alan.

We wanted to look at some of the other changes that we've made, places where we have accepted

what's -- analyses that are put in a general class of leak before break. These are basically probabilistic fracture mechanics analyses or determinations that derive from those kinds of analyses.

I mentioned the general design criterion 4 change from 1986. There we -- the underlying notion was that pipes will leak before they will break, and that was accepted for eliminating the dynamic effects associated with the big pipe fracture.

What that led to was the removal or relief from having to install pipe whip restraints and jet impingement barriers. There were a few other spinoffs to that, but it -- those were the big issues at the time the rule was promulgated.

Subsequently, we've used these same kinds of arguments to get some relaxation on break opening time for the baffle bolt analyses, the risk-informed changes to the in-service inspection programs, and we used the same basic approach looking at the resolution to GSI-190 on environmental effects on fatigue a year or so ago.

Slide 11. The traits from those prior applications -- they all seem to have both probabilistic and deterministic aspects. Defense in depth, however, hasn't been challenged. We were

always still covered by the large break LOCA, the 50.46 requirement. So we weren't getting to fundamental changes in the plants. Rather, we were dealing with some ancillary things.

The general design criterion 4 change, back when the staff made the presentation to the ACRS, they described the pipe whip restraints as the evil pipe whip restraints. The notion was that, by and large, these devices were being contrary to safety.

They were contributing to containment heat load, they were impeding access for in-service inspection, and if they didn't get shimmed up right you could actually introduce loadings that hadn't been previously analyzed, if the pipe managed to hang up on the whip restraint. So there was an underlying notion that these were good changes.

Similarly, with the risk-informed ISI, there was the underlying notion that inspection resources could be better shifted to other piping systems, and there was also a -- both a quantitative and qualitative approach, and they gave similar results. So in each of these cases there was something else that -- that supplemented the change rather than just the analysis.

And as I mentioned, we don't think those

prior analyses, the probabilistic fracture, were as rigorous as what we would apply today in supporting a rule change, at least a rule change like this.

MEMBER APOSTOLAKIS: But let me, again, say --

MR. MAYFIELD: Sure.

MEMBER APOSTOLAKIS: -- what would be the change of the rule under this option? What exactly would be the change? I mean, you are arguing that they don't have sufficient analytical basis.

MR. MAYFIELD: But the notion here is that if you -- if, for example, you wanted to use this type of analysis to redefine the large break LOCA frequency, or -- or subsequently use this approach to determine what is an appropriate break size.

MEMBER APOSTOLAKIS: But large break LOCA frequency -- do you mean the frequency per year?

MR. MAYFIELD: Yes, sir.

MEMBER APOSTOLAKIS: Wouldn't that be a fundamental change in the rule there? Because the rule deals with the conditional stuff. Given that there is a break, it shows this and this and that.

MR. MAYFIELD: And if you -- yes. Now, the notion is here -- I guess the notion I've been working to is that the approach would go along the

lines of showing that the large break -- the frequency of the large break LOCA is so low that it shouldn't be the governing consideration. And so now, what is the break size that is more appropriate to include in the analysis?

MEMBER APOSTOLAKIS: But does the rule, as written now, it does not take into account the frequency of the LOCA at all?

MR. MAYFIELD: Then, it assumes it's one.

MEMBER APOSTOLAKIS: Does it?

MR. MAYFIELD: By --

MEMBER APOSTOLAKIS: It assumes it?

MR. MAYFIELD: It just assumes it.

MEMBER APOSTOLAKIS: But if you go this way, then you are really changing the argument here in a fundamental way.

MR. MAYFIELD: Well, either that or you're saying that the frequency -- well, that's right. This is --

MEMBER APOSTOLAKIS: But that's what I don't understand. That's a fundamental change in the rule. The rest is the mechanics of doing it. Now, what there is fundamental? I mean, I read the rule. I'm trying to --

MR. MAYFIELD: Well, the idea is you're

going to redefine the break size, the design break size, as something other than the largest pipe.

MEMBER APOSTOLAKIS: So then you would go back to this idea of conditional that --

MR. MAYFIELD: You're going to ultimately go back to this idea of some conditional break and use that as the design criterion. And you would use this type of analysis to support defining that alternate break.

MEMBER APOSTOLAKIS: Again, you know, it's not obvious to me why you have to switch back to that and not deal with the frequencies of the accident sequences of various LOCAs, and deal with the whole sequence.

MR. MAYFIELD: Again, I think the same analysis schemes would come to play.

MEMBER APOSTOLAKIS: That's correct.

MR. MAYFIELD: Whether you did it with -- just as an alternative to the existing conditional approach or deal with a spectrum. The underlying analysis would be the same.

MEMBER APOSTOLAKIS: But you would still deal with the frequency of the initiator that way.

MR. MAYFIELD: That's correct. But don't --

MEMBER APOSTOLAKIS: If we could get a listing of these changes, that would be very helpful to me.

MR. KING: There's two parts you're going to hear. Mike is talking about changing the definition of a large break LOCA, which is really what size pipe you assume. There's another part we've looked at; it's all the assumptions that are made.

Regardless of what pipe size you assume, there's a whole bunch of other assumptions that are in the way we do business today and we're looking at those as well, because of them don't make sense when you look at it from a risk perspective. And Alan Kuritzky is going to talk about those, so there's two parts to this.

MEMBER BONACA: So what you're talking about now is really addressing what has been presented this morning by the industry.

MR. MAYFIELD: In part, yes.

MEMBER APOSTOLAKIS: In part.

MEMBER BONACA: And then, one thing that would be interesting, of course, in that respect would be if you define large break LOCA as a smaller break than the current one. What kind of criteria, I mean, would -- is there a possibility of accepting some

higher consequences for a large break LOCA that we have today? Because this was to get done in the FSAR.

It would probably lead to more than 2,200 degrees Fahrenheit temperature. It would lead to some more percent oxidation.

All I'd like to say is that it seems to me that the only conflicts from the presentations we had this morning and now is abandoning large break LOCA, and that becomes almost like a severe accident consideration where you can have, you know, core damage to whatever extent.

Isn't there some possibility right now you are setting your target to a smaller break size, but you can also look at large break LOCA and see what -- given the -- all the changes that a plant would make, you have some results that you might find as acceptable now. See, that would allow you to deal with the fact that you're not abandoning completely some expectation for large break LOCA.

MR. KING: Well, I think what was said this morning was the risk assessments will still have the large break LOCA in them.

MEMBER BONACA: Yes.

MR. KING: And the risk assessments are still going to need to show that the large break LOCA

is a very small contributor to risk for this whole scheme to work. I mean, if we make changes and now all of a sudden the large break LOCA is a high contributor to risk, then we haven't done our job.

MEMBER KRESS: I think that's true, that if it came out to be a high contributor to risk for specific plants, then you need to consider it in your design basis. But I don't think the inverse is true, that if it comes out to be a low contributor to risk, that doesn't necessarily mean that makes it a bad design basis.

And the reason for that is when you invoke and impose a design basis, you end up with certain design features and certain procedures and certain things that help control the total risk, not just for that set of sequences but for all of the other sequences involving LOCAs, and so forth. And you want that total risk to be within acceptable limits.

So, you know, my perspective is your Option 3, if you look at -- if I go from -- to a specific leak rate or a specific size different than this, what changes will the plants make? And are those changes acceptable from a risk standpoint? And that, to me, seems to be the only rational way to view this.

MR. KING: I agree.

MEMBER KRESS: Not deal with, is the large break LOCA a risk contributor? Maybe it is, maybe it isn't. You know, if it is, you have to deal with. But if it's not, I still don't think it's the right perspective.

MR. KING: No, I agree with everything you said. The large break LOCA probably is a surrogate for some other things that you don't have to worry about because you take care of it through dealing with the large break LOCA, although that has to be considered.

MEMBER KRESS: Okay.

MR. MAYFIELD: Which I think is at least, in part, the message here is that this is perhaps a tougher analysis than has been thought about.

And that -- on Slide 12, the notion here is, again, we think that we've started setting some guidelines on what is an appropriate level of rigor in these analyses, based on what we're doing for the PTS rule. And the presumption here is that we're going to actually be successful with the PTS rule.

You can look, of course, at transients, at thermal-hydraulic response, and so on. There are a couple of these that get to be more interesting if you

were actually going to try and do this for piping. The flaw distribution is one that gets significantly more challenging.

We've actually done more work on flaw distributions for vessels than we have for piping. The other one that we haven't gotten into for these kinds of analyses are the uncertainty analyses, and to do that rigorously dealing with both epistemic and aleatory uncertainties.

We think that would become a significantly more challenging approach for this piping analysis than it is for the vessel. There are more degradation mechanisms, there are more unknowns, there are more model uncertainties, and on and on. It gets to be a much tougher challenge than it is for the vessel.

If we can have Slide 13, Alan.

The next several slides I don't propose to go through in any detail. They are more for your information. They're the kinds of things that we think would have to be treated, some examples of issues that we think haven't been dealt with very well. The analyses themselves would have to deal with both the initiation of subcritical cracking, the subcritical crack growth, leak rate detection under normal operating loads, and the fracture during upset

loads. Those are just the kinds of analyses that have to be dealt with.

The main inputs to the probabilistic fracture, the material property input, the crack morphology -- what the crack surfaces look like -- the loads under normal and transient conditions, the flaw distributions.

On Slide 15, we need to deal with the current and as-yet unknown mechanisms. This is something, how do you know what hasn't happened yet, and that's part of the speculation that gets to be challenging in doing this.

There are some kind of notable examples of things that we didn't think were likely.

MEMBER WALLIS: It's not just what hasn't happened. It's what you --

MR. MAYFIELD: It's what we don't know.

MEMBER WALLIS: -- are not yet aware of.

MR. MAYFIELD: Yes. Exactly. So there are some examples here of the kinds of things that have caught us a bit by surprise in the past, the most recent one perhaps being the primary water stress corrosion cracking in the Inconel 182 welds. It's not that we didn't know that material would crack. We just didn't think that the loading and conditions were

right for it to crack in that particular application.

There are a host of things on Slide 16 that go into the leak rate analyses. So if we really wanted to follow Dr. Kress' suggestion and take a leak size and work backwards to a pipe size, that gets to be a -- first of all, you can get a range of pipe sizes depending on the crack size and loading. So it -- there would be a fair bit of uncertainty to deal with in that analysis.

But things like residual stresses come into it, the pipe to system boundary conditions, are you getting some restraint of free thermal expansion, some restraint of bending in the pipe, crack face pressures, some things that haven't been included. And it -- as you work backwards from a leak size to a pipe size, those things get to be important and you change from a conservative approach to a non-conservative approach, just depending on the direction you're going.

MEMBER KRESS: Would this analysis also be time-dependent, then?

MR. MAYFIELD: Absolutely.

MEMBER KRESS: So that's a factor we never really --

MR. MAYFIELD: Yes.

MEMBER KRESS: -- had in this design basis before.

MR. MAYFIELD: That's correct. That's correct.

On Slide 17, the fracture mechanics analyses, this would go to an elastic plastic fracture rather than the net section collapse or limit load kinds of approaches. We have historically assumed some idealized through wall circumferential cracks, nice regularly-shaped things. But if the subcritical cracking caused large surface cracks, long on the inside surface and relatively short on the outside surface, it introduces another complication in either direction in the analysis.

You'd need to look at things like the earthquake rate -- loading rate effects on material properties. These are not dynamic loading rates in the classic sense, but there is a phenomena known as dynamic strain aging that at these loading rates does get to be an issue.

One of the interesting things that we've discovered from some of our experimental work at Battelle is that if the bending plane happens to be different than the normal -- the primary plane for the crack, you can get some significantly different

fracture behavior, and that is physically possible. We've seen it. So that gets to be an interesting twist to the analyses.

On Slide 18, the material property input, these are normal kinds of things that you would hear about, and I think you've heard about them before. The difficulty now comes in quantifying them and quantifying the distributions on them into the analysis and to feed into the uncertainty analysis.

This is something that we met with the committee and talked about just on the fracture toughness for the vessel steels. And that, in and of itself, is fairly complicated. This expands significantly.

On Slide 19, the loads, looking at normal operating versus upset loadings, and looking at the actual stress levels versus the design basis levels -- and that got to be an important consideration when we were looking at the environmental effects on fatigue, to not just roll in the design basis stresses but to actually come up -- try to come up with the true operating stresses. And in some cases they were substantially lower.

There are some thermal gradient effects that I guess I hadn't been aware of until a

conversation that was being held on the steam generator tube ruptures, some helical thermal gradient in the hot leg. How much that changes with time, is it a consideration, it's not something we have rolled into the previous analysis; it's something that ought to at least be considered here. Whether it has to be incorporated rigorously is something you'd have to decide as you went along.

The initial flaw distributions -- again, this is something that will be even more complicated for the piping evaluation than it was for the vessel because of the nature of the loadings, the potential for the environment to expand the number of flaws, the way you would have to treat the potential for pre-service or fabrication-induced flaws, to pick up and grow during operation, which is not something that we have seen or are able to predict in the vessel analysis.

So, again, the piping is a more difficult analysis to perform.

We've talked about other sources of large breaks where the large break LOCA or the -- at least the failure of the big pipe is a surrogate for these things. Losing the steam generator manways, the potential for those few plants that have loop stop

valves, the potential for losing the bolts that hold the bonnet on. We've seen in some smaller valves some valve body cracking; would that be an issue here?

Then, there is the subject of indirect sources of pipe failure, and the notion here is moving heavy loads inside the containment during power operations.

In the work that was done by -- at Lawrence Livermore in support of the GDC4 changes, these indirect sources of pipe failure -- actually, you got up to where that was the dominating contributor to pipe failure frequency. So it's something that needs to at least be considered here.

MEMBER BONACA: Moving heavy loads, the power operations, is that containment?

MR. MAYFIELD: Well, at any rate, in summary on Slide 22, the service data alone don't appear to us to support eliminating a large break LOCA without some further evaluation. The data, such as they are, with some -- potentially with some limited additional analysis would appear to be sufficient to support some other types of changes.

The probabilistic analyses to support eliminating the large break LOCA we believe would have to be significantly more rigorous than what we've done

in the past, both from the staff as well as the industry. And we think that active degradation of the piping is not the only consideration.

The analyses would have to consider other breaks, and they'd have to consider things like weld repair history to make sure we capture potential for other degradation mechanisms.

MR. KING: Okay. Now Alan Kuritzky is going to talk about putting the redefinition of the break size aside, what other things that we looked at in terms of potential changes in risk-informing 50.46.

MR. KURITZKY: Yes. As I mentioned earlier right before Mike began speaking, there was about 10 different options we looked at during this program. The first three all involved various -- you know, different variations of redefining the large break LOCA, and now here we have seven more options. And these look more specifically --

MEMBER APOSTOLAKIS: Again -- I'm sorry, maybe it's not a good day for me. Why are they risk informed?

MR. KURITZKY: Why are they risk informed? Well, because as I go through these items that are on this list I'll explain the risk implications and what risk aspects led us to come up with these as options.

MEMBER APOSTOLAKIS: And you have criteria for deciding that these aspects are good or bad?

MR. KURITZKY: Well, what we're using right now, as Tom mentioned before, is based on our framework document. We have about a 10^{-6} roughly for something that may be low enough that it's, you know, considered to be a rare event and may not need to be considered. And so that's kind of like a threshold.

MS. DROUIN: That's only one threshold. Also remember that one of our ground rules under Option 3 is that when you look at the analyses, if the analyses are conservative, we see that in a risk arena you want to be realistic. So some of the options might -- it may have no relationship to the quantitative guideline. It's because there is excess conservatism, and our ground rules -- one of the ground rules in the framework was to be realistic.

MEMBER APOSTOLAKIS: But, again, we are talking about a fleet of 103 units. So, I mean if I want to delete loss of offsite power consideration, that may have different impact on CDF on different units. On what basis do I decide to delete? By the largest impact or when we --

MEMBER KRESS: The average or --

MEMBER APOSTOLAKIS: Yes.

MEMBER KRESS: On a specific basis?

MEMBER APOSTOLAKIS: Yes, I don't know. You see, that's where I get confused.

MEMBER KRESS: Yes, I had that same problem.

MR. KING: Or you set some criteria.

MEMBER APOSTOLAKIS: So we don't have them yet.

MR. KING: We have not reached the point where we've nailed down every detail of what we're going to propose. What we're talking about are certain areas that we think make sense for -- for looking at it a little further and possibly going forward with recommendations to the Commission.

Just take the first one -- simultaneous loss of offsite power at the same time the large break LOCA occurs. You know, you can use frequency information and risk information to say that that assumption is pretty -- pretty low in terms of frequency and pretty low in terms of risk --

MEMBER KRESS: Well, let me --

MR. KING: -- for the large break LOCA.

MEMBER KRESS: Yes, let me tell you what bothers me about that. Let's go back to the framework document where you have these categories and ranges of

frequencies for basically specific sequence sets.

Now, if I look at, say, a large break LOCA of a given size, and it fits into one of those categories, that's the wrong way to use that framework document. That's not what it was intended for. What you need to say is, "We've defined this as my large break LOCA." What does it do to the frequencies of all the sequences that go into the PRA, and how does this shift them all with respect to that framework document? And is that total shift --

MEMBER APOSTOLAKIS: Which means look at some global method.

MEMBER KRESS: Some global method, yes.

MEMBER APOSTOLAKIS: Like the CDF.

MEMBER KRESS: Well, like the CDF. Well, not exactly global because I think defense in depth gets involved in terms of this allocation that you have. I think that's a defense in depth concept. So that's one way you bring that in.

But I think just to say large break LOCA, if it's this size, that particular sequence provides this contribution that we have in this box, is the wrong way to use that framework.

MR. KING: I think you have to do both. I think you have to start somewhere, and you have to

say if large break LOCAs are very low frequency, then maybe we ought to consider not calling them design basis accidents anymore. Then you have to go and look, well, what does that do to my risk for the plant? And if it turns out that that drives other things up, then maybe you don't want to do that.

If it turns out it doesn't drive other things up, that it really is a very low risk type of item --

MEMBER KRESS: I think that's the key element right there.

MR. KING: Yes, I agree with you.

MEMBER KRESS: I think that part of it --

MR. KING: But you've got to start somewhere.

MEMBER KRESS: Yes. Yes, because you can't really do that other part yet, the second part, the important part, the risk -- and it's awfully hard to do. You probably don't have the capabilities of doing that just yet.

MR. KING: Well, I think you have the capabilities. I think, you know, you have to take some time and some, you know, effort to do that.

MEMBER KRESS: Each plant-specific PRA would have to be -- would have to decide what changes

in a plant are made and see how that impacts the PRA, and do it on a plant-specific basis, and average it out or add it up or something. It's not easy.

MR. KING: Everything we're talking about today, not just the break size, there is the question of how much can you do generically, and how much do you have to do plant-specific?

MEMBER KRESS: And that's --

MR. KING: And the question applies to everything we're talking about. And we haven't nailed down where you draw that line yet, but we recognize that that line has to be drawn somewhere.

MEMBER APOSTOLAKIS: Now, what is the Commission's attitude towards Option 3? Have they approved it or what? I don't remember.

MR. KING: Option 3 was approved, yes, a couple of years ago. Remember, 50.44 was the first one that came out of that, and this is the second one.

MS. DROUIN: It's in the SRM in response to SECY98-300.

MR. KING: Yes.

MEMBER KRESS: Yes, 50.44 was a breeze. That's one of the ones that --

MEMBER APOSTOLAKIS: Mary, you live with those numbers. We come here once a month. You know,

SRM does this and that. It's not as alive to me as it is to you.

(Laughter.)

MR. KING: Why don't you let Alan talk about these, and then we can come back and maybe talk about some of these generic questions.

MEMBER APOSTOLAKIS: Okay.

MR. KURITZKY: Okay. One of the first things that we just talked about -- just momentarily about the simultaneous loss of offsite power assumption. One of the ways that we can envision something like that playing out is -- is if the NRC were to come up with some acceptable frequency distribution for large break LOCAs, Tom already mentioned that in NUREG 5750 we have -- or I guess Mike may have mentioned that we had a range from 1E-7 to 1E-5 for PWRs for large break LOCA.

If 1E-5 is your upper bound, you could say that's the upper bound for large break LOCA and you can show that your conditional loss of offsite power -- you know, loss of offsite power frequency is on the order of 10^{-2}, 10^{-3}, and that could put you below some threshold. And you may decide that that doesn't need to be one of your design basis considerations, you know, assuming loss of offsite power with the large

break LOCA.

Numbers like that have already been -- as part of the resolution I think of generic issue 171, there was some look into the conditional loss of offsite power probabilities and --

MEMBER KRESS: As a function of time after the LOCA?

MR. KURITZKY: No, it was just a -- it was just given that you had --

MEMBER KRESS: You may have one eventually within --

MR. KURITZKY: Right. In fact, what was driving the initial failure probability was the starting of the large ECCS pumps.

MEMBER KRESS: Okay.

MR. KURITZKY: And so that was in the range I think for PWRs about 1.1-something, 10^{-2}, and for BWRs I think it was 6^{-2}. So we can see that the numbers -- given the large break LOCA frequencies, and those numbers put you somewhere in that -- in that threshold range. It was something that may be feasible, but --

MEMBER KRESS: Once again, I fail to see the relevance of the, say, 10^{-7}, because what I was saying is if I want to drop the loop, simultaneous

loop LOCA rule, why does that change? Why do people want to change? And does that change the risk status? You know, that's irrespective of the frequency.

MR. KURITZKY: And I would have to -- and if someone were to come through and supply the justification why they feel their initial loss of power is -- why they would make a change, then whatever plant change they would then want to --

MEMBER KRESS: You know --

MR. KURITZKY: -- make because of it they would have to justify on a risk basis, and it could impact many things besides just the large break LOCA. They have to show that the delta risk is acceptable, you know, maybe per Reg. Guide 1.174 or --

MEMBER KRESS: But, see, my point is I don't see that you can do ahead of time a look at the conditional loop, for example, and say you come up with a frequency of 10^{-8} or 10^{-7} or 10^{-9} even. I don't see that it tells you anything that's useful in saying, "Okay. We'll do away with that part of it." I don't see that that's helpful to you.

MR. KING: I don't see why you don't see it's helpful. I mean, if you're making assumptions that are rather remote in likelihood, does it really make sense? And particularly if it's causing the

plant --

MEMBER KRESS: There may be some very specific things just related to that. I don't want to be, you know, completely on one side of that. There may be some very specific things relating to that that has no impact on anything else, and, in fact, may have a negative impact that you could obviously change.

But I think just to use it as an ultimate reason is --

MR. KING: But if it's causing the diesel generators to have to start up very quickly --

MEMBER KRESS: Well, there may be other reasons that you want the diesels to start up quickly.

MR. KING: There may be. There may be other things that would catch -- I agree with that.

MEMBER KRESS: You can't just throw it out.

MS. DROUIN: No. And if you go back to the framework, nothing is ever thrown away or added in just because of a number. And that's where we bring in this -- we bring in the defense in depth and we have six things that we had identified there.

Also, another part of the framework is that before -- one of the other ground rules before we delete something, we have to go in and go back and use

50.44 as an example, look at all of the tentacles and where it would have impact. And that has to be brought in, and that's all part of the ground rules under which we make the decisions.

So it's not just, oh, well, there's a number and it's below it, so we can throw it away. It's not -- that's not what we do.

MR. KURITZKY: And just to follow -- just in direct response to what you said, Dr. Kress, in the case of if we were going to relax -- you know, the start time had to be relaxed, then we would let -- one of the things we would need to consider is, do we need some other type of design-based accident that -- that governs diesel start time? Because there may be some other parameters that need to be looked at. So, you're right. That would have to be considered.

Okay. The second one on there is the excluding highly unlikely combinations of large break LOCA initiators and single -- it's going to fall along the same lines of what we just talked about -- loss of -- initial loss of offsite power. It would run in the same -- have that same --

MEMBER KRESS: Yes, it's the same issue.

MR. KURITZKY: So whenever fair, the same thing holds.

Again, so that is something we would consider. There would be a threshold, and we'd have to consider other aspects, too, what would be the overall risk impact of changes associated with that.

The next bullet is to look at the conservatisms in Appendix K and decide whether or not there are certain conservative models in Appendix K that we feel can be replaced with more realistic models or assumptions.

MEMBER KRESS: I see that as sort of a separate issue. I don't know -- I don't see that's related to this particular issue.

MR. KURITZKY: Only in the sense that we're looking to make things more realistic.

MR. KING: Yes. Isn't risk-informing also being more realistic? I mean, the risk analysis is supposed to be a realistic analysis.

MEMBER KRESS: Well, the risk analysis is supposed to be realistic. But Appendix K doesn't necessarily have to be realistic. It can be risk-informed and be very --

MR. KING: If they're going to be risk-informed, that to me also implies we want to be realistic.

MEMBER WALLIS: Is the idea that something

like the peak clad temperature might be a function of the risk? That you might allow a 2300 if it's less likely or --

MR. KING: Well, it depends. Is the peak clad temperature 2200? Is that a very conservative number? Is that a --

MEMBER WALLIS: Even if it's conservative. Does it -- if it's a very likely event, you might want some more conservatism.

MR. KING: Yes, I agree with that. That's the margin issue.

MEMBER WALLIS: So you'd reexamine on the basis of risk.

MR. KING: Yes.

MR. KURITZKY: In fact, the last bullet up there is -- that's pretty low on the screen for you guys, but it's modify the ECCS acceptance criteria. It's another one that --

MEMBER WALLIS: We got that.

MR. KURITZKY: Okay. And then, actually, the next three bullets all are things that are associated with the best estimate calculations. And just various ways of -- well, in the first case, they would be using -- we would be considering, you know, would it be possible to use a distribution of break

size allocation as input to the best estimate file and propagate it just like we do with other parameters. Therefore --

MEMBER WALLIS: It's just one of the other uncertainties.

MR. KURITZKY: Right. And, in fact, you have the very tail end of the LOCA, the very large break -- you know, it's driving what you're getting out because it's --

MEMBER WALLIS: It's not --

MEMBER KRESS: Sorry. Once again, I'm a little bothered by that one because to me the break size or, alternatively, the leak rate was the independent variable. And you don't normally attach uncertainty distributions to your independent variable. You're looking at something that results from that independent variable, which is a specific number.

And you put the uncertainties on the things that give you the result, and that one -- I just don't quite understand what that one is saying to me.

MEMBER WALLIS: I don't have any problem at all admitting I'm uncertain about the break size and trying to put it into the analysis.

MEMBER KRESS: Well, sure you're uncertain about the break size if you're going to go in and decide on a frequency of a given break size to feed into a PRA, as part of PRA. But --

MEMBER WALLIS: You don't think it's part of the thermal-hydraulics?

MEMBER KRESS: Oh, I'm sorry. I think it's part of this element of fracture mechanics that Mike said when you go from a given leak rate to decide what kind of a break size that relates to, it's certainly a part of that. I didn't mean that. But to me it's not part of risk-informing the 10 CFR 50.46. It's a -- it's how you implement that risk-informed version. Once you go back to -- if you're going to go so -- say, now what break size can I live with?

MEMBER WALLIS: I'm just sitting here looking at all of these things and thinking of how much work it would take to do them.

MEMBER KRESS: Oh, this is -- this looks like a lot of work.

MR. KING: This is a list of things we've considered. What you're going to hear is how we split those up as to what we think is reasonable to go forward with in the short term and which ones need more work. This is one of the ones that falls on the

"more work" list. It's not anything we're to the point we feel comfortable to go forward with now.

MR. KURITZKY: These are all the things we -- actually, we've had these on the table for probably close to a year now, and we've presented them at various public meetings, so -- and in the last -- well, the next two there as far as the best estimate calculation, the fifth bullet, meet improved efficiency of the calculations using improved statistical sampling methods like Latin Hypercube sampling to try and make it a little more efficient.

And the sixth one was one we had considered the possibility of having the NRC approve certain uncertainty increments that would then be input, and licensees could then just do their best estimate calculation without having to necessarily do all of the costs of the uncertainty analysis. There would be some fixed offer or safety margin or something that would be associated with a predetermined uncertainty increment.

Again, these are just things that we had put out on the table for possible consideration.

And the last one was modifying the ECCS acceptance criteria for looking at peak cladding temperature, the oxidation, and determining whether or

not there is any better way, you know, to -- in other words, of those acceptance criteria, is there a better way to handle it?

MEMBER WALLIS: About like rewriting the works of Shakespeare.

MR. KURITZKY: In our spare time.

MEMBER WALLIS: Spare time.

(Laughter.)

MR. KURITZKY: Okay. Based on the -- those are some of the options we had thought about. Of those options, there was a few that we felt in the -- in the short term we felt we could establish the feasibility of. And when we say "short term" we mean in order to get something in the Commission paper by June.

And the ones that we thought we had a fair shot at establishing the feasibility or determining the feasibility of are the large break LOCA, the simultaneous loss of offsite power, large break LOCA assumption, and that effects -- these, in fact, don't affect -- I think none of these actually affect 50.46 -- the actual 50.46 itself, but rather Appendix K or some of the GDCs.

Also, we have the single failure assumptions just like we talked about in the previous

slide.

MEMBER WALLIS: Associated with the large break LOCA.

MR. KURITZKY: Like we have unlikely combinations. And an additional thing with the single failure assumption is -- is to pursue maybe the use of some type of risk-informed approach consistent with the framework that would us to determine how and where we might want to change the single failure criteria. But that's a little broader than just looking at the single failure associated with that large break LOCA.

Reducing decay heat conservatism -- Appendix K is also one we feel we might --

MEMBER WALLIS: That might be one of the easiest ones.

MR. KURITZKY: That's what we like to hear.

MEMBER WALLIS: Well, is that your statement? Isn't this one of the easier ones?

MR. KURITZKY: That depends who you ask.

MEMBER WALLIS: Oh, okay.

MR. KING: We can have Norm Laubin explain that to you, but we've done some work on it, and it's not as easy as you may think.

MR. KURITZKY: A lot of these are -- some

of them appear easier, and then if you ask certain people there are reasons why they don't think they're that easy, so it --

MS. DROUIN: A lot of it -- why it didn't get so easy is that, as you see, just the effects of it and how far you have to dig down and the things that it affects is sometimes not as straightforward. And as you start uncovering all these layers it just becomes a little bit more complicated than you thought at the onset.

MR. KURITZKY: And another one, actually, is not on this slide, but we are also kind of tossing about is the possibility of some relaxation in the break opening time. Right now, I think it's specified in the standard review plan, Section 3.6.2, as a one millisecond break opening time. And we're considering --

MEMBER WALLIS: If it goes to two milliseconds, it won't make much difference.

MR. KURITZKY: Or one and a half.

(Laughter.)

Or maybe something else along the lines of 20 milliseconds or something, and one of the areas that they may have significant benefit is for the barrel -- the baffle form of bolt.

MEMBER WALLIS: On the loads, is it when you get sort of --

MR. KURITZKY: Yes.

MEMBER WALLIS: -- propagations and things that --

MR. KURITZKY: Yes. Lastly, we have up there consider enhancements based upon risk insights, and then we want to look through the risk insights and see if there -- if it indicates that there may be any, you know, related safety concerns.

MEMBER WALLIS: What do you mean by "enhancement" here?

MR. KURITZKY: Enhancement would be if there is a safety concern that is indicated by the risk insights, is there something we feel needs to be beefed up?

MEMBER WALLIS: Oh, beefed up. Okay. It means toughening up the regulation.

MR. KING: An example is maybe automatic switchover to ECCS recirculation for those plants that don't have it. Is that something the risk insights are telling us ought to be in place? You know, that's an example of what we're looking at.

MEMBER WALLIS: It makes sense that you should look at both directions, if you can improve

safety based on risk insights.

MR. KURITZKY: Right. And then our Option 3 framework. That's part of the Option 3 program.

Okay. Some of the benefits that we've identified with these near term -- these possible near-term changes, and as they relate to the agency's performance goals -- to maintain safety, we feel that these changes would help to maintain safety. In fact, there may even be some improvement in safety.

Diesel generator liability, as was discussed earlier today, is one area where there may be some improvement in safety. We would maintain the elements of defense in depth so there would be no degradation there.

And, again, safety system reliability would either -- we would -- there would be no significant decrease based on these changes, and, in fact, in some cases there may be an increase, depending on how that -- how we would address the single failure criteria. There's actually some places where there may be enhanced system reliability.

Also, these changes -- these near-term changes would make the PRSA activities more effective, efficient, and realistic. Particularly in the

realistic arena we would have more realistic assumptions in the DBAs. We'd have, you know, maybe more realistic assumptions for Appendix K, and so that would -- in keeping with that second goal.

MEMBER APOSTOLAKIS: How would you decide whether key elements of defense in depth are maintained? Is that a judgment call, really?

MR. KURITZKY: Well, I guess the actual elements themselves we're going to take from doing the framework document, which is fairly similar to the one that is in Reg. Guide 1.174. And you would -- I guess it is -- I mean, it's necessarily a qualitative analysis. I mean, there may be some qualitative pieces to it, but it's going to be some kind of judgment qualitative decision that you're not degrading anything.

MR. KING: Do you still have prevention and mitigation? Do you still have sufficient, you know, redundancy based upon the reliability of the system?

MEMBER APOSTOLAKIS: You can look at the single failure criterion and you'll decide to abolish it. You will rely on some quantitative analysis to show that you have not really degraded the --

MR. KING: Some, for example,

probabilistic definition of the failure criteria. Maybe it results in not having to assume a single failure. Maybe it results in having to assume a multiple failure, depending upon the system reliability and the break you're looking at. So it can work both ways again.

MEMBER WALLIS: Some people might argue that certainly large break LOCA is the biggest thing that could ever happen. Is that kind of element -- it has an element of defense in depth to it. I mean, that you -- because you're uncertain, you look at the extreme case and defend against that?

MR. KING: Sounds like pre-TMI discussions.

MEMBER WALLIS: Isn't that the sort of argument that was originally used in support of the regulation?

MR. KING: Yes, I think it probably was.

MEMBER WALLIS: Was that defense in depth or is that something else?

MR. KING: I'm not sure I'd call it defense in depth. You may argue, well, that gives you a margin because you know you can handle this big break. Therefore, you can handle anything smaller.

MEMBER WALLIS: Defense in depth in depth

is what you went to when you were uncertain, because you sort of have a nagging feeling that if something were to happen you're not quite certain about, then you --

MR. KING: Defense in depth to me is different ways to accomplish the same function. Again, you know, just assuming the large break covers everything that --

MEMBER WALLIS: The containment is there for the same sort of reason. But there are different ways to perform the function that containment performs. But because you're uncertain you put it there anyway.

MR. KING: Okay.

MR. KURITZKY: And the last thing here we have the performance goal reduce the unnecessary regulatory burden. And the near-term changes that we listed previously should help in a number of these areas that are listed up there. Extension of the diesel generator start and loading time, which was discussed already. That's one of the big issues.

In fact, we have some cost information that was provided to us from industry which shows that extending the diesel generator start and loading time could, in fact, save upwards of $400,000 to as much as

$1.2 million per plant per year. The big swing there is whether or not it's on the critical path outage.

Also, relaxation of some AOTs or, in fact, even removing equipment from the tech specs, like the accumulator, which, again, I think we had some data from industry that shows that could save upwards of around $17,000 per plant per year. And additional analytic margin for plants that are limited by Appendix K right now.

It's only going to be some plants, and exactly how they're limited and what -- unnecessary regulatory burden, we feel, again, is going to be very plant-specific. But it's certainly one area where there's some potential.

Okay. We recognize that, obviously, as we move forward with these short-term potential changes that there's a number of implementation issues that will have to be addressed. And we have them listed I think on the next two slides. We don't need to go into a lot of detail on them because there is stuff that we can still -- the staff needs to still think about the nuances of them, but basically they're many of the similar things that we've discussed already.

If we're going to use something like a combined reliability threshold or a frequency

threshold for the San Mateas LOOP assumption or the single failure criterion, then we're going to need to have some kind of frequency of the large break LOCA distribution. And since we can't make a convenient cut necessarily at the six inches or wherever a PRA says a large break LOCA is, we would actually need to have that distribution across all pipe sizes or all affected break sizes. That's one thing we'd have to -- we have to consider.

When going to the San Mateas LOOP assumption there are a number of concerns, at least from doing something generically because there are a lot of plant-specific aspects. Plants have different types of procedures and designs to handle loss of offsite power, particularly delayed loss of offsite power concerns, and so there may be, you know, some significant work that may have to be done to make sure that that's feasible.

Again, as we mentioned before for the single failure criterion, we may consider whether there's some kind of risk-informed replacement for what will be combined initiator frequency and failure probabilities.

One of the issues we want to keep in mind as we move forward is that we want to try and utilize

a performance-based approach wherever possible.

MEMBER WALLIS: How do you apply that to LOCA?

MR. KURITZKY: Well, I think that performance-based to my mind -- maybe in the example we've talked before about the conditional loss of offsite power where if you have some kind of curve for the -- you know, for the frequency of the large break or breaks, then the utility may come in and try and demonstrate that there conditional loss of offsite power probability is of a certain value.

MEMBER WALLIS: It also would involve perhaps utilities showing that their ultrasound method for detecting cracks really could detect cracks. Is that performance-based, too?

MR. KURITZKY: I leave that one to Mike.

MEMBER WALLIS: They would just go through the ritual, but it actually works.

MR. MAYFIELD: There is clearly a performance-based element in that, yes.

MR. KURITZKY: Delayed LOOP we just talked about. Just a couple of the issues there -- the double sequencing and the degraded voltage issues are the ones that we have to kind of do some more thinking on.

And also, the impact other modes of operation and potential accidents. Low power shutdown, for example -- whatever we do for -- anything for 50.46 or large break LOCA, we have to make sure that while we're thinking primarily of this operation, we've got to make sure that for low power shutdown modes we're not going to do anything dumb, not giving anything away, we need to be conscious of it.

MEMBER APOSTOLAKIS: Are you going to be able to do that without very good risk assessments for shutdown?

MR. KURITZKY: There are limitations that we have to deal with. I mean, that's obvious. And even for operation for --

MEMBER APOSTOLAKIS: What does it mean "limitations"? So how would you do it? Would you be more concerned with it?

MR. KURITZKY: That's one possibility. You have to be -- I mean, where there's uncertainty, you go to conservatism if you can't address certain things.

Okay. Some things aren't --

MS. DROUIN: We don't have an answer to that, George, at this point of how we're going to deal

with it.

MEMBER APOSTOLAKIS: All right.

MR. KURITZKY: Okay. As Tom mentioned before, there is also some things that we're thinking about more for the longer term, other changes to 10 CFR 50.46 or associated GDCs.

One is to redefine large break LOCA. As was discussed previously, that goes back to the first three options that we talked about right before Mike spoke and also what industry spoke of this morning. We would want to continue working with industry on the scope and depth of what work would be entailed.

MEMBER WALLIS: I've been waiting to ask you the question, and it seems to me your presentation and the industry presentation don't have too much overlap.

MR. KURITZKY: Where the overlap would have been is those first three options or parts of this first step which we've kind of -- we skipped over pretty quickly.

MEMBER WALLIS: Maybe we need to discover what this extent -- the extent of this work with industry is. I mean, they have their point of view, and you have your point of view. They seem to be rather different. Are you working together or --

MR. KURITZKY: We are now having exchanges of information, but our first three options that we discussed in the beginning where we -- particularly Option 1 is very closely related to what industry is doing.

MR. KING: We've had a number of meetings with the industry as was mentioned, and I think what you heard Mike say was we're not closing the door on the path that they're pursuing. What Mike's presentation tried to do was lay out the issues that we felt needed to be addressed if we're going to go down that path.

It doesn't mean ultimately we won't go down that path, but it means between now and June not enough work has been done for us to go to the Commission and say, "Let's proceed down that path."

MEMBER WALLIS: What they seem to be looking for, though, was for you to open the door and say, "We're going to encourage you to do more work because we think it's fruitful," rather than to hang a plaque on the door which discourages them from doing a lot more work.

MR. KING: I think one of the things we have to talk about is, how wide is the door? You know, how wide do they see it, and how wide do we see

it?

MEMBER WALLIS: We don't seem to agree yet on that.

MR. KING: We probably don't agree on that, but I think from our perspective the door is open, and we've got to talk about is how wide is it open.

MEMBER WALLIS: I'm not sure that at this stage the ACRS has enough evidence from both sides to give much advice about how open the door is. If that's what we're being asked to do.

MEMBER BONACA: One question I have is, have you given second thoughts about the generic implications of this step? Really, this is the LOCA. It was presented as the first DBA that can be changed where there is implications to load rejection.

It's equally unlikely, I think, as an event that you will have a sheer load rejection the way that you have in the FSAR. It's true of the steam line break.

So if you make a change to the LOCA and then you go back into the risk evaluation and look at the comparisons between, you know, LOCA, you are reducing now the expectation resulting from the LOCA, but you are looking at the one imposed by the steam

line break. Well, tomorrow you will be changing the steam line break. It will change further.

I think you have to look globally at here you are really fundamentally changing the way you're looking at your design of the plant, I mean, and you'll do it for a LOCA. That's a point that also Dr. Kress has made, and, you know, without the implications for the other accidents. I mean, it's --

MR. KURITZKY: I think your point is very good. Even if --

MEMBER BONACA: I don't think you can wait until you have gone through this gate, and then decide how you're going to treat the other accident. I think you have to think about and have some position on that, because it will have implications about, you know, anything that -- I mean, the example I made of doing your risk assessment based on the consequences of the LOCA and comparing it to other restrictions being imposed by the steam line break, and then coming in and having changes to the steam line break that will affect the changes you have made now with the LOCA. I mean --

MR. KING: What you are suggesting is let's take the whole set of DBAs, take a look at what risk information says about them.

MEMBER BONACA: Yes. I mean, if you're making --

MR. KING: Make whatever changes you think make sense and then assess that.

MEMBER BONACA: Or even if you progress aggressively just with the LOCA, I think you ought to have in mind some thoughts about how do you agree with the fact that this is a new approach that most likely is going to be applied with time to the other accidents in the way you design your plant. I think you have to have an understanding; at least I think we have to have an understanding of how that will come together.

MR. KING: I agree there are other things on the plate to be looked at, like the rod ejection accident.

MEMBER BONACA: Yes. Steam line break, too, most likely.

MR. KING: Steam line break, probably some others as well.

MEMBER BONACA: Yes.

MR. KING: And I agree you need to think about the implications of this for those other events, particularly if -- if those other events are preventing some of the -- the benefit or some of the

improvements you're really expecting when you go to make this change, does it make sense to do that individually, or would you be better to go in and look at them as a group?

MEMBER BONACA: Right.

MR. KING: One of the things we need to spend more time on is looking at, if we would make such a change here, what are the other things that are going to catch you? And how do we deal with those things, so that we take more of a collective or holistic look at this whole LOCA situation?

CHAIRMAN SHACK: Of course, you know, one of the problems that Tom keeps pointing out, when you tackle the design basis approach here, you have a touch time evaluating the risk, because you don't -- you're not really dealing with a specific change in a plant.

You know, it's easier to estimate the change in CDF if the guy comes in and says, "I want to change my tech spec for diesel startup." I can sit down and compute a delta CDF score. Here you're going to change a design basis accident, and you really don't know exactly what he's going to do in response to that.

MR. KING: Right.

CHAIRMAN SHACK: So it becomes very difficult to go back and try to estimate the risk impact of this change because you don't know what the changes are, whereas if you're coming the other way it's a good deal easier.

MR. KING: You have to think through, what are those changes that would ensue? And what is the risk impact? And maybe some licensees will implement them all and some won't.

CHAIRMAN SHACK: But that's the fortune-telling aspect of this.

MR. KING: Right. But you've got to look at that. I mean, there's no way around it.

MEMBER BONACA: Although, I mean, for those changes which are being driven by LOCA -- for example, the diesel start times -- and you can determine that there are no other accidents driving that, okay, then you can, you know -- some assessment of it can be done.

There are others which are more complicated because they are driven by other events, and so I agree with --

CHAIRMAN SHACK: Yes. But could you do a -- you know, a standard tech spec change for diesel start times? You know, I mean, we -- I was just going

to make a wise remark that, you know, it was a good thing you got the jet pipe whip restraints out there before we decided to risk-inform the regulations.

MR. MAYFIELD: They'd still be there.

CHAIRMAN SHACK: They'd still be there.

MR. MAYFIELD: You were talk about the tentacles this thing has. There was mention made this morning that one of the reliefs you'd get is some improvement. Without making a change in containment design, you'd get some improvement in the calculated margin against failure.

If you had that improved calculated margin and then discovered that your containment was being degraded, and it was going to be a major deal to go get to it to repair it, would you then be inclined to use up that margin, or a part of it, to avoid a repair for a degraded containment?

I'm not going to speculate, but it seems to me that that's a question that if you were going to look at how the -- what changes might be made to a plant, you get captured in those kinds of things. And it -- I think that's a very tough thing to do to -- to get out the crystal ball and guess at all the things people might do.

MEMBER KRESS: It's crystal-balling,

that's right, yes. That's why it's hard.

MR. WARD: That's one reason that we had -- are proposing an implementation guide with the large break LOCA redefinition, so that we go to you with a complete package of standard changes that had already been reviewed, so that if I get the rule change for my plant, then what we have already looked at on a generic basis for the diesel start times, accumulator number reduction, ECCS flow balancing, on and on and on, and have a complete package already reviewed and looked at as a compiled list, instead of trying to go at it like this, you know, piecemeal one at a time, and then figure out the impact, and then to piecemeal another one and figure out the impact of it.

There are other things, you know, that would go beyond that, of course, but if we -- if we try to piecemeal it one piece at a time like this, I don't think we'll get through it in my lifetime or most of our careers. I think we will still be working on that list -- the near-term list, you know, when all of us are retired.

I think that's the reason we felt like we had to go all the way to the beginning and start from there and then work down and come up with a reasonable list of things to work on at the same time and not try

to piecemeal this thing to death, because I think that's what will happen if we try to take that approach.

MR. KURITZKY: Okay. In any case, so on the rest of these things, I think most of these items we've already discussed at various times. Some of the things we're looking at in the longer term, maybe changing the ECCS acceptance criteria, the propagation of break size frequency, looking at ECCS availability for other modes of operation, and things like multiple steam generator tube rupture, you know, whether there's a need for multiple steam generator tube rupture DBA.

Going back to what we discussed before, even -- or maybe even in the short term looking at the need for maybe a different diesel generator DBA if we're going to relax that loss of offsite power assumption.

So these are some of the things that in the longer term we still -- we think we can come to some kind of grips on their feasibility.

MR. KING: Okay. The last viewgraph -- I mean, the purpose of the meeting today was to sort of put our cards on the table to show you where we stand. We don't have all the answers. We still have some

work to do. But at least we wanted to give you the opportunity here, from all the work that's been done so far, you know, where we've -- where we are today on some of these issues and how we see perceiving in the future both the near term and the long term.

Again, we're subject to scheduling. You know, we'd like to have some future interactions with the committee leading up to our June paper. That's it.

CHAIRMAN SHACK: Just, you know, if you take the industry's suggestion with, you know, this -- you're not defining -- you're not redefining the large break LOCA in the rule. You're simply saying the large break LOCA can be redefined, and they will have to submit a package showing all the implications of that in terms of a risk argument.

Doesn't that still leave you in control and let you evaluate the things the way they -- rather than trying to crystal ball it --

MR. KING: That's certainly one way to do it, just open the door for any plant to come in and say, "Here's my proposal. These are the things I want to change."

CHAIRMAN SHACK: But I'd have to do a fully risk-informed version of that.

MR. KING: Risk study, fracture mechanics study, everything that comes along with it. I think the question -- maybe Mike is better to answer this than me -- but are we in the position to lay out the Regulatory Guide that would have to be met, and the acceptance criteria that would have to be met?

There's a lot of things on Mike's list of things that should be addressed in such an analysis, and, you know, it's not clear to me that at this point we're ready to say, "This is the list, and this is how it ought to be approached."

MR. MAYFIELD: I think that that really was the point I was trying to get to. It's not that it can't be done. It's that it's, we believe, a much more significant undertaking than has been suggested by some of the other discussions we've had.

As we've looked at what would -- what kinds of things would have to be addressed, it's a tougher analysis than has been suggested, where we don't believe what was done before for the leak before break rule change, in and of itself, was sufficient. Is it a starting point? Sure. Of course.

But it's a much tougher analysis to do. The hurdle is higher than it has been for these other kinds of changes. I mean, it's a tough job. It's not

that it can't be done, although I personally am skeptical that it's practical, but it's not that it can't be done. But it's going to be a major resource investment.

MEMBER BONACA: You said that that was because for leak before break defense in depth was not challenged. You said that it was covered by large break LOCA in 50.46 requirements. So in case we really missed it, and you have a large break LOCA, you still have the ECCS capable of dealing with its own certain criteria.

MR. MAYFIELD: Right.

MEMBER BONACA: Well, have you thought about the possibility of the criteria being -- I'm talking about, you know, there are a number of restrictions to the plant that you could relax based on a more likely break -- maximum break size. And you could still impose some fundamental requirements, for example, coolability of the core, for, you know, that will end -- you can break.

I'm just throwing out a thought because -- because you still will have some results by the ECCS that will not deliver exactly for a full -- give you what you are supposed to, but it will, you know --

MR. KING: You say relax the acceptance

criteria for the large break, is that --

MEMBER BONACA: I'm thinking about the fact that if you take out the DBA, not only the LOCA, and you reevaluate those with these new concepts in mind, you may think about the criteria as something with -- with expectations for the current DBAs to still be fulfilled, and probably systems are capable of delivering that. And, you know, just --

MR. KING: Yes. I think I'm still not sure exactly what you're proposing. Maybe we need some discussion.

MEMBER BONACA: Well, once you relax your diesel starting time, and all of the other things we have seen here, okay, you still deliver a flow, and you will have some expectations for coolability of the core in case -- in case you have the truly double-ended guillotine break.

MR. KING: I don't know. Given the fact that the plants already have the right size pumps and pipes and everything in there --

MEMBER BONACA: That's exactly right.

MR. KING: For existing plants, that probably is --

MEMBER BONACA: As was said this morning, that for new plants there will be a different kind

of --

MR. KING: Yes, new plants will be a different story.

I may want to go back and mention one other fundamental assumption. We're talking about, you know, we have a short-term and a long-term list. One of our fundamental assumptions was, I mean, we could continue to work on the issues Mike has raised and do the -- do all of the analysis and develop the Reg. Guide and then have a complete package type change.

We're not ready to do that by June, but one of our fundamental assumptions was we thought it would be important to get some short-term successes under our belt on this issue and some short-term, you know, changes that would get rid of some of these unnecessary burdens and maybe -- maybe plug some safety enhancement holes.

That's why we're proposing to go forward in June with some -- some things that we think are reasonable, some things that will provide some advantages, some safety improvements, and continue to work on the long-term.

I think if we decide not to do anything until all of the work is done, it's going to take some

more time, and it's going to have negative implications for all of Option 3. I think getting some successes under our belt is important, and that's one of the reasons we're proposing to have this two-tiered approach. So, you know, I don't know what the committee's views on that are, or the industry's views, but that's our view.

MEMBER WALLIS: Well, my impression, if you want a view, is that you have thought enough about these issues that you will probably come up with a good document in April, whenever this -- you know, April/May, that timeframe. I mean, I've got a feeling that you know enough about it that --

MR. KING: For the short-term things.

MEMBER WALLIS: -- that you will come up with something by then, yes.

MR. KING: Right.

MEMBER WALLIS: So I'm sort of encouraged by the progress I've seen so far.

MEMBER KRESS: I would like to throw out one of my favorite comments, and that is when you actually get around to doing this, the risk implications of the changes -- which may be way down the road on this thing -- I urge you to reconsider the guidance in 1.174 a little more, because the overall

objectives of this agency are not just CDF and LERF.

They're releases of all magnitudes of fission products, including late failures and contamination, and even worker exposure. So if those things are impacted and are going to change, you need to know it also. And when you do the risk impact evaluation, don't just focus on CDF and LERF. That's my plain issue.

MR. KING: Okay. We're finished with our presentation.

CHAIRMAN SHACK: Okay. I believe Mr. Heymer wanted to make some comments.

MR. HEYMER: Adrian Heymer, NEI. I've listened to the staff. We've been discussing the issues with the staff for 15 months now. I think what you've heard today is very much along the lines that the discussions have gone for the last 15 months. We've looked into this. We've evaluated it.

The owners groups have got funding authorized to move forward on redefining the large break LOCA, and we believe that's where the priority should be.

So that's what we believe at the moment, and we are under no illusions that it's going to be a tough task. But it's a tough task that's got, we

believe, rewards commensurate with what they're going to have to expend to achieve our aim, in the order of probably quite substantial funding from the owners groups. And by substantial I'm talking in the millions, not in the thousands.

I hear the staff talk about short term and near term, and I don't want to ask a question of the staff, but at some stage I would like a definition of what near term and short term is in their mind, because I've got a nasty feeling that what I think is near term is what they're thinking is something else. So I'd be interested in hearing from the staff at that point in time.

We need to think about what's been said here today again and go back and discuss it amongst ourselves as an industry, and then see where we go from here. So that's what I wanted to say.

MR. KING: I mean, I think near term is propose some changes this June. That's near term. We want to be able to --

MR. HEYMER: And do rulemaking by the end of the year?

MR. KING: No, of course not. You know, we go to the Commission in June and propose specific changes. They say yes; the rulemaking starts. Now,

rulemaking doesn't take six months. Generally, it takes two years. Maybe 18 months if --

MR. HEYMER: But, I mean, the -- it would be out by, say, six to nine months from the time the Commission said move ahead.

MR. KING: Do you mean the proposed -- the notice of proposed rulemaking?

MR. HEYMER: Yes.

MR. KING: With the proposed rule?

MR. HEYMER: Yes.

MR. KING: That's probably a reasonable timeframe.

CHAIRMAN SHACK: Are there any more comments or questions from the committee members? Any more questions or comments from the members of the audience?

Okay. Mike tells me our next subcommittee meeting on this subject will be May 8th. Whether that's --

MEMBER WALLIS: It will be a joint subcommittee like these three subcommittees together.

MEMBER APOSTOLAKIS: Why was -- why May 8th for the May meeting?

MR. MARKLEY: You decided at the last full committee meeting on that date.

MEMBER APOSTOLAKIS: Well, that's a good reason.

(Laughter.)

So May 8th is -- okay.

CHAIRMAN SHACK: That basically means that the full committee can attend the meeting because it's sort of banged up against the full committee meeting, which is probably a good thing.

If there are no more questions or comments, then I think we can adjourn.

(Whereupon, at 2:07 p.m., the proceedings in the foregoing matter were adjourned.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards

Docket Number: (Not Applicable)

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

John Mongoven
Official Reporter
Neal R. Gross & Co., Inc.

REVISED 3/5/01

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
JOINT MEETING OF THE ACRS SUBCOMMITTEES ON
MATERIALS AND METALLURGY, THERMAL-HYDRAULIC PHENOMENA,
AND RELIABILITY AND PROBABILISTIC RISK ASSESSMENT
ROOM T-2B3, 11545 ROCKVILLE PIKE, ROCKVILLE, MD
MARCH 16, 2000

ACRS Contact: Michael T. Markley (301) 415-6885
E-mail: mtm@nrc.gov

- PROPOSED SCHEDULE -

	TOPIC	PRESENTER	TIME
1)	**Introduction**		8:30-8:35 am
•	Review goals and objectives for this meeting; introductions	Bill Shack, ACRS	
•	Proposed final ACRS report on the NRC Safety Research Program		
•	Risk-informing 10 CFR 50.46 for emergency core cooling systems		
•	Technical issues associated with large-break loss-of-coolant accidents (LBLOCA), leak-before-break phenomena (LBB), and probabilistic fracture mechanics (PFM)		
2)	**NRC Safety Research Program**		8:35-9:30 am
•	Proposed final ACRS report on the NRC Safety Research Program	George Apostolakis,ACRS	
3)	**Industry Presentation**		9:30-10:30 am
•	Overall industry approach: Why redefine LBLOCA?	Adrian Heymer, NEI	
•	Owners Group perspectives	Bob Osterrieder, WOG Lewis Ward, SNC (TBD), CEOG (TBD), B&WOG	
	** **BREAK** **		10:30-10:45 am

4)	**Industry Presentation-continued**		10:45-11:30 am
•	Overall industry approach: Why redefine LBLOCA?	Adrian Heymer, NEI	
•	Owners Group perspectives	Bob Osterrieder, WOG Lewis Ward, SNC (TBD), CEOG (TBD), B&WOG	
	**** LUNCH ****		11:30-12:30 pm
5)	**NRC Staff Presentation**		12:30-2:00 pm
•	Overview of staff activities	Tom King, RES	
•	Options for revising 10 CFR 50.46; advantages and disadvantages	Mark Cunningham, RES Mary Drouin, RES NRC contractors (TBD)	
•	Comments on approach proposed by the industry	M.Mayfield, RES	
•	Preliminary approach proposed by the staff	Mark Cunningham, RES Mary Drouin, RES	
6)	**ACRS General Discussion and Adjournment**		2:00-2:30 pm
•	General discussion and comments by Members of the Subcommittee; items for future meetings	Bill Shack, ACRS	

Note: **Presentation time should not exceed 50% of the total time allocated for a specific item. Number of copies of presentation materials to be provided to the ACRS/ ACNW - 35.**

Risk-Informing NRC Technical Requirements-- Redefining LBLOCA Requirement

Industry Presentation

USNRC Advisory Committee on Reactor Safeguards

March 16, 2001

NEI

Risk-Informing NRC Technical Requirements

- **Focus on redefining LBLOCA**
- **Background information & general approach**
- **Owners' group activities & approach**
- **Example of a LBLOCA application**

NEI

Risk-Informing NRC Technical Requirements

- **Improve the efficiency and effectiveness of the NRC regulatory regime in a manner that increases the focus on safety-significant matters while reducing unnecessary resource burden**
- **Assess and, as necessary, amend**
  - NRC regulations
  - Regulatory guidance (Reg. Guides, NUREGS, Standard Review Plan, etc.,…)
  - Industry codes & standards

NEI

Why Redefine LBLOCA?

- **Enhance safety and improve process efficiency**
- **Opportunity to shift design and operational focus onto more safety significant events**
- **LBLOCA very low probability event (NUREG 5750)**
  - Very low risk significance -- Negligible public risk
- **Evaluations, detection and piping inspections ensure integrity and high reliability**

NEI

Why Redefine LBLOCA?

- **Linked to numerous requirements and regulatory guidance documents**
  - A central & controlling element for other requirements & guidance documents
  - Large focus of design, operational and management resources
- **Initial industry activity based on WOG LBLOCA project**
  - All Owners' groups involved
  - Meetings & workshops with NRC staff

NEI

Safety Enhancements from Redefining LBLOCA

- **Resources can be focused on activities of greater risk significance**
- **Reduction in the number of unnecessary plant transients**
- **Operator and maintenance procedures and training focused on more probable, more risk significant equipment and events**
- **Realistic equipment testing requirements**

NEI

Safety Enhancements from Redefining LBLOCA

- **Improved worker safety profile**
- **Potential to increase ECCS efficiency and effectiveness for more probable events**
- **More realistic safety and PRA assessments**
- **Improved regulatory consistency**

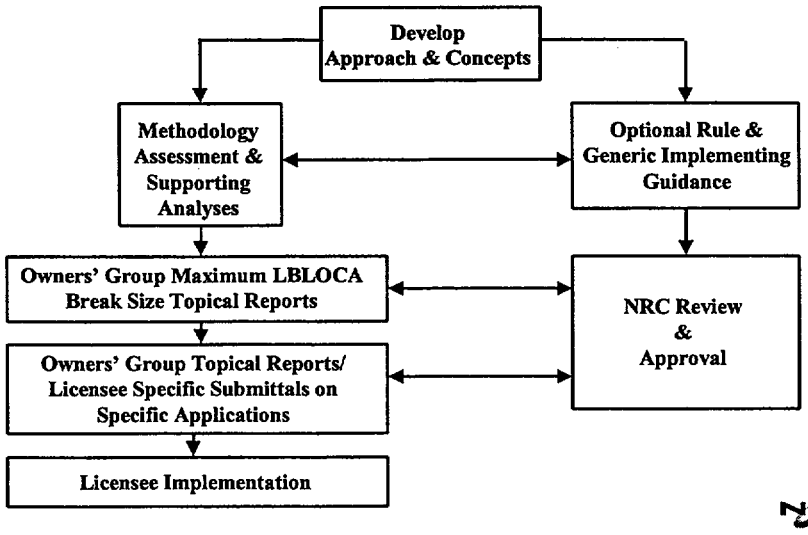
NEI

Industry LBLOCA Approach

- **Simple rule change to allow NRC to approve alternative break-sizes**
  - Specific break size not in the rule
  - Conforming changes to other regulations
- **Owners' group submittal to justify new break-size**
- **Owners' group specific application(s) submittals**
- **Licensee submittals**

NEI

LBLOCA REDEFINITION PROGRAM



Westinghouse Owners Group
Large Break (LB) LOCA Redefinition Program

ACRS
March 16, 2001

Westinghouse Owners Group
LBLOCA Redefinition Program

Presentation Overview

- Safety Benefits
- Program Approach
- Example Follow-on Activities
- Safety Margin
- Conclusions

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Safety Benefits

- Focus Resources on Activities of Greater Risk Significance
- Reduce Burden of Revising and Maintaining LBLOCA Design/Licensing Basis
- Consistency within the Regulations
- Consistency in Various Individual Analytical Applications
- Provides a More Realistic Basis for Design Evaluations
- Promotes Realistic Equipment Testing Requirements

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Program Approach

- Utilize Rule-making Based on SECY-98-300 Option 3
- Include Option of Retaining Current Licensing Basis
- Changes to 10 CFR Part 50
  - 50.46 Acceptance Criteria for ECCS
  - Appendix A GDC (LOCA definition)
  - Appendix K (I.C.1)
- Redefine the Licensing Basis LOCA
  - Maximum Size
  - Attendant Consequences
- Maintain an Acceptable Margin of Safety

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Program Approach (continued)

- Technical Justification
  - Use Risk-Informed Technology to Show Low Risk of LBLOCA
    - Utilize the Framework Contained in Regulatory Guide 1.174
  - Use Leak Before Break Analysis to Justify Break Size
    - Define New Maximum Break Size & Reanalyze, as Necessary, to Obtain Benefits

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Program Approach (continued)

- Leak Before Break (LBB)
  - GDC 4 Allows Application of LBB to High Energy Piping
  - LBB Approved to Eliminate Dynamic Effects (GDC 4) for Some Plants
    - Main Coolant Piping
    - Pressurizer Surge Piping
    - Accumulator Piping
    - RHR Piping
    - Main Coolant Bypass Piping

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Program Approach (continued)

- Extend Existing LBB Approvals to Other Applications
  - Extend Beyond Application to Dynamic Effects
    - No Changes to Existing Methodology Contained in NUREG-1061, Vol. 3 and Draft SRP 3.6.3
- Perform LBB on additional lines as needed to implement desired maximum LOCA size in plant licensing basis
- Perform scoping review to justify one maximum size LOCA for Westinghouse fleet of plants

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Program Approach (continued)

- Determine if any events previously bounded by LBLOCA must be analyzed following LOCA Redefinition

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Program Approach (continued)

- Following Rule Change, Plant Specific Change to Maximum LOCA Break Size in Licensing Basis Requires Submittal and NRC Approval
- Follow-up Plant Changes to Obtain Benefits
  - Plant will follow the appropriate change control process for licensing basis (e.g., §50.59, §50.92,...)
  - NRC Submittal will be made if Required by Change Control Processes

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Example Follow-on Activities

- Increase Diesel Generator Start Time
  (Enhance diesel reliability)
- Relax ECCS Flow Balancing Requirements
  (Increase ECCS effectiveness for more probable events)
- Decrease Number of Accumulators in Tech Specs (N-1) or Relax Accumulator Parameter Requirements (Boron, Pressure, Water Volume)
  (Reduce potential for unnecessary plant shutdowns and thermal transients)
- Relax Ultimate Heat Sink Requirements
  (Reduce potential for unnecessary plant shutdowns and thermal transients)
- Relax Containment Fan Cooler Requirements
- Power Uprate
- More realistic Emergency Procedures and Operator training

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Safety Margin

- Risk-Informed Approach Maintains the Defense-In-Depth Philosophy that Underlies the Safety Regulations (SECY-98-300)
- CDF and LERF Ensure Margins for Health and Safety of the Public
- Redefinition of LBLOCA, Retains LOCA as a DBE
- Other DBAs Continue to Maintain Adequate Margin
- Focus Resources on Activities of Greater Risk Significance

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LBLOCA Redefinition Program

Conclusions

- Maintains Acceptable Margin of Safety
- Single Approach to Reduce Burdens Imposed by an Unrealistic Event
  - Complementary to the 1987 GDC-4 Rule Change
  - Integrates Pursuit of Individual Applications in a Cohesive One Time Rule Change
- Consistent with Technological Advances/Knowledge
- Reduces both Staff and Industry Resources Associated with LBLOCA
- Increases Efficiency and Effectiveness
- LBLOCA Redefinition should be Pursued

Combustion Engineering Owners Group (CEOG)

Large Break (LB) LOCA Redefinition

Dave Bajumpaa
Millstone Nuclear Power Station

Large Break LOCA Redefinition

- GDC 4 Currently Allows for the Application of Leak Before Break Analyses to Eliminate Dynamic Effects Associated with LBLOCA
- CEOG Supports the Consistent Application of LBLOCA Redefinition throughout the 10CFR50 Regulations, Including:
  - » 10CFR50.46 and 10CFR50 Appendix K
    - – ECCS Performance Analyses
  - » 10CFR50 Appendix A General Design Criteria
    - – Containment Related Analyses

Large Break LOCA Redefinition

- NEI and WOG Presentations Identified the Safety Benefits and Programmatic Approach for Large Break LOCA Redefinition.
- The CEOG Approach to Redefine LBLOCA would be similar to the WOG Approach:
  - » Using risk informed technology to show low risk of LBLOCA
  - » Using leak before break analyses to justify a maximum break size
  - » Continue to analyze LOCAs up to this maximum break size

Large Break LOCA Redefinition

- Two Major Applications for the Extension of LBLOCA Redefinition :
  - » 10CFR50.46 ECCS Performance Analyses
    - – LOCA analysis performed to demonstrate compliance with the 10CFR50.46 limits
  - » Containment Related Analyses:
    - – Increased analytical margin to several containment related design limits

Containment Related LOCA Design Limits

- Peak Containment Pressure
- Inside Containment EQ Temperature Profile
- ECCS/Containment Spray Pump Room Temperature Profile.
- Closed Cooling Water Inlet and Outlet Temperatures at the Containment Air Recirculation Coolers, and Shutdown Cooling and Spent Fuel Pool Cooling Heat Exchangers.
- GL 96-06 Evaluations of the CAR Coolers
- Service Water Discharge Temperature
- Sub-Compartment Pressure Analyses
- Debris Generation/Transport for Sump Design Verification

Application of LBLOCA Redefinition - Containment Related LOCA Design Limits

- Analytical margin to these design limits are generally small
- Changes to these design limits are costly
- Increased analytical margin to these design limits proves useful to accommodate unforeseen plant problems, and reduces complexity and frequency of re-analyses
- Limiting maximum break size by LBLOCA redefinition expected to increase analytical margin to containment design pressure by approximately 10%

LOCA Redefinition - Examples of Containment-Related Benefits

- Peak Containment Pressure - Typical Large Dry Containment
  - » Containment design pressure - 54 psig
  - » Peak calculated containment pressure following a LOCA - 52.9 psig
  - » Peak calculated containment pressure following a main steam line break 53.8 psig
  - » Plant is main steam line break limited
    - – While not a direct benefit, increased LOCA containment pressure margin simplifies evaluation of various plant changes

LOCA Redefinition - Examples of Containment-Related Benefits

- Inside Containment EQ Temperature Profile
  - » Increased analytical margin between the calculated post accident containment temperature profile and the EQ test envelope of equipment inside containment
- ECCS/Containment Spray Pump Room EQ Temperature Profile.
  - » Reduction in calculated post accident Closed Cooling Water (CCW) temperature profile. Reduced CCW temperature profile reduces post-accident room temperature. Increased analytical margin between the calculated post-accident room temperature and EQ test envelope of equipment in the room.
- CCW Temperature Limits
  - » Increased analytical between the post accident calculated temperatures and the design limits in the Containment Air Recirculation Coolers.

LOCA Redefinition - Examples of Containment-Related Benefits

- Potential Uses of Increased Analytical Margin to Design Limits
  - » Relax CCW flow limits through containment air recirculation coolers, shutdown cooling and spent fuel pool cooling heat exchangers
  - » Greater tube plugging limits
    - – CCW to service water heat exchanger
    - – Shutdown cooling heat exchanger
    - – Containment air recirculation cooling units
  - » Increased ultimate heat sink temperature limit
  - » Accommodate power uprates

LOCA Redefinition - Examples of Containment-Related Benefits

- Additional Potential Uses of Increased Margin to Design Limits
  - » Margin to accommodate unforeseen problems without revising design limits
    - – Examples of recent changes to LOCA containment pressure analyses at an existing plant
      - Increased safety injection pump flow
      - Increased spent fuel pool cooling heat loads
      - More detailed containment air cooling modeling including CCW and service water feedbacks
      - Increased containment spray header fill time
      - Increased containment paint thickness
      - Increased refueling water storage tank temperature

Consistent Application of Large Break LOCA Redefinition to 10CFR50

- Allows Optimization of Potential Safety Benefits
  - » e.g., increase Emergency Diesel Generator (EDG) start time to enhance diesel reliability
    - – Impacted by ECCS analyses (increased ECCS pump start time) and containment analyses (containment spray, CCW and containment air recirculation cooler start time)
    - – Benefit of relaxed EDG start time may not realized if LOCA redefinition limited to ECCS performance area.
      - » Subtle containment related impact - increased time to restart CCW pumps has the potential to increase water hammer loading beyond limits (Generic Letter 96-06 issue)

Large Break LOCA Redefinition - Summary

- CEOG Supports the Consistent Application of LBLOCA Redefinition throughout the 10CFR50 Regulations, Including:
  - » 10CFR50.46 and 10CFR50 Appendix K
    - – ECCS Performance Analyses
  - » 10CFR50 Appendix A General Design Criteria
    - – Containment Related Analyses

Potential Impact from LBLOCA Redefinition

- Emergency Diesel Generators
- Systems inspection & testing
- Piping & piping support inspections
- Containment heat removal
- Debris
- Maintaining coolable fuel geometry & improving fuel design
- RCS & Core Internals analyses
- Ultimate Heat Sink Capacity
- Electrical coordination & sequencing
- Coolant injection requirements (timing and flow)
- Reactivity insertion events
- Technical specifications
- Safety analyses
- Power uprates
- More realistic treatment of emergent issues

NEI

Risk-Informing 10 CFR 50.46

Presented to
Advisory Committee on Reactor Safeguards

Presented by
Tom King, Mike Mayfield, Mary Drouin,
Alan Kuritzky and Carolyn Fairbanks
U.S. Nuclear Regulatory Commission

March 16, 2001

Purpose/Goal of Meeting

- Provide status report on staff's efforts to risk-inform 10 CFR 50.46
- Solicit feedback and comments from ACRS:
  - Options
  - Implementation issues
  - Feasibility
- No letter requested

Staff Approach for Risk-Informing 10 CFR Part 50

Review/Prioritize All of Part 50

For candidate regulation or DBA prioritized high:

- Identify potentially feasible risk-informed options
- Recommend a feasible risk-informed alternative to Commission consistent with the Strategic Plan Performance Goals and the guidelines from the Option 3 framework
- For recommendations approved by Commission, proceed to rulemaking/detailed technical study

Status

- 10 CFR 50.46 and Large break LOCA (LBLOCA) – Identifying potentially feasible risk-informed options
- Consideration of industry and public views:
  - Public workshops (February and October 2000)
  - Public meetings (Mar., May, July, Nov. 2000; Jan. 2001)

Schedule/Milestones

- Public meeting (April/May)
- ACRS subcommittee meeting (May)
- Draft SECY paper to ACRS (mid-May)
- ACRS full committee meeting (early-June) [letter]
- SECY paper to Commission (June 29)
  - Preliminary recommendations on the feasibility of risk-informed changes to 10 CFR 50.46 and feasibility of redefining the LBLOCA
  - Plan and schedule for completion of work on 50.46

Overview of Risk-Informed Options

- Risk-informing LBLOCA definition
- Risk-informing the technical requirements associated with 10 CFR 50.46 and associated implementing documents
- Near term vs. longer term changes

Risk-Informed Options: LBLOCA Redefinition

- Redefine LBLOCA by plant based on leak-before-break (LBB) and probabilistic fracture mechanics (PFM) analyses
- Exclude low risk LBLOCAs by plant type
- Exclude LBLOCAs for plants with small risk increments associated with plant changes

Suggested Redefinition of LBLOCA

- Estimates of LBLOCA frequency should address
  - Service Experience
  - Analysis to predict piping failure frequency
  - Other failures where large break is surrogate
- Prior analyses addressing piping failure frequency not sufficiently rigorous basis for change to 50.46
  - 1986 change to GDC-4
  - RI-ISI programs
- Analysis at least as rigorous as PTS

Service Experience

- Prior staff study (NUREG/CR-5750) estimated LBLOCA
  - PWRs – 5E-06/critical-year with 90% confidence interval of (1E-07 to 1E-05/critical year)
- Recent experience at V.C. Summer
  - Best Estimate is 7E-06/critical-year
  - Within band of NUREG/CR-5750 study
  - Believed to be conservative estimate

Prior Applications of Pipe Fracture Analysis and LBB

- 1986 GDC-4 change
  - LBB accepted for eliminating dynamic effects from postulated pipe fracture
    - Removal, or relief from, pipe whip restraints and jet impingement shields
- Break Opening Time Relaxed for Baffel Bolt Analyses
- Risk-Informed Changes to ISI Program
- Resolution of GSI-190 on Environmental Effects on Fatigue

Prior Applications of Pipe Fracture Analysis and LBB

- Traits of Prior Applications
  - Analyses have both probabilistic and deterministic aspects
  - Defense in Depth not challenged
    - Still covered by LBLOCA and 50.46 requirements
  - Supplemental Analyses and Information
    - RI-ISI supported by quantitative and qualitative approaches – similar results
- Prior analyses not as rigorous as analyses supporting rule changes today

Analytical Treatment Premise

- Analysis rigor should be consistent with current effort on PTS rule reevaluation
  - Transients
  - T-H response
  - Material Properties
  - Degradation Mechanisms
  - Flaw Distributions
  - Uncertainty Analyses

Probabilistic Fracture Mechanics (PFM) Considerations

Main elements of PFM analysis

- Analyses
  - Initiation of subcritical crack
  - Subcritical crack growth
  - Leak-rate detection under normal operating loads
  - Fracture under upset loads

Probabilistic Fracture Mechanics (PFM) Considerations

Main elements of PFM analysis

- Input and variables
  - Material property input (environmental/fatigue; toughness; aging and loading rate effect; weld repair history)
  - Crack morphology by cracking mechanism
  - Loads (normal and transient)
  - Flaw distributions and orientations

Probabilistic Fracture Mechanics (PFM) Considerations

Initiation of subcritical crack and subcritical crack growth analyses

- Handle current and as-yet-unknown mechanisms. Some cases previously not thought likely;
  - IGSCC in TP304 stainless steel (BWRs)
  - Corrosion fatigue of feedwater lines
  - Flow accelerated corrosion (erosion/corrosion)
  - IGSCC of Ti stabilized stainless steel (Germany)
  - PWSCC of Inconel 182/82 welds (Summer, Ringhals, and Krsko)

Probabilistic Fracture Mechanics (PFM) Considerations

Leak-Rate Analyses

- Factors that affect crack-opening displacements, i.e.,
  - **Residual stresses** (depends on distribution and relative magnitude compared to normal operating loads)
  - **Pipe-system boundary conditions** (restraint of pipe rotation for pressure-induced and other axial loads)
  - **Other than circumferential through-wall cracks in straight pipe,** i.e., axial cracks in welds, cracks in elbows, etc.
  - **Crack-face pressure,** conservatively ignored in past
  - **Real cracks may not be centered on the bending plane**
- Factors that affect thermal hydraulic analyses, i.e.,
  - **Roughness and number of turns**

Probabilistic Fracture Mechanics (PFM) Considerations

Fracture Analyses

- Use EPFM rather than limit load (PRAISE/SRRA)
- LBB analyses assume idealized through-wall circumferential crack in straight pipe
  - What if subcritical cracking causes long surface flaws?
  - Cracks in elbows or pipe fittings
  - SSE rate effects on material properties (DSA)
- Primary and secondary stresses combination affects on margins
- Bending plane different for normal and SSE loading?

Probabilistic Fracture Mechanics (PFM) Considerations

Material property input

- Environmental/fatigue crack initiation variability
  - Impact of Section XI allowable fabrication flaws on Section III Fatigue Design Curves
- Rate of subcritical crack growth
- Strength variability
- Toughness
  - Base metal, welds, fusion lines
  - Seismic loading rates lower toughness of most carbon steels (dynamic strain aging)
  - Thermal aging of cast stainless and stainless weld metals

Probabilistic Fracture Mechanics (PFM) Considerations

Loads

- Normal operating
  - Pressure, dead-weight, and thermal expansion
  - Combining bending and torsional loads
  - Residual stress (including repairs)
  - Fabrication
  - Thermal transients
- Upset (seismic, thermal transient, or water hammer)
  - Include probability of variable SSE levels, i.e., beyond-design-basis-earthquakes
  - Seismic anchor motion
  - Thermal transients may be worse than SSE loading in surge lines
- Design basis versus actual

Probabilistic Fracture Mechanics (PFM) Considerations

- **Initial flaw distributions**
  - Pre-service inspection allowable flaws (undocumented?)
  - Multiple flaws (typically ignored in PFM analysis)
  - Locations (in pipe or fitting)
  - Orientation (axial or circumferential, circumferential position relative to bending plane)

Other Sources of 'Large Break'

- Manway bolting failure
- Large valve bonnet bolting failure – valve body cracking?
- Indirect sources of pipe failure – moving heavy loads inside containment during power operations

Summary: LBLOCA Redefinition

- Service Data alone do not appear to support eliminating LBLOCA without further evaluation
  - Data or data with limited analysis may be sufficient to support other changes
- Probabilistic analyses to support eliminating LBLOCA would have to be significantly more rigorous than previous applications
- Active degradation of piping is not only consideration
  - Analyses would have to address other breaks and other causes, and weld repair history

Risk-Informed Options: Technical Requirements Related to 10 CFR 50.46

- Delete loss of offsite power (LOOP) consideration for some or all LBLOCAs
- Exclude highly unlikely combinations of LBLOCA initiators and single failures
- Replace conservatisms in Appendix K with more realistic models/assumptions
- Propagate uncertainty in break size and location
- Improve efficiency of best-estimate ECCS performance analyses and reviews
- Allow NRC-approved uncertainty increments to be used in best-estimate ECCS performance analyses
- Modify ECCS acceptance criteria

Potential Near Term Risk-Informed Changes Related to 10 CFR 50.46

- Change design basis LBLOCA-LOOP assumptions (GDCs 17, 34, 35, 38, 41 and 44)
- Change single failure assumptions (GDCs 17, 21, 34, 35, 38, 41 and 44)
- Reduce decay heat conservatism in Appendix K
- Consider enhancements based upon risk insights

Benefits of Near Term Risk-Informed Changes Related to 10 CFR 50.46

- Maintain safety
  - Improvement in emergency AC system reliability/ availability (reduction in fast start and loading of diesel generators)
  - Key elements of defense-in-depth maintained and no significant decrease in safety system reliability
- Make NRC activities and decision-making more effective, efficient and realistic
  - More realistic assumptions for postulated DBAs
  - More realistic Appendix K models/assumptions

Benefits of Near Term Risk-Informed Changes Related to 10 CFR 50.46 (Continued)

- Reduce unnecessary regulatory burden
  - Extension of DG start and loading time
  - Relaxation of some AOTs
  - Removal of equipment from Tech. Specs. (e.g., one accumulator)
  - Additional analytic margin for plants that are Appendix K limited

Implementation Issues

- Identification of the LBLOCA size where the LOOP and single failure assumptions no longer need be applied
- Plant-specific analysis (due to wide range of grid capability and plant design and procedures) to determine conditional LOOP probability, in order to change LOCA-LOOP assumption
- Development of a risk-informed replacement for the single failure criterion (e.g., combined initiator frequency and system reliability threshold)

Implementation Issues (Continued)

- Utilize performance-based approach, where possible
- Delayed LOOP
  - Double-sequencing
  - Degraded voltage
- Impact on other modes of operation and potential accidents

Potential Longer Term Risk-Informed Changes to 10 CFR 50.46

- Redefine LBLOCA
  - Continue to work with industry on scope/depth of work required
- Replacement of 2200°F PCT/17% oxidation/ cladding specification with more general criteria
- Propagation of pipe break size frequency distribution into best estimate analysis
- ECCS availability for shutdown
- Multiple SGTR DBA

Conclusions

- Staff proceeding to evaluate feasibility of risk-informed changes to 10 CFR 50.46 and LBLOCA
  - Near term
  - Longer term
- Will provide recommendations to Commission in June on the feasibility of near term potential changes

BWR Owners Group
Risk-Informed Part 50
Option 3 Program

Terry Rieck

ACRS

March 16, 2001

BWROG Risk-Informed Part 50 Option 3 Program

BWROG Technical Committee Position

- Agree that Redefining the LBLOCA should be the highest priority
- LBLOCA Redefinition comparison to PWR approach:
  - Safety benefits similar
  - More BWR LBLOCA margin
  - BWROG may need to perform additional analyses so implementation cost may be greater or alternative pipe break size may be larger
- Option 3 Framework refinement through LBLOCA redefinition will provide for better cost/benefit analysis for other Option 3 activities
- Other potential Option 3 activities are being prioritized

BWROG Risk-Informed Regulation
Option 3 Program

LBLOCA Redefinition Activities

- Refine safety benefits and burden reduction
- Assess approaches
- Perform cost/benefit analysis

Other Option 3 Activities

- Perform assessment (safety and cost/benefit analyses) on other potential Option 3 programs

March 16, 2001