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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMITTEE

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

MEETING OF THE

MATERIALS AND METALLURGY

THERMAL HYDRAULIC PHENOMENA

and

RELIABILITY AND PROBABILISTIC RISK ASSESSMENT

SUBCOMMITTEES

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FRIDAY

MAY 31, 2002

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ROCKVILLE, MARYLAND

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The Subcommittees met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., William J. Shack, Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

WILLIAM J. SHACK, Chairman

GEORGE E. APOSTOLAKIS

VICTOR H. RANSON

SUBCOMMITTEE MEMBERS PRESENT (cont.):

F. PETER FORD

STEPHEN L. ROSEN

AUGUST W. CRONENBERG

JOHN D. SIEBER

THOMAS S. KRESS

GRAHAM M. LEITCH

GRAHAM B. WALLIS

MARIO V. BONACA

NRC STAFF AND CONSULTANTS PRESENT:

VIRGIL SCHROCK

PAUL A. BOCHNERT

SANJOY BANERJEE

OTHER NRC MEMBERS PRESENT:

MARK CUNNINGHAM

MARY DROUIN

ALAN KURITZKY

ROB TREGONING

STEVE BAJOREK

NORM LAUBEN

SAM LEE

CHRIS GRIMES

NILESH CHOKSHI

MIKE MAYFIELD

HAROLD SCOTT

OTHER NRC MEMBERS PRESENT (cont.):

JACK E. ROSENTHAL

RALPH CARUSO

C O N T E N T S

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

(8:30 a.m.)

CHAIRMAN STACK: On the record. The meeting will now come to order. This is a meeting of the ACRS Subcommittees on Materials and Metallurgy, Thermal-Hydraulics and Reliability and PRA. I am Dr. William Shack, Chairman of the Subcommittee on Materials and Metallurgy. Dr. Graham Wallis and Dr. George Apostolakis are my co-chairmen for today's meeting. The rest of the ACRS members join us today except for Dr. Powers.

The purpose of this meeting is to discuss the status of the staff efforts and industry initiatives of risk-informing 10 CFR 50.46 concerning emergency core cooling systems for reactors. Gus Cronenberg is the cognizant ACRS staff engineer for this meeting. Mr. Paul Boehnert is the designated federal official.

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 May 13, 2002. A transcript of this meeting is being kept in the open portions. This transcript 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 that they can be readily heard. We have received no written comments or request for time to make oral statements from members of the public. We will now proceed with the meeting. I call upon Mr. Mark Cunningham of research to begin the presentation.

MR. CUNNINGHAM: Thank you, sir. Good morning. We are here today. We have a large cast of characters to talk to you about, a variety of technical subjects related to possible changes to 10 CFR 50.46 ECCS requirements.

I'm going to talk a bit about some of our goals for the meeting and where we are in terms of the status of the work. We're going to have then a series of presentations on possible changes to 50.46 and the technical work that we've been doing to support, to underpin such possible changes. More specifically Alan and Mary will talk about possible changes to the reliability requirement aspects of 50.46.

Rob and Lee will talk about issues related to the frequency of losses of coolant which is an important contributing issue to all of the possible reassessments of 50.46. Then Steve and Norm will talk about possible changes to the acceptance criteria and

the evaluation model. At the end of the day, we'll also have some NRR staff talking about rule-making activities that are related to these possible changes in 50.46.

In terms of purposes of the meeting, we're here to provide you with a status report on the technical work that we've been performing related to 50.46 changes. We're interested in getting feedback from the Committee and comments on the particular technical work that we've been doing. At this point, we're not requesting a letter from the Committee.

In terms of status, I'll have you recall that option three when we investigate possible rule changes in option three, we really have three phases to our work. Those phases aren't necessarily sequential.

The first phase is looking at the feasibility of changes. Over the last few years, we've been looking across all of Part 50 to identify what seemed to be potentially important changes to Part 50. The first of these we identified a few years ago. They were changes to 50.44 on hydrogen control requirements. That's moved on to the point that we're having a proposed rule. It's near to being issued, I believe with respect to making some changes to 50.44.

Our next subject if you will within Part 50 was 50.46. In July of last year, we wrote in SECY-01-0133 that we concluded that it was feasible to make some specific changes to 50.46 and related regulatory documents. In particular, we thought we could change the ECCS reliability requirements. We thought we could change the acceptance criteria, and we could change the evaluation model.

We also suggested and recommended in that commission paper that another longer term change might be recharacterization or redefinition of the design basis large-break LOCA. We're still considering the feasibility of that change, but you will hear about some of the work on that today as well.

Since July of last year, we've been spending most of our time performing technical work that would provide more substance to justify rule changes. Again, we've been looking at reliability requirements, acceptance criteria, and evaluation models. In April of this year, we provided to rule making folks an interim product in terms of technical work that we've done with respect to plant specifics, the potential of changing the reliability requirements of GDC 35 to reflect a more plant specific reliability approach. You'll hear more about that later.

While we've been doing the technical work, other folks in the staff have been working on trying to decide how you would make the rule changes that would implement this technical work. We're at the phase now where we're focusing. In a sense, we're making the transition that over the next few months we'll be ramping down in terms of technical work and we'll be ramping up in terms of looking at specific rule changes.

MEMBER KRESS: So you're using George Apostolakis's concept of the darker the color, the more intense the activity is on that.

MR. CUNNINGHAM: Well, I thought about starting this by discussion of bright lines and fuzzy lines and colors and things like that. So, yes. The darkness of the colors suggest the concentration of activity if you will. Unfortunately some of the lines are brighter than I would have liked them to be.

In particular, there's a bright line at the end of July '02 for technical work. The technical work does not end in July '02. We have a particular deliverable then. We will still continue to provide support to the rule making people, but the concept is over the next few months we're going to be transitioning out of being principally oriented

towards technical work to our principal focus being specific rule changes.

MEMBER WALLIS: You're going convince us that you've done enough technical work so that you understand enough to be able to make the rule.

MR. CUNNINGHAM: Yes. That's part of what we have to do. We have to convince a variety of stakeholders that we have a sufficient technical basis to make the rule change. Yes, sir.

What you'll hear today is we're trying to make the case that we have a technical basis to change some rules. In July, we will be delivering, in a sense making a key transition point from technical work being done on the reliability requirements, acceptance criteria, and evaluation model requirements. We're going to be delivering a technical product to the people who do rule making for them to start more seriously thinking about how we would make the rule changes.

You're not going to hear today about specific plans for when we'll have rule making on this or when we'll have rule making on that. That's a little ways down the road yet. The focus today was intended to be the technical basis for possible changes. So as Dr. Wallis said, we need to have a

convincing argument that we have a basis to make the changes. Today is a piece of trying to convince you and get the feedback from you that we have a basis to make these changes.

In a nutshell, that's where we are at the moment. If there's no general questions, I'm going to turn it over to a discussion. These two folks are going to talk about an overview of 50.46 and then talk more specifically about reliability requirement changes.

MS. DROUIN: My name is Mary Drouin. Office of Research. This particular figure you've seen I believe several times before. What it shows is how we have in essence unbundled 50.46. We use the term 50.46 to always include Appendix K and GDC 35. These are the related regulations to the ECCS.

MEMBER KRESS: Could I ask you an aside question about your first box there? Appendix K and GDC, does it specifically say that it's for an LWR with ECCS?

MS. DROUIN: Yes. It does. The words on this slide particularly when you look at this box and when you look at the four here are lifted right out of Part 50. (Indicating.)

MEMBER KRESS: Could I interpret that to

mean for other design concepts that may not necessarily have to have an ECCS? You don't want to go there.

MS. DROUIN: I don't want to go there.

MEMBER WALLIS: Of course, that box on the right on the bottom talks about breaks in pipes.

MS. DROUIN: Yes. It does.

MEMBER WALLIS: Do you have some evidence that other types of breaks are possible?

MS. DROUIN: That is accurate. That will be covered later on in today's presentation. When you look at this there are four what we call topical technical areas to ECCS to 50.46. The first one looks at what we call the ECCS reliability. When you look at it, 50.46 and the associated GDC 35 when you read it, it talks about the simultaneous loss of off-site power with the LOCA and a single failure criterion. What those do is in essence tell you what the reliability in an indirect fashion with the reliability of the ECCS needs to be.

The next break that we have is on the ECCS acceptance criteria. When you look at 50.46, there are five very specific prescriptive requirements that are provided for the performance. The next part is on the evaluation model. That is both encompassing 50.46

and also Appendix K. In evaluation model when you look at these requirements, they are allowing two models to be used. You can use the realistic or you can use what is applied in Appendix K.

MEMBER APOSTOLAKIS: Mary, how does the third box differ from the first, the evaluation model and reliability?

MS. DROUIN: The first box is telling you that in your evaluation, you need to assume a simultaneous loss.

MEMBER APOSTOLAKIS: Okay. But you are using the evaluation model with the third.

MS. DROUIN: Yes.

MR. CUNNINGHAM: The first box feeds into the third.

MEMBER APOSTOLAKIS: The other way actually.

MR. CUNNINGHAM: Well.

MEMBER APOSTOLAKIS: The first one defines the conditions as Mary said by losing power and all that. You are using the acceptance criteria from the second box.

MS. DROUIN: Right.

MEMBER APOSTOLAKIS: You are using the model from the third to evaluate reliability.

MS. DROUIN: Correct.

MEMBER APOSTOLAKIS: You are doing all that assuming some LOCA size from the fourth box.

MR. CUNNINGHAM: Yes. The third box isn't really getting at reliability in a quantitative sense. It's functional success or not. Will you meet the 2200 degrees?

MEMBER APOSTOLAKIS: But it says "realistic including assessment of uncertainties."

MEMBER KRESS: If it's --

MEMBER APOSTOLAKIS: You are still -- reliability.

MR. KRESS: If it's the best estimate, you have to have the uncertainties.

MEMBER APOSTOLAKIS: Yes, but you are evaluating --

MR. CUNNINGHAM: It's those uncertainties they're talking about in that box; the thermal, the hydraulic.

MEMBER KRESS: The rule actually says you have to be 95 percent confident in your calculation of the peak plan.

MEMBER APOSTOLAKIS: If I calculate with an evaluation model the temperature and I have the uncertainties --

MEMBER KRESS: You have to use the 95 --

MEMBER APOSTOLAKIS: Is the probability that the temperature will be less than 2200 degrees the reliability of the system?

MEMBER KRESS: No, by no means.

MEMBER APOSTOLAKIS: Why isn't it?

MR. CUNNINGHAM: There's an additional piece which is the equipment you have in order to accomplish that function has to have a certain availability.

MEMBER APOSTOLAKIS: And that's not part of the evaluation. The evaluation is only a piece of it.

MR. CUNNINGHAM: Correct. It assumes it's there working.

MEMBER KRESS: Yes.

MR. CUNNINGHAM: It's your ability to calculate. It's not just reliability.

MEMBER APOSTOLAKIS: But if I want to do the first box, I will need the reliability of various components and then given this configuration, I will need the third box to do the calculation.

MR. CUNNINGHAM: Yes. The way the first box is today --

MEMBER APOSTOLAKIS: It's a piece of it.

MR. CUNNINGHAM: Yes. Today in the current GDC 35 as we'll get into, the reliability is prescribed by a certain set of characteristics 25 or 30 years ago was a way to attempt to accomplish a highly available system in terms of reliability. We're saying today we can accomplish that function without having to be so prescriptive about it.

MEMBER APOSTOLAKIS: Okay. So in the calculation as you were saying, most of the boundary conditions were predetermined.

MR. CUNNINGHAM: Yes.

MEMBER APOSTOLAKIS: Okay. Now when we say reliability in the first box, is that the rational man's definition or the nuclear industry's definition?

MR. CUNNINGHAM: The reliability there is the assumption that you'll have a high probability that the equipment will work such that the acceptance criteria are met.

MEMBER APOSTOLAKIS: But is it for a period of time or just at an instant when the LOCA occurs?

MR. CUNNINGHAM: It is in this case I guess it's --

PARTICIPANT: Mission time of the PRA.

MR. CUNNINGHAM: Yes.

MEMBER APOSTOLAKIS: -- the mission time? Or is it just I have a LOCA?

MR. CUNNINGHAM: Let's wait a little bit because we're going to go back and look at the specific words in GDC 35 and that may help you. But it's given a loss of coolant is the way I think of it. You have to have a set of equipment that would be highly likely to function successfully.

MEMBER APOSTOLAKIS: For a period of time?

MR. CUNNINGHAM: For a period of time.

MEMBER APOSTOLAKIS: Okay. So it's the standard reliability definition.

CHAIRMAN STACK: Except that the rule doesn't say that today. That's the way you're interpreting the requirements.

MS. DROUIN: That's correct.

MR. CUNNINGHAM: Yes. That's correct.

MS. DROUIN: When you actually look at the words of GDC 35 --

MR. CUNNINGHAM: That's a very stylized way of accomplishing that.

CHAIRMAN STACK: You'll never see that.

MS. DROUIN: You'll never see for a period of time.

MEMBER BONACA: Although the notices on

the dockets have to put them all straight; that you can continue to cool and to support and to get the circulation. That is accepted.

MR. CUNNINGHAM: The concept is there.

MS. DROUIN: Yes.

MR. CUNNINGHAM: Again, it's a very prescriptive way of accomplishing that goal. We're trying to become less prescriptive.

MEMBER APOSTOLAKIS: Now, the reliability is a probability. Right? Is that what the existing rule requires or is it just functional requirements?

MS. DROUIN: It's just the functional requirements.

MEMBER APOSTOLAKIS: That imply a certain reliability.

MS. DROUIN: It implies it.

MEMBER APOSTOLAKIS: But now you're actually calculating it.

MS. DROUIN: Correct. What's in this box, this is the actual requirement right now.

MEMBER APOSTOLAKIS: Okay.

MS. DROUIN: That you meet this function by assuming, by meeting the very prescriptive things.

MEMBER APOSTOLAKIS: Right.

MS. DROUIN: By meeting those, then you

have indirectly set what the reliability is.

MEMBER APOSTOLAKIS: That's right.

MR. CUNNINGHAM: And our goal is to change the way that reliability analysis is done.

MEMBER APOSTOLAKIS: To actually quantify it and then go back and see whether these make sense.

MR. CUNNINGHAM: Yes.

MEMBER KRESS: In order to do that, you have to have some risk acceptance level for the set of LOCAs --

MR. CUNNINGHAM: We're going to get into that. It's for the set of challenges to the ECCS.

MEMBER KRESS: Set of challenges.

MR. CUNNINGHAM: It's well beyond LOCAs.

MEMBER APOSTOLAKIS: Very good.

MEMBER KRESS: Then you're going to tell us what that criteria is.

MS. DROUIN: We're going to get into a lot of detail on this.

MEMBER APOSTOLAKIS: We don't want you to think we're not going to let you.

MEMBER WALLIS: George, I think we need you on the Thermal-Hydraulic Subcommittee. You can ask about reliability of codes and the probability that they're giving the right answer.

MEMBER APOSTOLAKIS: Why? You can't ask them yourself.

MS. DROUIN: Before we get into the --

MR. KELLY: This is Glen Kelly from the staff. Could I just address something about the previous discussion? In discussing GDC 35 and the way it's written, that doesn't really deal directly with reliability. It was a way when we put together the regulations prescriptively describing a capability that we wanted a plant to have. There's not directly discussed the reliability of the equipment itself.

It talks about just design features that you want the plan to have. What we're thinking about in the proposed possibility for changes to 50.46 is that we can look at what that design represents in PRA space and see whether today those requirements make as much sense as we thought they did back when we initially did it. We're looking to see whether there are other reliability requirements that we could look at the design and say if your design meets these following reliability requirements, then that's good enough for handling of various size LOCAs and other events.

But GDC 35 itself is not directly a reliability -- It doesn't say anything about

reliability. It does assure you about the design itself.

MEMBER WALLIS: It's even more appropriate that the codes must have momentum equations. But how reliable are they?

MEMBER APOSTOLAKIS: The equations themselves?

MEMBER WALLIS: Yes. They have to function just like a piece of equipment.

MEMBER APOSTOLAKIS: (Inaudible.)

MEMBER WALLIS: Yes.

MEMBER APOSTOLAKIS: Because the conservation of momentum is to some degree --

MEMBER WALLIS: Free to relax.

MEMBER APOSTOLAKIS: Maybe we can go on now.

MS. DROUIN: I just want to quickly recap at a high level what we had recommended in SECY 133 and he subsequent SECY 57. In terms of the ECCS reliability and looking at GDC 35, what we are talking about doing here is to come up with as we said a different way of looking at the reliability such that we can ensure the ECCS safety function reliability such that it's commensurate with the frequency of challenge to the ECCS safety function. In other

words, we would demonstrate a reliable ECCS safety function without assuming the LOCA loop and without assuming the single additional failure criteria. So that's what we're talking about here. We're going to get into details of what we mean by that in a few minutes.

MEMBER APOSTOLAKIS: I think Dr. Kress asked a similar question earlier. Wouldn't all this assume that you have some sort of idea as to what is an acceptable ECCS reliability?

MEMBER KRESS: Yes.

MS. DROUIN: Say this again. One more time.

MEMBER APOSTOLAKIS: You would need some target for ECCS reliability which right now is not in the books.

MEMBER KRESS: Yes.

MS. DROUIN: That is correct. We're going to get into that.

MEMBER KRESS: A different way to say it is you need an acceptable risk for those challenges. It has a function of the frequency I think you just said.

MS. DROUIN: Correct.

MEMBER KRESS: Okay. That would be --

MEMBER APOSTOLAKIS: Essentially we're allocating the goal.

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: So far we've been talking about the --

MEMBER KRESS: We're allocating the goal two ways. One is by those challenges to ECCS. The other is by the frequency of those challenges.

MEMBER APOSTOLAKIS: Yes.

MS. DROUIN: We're going to get into our guidelines, our criteria, what we propose. The next part is on the acceptance criteria. Again if you look at 50.46 they're very prescriptive. There's five very prescriptive materials. What we are proposing is to add a performance based option such that basically you'd be ensuring that the core remains amenable to cooling. This would allow the use of other cladding material without going through for example -- allow the use of there being a --

On the evaluation model which right now you can either use your best estimate or Appendix K, what we had recommended here was revising some of these requirements to be more realistic. Specifically we're talking about allowing the use of the 1994 ANS standard in place of the I believe the 1974 is what's

in there.

The last one as Mark indicated is on a much longer track. That's redefining the maximum pipe break size. We're continuing with the work. There has been some work accomplished. It's not like it's not being done. But there is some work. We're going to be also speaking to that in more detail.

MR. CUNNINGHAM: Mary, you didn't address the second sub-bullet under the first group there.

MS. DROUIN: Oh, sorry. When you look at Appendix K particularly there's a lot of uncertainty and conservatism. Those are going to be dealt with on a separate track. That will also be discussed in today's presentation.

MEMBER APOSTOLAKIS: And it will include model uncertainty.

MS. DROUIN: Yes.

MR. SCHROCK: Excuse me. Could you clarify the first bullet there? Is your point that none of the reg guides or regulations mentioned the 1994 ANS standard currently even though the reg guide accompanying rule change I think 88 says that the '78 standard is permitted? It doesn't say it's required. It says it's permitted.

So what is it that you're proposing here

to change? Do you want to have the '94 standard blessed as being suitable in place of the '78 via the reg guide statement that it is acceptable or are you looking for some other way of using the '94 standard to replace the '71, '73 standard? I think it's the latter. Isn't it?

MS. DROUIN: I'm going to put your question on hold. We are going to get into a very detailed presentation on this. Instead of trying to answer it right now, I would prefer to wait until we get to that part of the presentations.

MR. SCHROCK: Yes. But I think in the context of an overview, it ought to be a little more clear as to what it is you're attempting to accomplish.

MR. KURITZKY: The key here is that this change is for Appendix K. In other words, the 88 was for the best estimate, which was in the Guide 1.1587 gave us guides for doing the best estimate analysis which refers to the later ANS standard. Appendix K specifically states the '71 standard. What this is doing is a change to Appendix K. So if you're doing the Appendix K option, you can use the '94 standard. This is specifically for Appendix K.

MR. SCHROCK: Okay.

MEMBER BONACA: We had a presentation some time ago where some of the concerns were presented. Some of the concerns that were indicated were a -- setting for subcool boiling. So you'll talk about that at some point.

MS. DROUIN: Those were mentioned as possibilities. We were not definitive in they would be done. That will be covered also.

MEMBER BONACA: Okay.

MEMBER WALLIS: I don't see how you permit use of three different standards and you predict three different big clad temperatures. What do you do then? Pick the one you want?

PARTICIPANT: It's an average.

MR. KURITZKY: We need all the details on that.

MEMBER APOSTOLAKIS: On slide seven you said that you would "provide two voluntary performance-based options." Then there is a bullet on the ECCS evaluation model. The whole idea of a performance-based regulation is not to prescribe how you demonstrate compliance. Is it because of the importance of this issue here that we want to actually approve the evaluation model? Why wouldn't they be free to demonstrate compliance any way they want?

Because it's too complicated? Too many assumptions and you want to know about them?

MR. CUNNINGHAM: At this point, I think it's the combination of the two things you said. It's a very complicated set of analyses and it's at the heart of the thermal-hydraulic calculations of things. We're not ready in operating reactor space to take that additional step.

MEMBER APOSTOLAKIS: That makes sense.

MS. DROUIN: There's not really much I'm going to talk about here, just to reiterate that we're going to go through in some detail the technical work that we're doing in each of these areas. We did send a report up in April on some initial work that we had done on the ECCS reliability. We have a milestone due in July as Mark noted that will I hate to use the word "complete" the ECCS reliability and the acceptance criteria and evaluation model. Those are due in July. Then the spectrum of breaks is a longer track frame.

We're now going to get into the details of each one of these of what we're doing with the technical work. We're going to start with the ECCS reliability. At this point, I'll turn it over to Alan who will walk you through it and hopefully convince you that the opportunity is technically feasible.

MR. KURITZKY: Okay. I'm Alan Kuritzky. I work with Mary in the Office of Research. What we want to discuss with you right now is regard to our approach SECY-02-0057. We proposed some changes to the ECCS reliability requirements. In specific, we identified coming up with a risk informed alternative to GDC 35. As Mary was mentioning before and as we've had some discussions but not consensus, the GDC 35 indirectly gets to the heart of ECCS reliability by stipulating that this system, ECCS must be designed to operate and satisfy its mission function given a single failure and given a loss of off-site power.

What we're trying to do with the risk informed alternative is to allow the ECCS to be designed, operate, or possibly evaluated based in part on quantifiable reliability numbers instead. I make the point of saying in part because of course the work using the reliability numbers is just one piece of a risk informed defense and depth process. So we're not going to make pure decisions just based on bottom line numbers.

I just quickly want to identify a couple of limitations in the work we're doing and talk about the scope. As mentioned in the SECY, we're looking at the changes to the ECCS reliability requirements,

specifically in GDC 35. We are not at this time proposing changes to the single failure criterion as it applies to other systems in the other GDCs such as 17, 34, the ones dealing with electric power or RHR or cooling water, *et cetera*.

We're focusing right now just on ECCS. By the same token, we're also not recommending changes now to the containment's design, the performance requirements, or EQ. This is specifically just for ECCS itself.

Also because what we're proposing is more of a performance-based alternative, we have to have some performance monitoring also. Therefore, the implementation of this alternative needs to be done in a way that's consistent with other existing programs like the reactor oversight program and the maintenance rule or any risk informed technical specification issues that are coming along at the same time.

MEMBER ROSEN: That's really impenetrable for me. Are you suggesting some corrective action or strategy different than the corrective action programs now in place in the utilities?

MR. KURITZKY: No. We're not specifically stating that right now. What we're saying is, as we proceed now into the next phase we have a work group

that's been put together to address more of the implementation issues associated with this. We're going to have to go in lock-step with these other programs so that we can be consistent with them.

In other words, if there are already programs in place for getting a feedback on equipment, reliability and performance, we have to get those seamlessly tied in to what our program is going to do. We do not want to have to sit there and bring up a bunch of new programs. We want to make use of what's already out there and try to seamlessly interact with it.

MEMBER ROSEN: Okay. It seems to me that if someone uses any new strategies and they find out after they do an analysis and actually use it, that in fact, they had made a mistake in the strategy, in the calculation. Then that would simply be a problem identification report at that utility. It would go through the normal corrective action processes. It would be a root cause evaluation, sent of condition, corrective action. It's already in the requirements in Appendix B of 10 CF Part 50.

MR. KURITZKY: Again, we haven't gotten to the point of implementation discussion internally yet as to how this is going to work. Your point is valid.

What we're doing is trying to make use of, we're going to be looking to making use of existing programs to the extent possible.

MEMBER ROSEN: Nothing new is needed there. It's only implementation of an existing requirement.

MR. KURITZKY: Right. It's making sure the implementation, this change works seamlessly with what's already out there.

MR. CUNNINGHAM: You can think of GDC 35 as a design requirement. We're trying to bring the design requirement into line with the operational requirements that exist and are being implemented today. They ought to be giving you the same guidance if you will.

MEMBER LEITCH: It seems to me we're mixing design requirements with reliability requirements. In other words, if I understand where you're going with this, it would be possible as far as this rule change is concerned if one had a very reliable off-site electric power system to have a plant with no diesels for example as far as this is concerned and meet the reliability goals. My perception of ECCS reliability is it's more impacted by mechanical things; pump availability, balance and

so forth and by the availability of electric supply system. The off-site electric supply system associated with most plants is highly reliable. Are we saying then forget those design requirements?

The plants that are already built have those back up electric supply systems already there. I guess what I'm concerned about and I'm starting to develop a feel for this is if new plants were built using this device criteria, would it having a highly reliable off-site power supply system substitute for on-site diesels?

MR. KURITZKY: I would like to make two points in regard to that. The first is again as I mentioned in the previous slide this is one part of a risk informed defense in depth approach. The bottom decisions will not rest purely on the numbers. Just because you have an extremely reliable off-site power system doesn't mean you can justify not having diesels.

MEMBER LEITCH: But if I could demonstrate the reliability of the ECCS systems that met this new criteria without an onsite diesel --

MR. KURITZKY: But again you have to look at the defense in depth issues also. It may be that you don't want to have all your eggs in the off-site

power basket. That's one of the things we have to consider. Again, we're not going to make the decision based purely on the numbers.

The second point I can make is just that at this point we haven't gotten to the point where we've established exactly what extent of changes we're going to allow. I was going to bring that up later. Will we allow this program to be relaxed -- specifications? Will we allow actual equipment to be removed from the plant? Those types of decisions haven't been ironed out yet.

MEMBER BONACA: Although, you want to have some articulation on how issues like the ones that have been raised here are going to be dealt with. You have option three, the framework that you developed. You have reg guide 1.174 as principles for defense in depth. You already have there some elements of the issues.

MR. KURITZKY: Yes.

MEMBER BONACA: Do you? Within the context?

MS. DROUIN: Right. I think you'll see later on that Alan is going to get into it. You're not looking at the ECCS reliability just against the challenge of loss of off-site power. You're going to

have to look at all the initiators and all the challenges. He's going to get into more of that I think and that will answer your question in more detail.

MEMBER LEITCH: Okay. I'll hold off for a little while and see where he goes. Thanks, Alan.

MR. KURITZKY: This slide got talked about quite a bit already today. With the risk informed alternatives, GDC 35, what we're looking at doing and what we're envisioning is offering two approaches for demonstrating ECCS reliability commensurate to the frequency of the challenges through both a plant-specific approach and a generic approach. These approaches would be specified as we're envisioning in a regulatory guide not a rule itself. They would serve the purpose of demonstrating the ECCS reliability without using the prescriptive assumptions of the current GDC 35.

In the plan-specific approach, the licensee with appropriate consideration of uncertainties would demonstrate that they meet NRC established acceptance guidelines. For the generic approach, the NRC would -- and establish a minimum set of ECCS equipment needed to meet those guidelines based on a plant grouping, some form of generic plant

grouping. Both of these approached were derived out of using the guidance and the direction of option three framework.

As Mark mentioned at the April, we provided the rule making people with an interim report on some of the work being done on the plant-specific approach to a risk informed GDC 35. We're continuing to do work on the generic approach. We have a deliverable due in July which will hopefully demonstrate the feasibility and practicality of that approach.

The technical work that we have done, have worked on so far and in some cases are still working on for the plant-specific approach. These things would ultimately apply to the generic approach too. There are three principal technical areas that we've been working on.

One is the acceptance guidelines for demonstrating the appropriate ECCS reliability. The second on is coming up with LOCA frequencies. As Mark mentioned earlier, that's a key input to these activities. The third thing is a conditional probability of loss of off-site power given a LOCA. That's particularly of concern or interest when you're looking at the simultaneous LOOP assumption of whether

or not that is a risk significant or high enough frequency of probability of that which needs to be considered in the design basis.

MEMBER KRESS: Does LERF enter into this because of the bypass accidents?

MR. KURITZKY: The bypass is a part of it. But also just in general we don't want to just focus on preventing core damage. We also want to prevent early release. We want a multi-prominent approach from the framework which is going to address preventing core damage, preventing large release. We have consequence mitigation, *et cetera*.

MEMBER KRESS: I always thought the LERF would always show up in bypass accidents.

MR. KURITZKY: That's probably a driver.

MEMBER WALLIS: How do you determine acceptable LOCA frequencies?

MR. KURITZKY: When we say "acceptable" that means acceptable for something we would be willing to let the licensee use in their calculation.

MEMBER WALLIS: Eventually it's not just a calculation. You're predicting something which is likely to happen. So you envision a world where perhaps we have one LOCA every ten years and one CDF every 100 and one unacceptable LOCA every 1,000 or

something. LOCA becomes a new criteria?

MR. KURITZKY: Again, I think the word "acceptable" maybe is confusing. It's not acceptable as they have to be able to meet this certain LOCA frequency. It's rather just LCOA frequency. I'm going to discuss a little bit later on frequencies. In fact, Rob Tregoning is going to go into more detail on it. Right now the existing LOCA frequency is used in PRAs. There are questions and concerns about them. We need to determine what are some usable LOCA frequencies.

MEMBER KRESS: You're asking questions in frequencies that are used in PRAs.

MR. KURITZKY: Right.

MEMBER KRESS: Let me ask another question about that. I was beginning to think the LOCA frequency was a cut off value at which you would for defining your design basis accidents. Is that somehow related to that also?

MR. KURITZKY: That is more probably the long term, the redefinition of LOCA spectrum for locations. It may get into some of that. We are looking at from a risk point of view some essential cut offs in terms of risk contributors, so the LOCA frequency is one factor in an equation for that. It

does replicate to that. As far as a direct cut off with LOCA frequency, that's probably more in the domain of the long term project.

MEMBER KRESS: The reason I ask that of course is the question of what is the large-break LOCA. It feeds back into this question of are you going to get rid of the double-ended guillotine break.

MR. KURITZKY: Yes. That's going to get discussed probably a little more this afternoon. It's also part of the long term project.

Okay. Let me go over those three technical layers. The first is the acceptance guidelines. Before I go into exactly how we are proposing these CDF and LERF acceptance guidelines, I want to grab the concept of two different types of changes that we envision licensees may propose relating to the ECCS. My description of the guide will be slightly different for them

The first is a change in ECCS design or operation which is actually requesting the extension of and allow time for a piece of equipment or possibly moving some equipment from the plant or no longer maintaining it with certain standards. The second type of change is a change in the design basis which is actually moving some accent from your design basis.

MEMBER KRESS: Now why would we want to do that unless they wanted to do the first bullet?

MR. KURITZKY: Yes. You're right. The change obviously will be back to one of those. To come in with this second one, we have to have some means of avowing. That's the whole reason I made this split right here. I would need to talk about how you would evaluate the second one.

So now I just want to go over the guidelines as they pertain to the design/operational changes. The licensee if they had proposed an operational change would need to demonstrate that the ECCS functional reliability is commensurate with frequency of accidents for which ECCS needs to operate to mitigate that challenge and prevent core damage or large early release. That is accident, not just LOCAs.

As we all know, CDF responds to a whole spectrum of accidents. It responds to a lot of transients. It can respond to external event initiated scenarios and even during shut down, ECCS can be -- to respond. So there's a wide breadth of things ECCS must respond to.

A licensee can accomplish the first bullet by demonstrating that the following acceptance

guidelines are met. We have two acceptance guidelines. The first is a baseline total plant CDF and LERF which needs to meet the quantitative guidelines from the option three framework.

MEMBER APOSTOLAKIS: Are these different from the quantitative goals that we're using?

MR. KURITZKY: Derived from.

MEMBER APOSTOLAKIS: CDF and LERF, I mean.

MR. KURITZKY: CDF and LERF. The quantitative guidelines in the option three framework for CDF and LERF are the subsidiary goals on the quantitative objectives driver.

MEMBER APOSTOLAKIS: Right.

MR. KURITZKY: Actually now I think the new framework is going to have an appendix that actually documents and traces back that derivation.

MEMBER KRESS: Ten to the minus four and ten to the minus five.

MR. KURITZKY: Correct. Have you seen my next slide?

MEMBER KRESS: I haven't read any of them.

MR. KURITZKY: The second acceptance guideline is that the resulting delta risk or the change in risk from a proposed change must not represent a significant risk increase. Quickly

jumping to the next slide to explain the values. As Dr. Kress mentioned, ten to the minus four and ten to the minus five respectively are the option three framework guidelines for CDF and LERF. They are derived from the QHOs.

Again, since these values apply to a full scope PRA, we need to look at the total plant CDF and LERF not necessarily just the part that comes from the response to LOCA and not just the part that comes from ECCS values. This is for total plant all modes of operation.

MEMBER KRESS: Would you also look at the total site LERF if you have multiple plants on the site?

MR. KURITZKY: That's a good question. Right now we haven't specifically called that out.

MEMBER KRESS: Of course, whatever your uncertainties, it doubles if you have two plants on the site. It might be in the hash (PH).

MR. KURITZKY: Right.

MEMBER ROSEN: Well, there are some sites that have three plants.

MR. KURITZKY: Yes.

MEMBER KRESS: It still may be in the hash (PH).

MEMBER ROSEN: Here we're considering internal events, external events, shut down.

MR. KURITZKY: Yes.

MEMBER ROSEN: All of it.

MR. KURITZKY: Yes.

MEMBER ROSEN: It's going to be added together.

MR. KURITZKY: Yes. Which will lead to some of the issues that I'm going to bring up later. Also I just wanted to point out that the ten to the minus four and ten to the minus five are not set in stone. They're consistent with reg 1.174. There's some flexibility that we would probably allow in that depending on the extent of the delta risk. They are a flag to give more regulatory attention or more rigorous analysis that show that you're fairly accurate with your research.

MEMBER ROSEN: One more comment, Tom. In two plants you need to multiply it by two and in a three plant site by three, the ten plant site.

MEMBER KRESS: By ten for LERF, but you don't do it to the CDF.

MEMBER ROSEN: No, just to the LERF.

MEMBER KRESS: Yes.

MR. KURITZKY: Okay. The other point I

want to make on acceptance guidelines is that the option three framework only has absolute risk values in there. It does not have incremental or delta risk values. For that second acceptance guideline, we would be using the reg 1.174 acceptance criteria for delta risk, for changes in risk.

I want to re-emphasize, I mentioned before that consistent with the option three framework these quantitative guidelines only one part of a risk informed defense in depth approach. Decisions are not to be made entirely based on these values. Rather that's one input to the decision making process. The defense in depth principles cannot be violated.

MEMBER WALLIS: That's a very strong statement. I think you may always find someone who's going to say you can't possibly do this because of defense in depth.

MR. KURITZKY: Yes. It is a good point, Dr. Wallis. The principles that we refer to here, I think they're detailed in the framework. They're also detailed in the reg 1.174.

MEMBER WALLIS: They have to be more than principles. They have to be quantified or something so you can apply them. Otherwise, you're always going to find someone who interprets defense in depth as

being you can't do this because of defense in depth.

MR. KURITZKY: Right. There's half a dozen of these principles. Depending on who views and interprets those principles, they can say absolutely nothing can be changed or there is leeway for some things to be changed. I think that --

MEMBER WALLIS: You have to change their way of doing things though. You have to change the way in which you talk about defense in depth. They're not just principles that can't be violated. You have to be more specific about what they really mean.

MR. KURITZKY: Yes. That's true.

MEMBER APOSTOLAKIS: Maybe you can use a mild diversion. Say defense in depth philosophy should be satisfied or met. "Cannot be violated" is too strong. You can say there is something out there that you should try to comply with.

MEMBER WALLIS: It's like obscenity. You can always find something that violates somebody's sensitivity. Therefore, it's not allowed with them.

MEMBER APOSTOLAKIS: Are you saying defense in depth is obscene?

MEMBER WALLIS: I'm saying if they trying to apply defense in depth principles to obscenity, I think they'll get into great trouble.

MEMBER APOSTOLAKIS: Yes. So maybe comply with the philosophy.

MEMBER WALLIS: Yes.

MEMBER APOSTOLAKIS: Which essentially says deal with the uncertainties, but not how to deal with them. It doesn't say how, but it says deal with it.

MEMBER ROSEN: I think what you said is that depending on the issue and depending on which part of the staff is involved, defense in depth may be interpreted quite differently. That situation is unacceptable to you which I think is the right answer.

MEMBER KRESS: But when you get ready to try to figure out what this defense in depth means, I would recommend the ACRS rationalist approach which says that no set of sequences will contribute in order to the uncertainty in the final risk result. That's how we tied uncertainty in. It's -- to what that set of sequence is you're dealing with. If they contribute all the uncertainty and there's not much left over sequences, then that's a new ordinate. You have to somehow factor that into it. I don't know what ordinate means either, but you have to figure that out.

MEMBER APOSTOLAKIS: Since you raised

that, I think a pragmatic approach, suppose there is something that you may want to explore here. It may need to apply defense in depth in a more -- fashion with the high level, but then apply the rationalist approach at lower levels. The reason for that is because in the structuralist approach, they're also claiming that defense in depth protects you in case you are wrong in your calculations or you are wrong in some assumptions. Now if you apply that to every little detail then you'll never get out of it.

At some high level you might say I've done this beautiful analysis but what if I'm wrong. Why don't I put this extra protective system or some other measure to protect me? It's not a very satisfactory state of affairs, but I think it's a pragmatic state of affairs. At this point, given the uncertainties we have, a lot of them remain unquantified.

MEMBER KRESS: The problem with that is you don't have any guidance on how good that extra level of protection has to be.

MEMBER APOSTOLAKIS: We don't.

MEMBER KRESS: So you get back into the same problem you had.

MEMBER APOSTOLAKIS: We don't, but at least you are beginning to limit the applicability.

MEMBER KRESS: You limit where you're --

MEMBER APOSTOLAKIS: Otherwise, we might as well forget about all this. If we keep applying defense in depth at every level, why do all this? Do you want to say something?

MS. DROUIN: All I was going to say was in our next version of the framework paper in option three we have taken your discussion on the rationalist and the structures, the high level and the low level and expanded the discussion quite a bit to address these things and the uncertainties. That's all.

MEMBER APOSTOLAKIS: Very good.

MR. KURITZKY: Okay. The proposed acceptance guidelines for the design basis changes. Essentially they have to meet the same acceptance guidelines as the design operational changes that we just discussed. The only difference and the point we want to make here is that this is an analytical change, not a physical change at least initially. As it was pointed out, obviously you'd only make this change because you have some physical change in mind down the road.

Because it's now an analytical change, we need a method for counting what the delta risk is associated with it. Therefore, what we are proposing

was that the design basis or set of events as a candidate to be removed from design basis would be assumed to go to the record of core damage because the plant would be designed to be able to respond to it. If you assume that the assessment went directly to core damage and you were still able to meet the acceptance guidelines, both the absolute and the relative, then that would be essentially meeting the acceptance guidelines for the change.

MEMBER KRESS: You intend to have an absolute value on the deltas that's acceptable.

MR. KURITZKY: On the delta? It's from the reg guideline 1.174. I wouldn't say it's absolute because it's a cut off. In the reg guideline 1.174, there's a fuzzy chart in there which is based on baseline CDF and acceptable changes. There's different regions in there and intentionally fuzzy transitions between the regions. But it gives you a ball park of what's acceptable. We'd be going on the same --

MEMBER APOSTOLAKIS: I don't understand the second bullet. What does the second bullet mean?

MR. KURITZKY: As an example if the design basis, actually you wanted to move your design basis, a large based LOCA coincides with the loss of off-site

power. What you would do is assume that a large based LOCA and LOOP would directly do core damage, adjust your PRA model accordingly. If you still met the two acceptance guidelines, then that would be acceptable. In other words if you assume large break LOCA and coincident LOOP led directly to core damage and you still had a CDF below ten to the minus four if the delta risk or the delta CDF --

MEMBER APOSTOLAKIS: You assume that a large LOCA coincident with loss of power leads to core melt.

MR. KURITZKY: Right.

MEMBER APOSTOLAKIS: Now what probability are you calculating then?

MR. KURITZKY: It's no longer in the design basis.

MEMBER APOSTOLAKIS: You assume what happens.

CHAIRMAN STACK: No. The conditional probability is one, yes.

MEMBER APOSTOLAKIS: So you're calculating the probability of the coincident occurrence.

MR. KURITZKY: Right.

MEMBER APOSTOLAKIS: The frequency.

MR. KURITZKY: The frequency --

MEMBER APOSTOLAKIS: If that is less than what?

MR. KURITZKY: If the frequency of the large break LOCA and the conditional probability of LOOP, that quantity, then the conditional probability of core damage is at one. If that meets let's say the reg guideline 1.174 delta risk acceptance guidelines for CDF and LERF --

MEMBER APOSTOLAKIS: But why?

MEMBER WALLIS: It seems to me -- has a large break LOCA or other symptoms of large break LOCA being likely to occur, then you suddenly change that probability. You find that half the plants are no longer in compliance. What do you do? Do you go back and put in some different kind of LOCA?

MR. KURITZKY: Well, there's two points you made there. One is that risk any time you're making decisions in a risk informed environment you always run the risk that you're understanding of your data or whatever can change on you. One of the topics that the working group on this project is trying to work on is how to work the rule making package such that if something should change later on we don't have to go through a back-fit process to make a change.

You make a change based on the current

risk picture and that changes, then you should be required to go back to the way it was before. There shouldn't be a big burden of back-fit arguement to have to be addressed. That's one area that we're looking at right now.

The second thing as far as whether or not something would change and totally destroy the LOCA picture, that's an issue. Maybe it'll be brought up more when we discuss the LOCA frequency in detail and Rob or someone discusses LOCA frequencies in detail. We're looking at a range for LOCA frequencies and uncertainty. Obviously it's a very uncertain parameter. You have to hope that an event here or an event there isn't going to radically change your perception of what that range of LOCA frequencies is. Obviously we've had a couple of event in recent times that made us all sit down and re-think what we're doing.

MEMBER WALLIS: TMI did have a change, did make changes occur. The waves were pretty large after TMI. The waves would be pretty large after anything comparable like a large break LOCA.

MR. KURITZKY: If something not expected to happen actually happens of course and it really hasn't been accounted for, certain analysis to the

distributions, that risk is yes, that exists. That would be with any risk informed application.

MEMBER ROSEN: I see this as much more simply than you're discussing it. If something happens that puts a plan outside its analysis, then it's outside it's licensing basis. You know how to deal with that. We take steps to put it back within the licensing basis. This can happen, and when it does we know what to do.

MEMBER BONACA: If I remember, you already showed the results before that showed the LOCA and LOOP combined is an extremely low probability. What you're saying is if that is confirmed by plant specific calculation for a specific plant, you would treat it the way through those criteria 1.174 by saying that a contribution to risk of the particular combination is so small that you don't have to have lots of off-site power capability or assumption in your LOCA.

MR. KURITZKY: Yes. That's correct.

MEMBER APOSTOLAKIS: Why do you need the second bullet? Why isn't the first one sufficient?

MR. KURITZKY: The second one explains. For instance, if you differentiate between what I mentioned before the design and operation changes. If

someone came in and proposed to take a Lipsi Pump, they have four Lipsi Pumps and they propose taking one out of their plant and no longer maintaining it, they would do a calculation to show now we only have three Lipsi Pumps. What is the change in risk from our baseline? They would then see whether or not they meet the acceptance guidelines.

MEMBER APOSTOLAKIS: Let's go back to what Mr. Leitch said earlier. Unless I'm wrong, the current requirement is LOCA plus loss of off-site power. Then you say if you want to change that assume that the conditional probability given these circumstances of having core damage is one. But I have my diesels. Don't I? Why is that one? Don't I get extra power?

MR. KURITZKY: You have your diesels because that's in your design basis right now. If you take it out of your design basis anymore, you may not start your diesels rapidly enough to be able to respond to a large break LOCA.

MEMBER APOSTOLAKIS: But you're not even giving me the chance of investigating that. You're saying I have to assume I have core damage. I'm missing something here. Why don't you say just the first one? Do the first one. You want to change the

requirement of simultaneous concurrent loss of power and the LOCA, fine, analyze the sequence, show us how CDF and LERF change and go the normal way. Why do you have to assume that there is --

MEMBER BONACA: You're right. I think you're right. It's intriguing because this is a heavy burden on the licensee.

MEMBER APOSTOLAKIS: Which one? The second?

MEMBER BONACA: The assumption of having to use the diesels on your LOCA. That really places the most restrictive requirements on the diesels. You have to start them within a certain time and load everything.

MEMBER APOSTOLAKIS: Fine. That's their problem. Why should I put a second bullet?

MEMBER BONACA: I understand. I'm saying that the example given however in that kind of context for the licensee is an important issue. That's one of the areas where licensees are going to look for an exemption.

MEMBER APOSTOLAKIS: The issue here is the principle.

MEMBER BONACA: I understand.

MEMBER APOSTOLAKIS: So far I haven't seen

an application of 1.174 where we told the licensees what to assume.

MEMBER BONACA: Yes.

MEMBER APOSTOLAKIS: We just said do your calculations and come to us. If they are acceptable, fine. Now we're going one step beyond that. We're saying and we want you to assume this when you do your calculations. I'm afraid that this is going to lead to --

CHAIRMAN STACK: This is an example. This is their second step. I mean, you don't have to go this route. This one gets rid of the design basis accident. Once you do that, you can live in design basis space again.

MEMBER APOSTOLAKIS: But why can't I do that with the first bullet alone?

MR. CUNNINGHAM: You could. We're getting at the issue that we're applying the reg guide 1.174 structure to the removal of a design basis event as opposed to a tech spec change or something like that. So there's a perception that it is a more significant change in the requirements. Maybe there needs to be an additional test. This is one way of making that additional test. Maybe it's not the right way.

MEMBER WALLIS: In George's way then, you

don't have to meet this large break LOCA criterion, but you still have to analyze it because you have to evaluate the CDF. Therefore if you get a peak clad temperature of 3,000 degrees or something, you analyze the consequences.

MEMBER APOSTOLAKIS: Right.

MEMBER WALLIS: You still have to analyze.

MEMBER APOSTOLAKIS: The whole thing, yes.

MEMBER WALLIS: If you did the second one, you wouldn't even have to analyze it. You wouldn't.

MEMBER APOSTOLAKIS: You'd just assume that you're damage in the core.

MR. CUNNINGHAM: And we're assuming that you can remove this scenario from the set of design basis events purely on the frequency of the event.

MEMBER WALLIS: Which is one way to do it.

MEMBER APOSTOLAKIS: If you demonstrate, that's fine. But should it be a requirement?

MEMBER KRESS: But you don't remove it purely on the frequency. You use that as your first judgement. Then you go through the PRA calculation and show that you meet your risk criteria. It's the combination of that and --

MR. CUNNINGHAM: But you're right. There are others that can accomplish the same thing.

MEMBER BONACA: Bullet number one seems to be the approach.

MEMBER APOSTOLAKIS: That's the one.

MEMBER BONACA: The second bullet is just an example of how you can get there.

MEMBER APOSTOLAKIS: Exactly. If you said an example --

MEMBER BONACA: Right.

MEMBER APOSTOLAKIS: If that is conservative calculation, assume that you are in core damage and you still satisfy the reg, that's fine. But it shouldn't be the same kind of bullet.

MR. CUNNINGHAM: Okay. Good point.

MR. KELLY: What happens if the frequencies change with time? Say deregulation or whatever. How do you take care of that?

MR. CUNNINGHAM: That's an issue that comes up any time you're trying to make requirements more performance based. You have to make the judgement of whether or not the decision you're making is likely to be sensitive to changes in frequency over time.

MR. KELLY: So would they have to put the diesels back in?

MR. CUNNINGHAM: If we want to put it back

in, the burden becomes the staff's burden to justify it. So the staff has to be comfortable when it's removing this, for example, something from the design basis that it's not likely to be an issue down the road.

MEMBER ROSEN: Again, I see this more simply than that. I see the licensee that proposes a change that's based on some off-site power reliability numbers is now bound, some range obviously he's going to have, and has got that in his licensing basis. If the deregulation or some other factor leads to a degradation of that reliability, he's operating outside his licensing basis. He and his staff both should be interested in that.

MR. CUNNINGHAM: Yes.

MEMBER ROSEN: The corrective action is to get back within the licensing.

MR. CUNNINGHAM: And what we're doing is getting into the implementation of this concept. You're right. There are lots of ways to implement it so you don't go way out of balance and things. We're getting ahead of ourselves in terms of where we are in the development of rule changes.

MEMBER KRESS: One more comment, not to throw a monkey wrench into the system. In my view the

reason reg guide 1.174 ended up with this four dimensional set of acceptance criteria with the absolute values and the deltas is because we wouldn't face up to the need to have an absolute CDF and an absolute LERF as your acceptance criteria. If we had those and maybe some expression of the competence level in which you have to meet them, you wouldn't have to do the deltas.

MR. CUNNINGHAM: Yes.

MEMBER KRESS: That would quit penalizing those plants that are already good. So I just wanted to make that comment. There are things in 1.174 we ought to be thinking about.

CHAIRMAN STACK: But there are those of us who philosophically would also object to allowing the plant to increase its risk simply because we picked a limit. If they were ten to the minus six and the limit was ten to the minus four, do I really let them go to ten to the minus four?

MEMBER KRESS: That's a nice philosophical discussion.

MEMBER ROSEN: Why is that abnormal?

CHAIRMAN STACK: We're not here to debate 1.174.

MEMBER KRESS: We know 1.174 will allow

that to happen in set of increments anyway. You can do that with 1.174.

MEMBER ROSEN: There are several steps. I'm not sure we want to go into that.

MEMBER KRESS: We already said we're going to allow that is what I'm saying.

CHAIRMAN STACK: Let's get back on track.

MEMBER ROSEN: I would point out, Mr. Chairman, that you took us off track.

CHAIRMAN STACK: No, no. I was responding to a diversion.

MEMBER KRESS: I took us off track.

MR. KURITZKY: I'd like to talk just for a few minutes about the issues of PRA scope and uncertainty analysis. As we mentioned previously, the acceptance guidelines are intended for comparison with a full-scope PRA; external events, internal events, shut down, all different modes of operation. Recognizing of course that the majority of PRAs out there are not full-scope. You'd be hard pressed to find even one that's truly full-scope.

The significance of the out of scope items needs to be addressed. The importance of those items is going to be somewhat of a function of where your as calculated values line up compared to the acceptance

guidelines.

MEMBER APOSTOLAKIS: Are you going to demand the full-scope PRA?

MR. KURITZKY: No. We're not going to demand the full-scope PRA.

MEMBER APOSTOLAKIS: Even for such a great benefit?

MR. KURITZKY: Well, let me say this. We don't currently envision demanding a full-scope PRA. Whether or not use of a limited PRA for these applications is appropriate is a decision that maybe has not been rendered yet.

MEMBER APOSTOLAKIS: How about the level two full-scope PRA? I mean, shouldn't you be demanding that? You're giving them something --

MEMBER ROSEN: Let me take you around the trap that Dr. Apostolakis is trying to put you into. I think you have on slide 17 already said that the numbers are 1E-4 or 1E-5 and they apply to full-scope PRAs.

MR. KURITZKY: Yes.

MEMBER ROSEN: So someone who comes in and asks of that has to have the tools to show you that he meets 1E-4 or 1E-5. That's full-scope PRA.

MEMBER KRESS: Or he has to satisfy the

second bullet on this slide.

MEMBER APOSTOLAKIS: That's where the problem is.

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: The second bullet again is a way out of this. We'll start waving our arms and --

MEMBER KRESS: Like I did on the LERF. You'll say what is the significance of --

MEMBER APOSTOLAKIS: How much does it cost? What are we talking about? Is it a major undertaking to do a level two PRA?

PARTICIPANT: It's a million or two dollars.

MR. CUNNINGHAM: To do what?

MEMBER APOSTOLAKIS: A level two PRA. Million?

MEMBER ROSEN: Once you have a level one PRA, it's an incremental cost. You have to do some containment stuff.

MR. KURITZKY: Including shut down in all modes and full external events, *et cetera*.

MEMBER ROSEN: Now that's different. Level two is incremental. The shut down is another story and external events is another story.

MS. DROUIN: My experience in the past of doing these in terms of what we would bid for these jobs --

MEMBER ROSEN: When NRC was the bidding.

MS. DROUIN: No. In my previous life. You're looking at a million dollars for an external events PRA. Although the level two is incremental, it's not a small incremental. You're probably looking at about $800,000 for a full level two.

MEMBER ROSEN: You're making way too much money.

MS. DROUIN: The point is it's not a small amount of money.

MEMBER APOSTOLAKIS: But it is not an amount of money you are spending for one particular reason only. This model is being used now for all sorts of changes and requests and benefits and so on. You have to look at it from that point of view too, that it's an investment of long term.

MR. CUNNINGHAM: That's right. You know for the last several years since we talked about 1.174 and things, these are voluntary approaches. We have consciously left the door open for people to come in and ask for changes to their licensing basis even absent of whole scope PRA.

MEMBER ROSEN: The leadership and the utility and industry in the PRA field has level two PRAs and they have external events involved. Then they have shut down. Shut down analyses may not be full quantification but they're moving in that direction. This is all consistent with the direction that the industry leadership and the PRA utilization is going. It's clear that you can find places of where that's not true, but it's also clear that you can find lots of places where it is. The direction is more and more places where it will be true.

MR. CUNNINGHAM: Yes.

MEMBER APOSTOLAKIS: Well, the problem in my view is that regulatory guide 1.174 has all the right words, the right discussion and so on, but the implementation is very different. We are not really using the proper CDF when we enter the figures. We're using level one, internal events only.

Then we say how much do you think it would be if we include the shut down and other stuff and then factor of two or three. All right. It doesn't matter. Did you do uncertainty analysis? No. It doesn't matter. I don't know that anything matters anymore. You are giving us this beautiful discussion here. I am really concerned that it will not be

implemented that way judging from what has happened to 1.174. We're going backwards. People look at you and they seem to be puzzled when you say did you do an uncertainty analysis.

MR. CUNNINGHAM: It's a fair comment to say. In this context, we're talking about rule change. Should we continue to give the flexibility that 1.174 does for something like rule changes?

MEMBER APOSTOLAKIS: I don't know about that.

MR. CUNNINGHAM: That's a fair question.

MEMBER APOSTOLAKIS: I don't know about your second bullet, significance of out of scope items, because that's what people are going to do. They're going to do internal events, level one and then they will start arguing. What do you think if I put -- in there, what's going to happen? Nothing much.

MEMBER ROSEN: There's an inconsistency on your presentation in slide 17 and the second bullet on this slide, whatever it is.

MS. DROUIN: I think another way to look at it is that the more you do the first bullet and the less you do the second bullet is the more benefit you're going to get. The more you have to justify

things that are out of scope, the less benefit you're going to get.

MEMBER APOSTOLAKIS: Now what if for example in the last bullet you're saying "where possible." What do you mean by that?

MR. KURITZKY: Let me just back up to the second bullet. I was making a point on the second bullet. I want to finish my thought which addresses some of these issues.

Right now, obviously Dr. Rosen mentioned on slide 17 we talked about full-scope PRA. That's what we reiterate on the first bullet here. However, we recognize that very few if any plants have full-scope, all modes of operation, internal/external event PRAs. Do we want to say that it is a prerequisite for having any type of a risk informal change? It's not my call. Right now, we're going along with the minds that it's not necessarily required.

As such we have to be able to deal with out of scope items. Right now reg guide 1.174 has some discussion on how you deal with out of scope items. I think for this application or this effort something similar is what we were envisioning initially. Out of scope items would have to be addressed depending on how close you are to the

acceptance guidelines. We're trying to lead you to what type, how much you need to address, and whether or not you need a very rigorous analysis, whether you need rigorous PRA analyses for some items, or whether if you're far away from the acceptance guidelines you can get by with a simpler analysis or some type of qualitative argument.

MEMBER APOSTOLAKIS: Why would someone get the benefits of risk informed regulation when that person or that entity does not have good risk information?

MR. KELLY: Dr. Apostolakis, perhaps I can help out in some of the questions that are coming. This is Glen Kelly from the staff. The presentation that you're receiving today is the technical basis that's going to be presented to the working group from which we'll try to put together a rule to be able to do this.

Now as a member of the working group, one of the things that we'll be looking at is to what extent we want to allow out of scope items. That hasn't been determined yet because the rule hasn't been written about whether it will have to be a full-scope PRA or whether there will be some aspects that utility can come in with, a less than full-scope PRA.

At this point, what we're getting is the technical justification that would be provided for a rule. So we'll be going forward from there. A lot of your questions are very pertinent. Right now, what you've gotten so far is the technical work. What happens with the technical work and how the final rule gets written is still to be determined.

MEMBER APOSTOLAKIS: But shouldn't the technical work then get away from things like the second bullet and the fourth bullet? The technical work should say I have a full-scope PRA. Now how do I use it? The fact that some utilities don't have a full-scope PRA is a separate story. It's irrelevant to the technical work.

MR. KELLY: Right.

MEMBER APOSTOLAKIS: Now you're trying to embed in the technical work ways of getting out. I don't remember now. Does 1.174 address out of scope items?

MR. CUNNINGHAM: Yes.

MEMBER APOSTOLAKIS: It does? I remember it says something in the level two part.

MR. CUNNINGHAM: Yes. Even in level one.

MEMBER APOSTOLAKIS: Well, then it has been abused.

MR. KELLY: The other aspect of reg guide 1.174 that I think is important to remember is that reg guide 1.174 was written specifically for licensing basis changes.

MEMBER APOSTOLAKIS: Yes.

MR. KELLY: The commission has accepted the reg guide 1.174 as a process that can be used for making risk informed decisions. The numbers that should be used for the criteria for making regulatory decisions, in this case for changes to rules is still a policy decision that has to be made as to what exactly the appropriate numbers here to be used. It may well be that the numbers that are in reg guide 1.174 currently will be the ones that end up being used. That's still a policy decision to be made as to exactly how those numbers should be used.

In one case as we're talking about an option two for 50.46, we're talking about they are still maintaining the functionality of the equipment. Here we're talking about the capability of actually physically removing the equipment or taking away its capability to operate. It's a whole additional level of change to the plant that you get under option three.

MEMBER APOSTOLAKIS: Yes. These are the

policy issues. I'm talking about the technical basis.

MR. KELLY: Right.

MEMBER BONACA: This seems to me it goes beyond. For example, now that you're making a change that is based on risk information, you have a need on the part of the -- to have a commitment to configuration control in the PRAs itself. As you make changes that you made on the basis of a PRA product of a PRA model, you need to verify that as you make changes in the plant and you go forth you are not violating those commitments of information that you submitted there.

To me, that would say also that you had a commitment to PRA -- PRA that you have to have. It's something that you maintain and use and you have a verification process. You have clear flags that say you make a change. You're bumping into something you committed for to meet these requirements. So there are specific needs I think from a risk informed stand point that need to be defined.

MEMBER ROSEN: Mario, your point is a good one. In the experience I have and the staff has in option two with South Texas was the question of PRA configuration management was dealt with explicitly in the license. What we had to do to keep the PRA up to

date was because there had been a license exemption granted. It's exactly right. Now what you do with the PRA is going to have a much broader application in the plant then it did before. That becomes part of the licensing basis. That's part of the bargain that a utility who gets some relief will have to undertake.

MEMBER BONACA: That was the intent to 50.59 with the deterministic analysis. Now there isn't to make people stay in there for the PRA. The fact is that you're right. We have to do that. I think at some point the standards we expect -- I mean, I'm looking here at the standard for PRA, the SME standard that just came out.

There are still the definitions, the capability category one, two and three. When are we going to stick out our neck and say that to do such an application of this nature you need to have a capability three, for example? I think there is a need for some clarification there rather than simply leaving it as an option.

I also see reg guide 1.174 from their perspective as a historical document. It attempted to promote user risk information in an environment where not everybody had the PRAs. Does it mean that we're now going to support a system where ten years from now

everybody uses risk information that doesn't have strict --

MEMBER APOSTOLAKIS: Well, the accurate description that this is a level one PRA informed regulation, internal events only, partial.

MEMBER BONACA: Yes.

MEMBER APOSTOLAKIS: I don't see why it should be that way.

MEMBER BONACA: No. That's right.

MEMBER APOSTOLAKIS: I mean, a million dollars considering the benefits here is really not that much.

CHAIRMAN STACK: We make approximations all the time. You can do your Appendix K or you can do a best estimate. Now that we have best estimate capabilities, should we forbid people to use Appendix K? The purpose here is not to advance the technology but to assure public health and safety. Is it good enough?

I think that goes back to Mary's question. Perhaps you add conservatism. You're allowed to do more depending on the information that you have. Even if you make it a full-scope PRA, then we'll argue about how good the uncertainty analysis, how good the models are. It's never-ending. You're always going

to have to make judgements about how to handle that.

MEMBER APOSTOLAKIS: What you are saying now is that because there is no limit to perfection let's do a mediocre job.

CHAIRMAN STACK: No.

MEMBER APOSTOLAKIS: Well, yes. If you want to argue about it, you're saying I would talk about the models. I would talk about uncertainty. There's no end. This is a standard argument of rules. If you ask for something more, they say do you think, Dr. Apostolakis, there is an end to perfection. I've been asked that question. I had to say no. So, leave us alone.

MEMBER BONACA: Furthermore, I think the issue of configuration management of the PRA once you have commitment based on the PRA, it's an essential step. Once a utility goes to that step, to that level of commitment typically it has already decided all this stays behind. They already have a solid PRA with a level two. I'm saying some elements for example the configuration model is a requirement in my judgement once you make the commitments based on what you have in that model.

MEMBER KRESS: I presume the guidelines somewhere along the line will give the plant specific

analysis, will give them the option of actually seeing if they meet the -- safety goal as opposed to this LERF value.

MR. CUNNINGHAM: Going back to historical documents, that option is in 1.174.

MEMBER KRESS: That option is usually in there. I don't know if it's in 1.174 or not. I presume it will be retained.

MR. CUNNINGHAM: We're getting ahead of where we are in the process. We had some boundary conditions to define for the technical work we're doing. As we talk, you've sensitizes us to one of the boundary conditions of whether or not we should be staying with what's in 1.174, should we be given the precedents of the last few years, or should we be thinking differently about that.

MEMBER APOSTOLAKIS: Another way of doing it though if you want to think in terms of approximations is has anyone taken a full-scope level three PRA and work backwards. As Steve said, we have those. There are some plants that do have those. Say if this plant can submit at only a level one PRA, what would have been missed? You see because I have now the complete PRA and I start comparing. That's how you determine approximations, by having a more

complete tool and working backwards.

If I take the South Texas PRA for example and I say I'm going to use now for that plant only level one, am I missing something? Those guys have looked at the more complete picture. What is it that I'm missing? Then come back here and say here is a list that you might be missing or it's perfectly all right. Then I think we'll be well on our way of saying something. Now it's an article of faith.

MEMBER KRESS: You can't do that to a reactor because every one of them is plant specific and site specific.

MEMBER APOSTOLAKIS: So by not doing it at all, that's better.

MEMBER KRESS: You have to do it for every plant if you're going to get the full --

MEMBER APOSTOLAKIS: No. But at least I will have an idea of what's important. Because it's plant specific then I shouldn't even look into it?

CHAIRMAN STACK: You have to have that, George, to have any understanding of how to handle those. That's true.

MEMBER APOSTOLAKIS: Exactly. That's what I want to see.

CHAIRMAN STACK: The question is do you

have enough of that experience now to be able to make judgements.

MEMBER APOSTOLAKIS: I don't know especially when it comes to --

CHAIRMAN STACK: Well, it needs to be addressed.

MEMBER APOSTOLAKIS: If we didn't have the experience of 1.174, I would go along with this. But I don't think 1.174 is implement -- so that's why I'm raising this issue. I don't think it is. I mean, there's a beautiful discussion on model uncertainty in the Appendix which I think only I and -- So, at some point you say enough. Anyway, I have problems with this.

Why can't someone take a complete PRA and see what insights we can learn given that this is site specific I agree? What are we learning from that? If I used only the level one part, I think South Texas has one. I think Seabrook has one.

MEMBER ROSEN: South Texas does not have a level three. It has a level two.

MEMBER APOSTOLAKIS: No. But level two is good enough for our purposes.

MEMBER ROSEN: For the exercise you want, we could take South Texas PRA, we could take it and

tell you the differences and results from level two.

MEMBER APOSTOLAKIS: I know there are three or four of those.

MEMBER ROSEN: There are several at level three. Minstone (PH). They're typically in populations that's higher then some level.

MEMBER APOSTOLAKIS: Because then we would also be addressing a little bit your concern, Tom. Maybe there will be from South Texas we will learn this, but look Diablo says something entirely different. Then I'd like to know that too. I think it shouldn't be a big deal to do that.

The question would be under what conditions is a level one internal events only PRA good enough for these kinds of regulatory applications. That would be great.

MEMBER ROSEN: But that would be research.

MEMBER APOSTOLAKIS: And all three of them are.

MEMBER ROSEN: But why would the licensees do that.

MEMBER APOSTOLAKIS: No. We do that. Then from those insights we replace the second bullet with something more specific.

MEMBER ROSEN: I see.

MEMBER APOSTOLAKIS: Instead of saying address them, we say this is for example how you should address them.

MR. CUNNINGHAM: We'll look into that at this point to see what we can do.

MEMBER APOSTOLAKIS: That's the greatest answer.

MR. CUNNINGHAM: Thank you.

MR. GRIMES: Dr. Apostolakis, this is Chris Grimes newly installed as the Program Director for policy and rule making.

MEMBER APOSTOLAKIS: My condolences.

MR. GRIMES: Thank you. Save the condolences for when I need them. I would like to point out, I think much of what you're exploring was some of the thinking that went into developing reg guide 1.174. Our expectation is that we're looking at as Mark and our colleagues have described work that's being developed in order to define a voluntary rule that is going to be an alternative to a deterministic traditional engineering practice for current licensing basis.

As Dr. Bonaca has pointed out, there's a certain expectation that in order to be able to be risk informed and performance-based and maintain the

licensing basis, we are supposed to be offering up a rule change that will seek public comment on how well we've been able to articulate not a standard of excellence for maintaining the licensing basis but the necessary and sufficient requirements in order to be able to adopt this voluntary alternative.

MEMBER APOSTOLAKIS: Sufficient, not necessary.

MR. GRIMES: Necessary and sufficient.

MEMBER APOSTOLAKIS: Both?

MR. GRIMES: Yes. That's the regulatory standard that we build our rules upon. It has previous reasonable assurance of public health and safety, but at the same time only be that which is necessary to justify public health and safety. We've long argued about the philosophy of whether or not the regulatory standards should creep into excellence over time as knowledge is gained.

I think what's important to recognize here is that the technical information needs to be able to satisfy the largest population of trying to let the tools be market driven. We ought to be able to say that someone who has a level one probablistic risk analysis or probablistic safety analysis can achieve some benefit in its application provided that they can

address the uncertainties, the impacts of not having level two or level three. They might not get enough to justify the cost, but they should be able to understand what the threshold is.

Someone who has a level three PRA and implements it and maintains it and makes it part of the licensing basis should get a demonstrably larger benefit or reduced burden. I think that the challenge that we face in rule making space is being able to show how the threshold is going to be applied in a way that is clearly articulateable and understandable to the public and also demonstrateable to the industry in terms of if they spend more how much more do they get.

That's the way that our performance as regulators will be measured, our ability to articulate rules that have demonstrateable benefits. At this point, I'm not in a position to say that I agree or I disagree that the promulgation, the perpetuation of the reg guide 1.174 approach is the right way to do it. Certainly it was a starting point. I agree with Mark. We should be prepared to come back when we present a rule and say how we would address different ways to approach your question.

MEMBER APOSTOLAKIS: Well, what you said is it's certainly a consideration. In an integrated

decision making process, that's certainly a consideration. You don't want to have a rule that imposes such demands of the licensees that it's impractical. I agree with that. The question is where do you draw the line. All I'm suggesting here is since this is the situation out there and most people have a level one internal event PRA, we as the regulator should understand how that information can be used so that we don't make mistakes. That's all I'm saying.

But I still think the regulations are insufficient, not necessary. You are using conservatisms. You say if you do this, it is good enough. That's sufficient. If you do something else -- So it's not necessary. I'm really disappointed by the way 1.174 has been implemented. You mentioned also the public. Let's not forget that one of the goals of the Commission is to maintain and enhance public confidence. The rigor of our methods is an important consideration here.

MR. GRIMES: I agree.

MEMBER APOSTOLAKIS: I don't think we have a disagreement. It's just I'm asking for this extra step. You're going too slowly for me. I can't believe how slow you are.

MR. KURITZKY: I can talk fast.

MEMBER APOSTOLAKIS: Mr. Chairman, are we going to have a break at all?

CHAIRMAN STACK: At 10:30.

MEMBER APOSTOLAKIS: No. It doesn't say anything.

MEMBER ROSEN: No break is shown on the agenda.

MEMBER APOSTOLAKIS: No break is shown.

MEMBER ROSEN: 3:00, George.

MEMBER APOSTOLAKIS: Unless we go to 3:00.

CHAIRMAN STACK: Let's get into the LOCA.

MEMBER APOSTOLAKIS: Okay.

CHAIRMAN STACK: Let's go on with that.

MR. KURITZKY: Okay. That's the acceptance guidelines. The second technical area -- These last two will be a lot quicker. If there are any questions on this, I'm going to push off to Rob's presentation. You're going to get a more detailed discussion on what's going on with the LOCA redefinition and also some of the interim efforts for LOCA frequency estimation from Rob Tregoning.

Right now, I just want to mention a couple of the overview highlight items and some of the background. For risk informed alternative GDC 35,

obviously we need some kind of LOCA frequency to plug in. In doing so, we need to consider not just LOCA initiating events but also transient induced or consequential LOCAs, RCP LOCAs or stuck open valves. We're looking at the -- picture. Therefore, we need all forms of LOCAs, anything that may require ECCS to have a response.

MEMBER BONACA: CRDM (PH) induced LOCAs?

MR. KURITZKY: Exactly. Actually then going on to the next bullet when we talk about LOCA initiating events, it's not just pipe breaks but it's also any other type of LOCA that can conform. They would be CRDM, leakage, a pump casing rupture, valve failure, or steam failure, anything that can result in breech of the RCS boundaries.

MEMBER APOSTOLAKIS: Let me understand this. In the design basis, is that how LOCA is defined?

MR. KURITZKY: Well, for 50.46 right now it's just pipe break LOCAs.

MEMBER APOSTOLAKIS: Pipe breaks.

MR. KURITZKY: Just pipe break LOCAs. If we're going to go to a risk informed approach, we need to be risk informed which means all types of LOCAs.

MEMBER APOSTOLAKIS: Why not in the

deterministic rules?

MR. KURITZKY: You'll have to ask whoever came up with the deterministic rules.

CHAIRMAN STACK: It really is. It just says that it limits the size of the LOCA to the size of the largest pipe. That was intended to bound all other LOCAs.

MR. KURITZKY: Yes. That's true.

MEMBER APOSTOLAKIS: Yes. It was the size.

MEMBER ROSEN: It wasn't intended to bound all other LOCAs. Was it? What about the reactor vessel?

CHAIRMAN STACK: It was presuming that --

MEMBER ROSEN: So there is a risk limit even in the existing --

CHAIRMAN STACK: As I said, the pipe was intended to bound all the LOCAs that were thought to be credible.

MEMBER ROSEN: In other words, have a frequency large enough to be considered.

CHAIRMAN STACK: Yes.

MEMBER ROSEN: In other words, risk informed.

MEMBER BONACA: Larger breaks would imply

the fragile of the vessel. There was considered low enough probability that would not --

MEMBER ROSEN: So I'm saying this much -- deterministic basis that we have is in fact risk informed.

CHAIRMAN STACK: Yes.

MEMBER BONACA: That was the risk informed.

MEMBER ROSEN: It's just how far we've gone. Now we're going further.

CHAIRMAN STACK: Yes.

MEMBER ROSEN: We're still not going to consider those a failure, except the heads, the CRDM hazards. Be careful with this because there are some logical inconsistencies that you need to avoid.

CHAIRMAN STACK: The CRDM failure is less than the size of a pipe.

MEMBER BONACA: Yes.

MEMBER WALLIS: As long as it's just that one.

MEMBER ROSEN: It doesn't spread and involve more than one CRDM.

MR. CUNNINGHAM: I'll remind the Committee that separately we've been talking to you about pressurized thermal shock as a mechanism for big

failures of the reactor vessel. Part of that is what's the frequency of these types of challenges.

MEMBER ROSEN: I think that the more rational approach doesn't limit it. It just said anything can happen. It's just like the frequency.

CHAIRMAN STACK: Then you image what the frequencies are.

MEMBER WALLIS: You imagine what the frequencies are?

CHAIRMAN STACK: When you start dealing with frequencies that are so low, it's --

PARTICIPANT: Imagination.

CHAIRMAN STACK: Very difficult.

MEMBER APOSTOLAKIS: It's not really imagination. You do have an idea as to how high they can be on a technical basis. I mean, it's not ten to the minus 2 per year. Right? Now, what the shape of the distribution is below ten to the minus four, that's speculative. It's not that we know nothing. In fact, this "understood" there I don't like. I would say are not well known or something like that, not "understood." We do know a lot. You don't have a guillotine break every hundred years. Right? Not even every thousand years.

MR. CUNNINGHAM: Not so far.

MEMBER APOSTOLAKIS: If you use probability fracture mechanics, then --

MR. CUNNINGHAM: I'm going to see that this afternoon.

MR. KURITZKY: All right. The cause and frequencies of transient induced LOCAs and very small LOCA initializing events are relatively well understood or known depending on your perspective. However, the bigger concern is with some of the larger breaks. Even the large, maybe even what's typically called small, we don't have quite as good a grasp on those.

PRAs are typically used for the cores of those LOCA frequencies. It has been WASH-1400 or NUREG-1150 type numbers which were principally based on older oil and gas pipeline data and is not necessarily directly applicable to nuclear power plants as well as being older.

NUREG/CR-57510 which was a report updating initiating frequencies of all types for PRA came out in the mid to later '90s I think. It was based on actual nuclear power plant operating more recent experience. However, some technical issues have been raised regarding the estimation of larger LOCA frequencies in that report.

Details I think have been presented to the ACRS at a previous meeting maybe a year or so ago. Rob when he gives his talk may talk a little more about some of that. The bottom line is that we have no clear consensus LOCA frequencies to use in the PRAs for this application right now. We are working on a three pronged effort to try and come up with LOCA frequencies.

Again, Rob is going to go into more detail on each of these. I just throw them up so you can see what the three different prongs are. Short term, in house elicitation to come up with some place holder LOCA frequencies has already taken place. Those frequencies are just for our own internal use in doing some calculations under this piece of work for the generic approach so that we can crunch some numbers.

Simultaneously or in parallel, there is an effort to put together a formal expert elicitation which will include --

MEMBER APOSTOLAKIS: You mean expert opinion elicitation.

MR. KURITZKY: Expert opinion elicitation. The time frame for that should dove-tail nicely with the rule making for this effort so that we will have the benefit of those values if we go to rule making on

a risk informed GDC 35. The third prong is the longer term effort to redefine the LOCA spectrum of size and breaks to be used for 50.46. That's I think a couple of years away.

MEMBER APOSTOLAKIS: The reactor safety study also did some expert opinion stuff. Right? It was not formal, but basically that's what it was. Right? The ten to the minus four that they had there.

MR. KURITZKY: I guess a lot of it was also based on actual data --

MEMBER APOSTOLAKIS: But as you say they were applicable. They are not applicable.

MR. CUNNINGHAM: The range of expert opinions that ended up being used was probably much more limited.

MEMBER APOSTOLAKIS: It's more limited. That's correct. I mean, this panel that came up with the assessed range and all that was a combination of in house and external expert opinion. But it was much more limited. That's true.

MR. KURITZKY: Okay. So in any case as I mentioned, Rob will talk following my talk and give much more details on the efforts we've done on LOCA frequencies. The third technical area that we've been addressing as part of this effort is the conditional

probability loss of off-site power following a LOCA. Again, in PRAs what's typically done or probably across the board is that the probability of a conditional LOOP after a reactor trip or a LOCA is assumed to be an independent event. The probability of a LOOP after a reactor trip or a LOCA, it's essentially taken the frequency of loss of off-site power initiating event and divided by 365 for a 24 hour mission time type of thing.

However, more recent analysis that was done in support of generic issue 171 on delayed LOOP identified that there is a dependency between the probability of having a loss of off-site power after there is a reactor trip or a LOCA. In fact, there was identified a dependency between a conditional LOOP after a wreck or trip and then even more of a dependency given a LOCA because of the additional loads that are going to be thrown onto the safety buses. The ECCS loads can result in dropping the voltage at the buses down below the under voltage, the degrader voltage, really set points. Unfortunately, there's extremely limited data on these conditional loss of off-site power.

MEMBER APOSTOLAKIS: Let me understand this. There is a dependency.

MR. KURITZKY: Yes.

MEMBER APOSTOLAKIS: How strong is that?

MR. KURITZKY: Well, how strong it is has been undetermined right now.

MEMBER APOSTOLAKIS: Is it one?

MR. KURITZKY: That's what we're trying to work on.

MEMBER APOSTOLAKIS: Okay. The second question is --

MEMBER ROSEN: Wait a second. You asked a good question. Is it one?

MR. KURITZKY: No.

MEMBER APOSTOLAKIS: He said no.

MEMBER ROSEN: Oh. But that's what the regulations says.

MR. KURITZKY: Yes. That's correct.

MEMBER ROSEN: So now we know it's not nothing or not so low that you can't see it. It has some value.

MR. KURITZKY: We certainly know it's between zero and one.

MEMBER ROSEN: Yes. We've got it in our sights.

MEMBER APOSTOLAKIS: But is that the only thing that's of interest here? Isn't the recovery of

off-site power also relevant here?

MR. KURITZKY: Recovery of off-site power, it depends. When we're talking about large break LOCA, we're talking about things happening pretty fast.

MEMBER APOSTOLAKIS: So you're saying the time scale of interest is not recovery.

MEMBER ROSEN: What does 6583 say about site specificity of that finding?

MR. KURITZKY: I don't know exactly what the details are in 6583 in regards to that. I do know that they're identified. It gave the engineering reasons why you have this dependency. As part of our work now to try to come up with the conditional probability of loss of off-site power after a LOCA, we have looked into some of these site specific or plant specific features that could drive that probability.

Obviously the best way to come up with the probability is with data. That would be the method of choice. We have very limited data on that. There's very few instances of a LOCA or a major ECCS actuation out there.

MEMBER ROSEN: I made my point for a reason. When you talk about data for pipe breaks, you're talking about data that could be accumulated

someplace. As long as it's the same material and the same welding, you can apply the data fairly broadly. When you're talking about this, you need to understand that this is much more site specific.

MR. KURITZKY: Yes.

MEMBER ROSEN: Data that you get at one site which has a given configuration and redundancy and reliability of the off-site grid may not apply at all some place else.

MR. KURITZKY: That's correct. We agree to that. One of our initial efforts was to try and come up with some generic probabilities of conditional LOOP but trying to subdivide it based on some of these plant specific factors that could drive that conditional probability. Unfortunately, we weren't that successful in that effort.

In any case just going back from the beginning, we saw we had very little data. Regardless of the plant specificity of that data, there just wasn't enough data in any case to do much with. In fact, I think the total number of major ECCS actuations in our database is something like 14. We actually have one conditional loss of off-site power. Again, we're dealing with a very small data sample.

One of the things that we did, we

undertook as part of the technical work for the plant specific option was to come up with a plant specific method for estimating the conditional probability of loss of off-site power given a LOCA. That is included in the deliverable that research passed on to the rule making people at the end of April. That method is something that was possible to be included in a regulatory guide. However, we want to note that it's also a data-driven method too.

It doesn't need the actual data of number of conditional loss of off-site power after reactor trips. It does need data on the voltage levels and the switch off in the various plants. That's information that may not be all that available. I think given the current trend in the industry that data is going to become more and more available as time goes on. As far as having it archived or having a sufficient database to do some calculations, it still may be a limiting factor.

MEMBER LEITCH: There are several kinds of losses of off-site power too. I mean, you could postulate the collapse of the grids in which case you're probably hours away from getting the electric power back. Maybe some of the dependency between LOOP and LOCA is more driven by voltage transients or

operator error or a breaker is just mistakenly open.

All you have to do to re-establish off-site power is just reclose the breaker. You still have the grid out there. Depending on what kind of a situation you're dealing with, there's a wide range and time to restore off-site power. I think a lot of the dependency to me just thinking about it a little bit seems to be -- I don't see the relationship between LOCA and loss of the grid. I do see a relationship between LOCA and perhaps false or misoperation leading to opening of the breaker where you can just reclose the breaker and get it back again.

MEMBER BONACA: Although, the burden is the generators then to support immediate ECCS injection.

MEMBER LEITCH: Right.

MEMBER BONACA: So even I agree that you may recover power quickly.

MEMBER LEITCH: Within ten seconds, no.

MEMBER BONACA: Not in ten seconds.

MEMBER ROSEN: Typically what happens is the diesels pick up and then the grid comes back, but the licensees don't switch back to the grid right away. It's been unstable and the diesels are not. So

the operators say let's leave well enough alone. We're fine. The emergency buses are powered. We'll wait until whatever happens out there goes away and it's been gone for some time before we try to re-energize the buses from off-site power.

MEMBER BONACA: Right.

MEMBER LEITCH: That's true in the case of loss of grid. What I'm saying is if it's just been a misoperation of a breaker out in your own switchyard and the grid is still there, you can close it and go back to normal.

MEMBER ROSEN: Sure.

MR. CUNNINGHAM: As we've been alluding to though in the context of here, we're talking about the actuation of safety equipment and the seconds and few minutes after a large break LOCA.

MEMBER LEITCH: Right.

MR. CUNNINGHAM: So again the timing is maybe quite different for some of the things you've talked about.

MEMBER LEITCH: Absolutely.

MEMBER WALLIS: Why is it always a LOOP following a LOCA? Considerably, you could lose off-site power and then the plant could somehow mishandle the transient.

MR. KURITZKY: Actually that was addressed. 6538 looked at both LOCA/LOOP and LOOP/LOCA.

MEMBER WALLIS: It always seems to be looked at one way.

MR. KURITZKY: Right.

MEMBER WALLIS: I think this from a frequency point of view this is the more.

MEMBER ROSEN: I think we have quite a lot of data that says LOOPs don't cause loss of coolant accidents in general.

MEMBER WALLIS: They would probably be of a suck open valve type.

MEMBER ROSEN: Yes.

MEMBER WALLIS: There would be somehow a transient that leads to a loss of integrity of the circuit and probably a stuck open valve.

MEMBER ROSEN: Fortunately, we don't have a lot of data on that also.

MR. KURITZKY: Dr. Wallis, NUREG/CR-6538 did postulate a few ways that could occur. I don't know exactly the resolutions on that were. Just to get back to what Dr. Leitch said, the issue that we're looking at right here, it's not the only issue but the primary thing that we're looking at as far as the

dependency of the LOOP with the LOCA is a scenario where you have -- Actually the grid is still available out in the yard. All the homes in the neighborhood still have their lights on.

What happens is the grids are in somewhat of a degraded condition but not to an alarmed condition. Then you have the reactor trip which further degrades the grid. You may lose voltage support. Then if you have a LOCA right there and you're transferring all your loads from a unit auxiliary transformer onto this stark transformer that reserve station transformer sites further accident grid locally. Then you start your ECCS loads. What happens there is you can bring down the voltage to the point where you hit those trip set points.

There's not a lot of margin. Those trip set points have been raised fairly high because they want to protect the equipment. That's the whole purpose. Those are in a tough position because you need to worry about both sides. You can't just always set them high or always set them low because you have competing things. So it's a tight fit in there.

The real possibility exists that you'll drop down to that level and separate the plant. Then the diesels will come on as desired. But that's a

situation we're trying to avoid. What we're trying to calculate is to not need to have those diesels come on. What's the probability of not needing to have those diesels?

In any case like I said, we have a plan specific method that we've come up with. I don't know exactly how practical it will be. We're still looking at it. Simultaneously, we've been working with industry. We've been having a series of meetings on this topic particularly a focus on the LOCA/LOOP area. We've been meeting with them about every month or two for quite a number of months or a year.

We have been focusing a little bit more in detail on the conditional LOOP probability. Industry has done expert elicitation for the probability of LOOP after a LOCA. They have supplied that to us. We had one public meeting to discuss it just a short while ago. We have another one scheduled for later in June. The staff right now is reviewing that report. We have some questions, comments or concerns.

We're going to have a more detailed meeting with stakeholders later in June. We ultimately may accept it or adopt it into some method that we have. We're not exactly sure how that's going to play out yet. We are taking active measures to try

to come to some kind of resolution on that conditional LOOP probability.

MEMBER ROSEN: When you say in the first bullet that the plant specific method is in Appendix D to the RES report, what report is that?

MR. KURITZKY: That's the deliverable --

MEMBER ROSEN: 6538?

MR. KURITZKY: No. This is a package that you -- That's the report that went from research over to --

MR. CUNNINGHAM: It's page D10.

MS. DROUIN: It's the April report.

MEMBER APOSTOLAKIS: Now then this condition of probability will probably have significant uncertainties because it's really expert judgement. How are you going to handle that? You said in an earlier slide you had the words "with appropriate consideration of uncertainties." Now when the uncertainties are fairly large and you're about to make a decision of such an importance, do we know how to handle those? Are you still going with the mean value and you say I have -- attention?

MR. CUNNINGHAM: We're not there yet.

MEMBER APOSTOLAKIS: Okay.

MR. KURITZKY: Okay. Now the last slide

I have is just to go over -- Even though like I said up to now we've been working on --

MEMBER APOSTOLAKIS: The last thought you have?

MR. KURITZKY: The last slide.

MEMBER APOSTOLAKIS: Oh, slide.

MR. KURITZKY: We've been discussing out plant specific approach. That was our first milestone of trying to generate some kind of -- looking at a plant specific approach. We're still fine tuning some things obviously. However, we've also started embarking on looking at the generic approach. That's also going to be covered in our deliverable in July.

Many if not all the issues and areas that were brought up by the various members of the committee and other people are valid for the generic option as well as the plant specific. There are two additional items that particularly pertain to the generic and make it a little bit more complicated.

The technical work besides the other areas that we've already discussed include formulating plant groups based on ECCS configurations and support system configurations and trying to bin them appropriately and keeping the number of groups manageable, performing reliability or risk calculations for a

representative plant of each of those groups.

MEMBER APOSTOLAKIS: So there you will have the issue of what kind of distribution is used for the failure rates given LOCA conditions. Right?

MR. KURITZKY: We're going to have a lot of issues like that. When we're looking at it from a generic point of view, we have that issue. First, as I mentioned before, we do these calculations to represent a plant to try to come up with a minimum set of ECCS equipment to meet the guidelines and also to look at whether or not the LOCA/LOOP assumption is risk incidents and will cost a generic basis.

MEMBER APOSTOLAKIS: But if you're using frequencies to guide you in this selection, what numbers you use for the failure rates would be very important. Right?

MR. KURITZKY: You're talking about the basing of that input data for the PRA?

MEMBER APOSTOLAKIS: Yes.

MR. KURITZKY: Yes.

MEMBER APOSTOLAKIS: You say what kind of equipment. Right? Then the minimum number. All that has to be guided by numbers that are themselves uncertain.

MR. KURITZKY: Right.

MS. DROUIN: That's correct.

MR. KURITZKY: Not only that, but they're going to differ. Obviously when we look at a group of plants, Group A has six different plants in there, they may have a similar equation, but plant to plant they may have totally different failure rates for the different --

MEMBER APOSTOLAKIS: Of course. The other thing is can you really use the existing distributions for failure rates since we're using PRAs now. Here you have a specific event that has happened, assumed to have happened, a large LOCA. Right? Most of these distributions especially now that we're using this base and updating routinely are based really on normal routine tests that do not have any large LOCAs anywhere. So I'm not sure that those distributions are applicable.

MR. KURITZKY: This is not just going to be looking at that. When we do these calculations, this is going to be full plant PRA model calculations. This is not just looking at large LOCAs, regenerating the full PRA results.

MEMBER APOSTOLAKIS: Yes. But don't you assume, I mean --

MR. KURITZKY: But the testing regiments

from which the data is derived are intended to be appropriate to the function of the system, so that a valve that is tested is tested against the delta P and --

MEMBER APOSTOLAKIS: Well, the applicability of the distributions has to be scrutinized. You're saying that's fine.

MR. KURITZKY: I'm saying it's likely to be okay because if it weren't then the tests wouldn't have been right.

MEMBER APOSTOLAKIS: But still though having a large LOCA condition. Anyway.

MR. CUNNINGHAM: There are a number of challenges for this generic approach.

MEMBER APOSTOLAKIS: Yes. Do the operators come into this at all or is it the time is getting so short?

MR. CUNNINGHAM: This is ECCS reliability across a spectrum of initiators not just the broad.

MEMBER APOSTOLAKIS: Okay. So they will come.

MR. CUNNINGHAM: Yes. Which again brings a challenge to being in the plants if you will.

MR. KURITZKY: And also the big issue is a priori scope of quality as we've been discussing at

length previously. Of course as identified, that's something of concern for when we talk about the plant specific application. You may have a known application that you can get your hands around. You can try to see what it impacts. If there's areas around a scope, you can try and get a handle on maybe how important they are.

In the generic approach, we're not going to have that benefit. We're not going to know the applications of a priori. We're going to have to just do an across the board type of determination of what equipment is necessary based on our calculations without knowing how it's going to be applied. The out of scope items are going to be extremely difficult to address. You can't use some of these qualitative arguments for application specific arguments to cut pieces of the pie away. So I think this is one of the biggest potential limitations to the generic approach.

It's the whole PRA scope and quality issue. For quality, right now we're looking at the models in house which are SPAR models. In the most current versions that have the more complete set of initiating events have not been QA'd yet. So there's a decision that needs to be made about whether or not these SPAR models are usable for a regulatory purpose.

I think there is a plan to have those things QA'd by the end of next year which would work out I guess okay in terms of time for our rule making. But still just the issue of the completeness and the data used and the scope of these models because they're of course all just internal power raise some daunting challenges to doing this on a generic basis. Theoretically, if we can go ahead and do this on a generic basis and that's what we're at least for the next month or two are going to get a little more information on that as we try to do some sample cases.

MEMBER APOSTOLAKIS: We've been saying for a long time as an Agency and I think Chris Grimes repeated it earlier that if you have a detailed analysis plant specific full scope and everything, you should have some benefits. Right? Versus the guy who just comes in there with a very modest analysis. This is a generic approach. In principle, a guy who does a plant specific analysis should have more benefits. Right? So where is that hidden? Where can I have more benefits?

MR. KURITZKY: Well, I hope it's not hidden. The fact that you even asked the question means maybe it is. The idea is that if we can come up with a set of minimum ECCS equipment and/or design

basis analysis really focus on LOCA/LOOP for generic groups, then a plant can go through and pick that themselves and not have to do an analysis and are not required for an NRC review. That would probably be -- in a regulatory fashion.

However, if they're the limiting plant in that group, that may very well be the limit of what they can give in a plant specific analysis. If in fact they have a more detailed analysis and their configuration or whatever else is better then what's the limiting one of the plant in that group, then a plant specific analysis could get them a lot more benefits.

MEMBER APOSTOLAKIS: A lot. Okay.

MR. KURITZKY: Anyway, the last point I want to make is again the equipment in excess of the minimum would be candidates for design or operational changes. The full extent of what would be allowed as far as those changes is still a decision that has to be made; whether that's allowing relaxation of tech specs, or whether that's allowing equipment to be taken out of the plant or to be no longer maintained, *et cetera*. That's still an issue that has to be resolved. Okay. That's it.

CHAIRMAN STACK: This is through. If

there are no more questions, I think it's time for a break.

MEMBER RANSOM: I have a question. What is the benefit to the public safety and health of making these changes?

MR. KURITZKY: Well, to some extent that's on an application specific basis. Our units made that if you extend a diesel start time you'll end up with more reliable diesel. That's one outcome of this change. Focusing attention of the plant operators in training on more realistic accidents as opposed to large break LOCAs with a set of unlikely --

MEMBER RANSOM: Well, if you go through the full analysis, then you'd conclude that there is a lower risk to the public as a result of these changes. Is that right?

MR. KURITZKY: Well, again I would say that with -- there's a lower risk in the sense that it's just a regular -- Changes if the risk increase is insignificant are allowable. So that's different then saying there's a decrease in risk.

MEMBER APOSTOLAKIS: Well, the way we put it when 1.174 was formulated was that the results are a non-quantified part of the benefit and risk.

MS. DROUIN: That's right.

MEMBER APOSTOLAKIS: The overall result is really a net reduction.

MS. DROUIN: Yes.

MEMBER APOSTOLAKIS: We are hoping.

MS. DROUIN: You can't just take the part that's for the LOCA. You have to look at the overall effect, the overall plant operation and overall that would be a decrease.

MEMBER RANSOM: Certainly from the public's point of view, it would be much easier to sell these changes or whatever if you're giving something back. You take something away but you get maybe more back.

MR. CUNNINGHAM: The expectation is that this will happen. In some cases, it's not very quantifiable in terms of how that's occurred or how that would occur.

MEMBER WALLIS: I have a question. I don't know how far along you are. I was impressed by the range of your presentation and all the things you covered. It seemed to me that it hadn't come together to the point where you have the final product and there's some way to go.

MR. KURITZKY: Yes. In fact, I think Glen Kelly had mentioned that there's a working group that

has been put together. Now there's NRR and --

MEMBER WALLIS: But to go back to Mark saying that he's going to convince us that you have all the technical basis, it seems to me that you have some way to go before you can say now we really understand things enough that this is the basis for our decisions.

MR. KURITZKY: Right. As you've heard today, there's still issues.

MEMBER WALLIS: Is it another year or two? How long is this?

MR. KURITZKY: We're hoping that by July we have a much better handle on it.

MEMBER WALLIS: I'm wondering if that's realistic.

MR. KURITZKY: It depends on the time to resolve some of the issues. I think we should have a much better handle on whether or not it's a viable and practical alternative by July.

MEMBER WALLIS: Is that realistic?

MR. CUNNINGHAM: The next step then is what does this start to look like in real changes to the words in the regulations. Then we'll come back to the issue of have we given you a basis to do it.

MEMBER WALLIS: We're looking into this or

we're doing work on this but not much on we've concluded this.

MR. CUNNINGHAM: Yes.

MEMBER WALLIS: If you haven't done that by now you are unlikely to do it in my view by July.

MR. CUNNINGHAM: July is a point along the way. Beyond that, it's let's think about what the rules look like. Then we can focus the technical work a little better.

MS. DROUIN: We're starting to do the calculations on the plant grouping to see if that's going to work out. In terms of the technical work, that's where we are right now.

MR. KURITZKY: For the plant specific, I think we're a little further along. But as you heard today, there are still open issues. To conclude this up just to let you know when we come back, Rob Tregoning is going to talk about the technical work to support the changes for ECCS spectrum of break sizes and locations.

CHAIRMAN STACK: Okay. Let's take a break then until 11:00 a.m. Off the record.

(Whereupon, the foregoing matter went off the record at 10:39 a.m. and went back on the record at 11:00 a.m.)

CHAIRMAN STACK: We're on the record.

MR. TREGONING: Now that you're sufficiently warmed up and had a break. I'm assuming everyone's ready to jump into LOCA discussions. So we're going to be talking about two things; both LOCA frequency redefinition and redefinition and also the LB LOCA break size redefinition. I'm Rob Tregoning from RES. Lee Abramson is not here, but he's participated with me on this effort.

I just wanted to present the first slide. It's a bit of an update of what we've been doing since the prior ACRS briefs. You've heard about the LOCA definition a number of times. Probably the last substantive brief was given in March of last year. During subsequent meetings of both the sub and the main committee, there have been overview sorts of information provided on LOCAs similar to what Alan provided earlier today.

I'm really considering this as the first one since March that you've really heard any gritty details on. Since March, what has RES been doing in this issue? First, we developed a technical position paper documenting issues that need to be addressed for LOCA re-evaluation. This paper was provided in the packet that was sent to you prior to the meeting. As

well as all of the issues involved in that paper have been briefed to the ACRS before. I'm not going to cover in my slides a lot of those issues. However, they're certainly open for discussion here.

The other thing we did is we have some very real and definitive goals that are outlined in the SECY papers first 01-0133 which has been superseded by 02-0057 that we need to meet. Oh, thanks. We have everything. We're really skirting the outsets of technology. You said we don't define or push the boundaries of technology here. Well, we have everything. We have a laser pointer. We have a Power Point presentation and everything. The NRC does push the boundaries of technology regardless of what people might think.

MEMBER ROSEN: Our defense in depth is we have an overhead projector and we still have fingers.

(Laughter.)

MR. TREGONING: In my lack of defense, I didn't bring slides. I'm not practicing defense in depth on this talk. You would not want to grant me a license or anything for giving talks or anything like that obviously.

So what have we done? We've formulated an approach for realizing both the near term goals and

the long term goals which are outlined in these papers. We've actually completed the near term elicitation to develop what we're calling interim LOCA frequencies but also to develop ideas and issues that need to be probed more fully when we launch into this formal or what I'm calling here this intermediate term elicitation. I'm going to go into a bit of depth on the near term elicitation; how it was structured, what some of the outcome was, and even what the results were.

In terms of public interaction, we've had essentially three formal meetings in August, October and March 2002 which dealt specifically with LOCA issues, not LOCA/LOOP or other issues related to the 50.46 revision. Specifically it was LOCA issues. Next please.

I put the ending slide in the beginning because of not knowing how far I'll be able to make it through the presentation. I figured we'd hit the end-points here. All you'll hear from this point on is essentially filler or additional details. These first two bullets, again I'm not going to touch on much other than on this slide. Mainly the talk is going to focus on the efforts that we have ongoing.

In terms of summary, we know that

historically LOCA estimates have been based primarily or entirely essentially on service history experience and database and experience with pipe break failures, not just in the nuclear industry but also in other industries. In some cases, we've used other industry information to provide bounding information. In some cases as in the WASH-1400 studies, we actually used other industry experience; specifically oil and pipeline, gas transmission pipeline, military, even some commercial power experience to provide estimates that we've used in various studies.

However, the only problem with service history experience databases is since the last study was done there have been several potential LOCA initiating events that have occurred that have been very high profile. Certainly these include VC Summer, Oconee and most recently Davis Besse. These were events that people had never really considered as being plausible LOCA initiators in the past. The case of Davis Besse as you discussed earlier had not really even been considered at all. Like you had said, the initial rule was deterministically based and Davis Besse type events, things that could happen in the reactor was essentially the risk that people were willing to live with at that time.

MR. BOCHNERT: A question. What about the two recent events overseas with the hydrogen explosions?

MR. TREGONING: In terms of Hamo (PH) and Brumsbeter (PH)?

MR. BOCHNERT: Yes.

MR. TREGONING: I didn't list those specifically, but there's another case where we've had pipe failures that have occurred very dramatically without any precursor events. Those types of events definitely need to be considered also.

MEMBER WALLIS: One was very close to the vessel. There happened to be a valve in the way. It could have occurred close enough to the valve to prevent its closing.

MR. TREGONING: Yes. That's correct. So those events definitely have triggered some further digging and further investigation of potential generic implications, not just for our plants but then also specifically for these LOCA frequency estimates.

As Alan mentioned earlier, we have a three-pronged approach for trying to re-evaluate the LOCA frequencies to be utilized --

MEMBER WALLIS: Very interesting. If you would have done this work six months ago, you wouldn't

have had to consider the second bullet.

MR. TREGONING: You're correct. We'll get into this a little bit later. One of the things we need to look at when we're evaluating LOCA frequencies are the occurrence of surprise or potentially unknown events and how those factor into the database. That's a very good point and something we need to consider. It's not an easy thing to consider by any means.

MEMBER WALLIS: It's probably the most likely.

MR. TREGONING: Sure. You're right because once you know what a mechanism is you can set up mitigation factors to counter that mechanism occurring or decrease the likelihood of it occurring in the future.

MEMBER APOSTOLAKIS: In that first bullet, you're referring to frequencies, historical LOCA frequency estimates?

MR. TREGONING: Yes. Frequency estimates.

MEMBER APOSTOLAKIS: Were based on service history experience?

MR. TREGONING: Experience databases, yes.

MEMBER APOSTOLAKIS: Really?

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: I thought it was

expert --

MR. TREGONING: Well, expert opinion was used to justify usage of those databases. For WASH-1400, they used an oil and gas database. They used expert opinion to justify the use of that.

MEMBER APOSTOLAKIS: Okay.

MR. TREGONING: Expert opinion was certainly a very important part of the process.

CHAIRMAN STACK: When you get the large pipes, it's hard to have enough data. I mean it becomes a combination of data and expert opinion.

MR. TREGONING: It's hard to have any data.

MEMBER APOSTOLAKIS: Okay.

MR. TREGONING: Mystical science and everything's rolling into large pipe break LOCAs as we're going to find out a little bit.

MEMBER WALLIS: Which oracle do you use?

(Laughter.)

MR. BANERJEE: If it was WASH-1400, then you didn't have the Flixber (PH) accident in there which was a double ended guillotine break.

MR. TREGONING: Right. Although if you talk to the database guys, they would say implicitly all of these accidents were contained in the database.

It's just at the time that the database was sampled they hadn't occurred yet so they didn't show up as a frequency of occurrence. It's a matter of semantics possibly, but it's realistic nonetheless.

Getting back. We have a three-pronged approach for trying to deal with this issue. The first one is complete. We developed interim LOCA frequency numbers using a staff or an internal expert opinion process. So this is the near term. We'll talk about this in detail. The bottom line is the results that we got. We evaluated both small break, medium break, and large break LOCA frequency estimates. They were on the order of two to four times higher than some of the most recent estimates.

MEMBER WALLIS: Could I ask you about these expert opinions? I mean, are these people given enough time and money that they can go away and make some real calculations or are they just asked what do you think?

MR. TREGONING: In this effort, no, they were essentially asked what do you think. In the next effort as we'll see, the intent is to give them time to actually do some calculations to support their opinion. So you're right. If these are done in a textbook way, you have not only your opinion but then

the uncertainty in your opinion. So your opinion may not change but you may have more or less uncertainty depending on the amount of work you've been able to do in the interim to develop that opinion. Those issues like you said affect the opinion and then the uncertainty.

MEMBER WALLIS: You would be more convincing if there was an expert analytical conclusions rather than just opinions.

MR. TREGONING: Yes. We'll get into this I'm sure. There have been a lot of analytical studies over the years. You talk about model uncertainty. When you talk about LOCAs and specifically large break LOCAs, model uncertainty, you have to be careful because that tends to drive the problem. So you get a certain answer, but a lot of times you're uncertainty is a large percentage of that answer. That's really the problem I would say that we've had in the past and something that we really need to evaluate very rigorously especially when we're on this effort but then also this effort too.

MR. SCHROCK: The PERT process is supposed to be some structured way of integrating expert opinion to achieve a better judgement than you would looking at individual expert opinion. Is there some

way you can apply that in this context?

MR. TREGONING: I would say yes. I will say that I'm not that familiar with the formal requirements of PERT. However, I'm going to explain a little bit especially the philosophy and at least the initial approach of the plan behind the intermediate term elicitation. Maybe at that time, you can tell me if it fits within the guidelines of PERT. If it doesn't, what are the modifications we need to make to ensure that it's going to be compatible? Elicitations are somewhat dicey in that you have to be careful that you structure them correctly so that the results that you get are intentional and not unintentional.

MEMBER FORD: The second, the intermediate term, that is likely to be very plant specific especially if you're talking about degradation modes. Will that be taken into account or will it still be a generic change to LOCA frequencies?

MR. TREGONING: I think the intent is to do a generic change. Although, you're absolutely correct. There are certainly many aspects that are very plant specific. I think we do want to look at how plant specific differences would effect those generic numbers. If there's just a few plants that

are driving the generic numbers, then it doesn't make much sense. I think you look at potentially the Benning (PH) type of analysis that Alan does.

MEMBER FORD: Okay.

MR. TREGONING: Maybe you look at Benning (PH) at that point and develop potentially several generic. We're not there yet, but that's certainly a potential approach that could be utilized.

CHAIRMAN STACK: Now when EPRI did their risk informed inspection, they went through a database analysis to come up with the frequencies. One of the things I liked about that was they broke it out for pipes that were subject to flow assisted corrosion. They had one estimate to pipes that were subject to IGS. You had another estimate. So then you can go back to a plant and cobble up and answer appropriate to the plant by deciding whether this plant was susceptible to FAC or not.

MR. TREGONING: That's a good point. In the past especially with these historical estimates, we've never had databases that were that well defined and distinguished. We knew not just piping failure statistics but also root cause. We weren't able to factor that in for our near term study.

The hope is certainly through use of some

of the more recent, current databases that we'll be able to break things down on a mechanistic level. Then you're right. That's a particularly very solid approach for evaluating plant specific differences at that point.

MEMBER WALLIS: If you hired me as an expert, I would have to say that the major incidents in nuclear stations so far that the biggest influence has been human inappropriate behavior. I don't know how to put that into my -- That's something that changes all the time.

MR. TREGONING: Yes. Again, when you do an elicitation process, it's really an elicitation at that point in time. You talk about a basion (PH) update. When people get more knowledge, they do their own basion (PH) update of their opinion. You hope that the uncertainty bounds that you develop because you're not just developing best estimates, you're developing bounds also, that they will account for that uncertainty or likelihood that things may change in the future.

MEMBER FORD: Now, will a time element come into this?

MR. TREGONING: Yes.

MEMBER FORD: As well as a generic versus

specific aspect, will there be every year a change in this LOCA frequency because of time dependent degradation?

MR. TREGONING: Yes. I think what our intent is and again it's just an intent, so one of the reasons I'm here is to outline a potential philosophy and approach but also solicit ideas from the collective experience of the group. The initial intent is that we want to look at LOCA frequencies over defined periods of time, so from now, going forward, ten years out, 20 years out, 30 years out, up to the end of license renewal. You'd like to be able to use single numbers just for ease. So I think we'd like to get to the point where if possible we take these end of license extension numbers and utilize them within the PRAs.

If the assumption is and again I'm making an implicit assumption that LOCA frequencies are going to go up in the interim. Maybe we decide as an expert group that they're going stay level or go down. Then you might have a different interpretation of what numbers to use if that's the conclusion. If they were going to go down, I would argue we want to be using bounding numbers essentially in our analyses. I don't like to use bounding with the PRA guys. It makes them

uneasy. I'm a deterministic guy, so I still think in terms of bounding or conservative many times.

MEMBER ROSEN: I think the reason that we're doing this would not be served if we used estimates that were likely too low, non-conservative.

MR. TREGONING: Yes.

MEMBER ROSEN: Because we will take actions based on those non-conservative estimates which we will not be able to undo potentially when the estimates are raised, for instance, removing some equipment from a plant. We have to use conservative numbers that are good enough for the life of the plant. Otherwise, we're going to have an unworkable system.

MR. TREGONING: And I totally agree with that. However, I'll get back to the point that these elicitations are points in time. There may be other information that comes up subsequent to the information that would cause that elicitation and those estimates to be revised. We will try to account for that as best as possible, but there still will be some probability that there's a Three Mile Island type of event that calls us to really re-evaluate things from the ground floor.

CHAIRMAN STACK: But you did ask your

experts whether they thought the frequencies would increase. That was one of your questions.

MR. TREGONING: Of course. And it will be for this also. I think we've finished my talk now, so maybe I can -- I don't think I have many more slides past this. We'll go through them anyway.

MEMBER WALLIS: Don't you have some conclusions?

MR. TREGONING: This is it, executive summary. Then in the longer term and this is really a separate effort, we touched on this a little bit, we'll be looking to redefine the spectrum of pipe break sizes so that we can possibly consider capability changes. Again, we want to do this wherever possible within existing PRA and our risk informed ISI type of framework. This is very fuzzy.

I'll talk a little bit about approach. Again, this would be based on probablistic fracture mechanics which I know there's many in the group that have no love toward PFM, so we'll talk a little bit about some of the advances within PFM that will be required to do this. Then it will also need to be combined with PRA where necessary to augment the answers provided by the PFM.

You've seen this slide before. These are

Alan's four components. This is just up here to say the LOCA frequency distribution impacts this in terms of the reliability requirements, specifically LOCA/LOOP and then also the spectrum of break sizes. So there's really two of the four components or sub-categories that are affected by LOCA frequency distributions in this 50.46 re-evaluation effort.

These are just overview slides. This is the three-pronged approach that I talked about. All I'm showing here is that we're going to delve into now the near term elicitation. I wanted to provide you some more details as well as results from that and then obviously solicit feedback, opinions from this group that I can take to utilize in the intermediate term elicitation.

This is how it was structured. We had 11 staff on the panel. It was fairly well balanced between the regulatory folks and the research folks. We also had I thought a very good range of expertise in relevant technical areas. We sample amongst these 11 people, I think six or seven different branches, maybe even eight different branches within the NRC.

What we really tried to do was get people that knew something about PRAs; something about the ASME code of course; structural mechanics; thermo-

hydraulics in terms of loading; piping systems, their design fabrication and use; certainly seismic, thermal, vibrational loading; environmentally assisted cracking which is obviously a very important player; and thermal aging, so these are material effects; but then also people that knew something about these alternative LOCA mechanisms, things like CRDM failure, Davis Besse, that again historically hadn't been considered in the initiating event frequencies for LOCAs.

MEMBER WALLIS: Do have a human factors person?

MR. TREGONING: That's a good point. We didn't specifically have a human factors person. However, there were people within NRR that had some human factors experience. That wasn't specifically targeted in this. The other thing that we tried to do is when you're dealing with any group, you're looking for the optimal number too. We didn't want to make this to be so unyielding that we wouldn't be able to provide estimates.

However, when we go into the intermediate term and again I would like to get some feedback from the group if we need to specifically consider a person, two-person, three people that their primary or

sole expertise is in human factors. That's something I'd like to clear up today so that we can move forward at this point.

MEMBER APOSTOLAKIS: Are these people, the 11 experts going to work as a group?

MR. TREGONING: In terms of the elicitation?

MEMBER APOSTOLAKIS: Yes.

MR. TREGONING: Yes. I'm going to specifically outline how it was done. We individual elicited each person. However, we went through idea and issue development as a group. The idea was to develop the baseline set of issues and the baseline definition as a group, go away, and then answer your questions regarding changes in those baseline definitions individually.

MEMBER APOSTOLAKIS: But what would the thermo-hydraulics or PRA expert know about the frequency of LOCAs? Why are they experts? I can see them contributing to the discussion regarding circumstances, loads and so on.

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: Then I don't see. The PRA expert will give you frequencies that he has heard in the past.

MR. TREGONING: Right.

MEMBER APOSTOLAKIS: Why should I believe that?

MR. TREGONING: When you define any expert panel especially one that requires this broad range of technical expertise, you're not necessarily going to get -- Each person is going to have their own specialty. The way we structured the elicitation was for people that didn't have the baseline knowledge, they simply didn't provide responses. Obviously, if they weren't an expert in fracture mechanics or environmentally assisted degradation, they weren't required to provide answers with respect to --

MEMBER APOSTOLAKIS: Did anyone refuse to give you estimates?

MR. TREGONING: People gave estimates in areas that they were comfortable giving estimates in. That's a backward answer to saying, yes, people picked and chose what questions they wanted to answer.

MEMBER APOSTOLAKIS: This brings up another issue which maybe you want to implement in your intermediate term and longer term processes. We spent a lot of time and Nilesh, I think you were involved, some years ago thinking about these issues and expert opinion elicitation in the context of

seismic hazard analysis. Are you familiar with that work?

MR. TREGONING: Yes, in a general sense.

MEMBER APOSTOLAKIS: Well, maybe you should become a little more familiar because this is very relevant to this, maybe not to the near term. The issues there are similar if not worse than here. You're talking about very strong earthquakes in the eastern part of the United States where the experts disagreed, there are different models and so on.

As I recall, there were different approaches. One was by EPRI which formed groups of experts like your group. They recognized that one guy doesn't have the requisite knowledge. In your case, you would have say three different groups; each one having a PRA guy, a thermo-hydraulics guy, a piping guy and then the group would give you an estimate instead of individual people.

MR. TREGONING: Okay. So you have three different estimates from each group.

MEMBER APOSTOLAKIS: That's right. But each group had its own experts in it. That's one approach. Then we also proposed the technical facilitator integrator approach and so on. I think it's extremely relevant to this, and the NRC paid for

it. You should take advantage of it.

MR. CHOKSHI: George, I think in earlier planning definitely some SHAK (PH) principles and distribution -- formed technical community and basic guidelines there.

MEMBER APOSTOLAKIS: Well, that SHAK (PH) is not this Shaq.

MR. CHOKSHI: No. That's right.

MEMBER APOSTOLAKIS: That SHAK (PH) is a seismic hazard analysis.

MR. CHOKSHI: That's comedy. Good night.

MEMBER APOSTOLAKIS: It's a different SHAK (PH).

MR. CHOKSHI: We will intend this to follow --

MEMBER ROSEN: I think he's seven foot, one inch.

MR. CHOKSHI: That's another Shaq.

MEMBER APOSTOLAKIS: I think in these complex issues the ideas of having groups of experts -- You see because the issue is how do you make sure that you will have reasonably estimates. That's why you have separate groups. But these estimates must be meaningful which means that one guy does not necessarily know all this stuff, so you form two or

three.

MEMBER ROSEN: There are also several papers written by learned people on the dynamics of an expert elicitation panel that you ought to look at. One of them is even a member of this committee. In other words, making sure that it doesn't get dominated by one person.

MR. TREGONING: Right.

MEMBER WALLIS: Since the record shows that George's question the value of having a thermo-hydraulics person on this group --

MEMBER APOSTOLAKIS: No, I did not.

MEMBER WALLIS: I thought you did.

MEMBER APOSTOLAKIS: No. I questioned the value of having that person say it's ten to the minus four.

MEMBER WALLIS: I see.

MEMBER APOSTOLAKIS: But having him part of the group.

CHAIRMAN STACK: We didn't ask anybody that question. They start with databased destinations and then adjust those.

MEMBER APOSTOLAKIS: I'm not criticizing. I was just emphasizing the point that the group needs to have all these things.

CHAIRMAN STACK: The notion that somebody's going to come in and say the pipe break frequency is ten to the minus four is when heck will start to go to the ceiling.

MEMBER APOSTOLAKIS: I wouldn't be surprised. Many elicitations are --

CHAIRMAN STACK: Well, I know. That's why you have more faith in an elicitation that doesn't ask that question.

MR. TREGONING: Right. When we talk about the intermediate term at least and again, we're getting a little bit ahead, the idea that we had was essentially to structure the elicitation possibly two ways. Both ways you would have a baseline frequency estimate that you would be providing changes to up or down.

One would be a more I guess typical elicitation where the group and individual feedback provides changes to small questions which then you recombine those small questions through analysis to determine what the frequencies would be. That was essentially how we did this effort. The other way we're looking at proceeding is actually using the models to provide us numbers, but then using the expert elicitation process to provide the input

parameters for the models themselves. So that's really more along the lines that I think you've outlined here.

It's not necessarily the small group panel because you would have maybe one model or maybe two models that you would exercise. But you would exercise these models based on the input. Again, the expert opinion of the group provides the input itself to the models.

MEMBER APOSTOLAKIS: Yes. The exercise in the models is part of what is called in those reports the technical facilitator integrator approach.

MR. TREGONING: But then I get back to your point earlier this morning about model uncertainty. That's going to be a big driver especially when you get into the various codes and models.

MEMBER APOSTOLAKIS: Well, but this is what this exercise is supposed to do.

MR. TREGONING: Yes.

MR. CHOKSHI: I think the SHAK (PH) analogy with the -- models and things is already parallel to what we are doing here.

MR. TREGONING: Okay. So back to the near term.

MEMBER LEITCH: Rob, I see apparently the absence of people with an operating and maintenance background there. I would think that might be a valuable input as well because they have a good sense of the kind of things that can transpire as plant operations go.

MR. TREGONING: Right. Again, we were relying on in house corollary expertise in many of these areas. Certainly when we do the formal one, we'll be looking to bring more people that have that expertise. In fact, this was in house, so you're limited by your in house knowledge.

MEMBER LEITCH: Right.

MR. TREGONING: The next one is going to be teamed with international folks in the community. Certainly the industry is going to participate. It's going to draw from a much broader pool of people and expertise.

MEMBER APOSTOLAKIS: Does that paper from Sweden make sense here?

MR. TREGONING: Which one?

MEMBER APOSTOLAKIS: The Thomas (PH) correlations and all that with the -- Are you familiar with that?

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: Not the old Thomas (PH). There's an updated one done by a guy using data that the Swedes --

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: The SKI.

MR. TREGONING: The SKI. In fact, you'll see. The SKI stuff we're proposing will be the foundation of the intermediate term elicitation for a variety of reasons, not just because it's a newer look at pipe fracture.

MEMBER APOSTOLAKIS: But that would be another model, I guess.

MR. TREGONING: Yes.

CHAIRMAN STACK: When he says that, he means PFM.

MR. TREGONING: I mean PFM. I mean a predictive model of the future where --

MEMBER APOSTOLAKIS: That's predictive too. It's kind of --

CHAIRMAN STACK: It's a different kind of model.

MR. TREGONING: Right. It's a totally different kind of model. That's right.

MEMBER APOSTOLAKIS: Different.

CHAIRMAN STACK: Well, a statistical model

is one thing. A PFM is where the experts give you all the inputs for a PFM and the experts tell you which PFM code to use, but the PFM code generates the ten to the minus twelve.

MEMBER APOSTOLAKIS: No, but in an exercise like this I would like to know what the results of these other models are.

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: If there is a large difference between the PFM and that, I would like to understand why.

MR. CHOKSHI: In fact, there is a recent publication just comparing the work detail from PFM type analysis and the database. Here all processes and Rob will explain is to look at all of these things.

MEMBER APOSTOLAKIS: Very good.

MR. TREGONING: We're jumping around a bit, but that's okay. That's your prerogative. So again, focusing back on the near term the objectives of the near term elicitation was simply to adjust the 5750 Appendix J LOCA frequency distributions to account for contributions not considered in this original study; so things other than pipe break failures, the effect of aging specifically.

MEMBER KRESS: So you automatically biased the experts to increase the frequencies.

MR. TREGONING: No.

MEMBER KRESS: I don't see how you asked to do anything but increase.

MR. TREGONING: There are others. We specifically ask about effects of mitigation, effects of improvements in ISI.

MEMBER KRESS: Okay. You did ask those questions.

MR. TREGONING: Oh, yes. In fact, we had a few opinions for large break LOCAs amongst the experts. Large break LOCA frequencies would decrease.

MEMBER KRESS: When you say "LOCA contributions" then you mean things that would affect the LOCA.

MR. TREGONING: Yes. Other things like CRDMs or Davis Besse as well as contributions to things in ISI improvement, mitigation techniques, improved weld repair procedures, anything that could affect LOCAs on down the road. It's a whole host of things.

So we wanted to provide some quantitative estimates. More importantly, we wanted to prioritize issues and questions which the in house group feel

potentially provide the greatest contributions or change in the LOCA frequency estimates going forward. These issues we want to use and make sure that we consider these issues in the immediate term elicitation.

This near term elicitation was not just used to provide numbers. We actually tried to treat it as a pilot elicitation study. From what I know about elicitations and Lee Abramson who unfortunately is not here is really the person that's guiding the framework of the elicitation process. If you have any really in-depth questions about the elicitation process, I may have to defer and have Lee or get back to you at a different time. According to Lee, the pilot elicitation of any good elicitation is a necessary step to making sure your answers are right and believable.

So here's the approach for the near term elicitation. We had essentially a kick off meeting where we provided the background for historical LOCA estimates; specifically 5750 estimates, how they were developed, what was used, what was the philosophy behind it. This was a report done by INEO. We had Bill Gallian (PH) actually call in and provide this background talk.

We also had a talk with Joe Murphy from the staff on WASH-1400. WASH-1400, people certainly didn't feel it was applicable, but still, understanding the philosophy that people had even 25 years ago when they were developing these estimates we felt was very important. We provided background and we looked at this as providing a baseline of understanding for where we were so that all the people on the panel knew where we were coming from.

Then we also presented some of the technical concerns that we had in terms of new cracking modes, recent potential failure occurrences that had happened both nationally and internationally and then we also talked about the motivation for updating these frequencies. That motivation was 5046 revision. So there was the kick off meeting.

Then we had essentially this was followed about a week later by an issue development or brainstorming meeting. This was all the group. Both of these meetings was the entire elicitation group. What we did in the development meeting was we developed definitions of what LOCAs are and how we're going to distinguish between a small break, medium break, large break LOCAs. It seems very basic, but we wanted to make sure the group was operating from the

same definitions.

Then we were also very careful to define what we were using as our baseline case. As Bill mentioned, we didn't ask people to provide numbers, we asked people to provide relative changes in the baseline database. So a complete understanding for the group of what that baseline database is was absolutely critical. We spent a fair bit of time in the meeting defining this.

Then we spent probably the greatest amount of time similar to the Westinghouse Risk Informed ISI Study where we broke the plant down into pipe systems, materials for those systems, loadings for those systems, and potential initiating mechanisms that could cause pipe rupture or a LOCA within those systems. We spent a lot of time decomposing LOCAs into the prerequisite systems and components.

All that the group did is they provided a very generous threshold in that we decided as a group whether we were going to consider a certain system or not. For the most part, we considered certainly all the major systems within a plant. Then the other thing we talked about was potentially important factors which would affect future LOCA frequencies, again, things that we've touched on earlier in terms

of aging and improvements in ISI and some of these other issues.

So from this meeting, we developed an elicitation questionnaire where we decomposed the issues into very small questions related to specific mechanisms, systems and components. I have an example of that later. You'll see exactly what we did.

As we mentioned earlier, we were looking at the changes going forward. We asked people to evaluate their expected changes up through the license renewal process, so approximately 30 to 35 years from now. Not only did we ask for quantitative responses but also rationale. So you get into your question of what make a person an expert.

One of the ways you try to judge that is not just look at the number they've given but also the rationale. You have to show that the rationale is sufficiently based and that you've utilized this rationale to judge or develop your expert opinion. So we'd ask people not for numbers but again also their reasoning.

So then after the elicitation questionnaire was developed, it was sent out to all the participants individually. They filled them out and sent them back in. Then we had a wrap up meeting.

The wrap up meeting is very important. When you ask people the technical ideas, they don't know what frequencies you're going to come up with at the end of the day. So we presented the results to individual questions, summarized important findings and then also provided the group with a chance to look at the frequencies that we were coming up with from their responses. Again, I'm going to delve into all of these in detail later.

The other thing that we did which was equally important is we got some feedback on the process itself. We wanted to see where some weaknesses or strengths were from the elicitation so that there were things we could improve going forward in this next process. One of the discussions we got in quite specifically during this wrap up meeting was delving in the strategies and approaches to making sure that the experts were being queried and only providing the answers in areas that they had demonstrated expertise. It sounds obvious, but it's not always as easy to implement that. That was something that we spent quite a bit of time with at the feedback meeting.

I'm going to show an example for each of the three sub-bullets I showed before. This is

something that came out of the issue and development meeting. The next slide will look at a specific table within the questionnaire. The next slide will show results. I'm trying to make it consistent, so these are all for BWR LOCAs. Although, we separately elicited for BWR and PWR, so we dealt with both of them.

MEMBER WALLIS: I'm going to finish the sentence that was in reply to George. This is being made by a material scientist. It's feed-water lines cracking, thermo-fatigue and mechanical fatigue. If you look at history, core sprays have been broken by hydrogen explosions which is a thermo-hydraulic phenomenon. How did the gas get concentrated in that particular place? How did it get ignited?

Feed-water lines have been broken by water hammer which is a thermo-hydraulic phenomenon. Davis Besse essentially was a thermo-hydraulic chemistry phenomenon, and talking about cracking really missed the point of what was going on there once the crack got big enough. I'm a bit concerned that all these mechanisms seem to be material based.

MR. TREGONING: Well, again all this is these are the systems, these are the materials that make up --

MEMBER WALLIS: They're all mechanisms. They're all the cracking expert.

MR. TREGONING: These are the prominent mechanisms. Now we did discuss these other mechanisms; things like water hammer, things like hydrogen.

MEMBER WALLIS: They have actually happened. I mean major pipes have broken in nuclear plants as a result of water hammers.

MR. TREGONING: Right. We didn't get down to the level for this elicitation for delving into the likelihood in water hammer or hydrogen.

MEMBER WALLIS: I think you have to have someone on this panel who insists that this be comprehensive and include mechanisms other than cracking.

MR. TREGONING: We did consider those mechanisms. It would be erroneous to say that we didn't consider those mechanisms. What we didn't do was we didn't break down and consider those mechanisms for specific systems. We didn't get down to that level of detail. However, we lumped them in terms of global issues. We made an assumption here. I'm not saying it's a particularly good assumption. It was an assumption that was made that these global issues

roughly influence all systems equally. We discussed a large number of them.

We only ended up eliciting on five: that was the effect of risk informed ISI; hydrogen combustion which you've talked about; future degradation mechanisms, such things which could come up later; and mitigation strategies which would affect degradation; and then also potential uncertainties in the leak detection threshold that you have. So we did consider those. We just didn't break them down into this level of detail.

It's something with the next elicitation process that we'll certainly discuss. It will be up to that group itself to determine how they want to decompose the issues so that they can best arrive at the answers. But they certainly will be considered. They were certainly considered here. They just weren't broken down into this level of detail.

MR. SCHROCK: Did the recipients of the questionnaire comment on their view of the adequacy of the questionnaire?

MR. TREGONING: During the feedback session, they provided that. The recipients during the issue development meeting developed this structure. We tried to craft the elicitation

questionnaire over the ideas and the structure that arose from that issue development meeting. We tried to feed them back the questionnaire in ways that made sense with how the issues were discussed and people agreed at this meeting they should be discussed so that there was consistency there.

MR. SCHROCK: Questionnaires it seems to me almost always reflect the interest in getting a certain response.

MR. TREGONING: Yes.

MR. SCHROCK: Recipients of questionnaires by enlarge are restricted in their participation because of this. For that reason, I hate questionnaires. I refuse to fill them in most of the time. I just don't know for sure from what you've said how you've guarded against this problem here.

MR. TREGONING: Well, I would say that we haven't. Like you say in any questionnaire the phraseology of the questionnaire will tend to potentially lead you to a specific answer.

MR. SCHROCK: Right.

MR. TREGONING: We certainly tried to guard against this. The thing I want to emphasize here is that this was near term. So under the constraints we had for this first elicitation, that

was really all we could do. Certainly when we do the more formal elicitation, there will be no questionnaire. I take that back.

There will be questions which will be developed that will be supplied to the participants beforehand, but then each participant will be queried individually on those questions. There will be opportunity to certainly range from those questions as need be. So it won't be as defining when we do the final one. With this first one, it was defining almost by nature so that we could at least try to wrap our arms around it in a relatively quick way.

So all your concerns I certainly share. I come from the Navy. The thing we always used to get in the Navy is you do an analysis and they say well will you go down on the ship with that analysis. I wouldn't take the numbers that we've developed and go into the reactor and stand under the large pipes at this point. But I will say that the issues that came out of this meeting I think were very powerful. It's something we can use to go forward to help craft what we're doing on down the road.

MR. CHOKSHI: I think on the intermediate we'll be developing a more formal process using the guidelines which are available and have been used. So

for a lot of this development of questions and selection of experts we'll follow a more formal process to make sure that we don't introduce some kind of weaknesses. There will definitely be a formal process which can be documented and people can see.

MR. TREGONING: And I'm assuming that during this process which we expect to take roughly a year that the committee will be made available of the progress of that group and be able to provide feedback as we go along. So this is something that's a work in progress.

MEMBER APOSTOLAKIS: So ultimately you envision that there will be some models and I don't mean PFM models behind this, I mean I'm seconding now the comments by Dr. Wallis, that you will need to have some combination of experts in human factors or human performance, thermo-hydraulics and PRA and so on and develop some sort of sequence of events that might lead to these failure mechanisms instead of just focusing on the failure mechanisms themselves. Or who's going to do that if you don't do it? Is that part of the bigger project, Alan?

MR. KURITZKY: (Away from microphone.)

MR. TREGONING: Yes. We're not proposing to revisit those accident scenarios.

MEMBER APOSTOLAKIS: I'm not talking about the accident sequences that are already in the PRA. If you look at what happened at Davis Besse, that's not in the PRA.

MR. TREGONING: Right.

MEMBER APOSTOLAKIS: The -- control program was not implemented correctly. People didn't have questioning attitude and so on. All that stuff. Where is that going to go?

MR. TREGONING: Here's the danger with something like this. Let's say we did this intermediate term elicitation a year ago and we were done and we were presenting the results. I'd be getting beaten up because it would by why is Davis Besse not considered in this. If we would have done this a year ago, I doubt very seriously that a Davis Besse type of event per se would have been discussed.

MEMBER APOSTOLAKIS: That's true.

MR. TREGONING: So when we're at this point, we're at a year later. We have to develop something that goes 35 years forward. There's going to be, I hope not many, but there will be several other surprise events. The intent is to capture the surprise events, not the particular mechanism which makes up the surprise events.

MEMBER APOSTOLAKIS: Right. I fully agree with that. So what I learned from Davis Besse is that the programs are not necessarily implemented the way they are intended to be implemented.

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: Assumptions that we're making regarding people's vigilance are not always good.

MR. TREGONING: One of the things -- I'm sorry I don't mean to cut you off.

MEMBER APOSTOLAKIS: I cut you off all the time.

MR. TREGONING: I want to provide some more information. One of the things we talked about a lot in our issue development meeting was plant management safety culture. We argued about that. We just decided at the end of the day because it was so specific that we couldn't explicitly consider it because we were trying to define generic issues. That doesn't mean it's not important.

MEMBER APOSTOLAKIS: Safety culture isn't generic but I think it's much bigger than --

MR. TREGONING: No. Safety culture is generic but then you also have a lot of variability. So you have a generic best estimate but then I would

argue you have wide uncertainty bounds.

MEMBER APOSTOLAKIS: The fundamental issue here is we cannot ignore and close our eyes to operating experience. You said if I had done this a year ago, fine, this is a good intellectual exercise. The truth of the matter is you're doing it now.

MR. TREGONING: Right.

MEMBER APOSTOLAKIS: Davis Besse has happened.

MR. TREGONING: Right.

MEMBER APOSTOLAKIS: So we have to do something about it.

MR. TREGONING: Right.

MEMBER APOSTOLAKIS: Now it does not appeal to our technical preferences because it's not controlled by natural laws and we can't develop a computer program for that, but the truth of the matter is that when it comes to reactor safety negligence of that pipe is very important.

MEMBER FORD: Well, human events is done on that list.

MEMBER APOSTOLAKIS: By "human" we mean up until now, this Agency means operator response to an accident, not the kind of thing that you saw at Davis Besse.

MEMBER FORD: Oh, okay.

MEMBER APOSTOLAKIS: That's the same with PTS. They used the latest in human reliability but they really mean operator response during the accident.

MEMBER BONACA: Actually the cause of the factors may have been different, but I put them in the same category. You have now VC Summer, you have Oconee. Davis Besse is not. They probably think that they took about 20 or 25 years to begin to have this penetration of the RCS by different means, different locations or piping as a result of aging. So we're going to see more of that. In many problems we have, the statement is we will inspect, detect, and fix before this happens. Well, that's great, but there's now going to be something assured. Davis Besse is an indication of that.

The other issue, however, is we have -- and made commitments like for example on license renewal not to increase the frequency of inspection like the ISI with age. So there are a number of mechanisms there of core issues that we have to look at. I trust that these are very competent people, but there are so many elements there.

MEMBER APOSTOLAKIS: In truth, it's too

soon really. These guys have to digest their lessons --

MR. TREGONING: But your point is still well taken. You need to consider everything; the operating experience, the regulatory framework. Again, if it was an easy problem, we wouldn't need to do an elicitation. By definition, you do an elicitation as sort of and I won't say means of last resort but in some ways --

MEMBER BONACA: The whole dynamics are changing. For example, not only there are more events of these types happening but the outages are much shorter than they used to be ever.

MR. TREGONING: Yes.

MEMBER BONACA: Really what is being short changed is not the maintenance of the active systems which are being maintained on-line. It really is the inspections that are potentially being short changed. Judgements are being made that we don't have to look more than this much and then we can start. So there are these dynamics coming together. We really have to understand how they interplay.

MR. TREGONING: You're right. Those are all vitally important. It also ratchets it up greatly the level of difficulty with something like this.

MEMBER APOSTOLAKIS: That's true.

MR. TREGONING: Because you put everything into the soup at this point. You have political. You have technical. You have economic. Everything is in the soup. How you stir the soup at that point is critical.

MR. CHOKSHI: I just want to make one point to that. This near term elicitation followed the 1150 type of approach. It was not just an *ad hoc*. We followed what was done, how the 1150 did, how it was updated. It has a structure and a lot is going through the process.

MEMBER APOSTOLAKIS: I don't think we're criticizing it.

MR. CHOKSHI: No. I know.

MEMBER APOSTOLAKIS: That's what I meant earlier that it's too soon for you to have incorporated in your work the Davis Besse kind of thing. I hope the message you're getting from the discussion here is that this is a big concern for this committee. You're going to be hearing about this time and time again.

MR. CHOKSHI: We'll be --

MR. TREGONING: The reason here is to solicit that criticism too, obviously. Again, I feel

like I'm on the front --

MEMBER APOSTOLAKIS: You don't have to try hard to solicit criticism here. Just show up.

MR. TREGONING: I feel like with the solicitation, I'm on the crest of this staring over a great abyss. I just think all of us certainly realize the challenge ahead of us and are not taking it lightly at all.

MEMBER APOSTOLAKIS: Good.

MR. TREGONING: We're taking it very seriously. Now when I come back to you a year from now, how successful we are --

MEMBER APOSTOLAKIS: Don't be so modest. You'll do all right.

MR. TREGONING: I don't like to prejudge anything. I don't like to prejudge LOCA frequencies. I don't like to judge success probabilities, anything.

CHAIRMAN STACK: Are we ready to move on?

MR. TREGONING: I'm ready. Are you ready?

MEMBER APOSTOLAKIS: Let's move on. Yes.

CHAIRMAN STACK: We've had that same slide up for 30 minutes.

MR. TREGONING: Maybe we can only spend 30 seconds on this slide then potentially.

CHAIRMAN STACK: Oh, no.

MR. TREGONING: We essentially gave I think there were seven or eight tables related to various questions. This is one of the tables that we had for LB LOCA. This one was relative change. We asked people given a baseline how much did they expect LOCAs in these various systems to increase or decrease going forward based on the issues we discussed.

Most of this we've touched on. Every panel member got their own questionnaire. We asked them to look at changes over the next 35 years. We separately considered small, medium and large break LOCAs. As I said before, we used a quantitative responses and the rationales to determine. Because again, this tells the changes but the other part that I didn't show here is you have to show not just the relative changes but the importance of the given system to lead into a LOCA. So you combine your contributors with these changes to develop your frequencies at the end of the day.

The other thing that we did was we asked questions in several different ways to try to remove as much of that bias as we could. We asked the people for absolute changes. We asked them for relative ratio changes. For example, these things were assuming a small break LOCA frequency. What's the

ratio of medium breaks to small breaks? What's the ratio of large breaks to medium breaks? Decomposed the same question in a variety of different ways to get different answers. The idea behind that is to try to probe inconsistency.

Also for these global issues, we asked people what they felt was the global change in the system related to these issues. These different ways were utilized to perform at least a very informal sensitivity analysis to assure the results we were getting at the end of the day at least were somewhat rational.

MEMBER FORD: Could you give us some idea as to how these analysis were conducted? For instance, recirculation LOOPS which is ITS, how did the expert in this particular case go about assigning a number for those three categories of LOCA?

MR. TREGONING: Each individual expert had their own rationale for doing that. As I mentioned earlier, the time frame with this was short enough that we didn't allow people chance to go back in and run models. There was certainly time for them to go back and look up some background data in terms of frequency and things like that.

MEMBER FORD: Those numbers must be very

plant specific. They're extremely plant specific if they're going back to historical data to come up with their answer. So it can range from zero to 100 percent.

MR. TREGONING: That's true. I would argue that we're looking at developing generic bounding numbers. So if anyone was being penalized, it would be the plants that didn't have that problem. I can speak for myself when I filled out my questionnaire. I tended to think in terms of plants that might have the worst problems. I can't speak for the rest of the elicitors just to know if that was their rationale. That's another limitation of the questionnaire. You get what's written down in terms of the rationale but you don't get verbatim their philosophy.

MEMBER APOSTOLAKIS: How are you going to handle that though? Here is an expert telling us that these are extremely plant specific. Obviously your experts are not going to give you estimates for each plant. What do you do about that? I don't know. Maybe it's time to re-evaluate the whole approach of expert opinion.

There are also papers. One comes to mind where the experts are really way off in other

contexts. I don't know. Are the standard approaches still satisfactory?

MEMBER FORD: And for instance, you mentioned earlier on quite correctly that the incidents rate will normally go up if you don't do anything, but it can go down with the ISI and proven techniques. Those were also factored into that specific example of research --

MR. TREGONING: We didn't try to lead the experts.

CHAIRMAN STACK: I'd assume that would be if you said it was going down, you would say because all the plants now run on hydrogen water chemistries.

MEMBER FORD: Right.

MR. TREGONING: Right.

CHAIRMAN STACK: Therefore, you think the historical rates are probably higher, for example, then the future rates might be.

MEMBER FORD: The baseline rate, for instance, that you started off with, I agree with you entirely, going to a hydrogen water chemistry is going to go down.

MR. TREGONING: And go down in the near term. The thing we also said was look 35 years out and would you still expect it to go down 35 years out.

MEMBER FORD: So was the baseline number based on when the plants were built, and this wasn't even taken into account, or was it based on now?

MR. TREGONING: The baseline number was 5750. What 5750 did specifically for IGSEC as you probably know better than I, they applied a mitigation factor of one over 20 to their pipe rate frequencies for BWR plants of course only. So if we use 5750 --

MEMBER FORD: So it's probably going down.

MR. CHOKSHI: The baseline does include known things. That's mitigation factors. Right.

MR. TREGONING: So you talked about earlier defining baselines based on specific mechanisms. That's a very valuable tool. We weren't able to do that (a) because 5750 doesn't have that kind of information and (b) we didn't even have access to the database. There wasn't much that we can do. Certainly when we look going forward, that's something we're going to be evaluating. In a SKI type database, there have been presentations over the last few years where they have done that. They've queried the database on a mechanism by mechanism level.

CHAIRMAN STACK: You should look at the Epry (PH) report where they did their own statistical analysis of the SKI database. It's at least a place

to look at. They come up by mechanism and by weld.

MR. TREGONING: Right.

CHAIRMAN STACK: Again, when you put these systems together, it will make a difference.

MR. TREGONING: Right. You're right. So when we define the baseline for the next elicitation, we have to be very careful that we try to take all these things into consideration: mechanisms; what components they affect so you know what your denominator is and your initiating frequency if it's welds, if it's elbows for flow assisted corrosion, things like that. None of that was explicitly considered in this because it was just a very broad brush look at this thing in the short term.

CHAIRMAN STACK: But I'm sure all your experts also look at these lines and figure are these lines susceptible to FAC or are these susceptible to IGSE.

MR. TREGONING: It's implicitly in there.

CHAIRMAN STACK: They're doing the integration in their head rather then separating it out and then putting it back together.

MR. TREGONING: Right. Any more discussion on this slide? This one is going to take us back to 35 or 40 minutes I guess. This is a sample

of the output that we got. These are the sample quantitative results. Again, I'm focusing on BWRs large break LOCAs here.

We had essentially 12 issue categories in BWRs that you saw earlier. A lot of these are NAs because the group said drain line failure is not going to cause a large break LOCA. So six through ten is a bit misleading. It's not that no one considered it to be a contributing factor. It's that it couldn't be considered based on the size of the line.

We asked people for their top three contributors in terms of systems. What you see here is the number of people and again we had 11 people but not everyone answered based on their expertise. We had eight responses for this particular question. Of those eight, we had six which is a fairly high number, 75 percent, which assumed that jet pump risers will be a big contributing factor in terms of any potential large break LOCAs.

So we asked them not just to list their top three but also make a quantitative stab at what they thought the percentages of LOCAs would be due to that system. What I've given you here is the median response for the respondents. The median response is that the jet pump risers would contribute 33 percent

of the large break LOCAs so 33 percent of that frequency distribution. This tells what systems are important. Then we asked people, what will they look like --

MEMBER APOSTOLAKIS: I don't understand the figure though.

MR. TREGONING: Okay.

MEMBER APOSTOLAKIS: It says the vertical axis is count --

MR. TREGONING: Within top three. We only asked the people to provide their top three contributing factors. There were eight people, so there were 24 responses within these eight people.

MEMBER APOSTOLAKIS: So if I add all these heights of bars, I will get 24.

MR. TREGONING: I hope you do. You should.

MR. CUNNINGHAM: You do.

MR. TREGONING: Good. You did the math. I should have, but I didn't.

MEMBER APOSTOLAKIS: Now I understand.

MR. TREGONING: Some people might have had it rated at number three. Some people might have had that rated at number one. All I'm showing is that the top within somebody's top three. It made their top

three.

MEMBER APOSTOLAKIS: Right.

MR. TREGONING: Then this number says of the people that it made their top three what was the median contribution from all those different opinions. So those are the numbers here. It's important not just to say if it made the top three but how much it contributes. You see here three and four which were core spray -- We let some systems gather RHR and LPI. The same number of people considered them important. Of those people that considered them important, and this is probably marginal, this is probably not a good example, but slightly higher percentage coming from the core spray.

MEMBER WALLIS: Is that really 50 on the right hand there?

MR. TREGONING: Yes. But there was only one response. There was one person, but that person thought BWR stub tubes was very important.

MEMBER WALLIS: Very important.

MR. TREGONING: Yes. That person would give a relative change for BWR stub tubes. That would affect the frequency that you get from that person's responses.

MEMBER APOSTOLAKIS: I don't understand

that. To evaluate a change, you have to know what the baseline included.

MR. TREGONING: Right.

MEMBER APOSTOLAKIS: Did they know that?

MR. TREGONING: Again, we had a whole meeting where we discussed what was in the baseline.

MEMBER APOSTOLAKIS: The baseline came from where?

MR. TREGONING: 5750.

MR. CHOKSHI: That whole study. We had a whole session talking with people about what is the bases, what was covered --

MR. TREGONING: And as part of the issue development --

MEMBER APOSTOLAKIS: When was this published 5750?

MR. TREGONING: 1998. It covered plant experience up to 1997.

MEMBER APOSTOLAKIS: I still don't understand how these people feel that there will be almost always an increase from a study that was done four years ago.

MR. TREGONING: Again, we asked for people looking 35 years out. We asked people to look 35 years out and assume the 5750 gives us where we are

today.

MEMBER APOSTOLAKIS: So they include the -- favorite subject.

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: When things deteriorate.

MR. TREGONING: Yes.

MEMBER ROSEN: This just proves Yogi Berra's theory about predictions especially on the future are hard.

(Laughter.)

MR. TREGONING: It's worse than the stock market.

MEMBER APOSTOLAKIS: Well, I don't know.

MR. TREGONING: I think we might need Yogi before all this is said and done.

MEMBER APOSTOLAKIS: So the primary reason why I have increases in the frequency is because of 35 years? If you had asked them to do it for 70 years, this would have been longer?

MR. TREGONING: It would have been lower potentially.

MEMBER APOSTOLAKIS: Greater.

MR. TREGONING: It could have been lower percentage change if we would have only gone out 17

years.

MEMBER APOSTOLAKIS: Oh, 17.

MR. TREGONING: I'm sorry, you said 70.

MEMBER APOSTOLAKIS: I said 70. That's okay.

MR. TREGONING: I misunderstood you.

MEMBER WALLIS: The thing I would worry about in the long term would be changes in society and training and human behavior and economics and those sorts of things, the bigger variables then all this physical stuff.

MR. TREGONING: There was certainly a sense within the discussions. People were concerned about the way the people interpreted the safety culture and which way it was moving. This is implicit in that. These numbers take that implicitly into consideration. How each person did it was up to each person. So it becomes a bit mystical at that point.

MEMBER ROSEN: Just think about Chernoble (ph) (PH) and Three Mile Island. What were the main drivers?

MR. TREGONING: People.

MEMBER ROSEN: People. Safety culture.

MEMBER WALLIS: Davis Besse.

MEMBER ROSEN: I didn't want to put that

in along with the same category of those other two events. The issue is culture. It's nice to look at this but -- Well, 35 years out the cultural issues are even harder.

MR. TREGONING: I know. Again, we're faced with this impossible task. I'll be the first one to admit that this is an impossible task. We're never going to be able to account for all these variables adequately.

MEMBER APOSTOLAKIS: I doubt that these people really had culture in their mind when they did this.

MR. TREGONING: We discussed it. I will say that during the issue development meeting we discussed at length safety culture.

MEMBER APOSTOLAKIS: The way it is today.

MR. TREGONING: Current. But then there was some discussion on how people felt, and I'll use this nebulous word, things were moving to. Things happen that could change that dramatically. I'll get back to my original point. Elicitations are a period of time. We try to do them the best that we do. If we go back five years and re-elicit pending what's happened over that five years, we're likely to get potentially very different answers.

MEMBER APOSTOLAKIS: So if I look at the first bar there, what does that say? 75.

MR. TREGONING: Which bar?

MEMBER APOSTOLAKIS: The first one.

MR. TREGONING: This is just a box plot. This shows the percentage that it contributes. This shows the percentage change that people predicted over 35 years. The box plot shows the min and max. The 75 represents the median value. These are the 25th and 75th percentiles.

So you see for jet pump risers a huge difference of opinion. One person thought they would go up 400 percent. Another person said they'd go down a slight percent.

MEMBER APOSTOLAKIS: 400 percent?

MR. TREGONING: Yes.

MEMBER APOSTOLAKIS: I see that.

MR. TREGONING: That's why we used the median of course. We didn't try to use mean. We used the median response for all of these because the distributions and --

MEMBER APOSTOLAKIS: So the frequency can go up by a factor of 400? Is that what he's saying?

MR. TREGONING: That's what that particular person said.

MEMBER APOSTOLAKIS: The frequency right now for a large LOCA is what? Ten to the minus four or five?

MR. TREGONING: But you have to factor that in with the contribution. He said that for this particular system. For that system, he sees it going up, but he doesn't consider that system to be maybe that high a priority.

MEMBER APOSTOLAKIS: How do I make the -- Oh, JPR. Is that what it is?

MR. TREGONING: JPR, yes.

MEMBER APOSTOLAKIS: Oh, okay.

MR. TREGONING: So you need to multiple essentially this by this to get you your contribution to the LOCA. (Indicating.)

MEMBER APOSTOLAKIS: Okay. 33 percent of 400 is still a high number.

MR. TREGONING: Yes. You're saying 400 --

MEMBER APOSTOLAKIS: So he expects the frequency of a large LOCA in BWR to be doubled from that alone.

MR. CUNNINGHAM: Yes.

MR. TREGONING: From that alone, yes. If he was consistent for all of those, he would think that he expected them to go up a factor of four or

five let's say.

MEMBER APOSTOLAKIS: And what is it now? Ten to the minus four? The large LOCA.

MR. TREGONING: We'll see the results here very soon. It depends if your talking about Ps or Bs. It's either ten to the minus five or --

MEMBER APOSTOLAKIS: B.

MR. TREGONING: B is ten to the minus five.

MEMBER APOSTOLAKIS: But the uncertainty there is what? A factor of ten up and down. Isn't it?

MR. TREGONING: Uncertainty in this or in the existing?

MEMBER APOSTOLAKIS: The existing estimate.

MR. TREGONING: In the existing estimate, they assume -- normal distribution with an air factor of ten. So it's a very wide uncertainty.

MEMBER APOSTOLAKIS: So what these guys are saying then is already covered by that distribution.

MR. TREGONING: Yes.

MEMBER WALLIS: Are these things going up because the person estimates are too low or because

something is deteriorating? I would think as we get a wider margin they would all go down.

MR. TREGONING: That's one interpretation. Obviously that wasn't the general interpretation of the panel. There was a wide range of opinion on which way people expected them to go.

CHAIRMAN STACK: Historically pipe failures have gone down. You've gotten smarter. Now I think they're saying that you've probably maxed that out and you're --

MEMBER WALLIS: Right.

MR. TREGONING: If you look at failure curves, they all have that classical bathtub shape. I think a lot of people are concerned that we're on the tub of the bathtub and things like VC Summer, Davis Besse, Oconee might be showing that we're starting to rise on the slope of the failure curve for many of these materials and components.

MEMBER APOSTOLAKIS: I hope that the bathtub curve is not going to apply to large LOCAs. We'll be in deep trouble if it does. This is really very disturbing though. They all seem to think that things will become worse. What happens to all these age management problems we have?

CHAIRMAN STACK: They're run by people.

MEMBER APOSTOLAKIS: I don't believe that these guys really had in mind culture. It's too soon for people to do that. Way too soon. Especially technical guys. It takes a while to digest these things and start changing your estimates.

MEMBER WALLIS: If you're asking, these experts are all from the NRC.

MEMBER APOSTOLAKIS: Yes.

MEMBER WALLIS: So if you asked experts from the industry, they're all below the line.

MR. TREGONING: Right. That's exactly right.

(Discussion off the microphones.)

MEMBER ROSEN: The industry mantra is that the maintenance rule and aging management programs are intended to keep the failure rates constant.

MEMBER APOSTOLAKIS: That's the thing. We have all these problems in place. Of course, you might say people don't implement them right. I think that's a second order effect at this point.

MEMBER BONACA: The whole issue is the shift from active systems to passive systems components.

MR. TREGONING: Right.

MEMBER BONACA: Those statements are true.

MR. TREGONING: At the risk of shooting myself in the foot which I think I'll do anyway, but if you move into risk informed charts of ISI and you make the assumption that you're prioritizing your inspection based on probability of failure, that's a good approach. However, those lower probable things like possibly large pipes you may be inspecting less in the future potentially depending on how risk informed our ISI plays out. I don't know that to be the case. That's one potential. That was something that was discussed within the group.

MEMBER APOSTOLAKIS: But when the regulatory guide was approved, these guys should have spoken up if that's what they think is going to happen. That was not the intent of the guide, to increase the frequencies.

MR. TREGONING: The other thing I'll say is --

MEMBER APOSTOLAKIS: We better understand why these people are saying this. I think we need a very clear explanation.

MR. TREGONING: Yes. And again, I would say primarily aging effects were the dominant rationale.

MEMBER APOSTOLAKIS: Then again, why have

aging management programs in place if that's the case?

MEMBER LEITCH: One of the things --

MEMBER APOSTOLAKIS: If my regulators feel that the numbers are going to go up --

MEMBER LEITCH: One of the things that might be of concern is where do you attract the talent in years 50 through 60 of plant life. In other words, are you going to still be able to attract the kind of high level talent to implement some of these programs in the last few years of plant life?

MEMBER APOSTOLAKIS: But the question is, Graham, is that what these guys thought?

MEMBER LEITCH: I don't know what they thought.

MEMBER APOSTOLAKIS: I know.

MR. MAYFIELD: This is Mike Mayfield from the staff. I think it's important to not lose sight of what we were trying to do with this near term elicitation. To move forward with the 50.46 changes, we need to get some sense of is 5750 about right. Is it likely to go up? Is it likely to go down?

So we put together as balanced a group of staff people as we could put together in a short period of time and asked them to follow as best they could in a short period of time the approach that

would be used in a formal elicitation. We recognized you were going to get a somewhat biased view because the nature of the panel didn't get you the broad range of views that you would get in a formal elicitation. I would urge the committee to not make too much out of the specifics here. The point for this panel was the notion that the frequencies would go up. Yes, a bit.

They didn't suggest they were going up orders of magnitude. They go up two to four range. So they're up a bit. The idea was to give Alan and his colleagues some insights that they could use in deciding whether or not they should move forward with 50.46. We're not broadcasting this as the definitive answer or even the staff position.

This was an interim piece of information to enable Alan and his colleagues to move forward. That's why we want to go forward with as Rob calls it the interim elicitation, but to do this so that you get the balance of interest and you could then, George, I think meaningfully start drawing inferences about what people really think, what impact risk informed ISI might have. I would urge you to be cautious about drawing too much from the details of this.

MEMBER APOSTOLAKIS: I understand that.

I appreciate that. I have two comments on that. One is did these staff members who did this also consider the possibility that if the frequency starts going up, I mean the Agency will do something? We don't know that. Or is it the vote of no confidence in risk informed regulation here?

The second is instead of asking them to consider percent changes from a baseline value, I don't think that it would be pushing the state of the art asking them to consider the whole normal curve that you mentioned earlier and suggest changes to the curve. If I have right now an estimate that says it's low normal ten to the minus four factor of ten up and down which means we're doing ten to the minus five and ten to the minus three, these guys give me a factor of three. That doesn't move me much.

If they start saying, no, you're whole curve is moving up or something else is happening, I think these guys are knowledgeable enough to say that. Maybe when you do your intermediate exercise instead of giving a single number as baseline ask them at some point or throughout the exercise to look at the whole curve. What's happening? Maybe they will tell you, no, that the 5th percentile there is no way it will stay where it is. I'd like to know why. This is a

more complete presentation. Maybe we're making too much out of it.

MEMBER ROSEN: I think we're making too much of it. I heard the word place holder earlier.

MR. KURITZKY: Exactly.

MEMBER ROSEN: It's just a spot in which to put a better number.

MR. KURITZKY: Interim. Exactly. One internal application for temporary usage.

MEMBER ROSEN: This is survey said. Okay.

MEMBER APOSTOLAKIS: Yes.

MR. KURITZKY: Remember I think according to Rob, beginning to end is a three week effort.

MEMBER APOSTOLAKIS: I really think looking at the curves in the future will be very informative rather than a single number.

MR. TREGONING: And again based on the time, we only asked for people --

MEMBER APOSTOLAKIS: No, of course. This is okay.

MR. TREGONING: Certainly we asked on probing for each individual answer was not only the best estimate but the ten 90 percent confidence bounds. We're able to reconstruct those bounds in a very real way.

MEMBER APOSTOLAKIS: But how does it look to you guys that our experts in our regulatory agency think that the frequencies will go up?

MEMBER WALLIS: Are we going to hear from industry today?

MR. TREGONING: I don't know.

MEMBER WALLIS: When industry sat here and said that they wanted changes in 50.46, we said okay, make your case. They said yes, we're going to go away. We're going to spend a lot of money. We're going to come back with a good case. They're going to come back maybe with things like this that look very different.

MR. TREGONING: Sure.

MEMBER WALLIS: Then I wonder who to believe.

MEMBER BONACA: It doesn't surprise me to think that we're going to have more initiators of cracks. We had programs to inspect and prevent for the degradation. The fact however is that if you increase the number of initiators, you're not going to catch them all. That's not surprising to me that you will have some increase in initiators in LOCA.

Now, I don't know about the size. That's a different story. I have no judgement on that. To

me, they're intuitive somewhat because although I trust that they are going to put in place a good program for inspections, they're not going to be always successful in some cases because of cultural issues, in some cases because it's tough.

MEMBER ROSEN: Well, the regimen is completely changing you realize. We're going to these risk informed programs. We used to look at everything, even pipes that had no mechanisms acting on them. The results of the programs up to date are essentially zero. We haven't found anything. With all this work and inspection, we've hardly found any defects.

So the new programs were to aim at things that matter; they are risk significant, pipes that matter, and also pipes where there are active degradation mechanisms something we know something about. So I think we'll find more. We're hoping that these new programs will find more and that what they find will matter to us. In other words, a break in what they find would have had some important consequences.

MEMBER BONACA: The point I was making --

MEMBER ROSEN: So what I'm saying is looking backwards doesn't tell you much about what

we'll find in the future.

MEMBER BONACA: The point I'm trying to make is that the VC Summer crack to the nozzle, I would not be surprised if it took 15 years of pressure to develop a regional small defect into the thermal crack. It takes that kind of length of time for something to evolve. Therefore, for the first 20 years, they wouldn't have to worry about that if an inspection failed because it wasn't going through.

After 20 years, it becomes a different story because they're more vulnerable to that kind of defect to propagate and to become large. So you depend much more on the inspections and the quality of the inspection. I agree with you they're more focused now on significance. That's the point I was making.

MEMBER APOSTOLAKIS: Did 5750 do an uncertainty analysis?

MR. TREGONING: No. Again, they assumed the distribution and got their bounds that way. They essentially just looked at --

MEMBER APOSTOLAKIS: So, did --

MR. TREGONING: Well, they based their mean estimates on reportable incidents. There was no formal uncertainty analysis to the best of my knowledge. I certainly wasn't in the room.

MR. CUNNINGHAM: I think it's assumed that the error factor can be --

MR. TREGONING: For large and medium breaks, yes. So they assumed a log normal and an air factor of ten. They didn't try to develop --

MEMBER APOSTOLAKIS: I want to emphasize the issue of uncertainty here. I really don't think it makes much sense in the next trial to have a baseline and consider it. I would rather go with the curves themselves. You will be surprised how easy people will find it is to work with the curves. They're not normal curves themselves. Ask the experts how would you change them.

MR. TREGONING: We still have to have a basis for the log normal curve.

MEMBER APOSTOLAKIS: The baseline would be the curve itself.

MR. TREGONING: Were planning and maybe we'll get into this. It's getting close to lunch.

MEMBER APOSTOLAKIS: Because if I look at slide 12, you're comparing point values. I don't know how valid that comparison is.

CHAIRMAN STACK: Are we going to move on?

MR. TREGONING: I'm ready. Whenever you guys are.

MEMBER WALLIS: This went for a long time too.

MEMBER APOSTOLAKIS: It's okay. It really is.

MR. TREGONING: This one may be even longer. These are essentially the results which we've talked about in a very general sense. Notice the water marked interim here in large numbers. Again, this is a very interim or short term result. All this shows is the box plot for the median estimates. Again, we only asked people for their median or their best estimate guesses. All this shows is the uncertainty in the median estimates, not the uncertainty in the individual's guesses themselves which would be much larger.

We didn't use these to develop the bounds of our distribution obviously because they only sample a certain percentage of the uncertainty. The interesting thing that came from us is that the uncertainty bound was really in the small break LOCA number. The biggest variability in these median numbers were driven by people's opinions on the likelihood of non-piping contributions to the small break LOCA number.

When you got into large break LOCAs and

I'm going to make a general statement, people generally didn't consider other failure mechanisms other than a large pipe break to be significant in leading to these types of failures. With small breaks, there was quite a wide variety of opinion. I think that's reflected in this error bound here.

The other thing because again we were a slave to the baseline that we chose so 5750 had differences in BWRs and PWRs and small and large break LOCAs. Those differences were largely retained. You'll see here in the final these are actually the numbers. I've only presented the mean numbers here. However, we did develop distributions. I just wanted to present the mean numbers here for a reference point. I wanted to show 5750 and then WASH-1400.

MEMBER APOSTOLAKIS: So WASH-1400 was more conservative?

MR. TREGONING: Oh, yes. Dramatically so. What you see here is the comparative increases in the current over 5750 in terms of the means. So you had the biggest increase in small break LOCAs but still less than a factor of four. The decrease actually was greater with increasing LOCA size.

We've talked a lot about these so I'm going to go quickly if possible. This isn't rocket

science but I think it was worth noting that people expected all B --

MEMBER APOSTOLAKIS: Rocket science.

MR. TREGONING: Material science which is maybe more onerous. People felt that there were dominant initiators. At least a lot of people agreed on for small break and large break LOCAs what the dominant initiators are. For MB LOCAs there was much less agreement because of the number of the various things that can cause MB LOCAs. People considered especially and I talked about this for small break LOCAs the failure of non-piping components was a significant contribution, much lesser extent for MB LOCAs and almost no extent for large break LOCAs.

We talked about these global issues. In terms of the median response to impacts of these global issues, the group didn't consider that there were significant differences or significant impacts to things like risk informed ISI, hydrogen combustion, all the lists that I listed earlier.

However, there was a large degree of opinion about specifically three of those. Those were the roles of future mechanism and mitigation techniques, ISI, and the hydrogen combustion issue. I think we've heard even amongst the panel today a

pretty good difference of opinion for all of these global sorts of issues. These were the same things we were dealing with from the group.

MEMBER WALLIS: Well, hydrogen combustion seems to me is something you can get rid of by proper operation and design. It's not something like cracking that's there and it's a question of how fast in incurs. You can make it go away.

MR. TREGONING: Yes.

MEMBER WALLIS: For some of these things, you can make it go away. It's knowing more and operating better.

MR. TREGONING: Right. That's where the effective mitigation comes into play. I think I've touched on these. Again, I'll just highlight this one. Aging mechanisms are what at least this group felt would substantially affect and in general increase the LOCA frequencies in the future. The other thing that I didn't touch on --

MEMBER ROSEN: Not withstanding the aging management programs we're putting in place for plant's license renewals. They're basically expressing a vote of no confidence on the whole aging management program.

MR. TREGONING: I wouldn't say that.

MR. MAYFIELD: This is Mike Mayfield. I think you have to keep in mind there's a notion that from the time you identify a new mechanism until you have effective programs in place there is a time lapse. You don't identify the programs as a generic mechanism that needs an aging management program instantaneously. There's some time lapse. Sometimes that's measured in years.

We didn't recognize that with the BWR stress corrosion cracking as the prime example. So it takes some time before you recognize this really is a big deal that you need to deal with and put effective programs in place. I don't think it's at all the vote of no confidence rather it's recognition that there's a time lapse.

MEMBER ROSEN: For the new mechanisms.

MR. MAYFIELD: For new mechanisms.

MEMBER ROSEN: It's model incompleteness caution.

MEMBER WALLIS: Part of the problem is that a new mechanism is likely to show up in an environment where it has to be detected by the industry, not by the regulators. That's a question then as to how are you going to follow up some indication that something has gone wrong.

MEMBER ROSEN: It's a safety culture issue, Graham.

MEMBER WALLIS: It is a safety culture issue.

MEMBER BONACA: Not only. You have again we see the degradation mechanism coming through. There is higher lines inspection. You can't always be successful in inspections. Some of them we may impute to culture. Some of them we don't know. The judge is out. At times you've done volumetric inspections and you didn't see things. Is it true that people didn't look? I don't know. You can't judge. All I know is that we're not successful. We know many inspections are not successful.

MR. TREGONING: Okay. That covers the near term elicitation. We're at the point in the schedule where we talked about breaking for lunch. I have about six or seven slides. I would say that we've covered the bulk of this if not all of this and probably a little bit of this. (Indicating.) I'll leave it up to the group if we want to try to expedite the rest of these slides and get you guys to lunch or break and come back.

MEMBER ROSEN: I don't think you should stand in the way of the ACRS's lunch.

MR. TREGONING: That's why I bring that up.

MEMBER WALLIS: I think the big question to me is whether this kind of elicitation is really the right way to get enough information to file a rule making decision. I think that's the issue really. It's whether this sort of approach is going to get you where you need to be in order to make a decision.

MEMBER KRESS: Do you have another option?

MEMBER WALLIS: Well, one option is to do much more thorough research so you understand these things better rather than going for somebody's opinion.

MEMBER KRESS: That's going to get you there maybe ten years from now.

MEMBER WALLIS: Well, maybe that's the appropriate thing to do.

MR. TREGONING: The problem with this issue when you deal with pipe break LOCAs is different from PTS I'll say which PTS, there's been a lot of research on. You're dealing with essentially one mechanism, well defined, well studied. You have a variety of transients, but it's still relatively well defined. Here we're dealing with a whole compendium of mechanisms. Getting research to the point for each

of these mechanisms and I'll defer to Bill on this, where you really know enough to feel like you can accurately make predictions in light of all the uncertainties that you have is really unbelievably daunting.

MEMBER WALLIS: In two years we get your experts saying something and industry experts saying something else. You're going to get some rules. We're going to have to give advice. We may well say we don't believe either of you. We're in the position to make a decision.

MEMBER FORD: I think you're being unnecessarily pessimistic. I think if you had the right panel of industry and academia, I think you could come to a reasonably very narrow conclusion.

MEMBER WALLIS: If you have the right panel, you can always reach a narrow conclusion.

MEMBER FORD: That's what I'm saying. I think it depends very much on the choice of who you have on the panel to have an honest answer.

CHAIRMAN STACK: You look at the PFM calculations. If I use one code, I get an answer that's different by ten to the fifth by the other --

MR. TREGONING: And not just codes, yes, but the input into those codes.

CHAIRMAN STACK: I think you have a lot more going for you here. I mean, for one thing unlike other expert elicitations there is a very large database here.

MR. TREGONING: Yes.

CHAIRMAN STACK: We're talking about whether these things are going to shift by factors of two to four. Compared to other things we don't know about, you have a very large database. To find them shifting by a factor of two doesn't shock me all that much. Again, we have the data. We also have a much better mechanistic picture.

The fracture mechanics codes I think are useful when they are used in the way you've described them with an expert elicitation to look at the inputs because again there will certainly be uncertainty in those. At least I'm confident in the kind of time scale you're talking about you could come up with answers that aren't technically justified.

MEMBER KRESS: Frankly, I don't see any other option.

CHAIRMAN STACK: Yes.

MEMBER KRESS: If you're going to do this, and I agree with Bill, I think you have a significant database. To start from that and get a delta through

expert elicitation, I think that's your only option. The only question that may be is have you formulated the right experts and have you given them the right questions. That you guys know how to take care of.

MEMBER ROSEN: One of the possible outcomes is that you'll get so much disagreement, the bounds will be so wide that you'll throw your hands up and have to say we're just going to use the old bumpers, what you've always used.

MEMBER FORD: I don't think you're going to have that disagreement. I really don't.

MR. TREGONING: I suspect there to be a wide range of opinions.

MEMBER FORD: I also think there'll be a consensus.

MR. TREGONING: There may be a consensus. I don't want to speculate. I hope there will be a consensus.

MR. MAYFIELD: But the process is designed to deal with exactly that issue and still produce an answer that's usable. The concern always is when the uncertainty bounds are so large as to render the whole thing useless. The overall expert elicitation process that has been refined as part of the new reg 1150 effort and has been further refined over time is

designed to deal with exactly that situation where you do have a wide range of opinion. It's not that we expect everybody's going to come together and agree that the number is increased by 2.73. No. We expect there to be divergent opinion. The process is designed to deal with that.

MEMBER LEITCH: Depending upon how finely you break this down may also tend to converge the opinions. For example, it looks like now you have BWRs and PWRs. I guess there's BWRs that are operating with 304 stainless in the piping, and there's other BWRs that have 316 nuclear grade the best we know how to make. If you subdivide those, the opinions may tend to converge.

That's just one example. There's probably some kind of a compromise between getting one number for the whole fleet versus plant specific. Maybe there's groups of plants that could be used. I just don't know how finely you intend to divide the population.

MR. TREGONING: Yes. I wouldn't want to prejudge that. I'd like the expert panel to come up with those recommendations in terms of what they feel is the best way to move forward with the elicitation. If they feel like the best way is to try to bin plants

for various functionality in terms of materials or whatever, then I would be prepared to pursue that approach. If people feel comfortable grouping things together in one big generic lump recognizing that they're going to be penalizing certain plants unfairly, then --

There's an infinite number of ways to decompose these things. I think our goal is to make sure the expert panel decomposes them in a way that they're comfortable providing answers as a group. That in my mind is the focus, making sure that we put the expert panel in a framework or in a position to succeed so that they're going to feel comfortable with the types of questions that they're being asked to provide answers to. That's certainly one possible approach. I'm sure we'll discuss that. I don't want to prejudge that at this point.

MEMBER LEITCH: I understand.

CHAIRMAN STACK: I'd like to break for lunch now. You're just not going to get through this before lunch. Try to get through this in 15 minutes when we get back.

MR. TREGONING: I can do it in two minutes.

CHAIRMAN STACK: No, you can't. Let's

come back at 1:30 p.m. Off the record.

(Whereupon, at 12:38 p.m., the above-entitled matter recessed to reconvene at 1:30 p.m. the same day.)

CHAIRMAN STACK: On the record. Let's get back since there's a strong opinion that we ought to finish by 5:00 p.m. today.

MR. TREGONING: I can be brief potentially.

CHAIRMAN STACK: Good try.

MR. TREGONING: Next I'm going to talk about the plans for the intermediate term elicitation. We really discussed a lot of this. Hopefully we can get through this quickly or maybe not. The process is going to be designed and implemented by a whole team at NRC. We have contractual support that will be provided by Battelle and EMC^2 of Columbus to help us actually guide and develop the framework and the approach that's followed for the elicitation.

We talked about the panel. The panel make up is obviously very important. We're going to solicit panel members certainly from and it's primarily going to be made I would assume from non-NRC participants. We'll be looking for industry contributions, academia contributions, contractors

like Sandia and PNNL and people like that, other Government Agencies as relevant, and then certainly international participants.

We talked a lot about this. How it's important to have the panel members represent the full range of relevant technical specialties. This panel make up is obviously critical to the whole process. The process or the model that we're planning to follow is one similar to what was utilized in the flaw distribution determination for the PTS re-evaluation of 10 CF 50.61.

I believe you've been briefed on this whole process. That model you should be very familiar and at least philosophically that framework we plan on utilizing in some sense for this although we need to tailor it for our specific issues certainly. That's not to say we're going to follow this process in lock step.

What's going to be our baseline that we're going to be providing updates to? First of all, we're going to use a different pipe database then we used for the near term effort. For the near term effort, we utilized 5750. Here will be using a pipe database that's been provided by SKI. That'll serve as the database for the pipe break.

This is updated now through about 1998. SKI, the Swedish Institute. We have a separate effort that actually feeds into this where we're updating the database through a CSNI sponsored pipe database project. It's called the OPDE project. Currently there's ten countries that are participating in this effort. Each country is supposed to provide input to the database for their country's events.

Right now we're just focusing on '98, 2001 for year one of this project. This is actually a three year project. Each out year will focus on a preceding year as well as potentially go back and look at years earlier than 1998 to more fully complete the database. So that would either be provide more information or actually even uncover events depending on the country that's involved.

MEMBER LEITCH: Excuse me. Does pipe break mean a crack that's not through wall?

MR. TREGONING: They distinguish between the severity of the pipe; burst versus non-through wall crack versus erosion of the pipe due to FAC. All those things are included. Essentially what it's based on is any time you have to make a change or a repair or a replacement those things are considered in the database.