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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

SUBCOMMITTEE ON RELIABILITY AND

PROBABILISTIC ASSESSMENT

MEETING

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NOVEMBER 16, 2004

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The meeting was convened in Room T-2B1 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 12:10 p.m., Dr. George E. Apostolakis, Chairman of the subcommittee, presiding.

MEMBERS PRESENT:

GEORGE E. APOSTOLAKIS	Chairman
MARIO V. BONACA	ACRS Member
RICHARD S. DENNING	ACRS Member
THOMAS S. KRESS	ACRS
GRAHAM M. LEITCH	ACRS Member
VICTOR H. RANSOM	ACRS Member-at-Large
WILLIAM J. SHACK	ACRS Member
JOHN D. SIEBER	ACRS Member

ACRS STAFF PRESENT:

MICHAEL R. SNODDERLY	Designated Federal Official
CHARLES ADER	RES/DRAA
JS HYSLOP	RES/PRAB
DAVID LEW	RES/PRAB
GARETH PARRY	NRR/DSSA

ALSO PRESENT:

KEN CANAVAN	EPRI
GENE HUGHES, EXELON	ERIN
JOHN LEHNER	BNL
RAY SCHNEIDER	WEC
DOUG TRUE	ERIN

AGENDA ITEM **PAGE**

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

12:14 p.m.

CHAIRMAN APOSTOLAKIS: The meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Reliability and Probabilistic Risk Assessment. I'm George Apostolakis, the Chairman of the Subcommittee. Members in attendance are Mario Bonaca, Richard Denning, Tom Kress, Victor Ransom, William Shack and John Sieber.

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 November 2, 2004. Mike Snodderly is the designated federal official for this meeting. A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. It is requested the 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 requests for time to make oral statements from members of the public regarding today's meeting. In our September 22, 2003 report, we agreed with the staff's decision to develop a separate regulatory guide on how to perform sensitivity and uncertainty analyses. The Committee stated in this report that if model uncertainties are not addressed explicitly, their magnitude and potential impact may not be fully appreciated and thus, the decision-making process may not be truly risk-informed.

This statement formed the basis for the Committee's conclusion that inadequate theory, scope and quality may significantly affect regulatory decision-making. The EDO stated in his November 7, 2003 response that the staff agreed with the Committee's concern regarding the potential impact of model uncertainties. The staff went on to say "The ASME standard explicitly requires that model uncertainties be addressed. For example, the high level requirement in the standard states that uncertainties in the PRA results shall be characterized. Key sources of model uncertainty and key assumptions shall be identified and their potential impact on the results understood."

Now, this is an informational meeting of the subcommittee and we will gather information to understand what the staff is doing and report to the full Committee. The full Committee will review the draft final NUREG Report on this subject in the fall of 2005. So now, we can proceed with the meeting and I call upon Ms. Mary Drouin of the Office of Nuclear Regulatory Research to begin.

MS. DROUIN: Okay. I'm Mary Drouin with the Office of Research. At the table with me is Gareth Parry from NRR and another member of the team is here today John Lehner from Brookhaven, the National Lab. We're here today to share what we have done to date, but primarily there is particular guidance and issues that we would like to discuss with the Committee as we proceed forward on this task. We did send a list of these issues that we would like to focus on today about a week or so ago, which are showing up on the last two slides.

My hope is to get through these first slides relatively quickly. They are background information, but what we would like to really focus on is the issues that we are grappling with and that we would like to discuss with the Committee and get guidance. Sorry, Mike, I'm on background and history.

I just quoted from three primary documents, because there is two topics that we are undertaking in this NUREG, alternate methods, what we call alternate methods in the treatment of uncertainties. When you look at Reg Guide 1.174, when you look at the PRA Standard and when you look at Reg Guide 1.200, the Committee rightfully noted that in all of these documents and other documents, but these primary ones, is that you are allowed to have an out.

That if you have a standard that does not have a particular scope covered in it or a part of a technical element, all of these allow you to do something else. Either do a bounding analysis, do some supplementary thing, but if you chose to go that route, there is no guidance out there to tell you what is acceptable. And so that was a missing piece in all of this that, I think, was appropriately pointed out by the Committee.

In terms of the treatment of uncertainties, when you look at these documents --

CHAIRMAN APOSTOLAKIS: There's a question.

MEMBER RANSOM: I have a question.

MS. DROUIN: Oh, sorry.

MEMBER RANSOM: When you do a bounding analysis, do you assume all states in between are equally probable?

MS. DROUIN: I'm going to put you on hold on that.

MEMBER RANSOM: Okay.

MS. DROUIN: Because I'm going to get into those kinds of things when we get to the issues. On the treatment of uncertainties, these three documents also very similar in the sense that they all are asking you to identify what -- your key sources of uncertainty and to understand the impact. But then what's lacking again, and what the Committee pointed out, is that once you have that information, what do you do with it? How do you factor it into your decision-making process?

So even though you might have the standard that says okay, go through and identify your key sources of uncertainty, understand their impact, characterize it, it stops there. There is a little bit more in Reg Guide 1.174, but it pretty much stops and Reg Guide 1.200 very similar.

I won't spend really a lot of time on these next couple of slides. George pointed out what was in the letters from the ACRS. There were the two primary letters that pointed out these short comings. In our response, we agreed. It is going to be hard not to agree. But where we did differentiate is that we did not think that Reg Guide 1.200 was the appropriate place to develop this guidance, because the purpose of 1.200 is to endorse, primarily, the standards and we wanted to keep that clean.

You know, so now coming up with guidance on alternate methods on the treatment of uncertainties, that's separate from the standard. It's an addition. It's a major part of it, but we thought it deserved its own document. We're leaning right now more towards a NUREG than a regulatory guide, because this is more than just for licensees.

Okay. We have had a lot of discussions on what should be the objective of this NUREG, because at a high level, you know, it sounds easy, you know. We're going to provide guidance for the treatment of uncertainties. We're going to come up with guidance for acceptable approaches, for bounding analyses, what the roles of these things are. But the more you get into it, the scope of this program could be tremendous and could be huge, so trying to get our arms around it and really trying to get something done in the time frame that we have, but also make it worthwhile.

We had a lot of discussion and so this is where we are at this point in terms of what we have developed and what we are writing right now in this document. In terms of the acceptable approaches, the supplemented PRA, that is not a full scope or has some deficiencies in some of the elements. We're focusing on the appropriate use of bounding analyses, screen methods or qualitative approaches. We'll have identification, performance and discuss the role of sensitivity studies.

What should be in terms of quantification of model uncertainties and one we want to have a lot of discussion on, because we're hoping that your view is not to have a formal quantification as you've seen in NUREG 1.150. How to use the results from the uncertainty analyses in the decision-making process and specifically get into the role and definition of defense-in-depth. So these are the objectives that we have laid out for this document.

When we talk about the scope, we want to make it clear that we're only addressing the uncertainties associated with the use of the PRA results. There is a lot of other things that will get factored into your decision-making that could have uncertainties associated with them, but we're just addressing the uncertainties associated with the PRA.

In terms of the alternate approaches, there is two things that we're writing in the document. We're trying to provide specific guidance for what we call the risk contributor level. And what we mean by that is if you have a PRA that does not deal at all with seismic, it doesn't deal with internal fire or internal flood and you are going to do something else, we'll have guidance for what these something elses, what makes them acceptable.

But now, once you get into your PRA, you have your technical aspects of your PRA. Maybe there is a part of the PRA itself that you don't meet. Now, that could be huge if we try to go through the standard and address every single part. You know, you might choose to do something else. So we're going to address this more in a generic level to provide generic guidance if you're doing something different on a technical element level, instead of going through each one, because it just would be unwielding. Well, it would take care of my retirement. I could be here for the rest of my life doing that.

CHAIRMAN APOSTOLAKIS: That's so far in the future, Mary, that you have plenty of time to write many more reports, Mary.

MS. DROUIN: Absolutely. Okay. The approach we have taken in this document, in terms of the treatment of uncertainties. The process-oriented approach that we have proposed and are developing and it has four primary parts to it, as you see here, which I'll get into and is also shown. You know, it might be easier as I talk to this slide, put the slide up that shows the flow chart.

These say the same thing. This is just showing it. I apologize, the machine chopped off the title, but that's okay. The whole flow chart is there. So the first part, and this is also showing how the document is organized, in this big box, which is the primary part, the first major step is to look at your PRA scope and you want to ensure that the appropriate PRA scope for the decision that you're making, that when you look at it that the PRA model itself addresses all the significant risk contributors.

So if your decision is going to entail that you need a fire analysis or a seismic analysis, you want to make sure that your model deals with that, and if it doesn't deal with it directly, then some alternate approach, and you can see that's coming in from the side there. The next is you're going to assess and identify the impact of the known uncertainties, both parameter and model. And then your decision is going to be based on the consideration of the key uncertainties, the characterization of it, and the acceptance criteria that we're developing.

And then imposed and part of all this is maintaining the defense-in-depth to address the unknowns, the incompleteness. And part of this is coming up with the role or definition of defense-in-depth. And this is an aspect where, just on a side note, we're tying it very closely with the framework on advanced reactors and the definition of defense-in-depth that we're developing there, because ultimately we owe the Commission this definition in terms of add into it to the policy statement on PRA, so we're working all of these very closely together.

And then also on the side is we thought it would be a good idea to come up with what we considered a generic list of uncertainties, so when you go from PRA to PRA, there is just a certain set that, whether you're dealing with a Westinghouse or a BWR6, they all have to deal with these certain issues in their PRA and to try to come up with and identify this generic list. And then the next step is whether or not we should propose a resolution for consistency and standardization on these different uncertainties.

On the alternate approaches, you know, identify at a high level in terms of coming up with guidance, because we aren't going to be able to write detailed standards, and that's not what we're trying to do, this is more of a guidance, but coming up with the attributes and characteristics for an acceptable alternate approach. And then identify some particular alternate approaches and what aspects of them are acceptable or what they need to be to be acceptable. Such as looking at the seismic margin, looking at 5.

If those are going to be used as an alternate to the PRA Standard, what do they need to entail to make them acceptable?

CHAIRMAN APOSTOLAKIS: Has anybody proven that FIVE is a conservative approach? I mean, we all say it is, but I have never really seen it.

MS. DROUIN: I don't know. I would have to go back and look. It has been a while since I have thought about 5.

CHAIRMAN APOSTOLAKIS: Is JS here?

MR. HYSLOP: I'm here. I'm not sure that I've seen in the definitive frame that it is conservative. Certainly, there are some parts of internal events models that need to be made more robust, no matter what process you are using, since various operations and things. So it's not clear to me. At least I haven't seen anything definitive.

CHAIRMAN APOSTOLAKIS: Okay.

MR. LEHNER: I think maybe I can answer again. I think strictly speaking as to 5, it is just the screening approach. It wasn't intended to be quantitative. So really, I think what you have to ask is whether the use of FIVE supplemented by some PRA is conservative or not.

CHAIRMAN APOSTOLAKIS: Well, a screening approach implies that it's a conservative approach, right?

MR. LEHNER: And it's conservative in the sense that it only takes -- I mean, I think it assumes the fire engulfed room. It seems that everything that's not protected is damaged.

CHAIRMAN APOSTOLAKIS: I'm not sure that it does though, because if there is a fire in a cabinet then they divert on with a 35 degree angle and all that, then I really don't know whether the -- you know, the hot plume goes up and it goes 35 degrees and everything inside is destroyed and everything outside is fine. I'm not sure that there -- I haven't seen evidence that this is really a conservative approach.

My point really is not to discuss fire right now, but if you list conservative approaches, it seems to me these questions will come up, because one of the things that the letters of the Committee have emphasized is that when people use bounding approaches, they should have some evidence that these are indeed bounding approaches.

PARTICIPANT: Right.

CHAIRMAN APOSTOLAKIS: So, you know, FIVE has been used now for some time and we never really saw a convincing case that it is a conservative approach. And there may be others. I mean, I don't know about the seismic margins, most likely, because the NRC guys do.

MR. HYSLOP: Yes, as Karen said, certainly there are conservative aspects of it.

CHAIRMAN APOSTOLAKIS: Aspects, yes, I agree, they are conservative. I think you are right there. I mean, the question is whether the whole --

MR. LEHNER: The whole package is. Okay. Okay. That's a good point.

MR. LEW: Just a note on the PRA Branch, we are in the process of doing a fire model that includes 5. So we're looking at what the limitations of FIVE are as part of the input or the implementation of FIVE and 50.8(c). So if that's --

CHAIRMAN APOSTOLAKIS: That's good.

MR. LEW: We don't have anything right now.

CHAIRMAN APOSTOLAKIS: That's good. That's good. So we'll have some evaluations. Okay, Mary.

MS. DROUIN: Okay. At this point, I would like to go now to the issues and walk through them and hopefully get some guidance and direction from the Committee. These are not necessarily in any kind of order or priority, you know. It was just the list that we came up with.

CHAIRMAN APOSTOLAKIS: Well, I would say your first question is really the top, top question. Just out of curiosity, the whole tone of your presentation is that the Regulatory Guide 1.174 says this, 1.200 says that, 1.150 says that. Well, is it the NRC's documents that should be the basis for all this? I mean, having you guys are planning to review what people have said about model uncertainty in the open literature, there have been meetings, there have been conferences. I can assure you it's not that much, there are many papers, but the basic approaches are not that many.

But it seems to me for an issue like this, you ought to spend some time doing that and reviewing and evaluating what people have proposed. Don't just limit yourself to 1.150 for --

MS. DROUIN: We're not. We're not. This is just an example up here. We have been looking at other stuff and we plan to continue looking at other stuff.

CHAIRMAN APOSTOLAKIS: You know, there was a workshop 10 years ago in Maryland. I mean, that's one place.

MS. DROUIN: Yes.

CHAIRMAN APOSTOLAKIS: Okay.

MS. DROUIN: But I just used 1.150 here as an example of, you know, there is two extremes that we can go here. We can either, you know, provide guidance in there. We're hoping that it's not the Committee's desire that people are having to go out there and do this very detailed formal quantification, such as you saw in 1.150. Are we leaning more towards, in terms of modeling the uncertainties, doing more sensitivity type approach? And this is what -- when we were reading, we went back and read the letters from the Committee, it was unclear. You could interpret it either way. So we wanted to get some guidance where the Committee was coming from on this issue.

CHAIRMAN APOSTOLAKIS: Well, as you correctly stated earlier, what really matters is how these things affect decision-making. So if you -- it seems to me that ultimately -- let's say you find that an issue is important to decision-making. You do your sensitivity study and, you know, you use somebody's model and you find that you are exceeding the regulatory guidance compared to the minor slide, for example, that was CDF. What do you do? Well, you have to say something about the probability of that sensitivity study.

How likely is it that these guys' model is the correct one? So if you look at decision-making, you cannot avoid some quantification. Now, I'm not saying that this has to be the extensive 1.150 analysis, but, you know, you have to say something. So now, in that other report on expert opinion for seismic issue, I believe there are four categories of expert elicitation processes depending on the significance of the issue.

MS. DROUIN: Yes.

CHAIRMAN APOSTOLAKIS: And for the Nuclear Waste Depository of Yucca Mountain this is the wrong source of the elicitation process. There is a limited budget and so on. I don't expect that in routine model issues you have to go to that. Maybe something less than that and more informal elicitation process among the smaller group and so on. That was exactly what that group wrote that report had in mind. That you can't afford. It's not 1.150 or nothing. There is in between.

And I think a lot of these issues, take for example the C-LOCA issue. Where I understand there is more than one model. You really don't need to do an 1.150 evaluation. Maybe inviting a few cognizant experts to Rockville and spending half a day with them and all that and then using your own judgment can lead you to something. You seem to be puzzled by something.

MS. DROUIN: Some type of graded approach?

CHAIRMAN APOSTOLAKIS: Did I choose the wrong example?

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Okay.

MR. TRUE: Only because we've been working on our CPC LOCA for 20 years.

CHAIRMAN APOSTOLAKIS: So you believe it's resolved?

MR. TRUE: I believe it's as resolved as it's going to get and another day is not going to change that.

CHAIRMAN APOSTOLAKIS: Okay. I'll pick another example then. Although, as is always, there's going to be something that can be interpreted in many ways. But there aren't very many such issues in 1.150, I think.

MR. TRUE: It depends upon --

CHAIRMAN APOSTOLAKIS: You can work out many and my point is that it's not 1.150 or nothing. There are two degreeing stages. You can choose to do separate things, you know. Maybe some informal or semi-formal elicitation. And then the judgment of the staff can give some probabilities or some guidance. I don't think that sensitivity studies by themselves will help very much. Because eventually, you know, what if you do some sensitivity study and you exceed the limit? Then somehow you have to argue how likely that is.

MR. LEHNER: Yes, but maybe, I think, the difficulty comes in in arguing what that likelihood really is.

CHAIRMAN APOSTOLAKIS: Yes.

MR. LEHNER: Because, in a sense, it's a subjective assessment of a group of experts as to whether that particular model has more credence than the other models.

CHAIRMAN APOSTOLAKIS: Yes.

MR. LEHNER: So I think those were the types of arguments that we went through. I mean, this is almost like this is deja vu for me, because we talked about this.

CHAIRMAN APOSTOLAKIS: All over again.

MR. LEHNER: Back in 1997 when we were looking at Reg Guideline 1.174 and discussing the same issues. The sense that, you know, we didn't want to see ourselves going down the path of having to do broad uncertainty distributions and folding everything into a final answer, but rather have separate effects analyses, if you like, so you could identify what were the issues that really made you lean towards rejecting an application and then assessing the worth of those assumptions.

PARTICIPANT: Which means?

MR. LEHNER: Which means in a way it's quantification in a sense, but only in a relative sense.

CHAIRMAN APOSTOLAKIS: Look, I'm not saying that you should come up with something that says this model has .3 probability.

MR. LEHNER: Yes.

CHAIRMAN APOSTOLAKIS: But my --

MR. LEHNER: Whether it's low or not.

CHAIRMAN APOSTOLAKIS: -- argument is that you cannot avoid saying something about how likely or how credible this model is.

MR. LEHNER: Right, right.

CHAIRMAN APOSTOLAKIS: Now, what that something is, I don't know. We have to discuss it. But there are two points I'm making. First, it's not either or. It's not either 1.150 or something else. There are stages in between. Second, sensitivity studies by themselves I doubt very much will be very helpful. At some point you have to take the plunge and say well, you know, and we don't think this is to lightly or this is acceptable for whatever reason. In other words, say something about how likely it is a particular assumption is.

MR. LEHNER: I think, in a sense, that's always what we have had in mind.

CHAIRMAN APOSTOLAKIS: Yes.

MR. LEHNER: The sensitivity analysis anyway. So say that you're doing it. You don't just do it for the hell of it. You do it and you say does this issue affect my decision? If it does, do I really believe that this is a serious contender? And if it's not, then you can reject it. And if it is, then you have to --

MR. TRUE: And you try to push it as far as you can.

MR. LEHNER: Yes.

CHAIRMAN APOSTOLAKIS: I mean, take the 5069 thing. Originally, south Texas took all the failure rates and increased them by 10. Now, why 10 and not 11, why 10? Then NEI comes back and says no, we'll increase them by FIVE and then I think the same factor there. Well, what if you find that, you know, by increasing them by 10, you really violate the rules? I mean, you have to say something about how reasonable that 10 is.

MR. LEHNER: Sure.

CHAIRMAN APOSTOLAKIS: And that was something that we discussed in 5069.

PARTICIPANT: That was a deciding factor.

CHAIRMAN APOSTOLAKIS: It is a deciding factor. It was a deciding factor. So at some point you have to say something about these things. It goes beyond just yes, we did the sensitivity study. If you do sensitivity studies and everything is fine, I don't think you have a problem.

MEMBER SIEBER: It is --

MR. LEHNER: Right, right. It's when it doesn't work, it's the advantage.

CHAIRMAN APOSTOLAKIS: Yes.

MR. LEHNER: Although then you've --

CHAIRMAN APOSTOLAKIS: So that's mainly my point, Mary. You know, there is a whole spectrum in agreeing and choosing. And we have many more opportunities to discuss this.

MS. DROUIN: Yes.

MR. LEHNER: By agreement, I don't think we're --

CHAIRMAN APOSTOLAKIS: We want to finish this up at 1:00, because we have many opportunities to meet with Mary and Gareth and the other guys, but not as many to meet with people from these, so I really want to give two full hours to Gareth and whoever else is a part.

MR. TRUE: Whoever else isn't here right now, so maybe --

CHAIRMAN APOSTOLAKIS: So let's go on. When and how? Well, in September and --

MS. DROUIN: When and how should the uncertainty distribution be treated in the decision-making process? I mean, do we just go with the mean value and don't look at the spread?

CHAIRMAN APOSTOLAKIS: I don't know, Mary.

MS. DROUIN: I mean, we don't think that's a good idea.

CHAIRMAN APOSTOLAKIS: Well, the mean

value already has -- is influenced by the uncertainty.

MS. DROUIN: Yes.

CHAIRMAN APOSTOLAKIS: But I think you mean something more than that.

MS. DROUIN: Yes.

CHAIRMAN APOSTOLAKIS: Tom Kress is about to say something here.

MR. KRESS: Well, you have -- normally, when you deal with uncertainty in the decision-making process, you have an acceptance criteria in the circumference plan.

MS. DROUIN: That's right.

MR. KRESS: The question how do you arrive at that acceptance criteria has been the question. But generally, you use the loss function, utility function, which is based on it's mostly an opinion, but it's based on an informed opinion. But, in general, when you do, you're going to deal with confidence levels in your acceptance criteria. That's how you do that.

MR. LEHNER: But let me remind you though that the acceptance criteria that we use or have been using when chosen to be mean -- to be competitive to mean.

MR. KRESS: I'm not complaining about

that.

MR. LEHNER: Right.

MR. KRESS: But maybe you need a confidence level, but, you know, when you say the mean, I'm assuming that's 50/50 already. 50 percent high or 50 percent --

MR. LEHNER: No, it's more like 75/50 percent.

MR. KRESS: Oh, okay.

MR. LEHNER: Something like that.

MEMBER SHACK: It's 75/50.

MR. KRESS: That may be an appropriate choice, but I don't know what the loss function is associated with that. Partly it's all right, because that's what some people decided.

CHAIRMAN APOSTOLAKIS: I tried to once to have a loss function that increases as --

MR. KRESS: As you go up?

CHAIRMAN APOSTOLAKIS: -- go up.

MR. KRESS: That's what it should do.

CHAIRMAN APOSTOLAKIS: It's very --

MR. KRESS: It's hard.

CHAIRMAN APOSTOLAKIS: -- hard to work with.

MR. KRESS: It's hard to come by and it's almost a judgment call.

MR. LEHNER: I think one of the things that we have played around with is maybe looking at the shape of the distribution, still use the mean, but looking at the shape of the distribution and wondering how much of the tail lies above the acceptance guideline, for example, and I'm not sure that this works very well. It works great for distribution for defining model on multi-mobile, because the mean might be way down below the guideline, but you might have a little bit of a distribution that's way above that corresponds to some, you know, assumption that you've made or something like that.

Clearly, that's information worth knowing, because you want to know what's driving that thing that is above the guideline. But in terms of -- I mean, we're intending to hope that we don't have to develop new guidelines and new acceptance criteria, because those of you who were here when we did Reg Guide 1.174, you know what the agonies we went through with choosing those criterias.

CHAIRMAN APOSTOLAKIS: I guess if you can go a few small steps beyond just saying increase management attention.

MR. LEHNER: Yes.

CHAIRMAN APOSTOLAKIS: That would be good enough at this stage. Because I think that's what increase management attention means in the report. But if you're close to the family, you scrutinize the day of the distribution, what does it mean and so on.

MR. LEHNER: Yes.

CHAIRMAN APOSTOLAKIS: Should there be guidance to use uncertainties? Why is that your job?

MS. DROUIN: Well, we're asking whether or not. You know, as I indicated earlier, one of the things that we were doing was to identify a generic list of uncertainties, and we could go a step further and say okay, here is an acceptable approach for that uncertainty.

CHAIRMAN APOSTOLAKIS: So it's not really to refuse things, you're just saying if you quantify it this way, we'll accept it?

MS. DROUIN: Yes.

PARTICIPANT: Take it out of the equation basically.

CHAIRMAN APOSTOLAKIS: Take out the --

PARTICIPANT: Yes.

MS. DROUIN: And going that way, you know, do we create -- I mean, do we come up with an acceptable approach that is based on more bounding assumptions or do we go through more of a consensus process where you can end up with something that's not necessarily either bounding or conservative? But the biggest thing is is it worthwhile to even go that and come up with an acceptable approach? Try and come up with an acceptable approach.

CHAIRMAN APOSTOLAKIS: I think we will know much better or more to be able to say something intelligent about this after you do the first bullet or maybe the first one.

MS. DROUIN: Okay.

MR. KRESS: Another point about your second bullet here. You need to have distribution to get mean.

PARTICIPANT: Yes.

MR. KRESS: So, you know, it's all right to use some mean, because it's not too -- whatever choice you use for your decision criteria, you want mean to certain distribution to decide whether you are there or not. That's the reason there. You can't really do that with sensitivity.

CHAIRMAN APOSTOLAKIS: No. Okay. Next, Mary?

MS. DROUIN: Okay. This is the next point, the next one. If we do come up with and propose acceptable methods or models, you know, does this mean that if the specific model uncertainty is already addressed and does not need to be considered in the decision?

MR. LEHNER: The Westinghouse C-LOCA Model, no, sorry, the agreed upon C-LOCA Model, for example, for Westinghouse plants.

CHAIRMAN APOSTOLAKIS: Isn't it a matter of evaluation though? I don't understand the question. They agreed upon -- where is it?

MR. KRESS: Well, you know, take for example an Appendix K Model, you know, and, you know, we're talking about PRAs. The Appendix K Model might be used to develop success criteria, for example, and just because it's an acceptable model doesn't give you the probability that you're going to achieve that success criteria. So I don't think -- actually to me, you do need to still deal with uncertainties even if you have an acceptable model. I don't really know what you mean by acceptable models.

CHAIRMAN APOSTOLAKIS: Yes, it's not clear.

MR. KRESS: It's not clear.

MS. DROUIN: Well, let's go back and use the awful example of the C-LOCA. And let's say for discussion purposes what's put out there as an acceptable, and everybody has decided that's acceptable and that's what everybody is using, is the Rhodes Model. So now, you don't have the uncertainty and the variability from all the different models. Everybody has used this same model and now, you have the same uncertainty associated with it and now, you can take it out of the equation, because you don't have the uncertainty or the variability anymore.

MR. LEHNER: And I think the second, the sub-bullet, what that means is that the model itself might have some parameters set.

CHAIRMAN APOSTOLAKIS: Absolutely.

MS. DROUIN: Yes.

MR. LEHNER: So you would still have to deal with those.

MS. DROUIN: Right.

MR. LEHNER: And the other thing is that you have to understand whether that model was chosen because it was a somewhat conservative model and, therefore, you need to recognize that, because that might have an impact on certain applications. So it would be a way of characterizing. This is the model typically we will use, but it has these limitations and, therefore, when you're making these decisions, you have to be careful of it. I think that's, basically, what we're thinking of.

CHAIRMAN APOSTOLAKIS: That makes sense.

PARTICIPANT: Yes, that does make sense.

CHAIRMAN APOSTOLAKIS: It makes perfect sense.

MS. DROUIN: Right. I mean, it's getting to the benefit of why you would want to specify an acceptable model.

CHAIRMAN APOSTOLAKIS: Yes. But again, I really think that a lot of these questions can be addressed much more intelligently after some dictates of the various words in developing it.

MS. DROUIN: Okay.

CHAIRMAN APOSTOLAKIS: Some more specific.

MEMBER SHACK: Well, I mean, I think it is -- you know, the acceptable models are acceptable for certain things, you know.

CHAIRMAN APOSTOLAKIS: Yes.

MEMBER SHACK: If you're looking how fast a crack goes through a wall, you want to conserve the prediction of that. If you're trying to make a leak before break argument, you don't want to drive the crack through the wall faster than it really can do it. I mean, so what's conservative for one purpose may not be conservative for the other.

CHAIRMAN APOSTOLAKIS: Yes.

MEMBER SHACK: And you really have to be aware of just what assumptions you're making.

MEMBER SIEBER: And a lot of these models are part of the greater --

MEMBER SHACK: Yes.

MEMBER SIEBER: -- thing where the uncertainties are huge, and so you need to treat them explicitly, I think.

MS. DROUIN: Okay. Next one, what are the problems/issues in using bounding analyses with respect to generating insights that can be used in the decision-making?

MR. KRESS: Well, I think when you say bounding analysis, you have to be a little more definitive on what you mean in the sense that some people say if I had a distribution, but the value of the 95 percent boundary is down. You know, generally, we're dealing with distributions in reality, but when you say boundary analysis, you're talking about something that either can't go beyond or some very, very low probability. And I think we have to, somehow when we talk about boundary analysis and giving guidance on using it, you have to be more definitive about what you mean by bounding analysis.

MR. LEHNER: I think that's a good comment. I think that's one of the problems that we try, we're going to attempt to do wasn't it, was to define what was an acceptable bounding analysis.

PARTICIPANT: Yes.

CHAIRMAN APOSTOLAKIS: I think the problem or one problem case might be where we use a bounding analysis and you violate the criteria.

MR. LEHNER: Right.

CHAIRMAN APOSTOLAKIS: Then you have --

PARTICIPANT: Yes, that's --

CHAIRMAN APOSTOLAKIS: Have you been overly conservative?

MR. LEHNER: Right.

MEMBER SHACK: See, my argument was is if you're using a bounding analysis, if it's truly bounding, you know, the hard part of the problem to me is that you never almost always do a problem that's overall bounding. You bound some part and then you do some other part.

CHAIRMAN APOSTOLAKIS: Right.

MEMBER SHACK: And where are you really at now? If I was really convinced the whole problem was bounded, that addresses my concern.

MR. KRESS: I don't really know what you mean by bounded in this case, because the only thing we're dealing with is the probability distribution. See, that's my problem. When you say truly bounding, I don't really know what that means. I mean, I know what it means in mathematical sense. I know what it means in a mathematical sense when you're talking about truly bounding things mathematically, but from a relative sense, I don't know what you mean.

MEMBER SIEBER: Philosophically, there is no bounding analysis.

CHAIRMAN APOSTOLAKIS: That's true.

MR. KRESS: In a probability sense.

CHAIRMAN APOSTOLAKIS: But it's a very unlikely --

MR. KRESS: Yes, John, and it has to be somehow defined in those terms.

MEMBER SIEBER: You have to define that.

MR. LEHNER: But I think maybe Dr. Shack had it right, in some of the analyses that it's sort of bounding in certain aspects. For example, a model like FIVE, okay, just using the screening approach the same. If you have a fire in that room that takes everything out in that room, that is certainly bounding under those.

PARTICIPANT: That's bounding.

MR. LEHNER: But I think those are the types of things, I think, we're going to have to bring into the definition of what we really think is a bounding analysis.

MEMBER DENNING: I think there is another element here, and that is I think we're really looking often at the trade-off between risks and as we look to our risk-informing regulation and if you do bound, even if you're conservative in one area, you distort that comparison between risks.

MR. LEHNER: Yes, right.

MEMBER DENNING: I think there is concern about this conservativeness, a more bounding element in your analysis. How you say anything generically about it, that's what's difficult without looking specifically at the case that you're talking about.

MR. LEHNER: I think the good thing, a good bit of news in regard to that though is that the Commission has directed us to do this phase approach to PRA quality, so if anything is a significant contributor risk, it's supposed to be dealt with by PRA methods and not by bounding analysis. So I think the bounding things are always going to be, hopefully, at the lower level rather than swamping things, but yes, you have got to be careful about that.

CHAIRMAN APOSTOLAKIS: But seismic is usually a major contributor and, yet, a lot of utilities are using margins.

MR. LEHNER: I don't think seismic is a major contributor for any --

CHAIRMAN APOSTOLAKIS: A lot of PRAs.

MR. LEHNER: On the west coast maybe, I don't think in -- very few on the east coast.

CHAIRMAN APOSTOLAKIS: Oh, I don't know, because designation is so low on the east coast, you see the problem there.

MR. LEHNER: I think it's quick to say if you're saying that seismic --

CHAIRMAN APOSTOLAKIS: And prior contributions are among the top contributors is a general statement.

MR. KRESS: But you're never quite sure when you use such conservative analyses that you --

CHAIRMAN APOSTOLAKIS: In the current state of knowledge, this is a true statement. By the way, one thing that I think is missing here, I was looking at some of the regulatory decisions NRR has made, risk-informed, and in several cases, you know, as we all know, quantifying human error during accidents is one of the major uncertainties, right? And you look and the utility used a .5 for the human error rate. Gee, there is no problem there. There is no problem with model uncertainty here. They are so close to 1. Yes, I mean, what do you want to do? Make it to 1? Beat me up.

So I don't know. Maybe that belongs to the second bullet in the previous slide, when to worry about these things. I think what the applicant has done -- what?

MR. LEHNER: It wasn't associated with that bullet.

CHAIRMAN APOSTOLAKIS: Anyway, and then there is no bullet related to that, but what the applicant -- I mean, you know, everyone says model uncertainty, now I have to do model uncertainty. There is human error. Wow, what do I do? And then the guy says .5. For me it's a non-issue, because they came so close to 1 that I really don't care whether there is model uncertainty.

As Dr. Shack likes to say, it's way down, all the uncertainty is down, so I don't care. Isn't it true? I mean, in other words, you can put it a different way. They used the bounding analysis. They bounded the human error.

MR. LEHNER: But they are not going to use .5 for every human error.

CHAIRMAN APOSTOLAKIS: No, but these were actual obligations by the industry and I was so surprised.

MR. LEHNER: But if it comes up with an acceptable result.

CHAIRMAN APOSTOLAKIS: That's why they did it like this.

MR. LEHNER: Yes, then it --

CHAIRMAN APOSTOLAKIS: But the reviewer should be aware, because now there is no issue here.

MR. LEHNER: On that particular application.

MR. KRESS: What if you use .1?

CHAIRMAN APOSTOLAKIS: Yes. On that particular application, on that particular model uncertainty.

MR. KRESS: Would you have had an issue if they used .1?

CHAIRMAN APOSTOLAKIS: I don't know. It would depend how sensitive they are.

MR. KRESS: See, I don't want to start with --

CHAIRMAN APOSTOLAKIS: Probably not. I

think they have to use their judgment.

MR. KRESS: I don't know .5 is any better than .1. That's my point.

CHAIRMAN APOSTOLAKIS: It's much better than the -3 though. It's another case where you recognize it when you see it.

MR. KRESS: Okay.

CHAIRMAN APOSTOLAKIS: Okay, guys. It's 1:00.

MS. DROUIN: Okay. We'll skip the next one. We could be on that forever, but the last one, should the guidance for alternative approaches include guidance on the use of expert panels? We had originally not put that in our scope, but we're aware that this is an alternative that a lot of licensees are using. Instead of bounding analyses, instead of doing sensitivities, they are doing expert panels. So should we put this as part of our scope?

CHAIRMAN APOSTOLAKIS: My first reaction to this is most of the work that's behind this has already been done in that report on seismic, the use of experts in seismic. As I say, they have categories. All you have to do is take those.

MS. DROUIN: But that's expert elicitation.

MR. LEHNER: That's a different issue, George.

MS. DROUIN: Different issue.

CHAIRMAN APOSTOLAKIS: No, it refers to expert panels.

MR. LEHNER: But this is more like the IDPs. It's called --

CHAIRMAN APOSTOLAKIS: They are a variation of expert panels.

MR. LEHNER: It integrates a decision-making panel, yes.

CHAIRMAN APOSTOLAKIS: But they are a variation of those panels, I think. Even though you don't elicit information formally, it's still the use of an expert panel. As a group now they are telling you something. So what my point is, this is not a personal view. This is not worth spending too much time on. It exists already. Adjust it to the problem here and then later we'll see whether that's good enough.

MEMBER SHACK: But you're implicitly assuming it should be included?

MS. DROUIN: Included?

CHAIRMAN APOSTOLAKIS: Yes.

MS. DROUIN: We would build on whatever's out there.

CHAIRMAN APOSTOLAKIS: Yes, yes, yes.

MS. DROUIN: But it's whether or not to even include it?

CHAIRMAN APOSTOLAKIS: Yes.

MEMBER SIEBER: I think it's a legitimate thing to do but, you know, I think every case is going to be different.

CHAIRMAN APOSTOLAKIS: Yes, I agree with you. Okay. Then you tell us that you're going to come and visit us frequently?

MS. DROUIN: Yes.

CHAIRMAN APOSTOLAKIS: Is it because you like us or because --

MS. DROUIN: Oh, because we like you and we value your wisdom and --

CHAIRMAN APOSTOLAKIS: Oh, that's enough, that's enough. Okay. So we're done.

MS. DROUIN: Thank you.

CHAIRMAN APOSTOLAKIS: Thank you very much. Now, we go to Mr. True.

MR. SNODDERLY: George, do you mind?

CHAIRMAN APOSTOLAKIS: Yes.

MR. SNODDERLY: Could we take a five minute break to just stretch?

CHAIRMAN APOSTOLAKIS: Okay.

MR. SNODDERLY: I have got presentation that are --

CHAIRMAN APOSTOLAKIS: Five minute break.

(Whereupon, at 1:02 p.m. a recess until 1:11 p.m.)

CHAIRMAN APOSTOLAKIS: Okay. Let's get started with Doug True.

MR. TRUE: No.

MR. CANAVAN: I'll start us off.

CHAIRMAN APOSTOLAKIS: Okay. Tell us who you are.

MR. CANAVAN: Ken Canavan, Electric Power Research Institute. I'm a project manager for EPRI's PRA scope and quality efforts.

CHAIRMAN APOSTOLAKIS: Do we have copies of your --

MR. CANAVAN: It's on the way.

CHAIRMAN APOSTOLAKIS: Oh, okay.

MR. CANAVAN: They are being made as we speak. As I said, I am project manager of the PRA scope and quality effort at EPRI of which a framework for the treatment of uncertainties is a part of, granted, a fairly large part this year. And I'm going to start off our presentation briefly with some overview, and then Mr. Doug True will go through the details of our efforts in 2004. Can I do that? Yes.

To get right into it, our goal was to create a pragmatic process that can identify when point estimate solutions are not suitable in light of parametric uncertainties, assist the utilities in identifying and addressing key sources of uncertainty, provide a technical basis for using that in risk-informed decision-making, and addresses both the base model and a variety of applications.

The process is pragmatic and the pragmatism is required due to the extreme amount of resources that could be required in the alternative. And what I mean when I say pragmatic, I mean the pragmatism of the process is evidenced through the adherence to several principles, and to start off with those right away, I think, before Doug gets started, we will give you a framework to think about as we go through the presentation.

And some of those principles are, the first one is the rigorous treatment of detailed evaluation of uncertainty due to all causes is probably not attainable. The second principle would be conservatism has been included in PRA acceptance guidelines published by the NRC to account for uncertainty.

And then I have three other bullets to talk about the different types of uncertainty. The first one is in the case of parametric uncertainty, the PRA mean value and the point estimate value are typically fairly close together. In the case of modeling uncertainty, there is a need to develop guidance on deciding what causes or sources of uncertainty are key and then what to do with those key sources.

In the case of completeness uncertainty, there's two types. The first one is the things that we know about and in those cases, Reg Guide 1.200, the PRA standards, the PRA peer reviews provide confidence that we're in the completeness of those things that we know. In the case of the things that we don't know, the risk-informed process is laid out in Reg Guide 1.174, defense-in-depth, the safety margins and performance monitoring, provide protection against those things, the things that we don't know.

Going back to a little bit broader industry efforts, Westinghouse Owners Group has put a lot of effort into understanding uncertainty and has done the following projects. Key assumptions identification process, LOCA and LOOP uncertainty impact assessment, and I believe that they have started the PRA assumption mapping and cross comparison activities.

In the case of EPRI, we're working on guidelines for the uncertainty characterization in risk-informed applications, and we're developing two guides as part of that. The first guide is the technical basis document and the second guide is an applications guide.

Here's a quick slide on the interrelationship of industry activities on uncertainty. I'm not going to go through this slide in detail. I will give it to you real brief. That center large box is our applications guide. That applications guide is going to be used by Westinghouse in some form for their assumption mapping work, and we also plan to pilot that guide later in 2005.

The technical basis document, the center box directly below it, that is in publication now and will be out by the end of the year, and that technical basis document used input from the LOOP LOCA work that Westinghouse had done, from the key assumptions work Westinghouse has done, as well as from the Columbia Generating Station Reg Guide 1.200 pilot and several other sources we developed. And if you would like to know --

CHAIRMAN APOSTOLAKIS: Who?

MR. CANAVAN: Columbia Generating Station.

MR. TRUE: WP2. Formally, WEP.

PARTICIPANT: Whoops, whoops.

CHAIRMAN APOSTOLAKIS: Oh, okay.

MR. TRUE: Wasn't it in that EPRI report, the bases document is going to be --

MR. CANAVAN: Piloted.

MR. TRUE: But it's going to be available, made available?

MR. CANAVAN: It's going to be made available.

MR. TRUE: So you'll be able to gain access to that.

CHAIRMAN APOSTOLAKIS: When will this be published?

MR. CANAVAN: The publication date is December 24, 2004.

CHAIRMAN APOSTOLAKIS: Goodnight.

MR. CANAVAN: And Merry Christmas.

CHAIRMAN APOSTOLAKIS: Wonderful.

MEMBER SIEBER: Yes, watch your chimneys.

MR. CANAVAN: Yes, it is quite large. Down on the lower left hand side are our current PRA

Scope and Quality Committee Members. I won't go through them since they are listed.

And we jumped ahead to status, PRA scope and quality uncertainty activity status. The guidelines that we're developing, the technical basis document, is going to be available in December of 2004. The applications guide is under development and we're going to try to produce a draft for January 2005 and that looks like it will be complete.

There is going to be a joint EPRI and our group pilot of both the technical basis document and the applications guide for 2005, and then revisions to both the technical basis document and the applications guide are planned for after the pilot completion by the end of 2005. And that's a summary of the activities. I didn't have anything else after that, so it's all you.

MR. TRUE: Okay. It's all me. Okay. One of the things that I want to also preface this with is that the focus of this technical basis document and the guide right now is on internal events at power, basically, aligned with the ASME standard, and you will see how that was done and why it is limited to that, at this point, as we get into this.

As we get into this, we're trying to

create a process and bases information that will help utilities meet the regulatory requirements as they are today, and we think a lot of what we're doing actually compliments the project that Mary talked to you about just before. It overlaps some, but it also, we think, actually compliments it in a lot of ways, what they have been thinking about doing.

We have gone sort of down in detail in the internal events at power area. They have been kind of staying at the higher level, and we have had one physical meeting and a couple of phone meetings trying to coordinate activities in that area, and we expect that will continue into next year.

So we start at the mothership of what Reg Guide 1.174 on risk-informed decision-making. I brought this extra, so you could see where we started from at the highest level. And basically, 1.174 says that you need to deal with uncertainties and you need to understand how they could affect the decision, and that well formulated sensitivity studies or qualitative arguments are a means to do that. And so there was a fair amount of discussion earlier on sensitivity studies and other things. We have headed down the sensitivity study path.

Another thing that we thought was

important out of 1.174 is it talks about these well formulated sensitivity studies being reasonable and trying to keep them within physical reality and not be exhaustive or arbitrary. And so we have tried to help build from that into a lot more detail about what that might actually look like in trying to evaluate key sources of uncertainty in base models and in applications.

Reg Guide 1.200 goes on and makes a couple of other statements, which I won't read verbatim, but the two important elements are that the key sources of uncertainty are tied to the technical elements of the PRA. In the case of the ASME standard, that's things like initiating events, systems analysis, LERF or the nine technical elements of PRA, and that you are supposed to identify them within those technical elements and understand their impacts on the risk results, CDF and LERF.

And the key assumptions also are driven by those key sources of uncertainty, and also in Section 1.21, of Reg Guide 1.200, sorry, too many 1s and 2s there, they talk about doing combinations of sensitivity studies as a means to look at uncertainties in results. And so we have tried to also address that and how that is actually done, because beyond these high level statements, there really isn't anything written down that we could find that would really direct a licensee on how to actually tackle this subject, and that is part of what your letter addressed, but it even goes further than that, we think.

So we came up with a high level process, two high level process diagrams, one for the base model and one for applications, because we think they do different things to look at uncertainties for each of those uses of PRA. And then we start at the far left with a generic list of potential model uncertainties, and this list, I will get into it in some more detail here, we're not going to go through it in detail, but we'll talk about how we came up with it in detail, it is derived from the past work that has been done, 1.150 applications that have been done in our experience across the industry and the members of our working group and the log work that have identified a number of causes of uncertainty and specific types of uncertainty.

That list is used, it will be used by a licensee to evaluate the applicability of those model uncertainties to their model. Do they exist? You know, obviously, if you're a BWR, you don't have the

Westinghouse Reactor coolant pump seals, to use the tired example, but there may also be other areas of uncertainty related to room cooling or treatment of grid stability or some of the other more problematic aspects of modeling that might or might not apply to a particular PRA.

We also realized in the box below that there may be things that are done in developing the plant-specific model that in themselves have some sort of uncertainty associated with them. It might be something unique to the particular plant that has caused the model builder to have to make decisions that have had uncertainty associated with it, and they may have done that in a conservative way. They may have tried to do it realistically. It depends really a lot on the specific issue.

So we're trying to create a process for the PRA analysts to look at their PRA, and we look even beyond this generic list at places where they may have introduced uncertainties into their model.

And those lists of applicable model uncertainties are then culled through to see where those have been applied with conservative biases. I'm starting at the bottom of the next little dotted box, because a lot of the times in doing PRAs, the way we deal with uncertainty is we use a conservative bias. It's just easier and if it's not a large contributor to the result, it facilitates getting the analysis actually done, and that's okay in a base model as long as it's not driving the result. It's perfectly acceptable to disposition a source of uncertainty in that manner.

Another way that we'll deal with our source of uncertainty is to apply a consensus model. For example, the WOG 2000 Model, which is the newest endorsed version of the Westinghouse Model and Rhodes Model kind of married together into one. The result is now a consensus model that we would expect people would use in doing their base PRA. And that is a way in that model to address the best source of model uncertainty.

But then the other things that come through that weren't either done with a consensus model or may have been attempted to be done as realistically as possible because of their being significant contributors or that was the modeling approach taken by the model. For those, we're asking that the PRA user assess the magnitude of the impact of that uncertainty. They actually look at how sensitive the result is to that particular aspect of the model.

And what we're really after is identifying this term key model uncertainties. That term is used throughout the ASME standard and Reg Guide 1.200, and the qualifier of key is what really drives this, because there are thousands of model uncertainties in a PRA, maybe millions, I don't know, there's very, very many. And what we're really after are the ones that are really key. And we use magnitude of impact as a means to identify those key model uncertainties.

And then for those key model uncertainties, formulate the sensitivity studies and look at logical combinations of those sensitivity studies, we'll talk a little bit about logical combinations in a minute, and then make some assessment of what those results are telling you in light of the quantitative impacts of those key model uncertainties.

The application framework is a little bit different. We start off with a characterization of the application down in the lower left. And then we ask that the analyst identify what are the key application-specific contributors. You know, the things that are really driving risk ought to be there. Another tired example might be an EDG AOT extension.

You know you're really dealing with things that relate to LOOP, that relate to a station blackout and performance of the plant under those conditions. You can isolate the aspects of the model that are really contributing to your application and your decision.

From that look at the kind of calculation that you're doing to try and identify the cause and effect relationships that are being implicated by the change to understand then how the applicable model uncertainties that we identified up front on the base model apply. And you will note that we bring back now consensus models and conservative biases as candidates that need to be considered in the application. And that is because we don't think that you can make the case that just because I used a consensus model, that I have completely addressed the uncertainty in my decision. You may have dispositioned it adequately in the base model, but when you're trying to measure some difference in particular, we think you need to look at that again.

Going back down to the bottom of the chart, there is a little bypass right on the bottom that introduces another set of candidate model uncertainties, and those are things like peer review findings that might still be open from the PRA that is being used, because a lot of times not all of those have been addressed, you have got to disposition those, precursors that may have happened at the plant that might be relevant to the application that you have going on and regulatory issues.

Maybe a good example of that would be grate issues, I mentioned grate stability and maybe containment sump issues would be something that would be hard to sort of ignore today, because those are issues that are out there that have a risk implication. So we think those come in also as a means to identify those potential key sources of uncertainty.

Then we again formulate sensitivity studies, look for logical combinations and then interpret the results of those sensitivity studies. And we actually are so bold or foolish to come today with some suggestions on how those results could be interpreted, which will no doubt lead to some discussion.

MEMBER DENNING: Are you going to describe formulated logical combinations more?

MR. TRUE: I think we ended up taking that out, didn't we? Yes. The idea is that in the logical -- there's not more, actually, I thought we had it in here, but I think we took it out in the interest of time, that we're looking for potential synergies. It's really the place where the combination of two topics could cause your results to be skewed by synergism. Yes, so they are not just added. They are multiplicative, so to speak.

So there are five things we want to try and go through and we got a lot to bite off, so we'll try and cruise through this quickly. The first is this process we use for identifying sources of uncertainty. Then we have some definitions for this key aspect, the key assumptions, key source of uncertainty. We're also going to talk about consensus approaches and models. That was one of our buckets that we could disposition things into, and we think that's an important aspect that we need to wrestle with, and I think Mary's presentation talked about how the NRC is working on that side also.

And then guidance on interpreting sensitivity study results on these key model uncertainties, and then we have some information on the first bullet that Ken talked about, which is when do point estimate solutions from PRA models not match a fully parametric uncertainty where we would counter for the state exploration. And kind of some follow-on work to the earlier EPRI work we did on parametric uncertainties for 5069.

So in identifying the sources of uncertainty, we have gone about creating a generic list by examining the ASME standard in other PRAs, and we basically use the ASME standard elements and the high level requirements from the ASME standard as an organizing framework. So for each of the nine elements, there are somewhere between two and seven, I think, high level requirements that further define each of those elements and what is required in the standard. We have used that as an organizing framework.

And then we have come up with a list of generic causes of model uncertainty. The semantics here are a little bit tricky. A source is, you know, something like RCPC LOCA, but a cause is what's the real root cause of why we have that source of uncertainty.

CHAIRMAN APOSTOLAKIS: It's lack of knowledge?

MR. TRUE: We think there's a generic list of those.

CHAIRMAN APOSTOLAKIS: Isn't it lack of knowledge?

MR. TRUE: That's a very high level cause, but there are other -- not all of them fall under lack of knowledge. We'll get to this in just a second.

MEMBER SHACK: This would be something more specific like the heat transfer authority?

MR. TRUE: No, this is going the other way. This is --

MEMBER SHACK: That's directing upward.

MR. TRUE: Directing upward, upward. So we started with high level. Well, let's just jump into it. We started with the nine elements of PRA, initiating events. Each of those have or are subdivided into high level requirements, and I have kind of cryptically identified for initiating events there are three high level requirements that contain technical requirements.

First is identification of initiating events. The second is grouping of initiating events and the third is frequency. For each one of those high level requirement areas, we went through and looked for places where these seven causes could have led to a source of uncertainty. So these causes I talked about are a key part of this process. We wanted to be derivative. We didn't want to go out and just pick sources of uncertainty that we could think of and come across, and so these causes of uncertainty give us a means to be a little more systematic as we go through them, and I'm going to walk through those seven now.

The first is discretization. It's really the level of resolution that you built into the model and that works both ways. You can make a very multi-model and that can create certain opportunities and bounding versus not bounding or non-conservative/conservative issues or you can be very, very detailed, which can make interpreting the results difficult. You can actually discretize beyond the level of information that you have if you're not careful. And so we wanted to look for places where that might apply.

You will see for identification of initiating events, we didn't see that as being an issue, because identification is just a scope instead of definition. However, when you get into grouping, then discretization becomes very important and we have seen places where PRAs have gone off track, because they are grouped inappropriately and they haven't had an adequate breakdown of initiating events groups.

The second area is input applicability. We rely on all kinds of different information either generic or past performance information or even assumptions. Sometimes they are just flat out assumptions to go into the model to help build the model. And those inputs really drive how the model is constructed and how the model gets quantified, and that applicability to what you're actually analyzing may or may not be appropriate depending upon a base model or the application that you're doing.

And the example I used here was applicability of past performance to predicting future performance. We do have a lot of PRA, but with the changes in operating practices and things, that may or may not be a good assumption or a good approach, and it's a source of uncertainty in our results.

Deterministic modeling forms the backbone of the whole PRA. It sets all the success criteria. It sets the events sequences, and that deterministic modeling is really central to all the decisions that we make. And as much as we try to make that be realistic and applicable and everything, there are still uncertainties in whatever we apply.

CHAIRMAN APOSTOLAKIS: Isn't phenomenology part of deterministic modeling?

MR. TRUE: Yes. I broke those out, because I think there are aspects to -- and there is overlap in some of these categories. We tried to make them fairly discreet, but there is some overlap. Phenomenology, I kind of wanted a bin to just put things like induced tube ruptures, direct containment heating, atlas, core BWR atlas response, some of those kinds of things that are really more phenomena, special.

CHAIRMAN APOSTOLAKIS: Spacial.

MR. TRUE: Spacial, yes, spacial things that are more strictly phenomena. Deterministic modeling has other aspects to it like, in this case, FMEAs, which are used in identifying initiating events, the high level requirement we're in. How detailed you have gone and how complete you have been in that FMEA is a source of mulling uncertainty in your model, and it could be a fairly important one. If you miss an initiating event, then you may have an incomplete assessment.

Human performance gets its own category. It's sort of the poster child for uncertainty. And dependencies we broke out also. Again, you could also tie dependencies back into deterministic modeling, but dependencies are so important in making sure you have an appropriate risk profile. It's a thing that can completely overwhelm the probabilistics, is if you have a dependence that you didn't identify or you have over-depended or overly assigned a dependence that doesn't need to be there, you can skew your results.

And then the last category is temporal variability, which doesn't really apply to the base model so much, but can become very, very important in applications. Temporal variability is that, you know, when you get into a lot of applications, there are going to be variations in the probabilistic values that we use in the models, the plant conditions that exist at the time the analysis applies and it particularly gets in play when we get into things like significance determination process applications, which are a big issue right now in the industry.

There are a lot of resources spent on looking at the significance of inspection findings at certain plants under certain conditions. And the averaging that we do in a base PRA doesn't always apply, and so we wanted to break that out as another case for application purposes.

Consensus model and approach. That term is used in the ASME standard and it is undefined. And as we went to kind of work our way through this, we said oh, okay, consensus models. We get to bin things into that category and use that as a way to disposition things, but we didn't have a definition.

And so we have proposed what we call a working definition, and Mary talked about her list of NRC-acceptable models as their way of looking at it. We're hoping to dialogue on that to see if we can come to some consensus on the definition of consensus approaches.

There are two important aspects. One is the consensuses part of the issue, which is the top half of the definition. Then the bottom half is that we think it's important not to just be able to say I applied a consensus model, but to have the application of that consensus model have been peer reviewed.

It's not good enough to just hang your hat on some report and say oh, yes, I interpreted it and put it in right. It has got to actually have been reviewed to make sure it is implemented correctly and consistent with the assumptions of that consensus model and approach. Otherwise, we have introduced a new form of modeling uncertainty.

In terms of definitions and key definitions, the terms with key in them, key source of uncertainty and key assumption, we think that the 1.200 definitions as they stand in the trial used, the 1.200s, are a little bit too broad and there are two problem areas there.

The first is one of the criteria is changes in relative ranking of sequences. It doesn't take much, but a sneeze, to cause one sequence to move above another, particularly when you get down into the lower frequency sequences. Certainly, you wouldn't want the dominant contributor to be moving around, but the a notion of relative ranking of significant sequences is, we think, a problem in trying to implement that decision.

We also think that there ought to be some sort of a quantitative criteria for how to decide which ones are key. We think that's really the only way to get to a shorter list than all the possible sources of uncertainty.

And I guess the last area is that the definition is written really for a base model and not for applications, and we think we need to be able to address both since the base model doesn't really have an application right now. They are all done with IPEs. There is nothing really that those are used for as they exist. It's always an application.

So what we have done here is we have done sort of a line in/line out form of modifying the 1.200 definition. I won't go through it word by word. We also reformatted it slightly, so that it was a little bit easier to follow that, the line in/line out. But basically, we added introducing new functional accident sequences. The previous definition had said new accident sequences.

It's our interpretation that that was actually what was meant by accident sequences. If you read the definition of accident sequences, it talks about personnel, but we think it's a little bit better to have it explicitly identified here.

As I said, the changing of relative importance of sequences we think should be removed, and we have added a more quantitative definition to the phrase that had been there before, which involved affecting the overall CDF and LERF estimates that might have an impact on decision-making. We think we have made a cut at trying to actually define where you begin to impact that decision.

CHAIRMAN APOSTOLAKIS: But go back, please.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: The words may be -- well, they may mean different things. For example, you say a key source of uncertainty is one that is related to an issue where there is no consensus approach or model.

MR. TRUE: Right.

CHAIRMAN APOSTOLAKIS: What if, miraculously, we have an issue where there are three models, but there is consensus as to what to do with them? That could be a key source of uncertainty in which there is consensus, but there is no consensus on a single model or you can say there is a single model now that consists of the three models. The words, I think, need to be cleaned up a little bit. I know what you mean.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: But I'm just playing devil's advocate now that, you know, you have three models and we all agree, there is a miracle.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Including Gareth.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: You see?

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Yes, that this is the distribution, then there is a consensus and, yet, that may still be a key source of uncertainty, right?

MR. TRUE: And this was again from the base model.

CHAIRMAN APOSTOLAKIS: Yes.

MR. TRUE: In the base model we have allowed that if you have used a consensus approach, that that sort of terminates the process of evaluating that source of uncertainty.

CHAIRMAN APOSTOLAKIS: Well, I don't know, I mean.

MR. TRUE: Well, if it's an application and you're trying to make a decision, you know, based on that, then we believe you need to bring that back.

CHAIRMAN APOSTOLAKIS: Also, something can be a key source in the application.

MR. TRUE: Yes, it could be a not key in the base.

CHAIRMAN APOSTOLAKIS: But not in the base model?

MR. TRUE: It can be not key in the base, but it can be key in the application.

CHAIRMAN APOSTOLAKIS: How does that help with anything? I mean, are you --

MR. TRUE: Because applications often only deal with portions of the model, it allows you to focus in on just those pieces inherent to the decision. Whereas, if you try to identify everything that ever possibly could be key in the base model, we think you would drown in possibilities.

CHAIRMAN APOSTOLAKIS: How am I going to use the base model? I guess now, it becomes very important.

MR. TRUE: The base model you use in 1.174 space to make sure where you are on the existing.

CHAIRMAN APOSTOLAKIS: Horizontal axis?

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Yes. All right.

MR. TRUE: But like I said, there is not a particular application today for base models. We have done IPEs. We have already made the decision that there are no vulnerabilities. But they form the basis for the decision-making process and also, I should say, you will use base models and some applications like 5069 where you're using importance measures to evaluate the significance of something. So the base model gets actually directly used in that application.

But 1.200 is focused on the base model, not a particular application. It's assessing the quality in the base model. Key assumption. Basically, the changes are parallel. There is no significant difference in the way we editorially propose changes. Okay. Here we go into criteria.

There are two graphs. I want to focus on the left hand graph first. So we're looking at a basic PRA and we have identified that we have a source of uncertainty that's applicable to the plant and to the PRA, and it doesn't have a consensus model associated with it, and it wasn't treated with a conservative bias.

So at that point, we need to have a way to identify which of those are key. Well, we already said if we create a new functional sequence is one way. This left hand graph is looking at what causes it to be a key source of uncertainty based on a change, a potential change, in the CDF. And this is based on a sensitivity study of the, you know, reasonable assessment of what the model could represent.

And there are, basically, you know, four regions in this. I want to start in the region between 10^{-4} and 10^{-6}, which is where the 2.0 is. That region is sort of where most of our PRA results are, our baseline CDFs are for a particular risk contributor. And when I say risk contributor, I mean internal events at power, seismic at power, fire at power, low power shutdown internal events, those kind of contributors. They would all be compared against this chart individually.

And the assessment will be made. If you identify the model and, of course, also model uncertainty and in doing your sensitivity studies you found that it led to more than a factor of 2 difference in the CDF or LERF, that that would make it a key source of uncertainty. If you're above 10^{4}, if you're in 1.174 space, you're allowed, essentially, to go up as high as 10^{-3}. At 10^{-3} we truncate the curve and cut it off at a 10 percent change in CDF.

And the theory there is that, basically, that 10 percent on an absolute basis is the same as the factor of 2 at 10^{-4}. 10 percent of 10^{-3} is 10^{-4}. A factor of 2 change in 10^{-4} is 10^{-4} absolute change. And the line just slopes you down at that constant level.

Below 10^{-6} or below 10^{-7} if I go all the way to the other end of the range, you're now so far below any acceptance criteria that we think that it should be allowed to have a lot larger uncertainty in order for something to be considered key that you have to really worry about it. You're well down from any place where you're going to threaten safety goals or subsidiary objectives or anything else, and there may well be risk contributors in that region. There might be high winds. There might be hurricanes in certain places. There might be other things where we're not so worried about the overall result and having a larger factor, we think, is appropriate.

Between 10^{-6} and 10^{-7}, we make a transition. We couldn't figure out a way to just jump from 2 to 10, and so we put a little no man's land in there where you're transitioning up from 2 to 10. And the reason is that if you were at 9 times 10^{-7} and you got a factor of 10, but you were at 1 minus 6 and you got a factor of 2, it's hard to reconcile those two, so we put a transition zone in.

Okay. If I go then to the other end, what I'm doing now is a risk-informed decision. In that case, and I'm talking like a 1.174 application where I have a delta CDF or a delta LERF. You will recall that the guidelines, basically, put you into a couple of regions. One, for CDF, it starts at 10^{-5} and goes down to 10^{-6} and then everything below 10^{-6} is treated differently.

So we have done the same thing in the 10^{-6} to the 10^{-5} range. We have used the factor of 2 down to 10^{-7} where you're now at an order of magnitude below your acceptance guidelines. We put a factor of 10 and put the transitional region in there. Now, you might ask where did we come up with 2? Why 2?

MEMBER DENNING: Where did you come up with 2?

MR. TRUE: There you go. Okay. We came up with 2 after -- we actually started out higher than that, probably up around the 3 or 5 or 10 or something. We threw in different things. Some people were saying oh, no, it has to be more like 10 percent. What we did was we went back and looked at how do we actually interpret results today, and there are a couple of things that came out and became clear.

The first is that when we're trying to define something as risk-significant, we'll use a risk increase factor or a raw of 2 as the basis. So we have already got some precedents. We're looking at things that change the risk by a factor of 2 as having enough significance different than things that are less than a factor of 2. That seemed like a reasonable way to look at it.

The second thing was that if you look at the log normal distribution, and which the majority of our parametric uncertainties are represented by log normal distributions, for the range of error factors that we have normally represented in a PRA, the mean value is always more than a factor of 2 below the 95th percentile. So we know if we use a factor of 2, we're not jumping, in a sense, outside of what we would be seeing in a 95th percentile value from a parametric uncertainty. So we're within the parametric uncertainties that are out there.

And then the third thing is that we went back and looked at NUREG 1.150 at some of the uncertainty analyses or importance measures that were done for uncertainty, and we found that in every one of the studies there were basic events in the model that had more than a factor of 2 risk change at the 95th percentile level. So there were individual basic events in the model that, just given their parametric distribution at the 95th percentile, would change the answer by more than a factor of 2.

And so we said well, if we're willing to live with that kind of parametric uncertainty where we have individual basic events that can change the answer by a factor of 2 within the nominal bands, why wouldn't we be willing to live with modeling uncertainties that are within a factor of 2, because the parametric is always there. We accept it. We don't even think twice about it really most of the time as long as we have got the right mean value calculated.

So we felt like those three reasons all kind of pointed us towards a factor of 2. There were no cases in NUREG 1.150 where the change was like a factor of 10. It was usually in the order of around factor of 2, factor of 3 for the larger contributing basic events. So we found ourselves kind of zeroing in on this factor of 2 as being the right kind of range to be using.

We also think that by using a factor of 2, and this is why these pilots that Ken talked about are so important, is that we won't end up with a gazillion of them, that we'll have a manageable number of key sources of uncertainty to deal with and disposition, because we didn't want to have a criteria that was so fine like the reordering of sequences where, you know, anything could qualify as a key source of uncertainty. We really wanted to be the ones that were driving the answer or could drive the answer significantly.

The factor of 10 basis is really just based on the decade, peer analysts always think in decades, maybe one of our weaknesses, but in the fact that the decision criteria are set at, basically, decade levels. We felt like a factor of 10 would be A, big enough that we wouldn't find lots of those in these very small contributors and, B, would make sure that we didn't go jumping out of bands that we were in, we thought we were in and things like that perspective.

MEMBER DENNING: Do you run into anything with combinations here?

MR. TRUE: They would be the same. No, I take that back. These are looked at individually and then if they qualify on this basis, then we look at logical combinations to identify the logical combinations, and then we actually quantify how big those are, the combinations are for the ones that, so to speak, fail the key test individually. Okay? I expected more dialogue.

This is back to the consensus model and approaches. We think there are both necessary and effective means of trying to deal with uncertainties in the base PRA. This sort of came up in Mary's presentation. When you get into applications, we're not sure that just because you have a key source of uncertainty or a consensus model that it dispositions fully that source of uncertainty. And we talked about the consensus model definition. And actually, the industry is entertaining some activities next year, which we didn't mention, to try to start creating lists of consensus models that, we believe, meet the need. Okay.

So now, we have gone about identifying key sources of uncertainty, but we still are in a position where we have got to say okay, what do we do about this in terms of decision-making? How do those uncertainties affect our decision-making? And what we're trying to look at is a case where we have done a calculation using our mean values in the base model or base application of the model, and we have found that the --

MEMBER SHACK: Your point estimates really.

MR. TRUE: Could be, it could be. It depends upon how it's done. We'll get to that later, too. Well, point estimate model, and we have shown that we can make this decision. And now, we're trying to say okay, well, are there uncertainties that might influence that decision based on what we have learned from looking at key sources of uncertainty and go through that characterization as culled out for by 1.200. And as I said, the important thing is that we have already met the decision criteria using our point estimate model. We want to make sure that we're doing that appropriately.

This is another one that could draw some discussion. So in this case, we have done a sensitivity study on one of our key model uncertainties, and the first question we ask is is it less than the acceptance guideline? So I had a delta CDF of 3 times 10^{-7}, began a sensitivity study and it came out to be 7 times 10^{-7}. So I'm still below 10^{-6}. If that's the case, I'm done and I just tell my decision-maker I looked at my sensitivity studies and I never exceeded the acceptance guideline.

MEMBER DENNING: What kind of criteria or what kind of review do you have of the magnitude per division you make in the sensitivity study?

MR. TRUE: That is part of the guidance document that we're going to be working on to try and lay out how you go about identifying those, what the magnitude is. We don't want to directly say you should go immediately to bounding assumptions. We want to try and keep it within the reasonable range. Articulating exactly how to do that is what we're struggling with now, how to define what those limits are, so that you --

CHAIRMAN APOSTOLAKIS: You're doing the sensitivity analysis?

MR. TRUE: Staying credible, I think, was the term somebody used before. I'm sorry, George.

CHAIRMAN APOSTOLAKIS: You're doing the sensitivity analysis on what, on point values?

MR. TRUE: On the particular modeling uncertainty.

CHAIRMAN APOSTOLAKIS: So the distribution? What do you mean by uncertainty?

MR. TRUE: On the individual factor, I mean, not numerical factor, the individual --

CHAIRMAN APOSTOLAKIS: Issue.

MR. TRUE: Issue. Yes, yes, that's the word.

CHAIRMAN APOSTOLAKIS: But why don't you just develop a distribution for that issue?

MR. TRUE: Because I don't know how to do that.

CHAIRMAN APOSTOLAKIS: But you don't know how to do sensitivity analysis either. You're going to get questions from Rich all the time like that.

MR. TRUE: But I can --

CHAIRMAN APOSTOLAKIS: Why is 3 reasonable and not 6? So eventually, you will have to consider some sort of a distribution and say 6 is unreasonable, because it's way out there.

MR. TRUE: I don't think that's always going to be the case. I mean, there are places where that may happen.

CHAIRMAN APOSTOLAKIS: But --

MR. TRUE: And that will be up to the analysts to have to --

CHAIRMAN APOSTOLAKIS: But you're not even willing to try. You don't seem to be willing to try. You are dismissing the issue of uncertainty and you go straight to sensitivities, and that is what the ACRS meant in the letter. What is the proper role of sensitivity analysis, the proper role?

And the proper role is not just to take point estimates, in my view, I'm not speaking for the Committee now, and just start changing them. I mean, why don't we do the same with the parameters? We put distributions there. So here we could put some. You know, at least try first to put the distribution and then do sensitivities on the distribution not on point values.

MR. CANAVAN: I think it's possible you could end up there, but the reason why we're not using distributions is because a sensitivity case is supposed to be based on a reasonable alternative hypothesis.

CHAIRMAN APOSTOLAKIS: And a reasonable alternative hypothesis means a distribution.

MR. CANAVAN: Well, that's why I said you may end up there. For example, if you were looking at a particular source of uncertainty that you felt ranged, that had three different outcomes, for example, it had one where there was 30 GPM and that affected the timing to X, and then you look at another alternative hypothesis and that's a 40 GPM leak and the timing is Y, 90, you may end up creating a distribution by analyzing two or three possible sensitivity cases concerning the same key assumption.

But the goal is to be pragmatic and not jump right either to a full distribution or a range of sensitivity cases when you can show that perhaps the largest reasonable alternative hypothesis could be dispositioned below a certain criteria.

CHAIRMAN APOSTOLAKIS: That's very different from saying that you do sensitivity analysis. You can say I started with some bounding analysis and I look at the worse case and then it's inevitable. Then I don't proceed. I agree with that. But I am really disturbed by the fact that you are really jumping into sensitivity studies.

Sensitivity analysis was developed in the old days when the form of engineering was deterministic, and people wanted to account for uncertainties. I say okay, if I take this number, which is now a 2 and make it 4, what happens?

In PRA space though, it's the language of distributions and we keep this old -- I mean, sensitivity analysis in PRA space might be -- a ridiculous case is okay, I don't think thing it's log normal, it might be gamma, so I will try that. Nobody in his right mind will do that, but it might be that I have a log normal distribution and I'm not quite sure about the tail. So I say well, gee, you know, the 95th percentile might be a little greater, so what happens then? So I have a new distribution now.

In other words, I'm doing my sensitivity analysis on the distributions, on the uncertainty evaluations that I have done. I am not mixing the old way of thinking, old engineering, 1940s, you know, changing numbers, with the new one. I mean, we spent 35 years developing this thing.

And you see, I would like to hear we started with the uncertainties, so we might end up with sensitivity rather than the other way around, because you will always have that question. In fact, I'll tell you. In the old days, in the '70s when PRA studies were coming out, there were some ACRS members who loved, loved to take an analysis and say ah, but see, if I take this number and multiply it by 10, your conclusions go out of the window and they left it at that.

Now, that is as unreasonable as saying, you know, by multiplying by 10, I'm okay, because the factor of 10 has to be justified.

MR. TRUE: Right.

CHAIRMAN APOSTOLAKIS: And justifying it means making a probabilistic statement.

MR. TRUE: Well, probabilistic, is that a qualitative probabilistic statement or a quantitative probabilistic statement?

CHAIRMAN APOSTOLAKIS: Quantitative.

MR. TRUE: I don't know how you do that.

CHAIRMAN APOSTOLAKIS: In some cases, you may be able to convince people, you know, by saying that this is extremely unlikely.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: But it seems to me that that was the intent of that comment the ACRS made. What is the proper role of sensitivity analysis? And you are just jumping into this that, you know, we're going to do a sensitivity analysis and then, you know, I will support Rich Denning. Why 6 and not 12?

MEMBER RANSOM: Is there any narrative calling that screening now where you simply take those things I don't know much about, you simply perturb them and then see what the effect is on the result, at least those that are significant, to go further with?

CHAIRMAN APOSTOLAKIS: Oh, that's perfectly all right for me. I mean, I don't have any problem with that. But ultimately, you see, perturbing them, again, by how much?

MEMBER RANSOM: Well, 10 percent.

CHAIRMAN APOSTOLAKIS: But why? Why 10 percent and not 60 percent? That's the heart of the matter.

MR. CANAVAN: It depends upon --

CHAIRMAN APOSTOLAKIS: If we decide to skip that, then everything else follows. Yes, I agree with that, but we will always have that problem. Why did you change it this much and not this other much?

MEMBER RANSOM: But you may be able to develop criteria, George, that are engineering.

MR. CANAVAN: It would have to be a reasonable alternative hypothesis, which could include using the distribution and saying well, this is at the 95^{th}.

CHAIRMAN APOSTOLAKIS: I am not arguing

that you have to develop detailed distributions for every single case. I'm not saying that. What I'm saying is that unless you consider some element of probability there, you will always be on a ground where you will be vulnerable.

Now, you guys got away with it in '69. The Committee was unwilling to really challenge this factor of 5 or whatever it was. But you know, I don't know for how long. I mean, if south Texas says 10, then we go to 5. I hope the public doesn't read those things.

PARTICIPANT: 3 to 5.

CHAIRMAN APOSTOLAKIS: 3 to 5, yes. Sure, the licensee in six months will not make it with 3. He will say well, 2, you know, is very reasonable, too.

MR. TRUE: Right. And in doing that, he has to --

CHAIRMAN APOSTOLAKIS: There goes the credibility of the regulatory system.

MR. TRUE: And when he does that though, he has to establish his monitoring program to be able to detect that change. So he has given -- that is a basis for what factor he picked.

CHAIRMAN APOSTOLAKIS: It still outweighs that. I mean, it's 2, no, it's 3, no, it's 2 and a half. I mean, you know, unless we try seriously to quantify things and, again, I don't mean detailed distributions, but something that would give me something like some bounding analysis that is well documented. Some say, you know, that we don't think that the probability of this exceeds that, you know, some quantitative evaluation, because you are just taking it for granted that what was done in the past decades on sensitivity analysis prior to PRA is equally valid in PRA space.

MR. TRUE: Okay. Ray had wanted to say something.

MR. SCHNEIDER: This is Ray Schneider.

CHAIRMAN APOSTOLAKIS: You have to come closer to the microphone and tell us who you are.

MR. SCHNEIDER: Ray Schneider, Westinghouse. I don't believe that we're really saying that we're just going to randomly select numbers and do sensitivities.

CHAIRMAN APOSTOLAKIS: Right.

MR. SCHNEIDER: We're going to look at the distributions. We're going to look at the issues, look at the different success criteria, make technical judgments as to why we're selecting these for assessment, and then do the assessment. It's not to be -- you know, I don't expect there will be a number saying well, let's try 10, let's try 8, let's try 6. That's not the intent of the overall scheme of where we're going to go in the future with this.

MR. TRUE: Right.

CHAIRMAN APOSTOLAKIS: Which distributions are you going to look at when you refuse to produce distributions?

MR. TRUE: Well, you --

CHAIRMAN APOSTOLAKIS: If you have the distributions with you --

MR. SCHNEIDER: But you may know the max and mins. You will know like for success criteria, you will know your best estimate kind of results and you will know your conservative design basis results and you may not be able to figure out exactly 95 percent or 90 percent distribution, but you can have a rough idea of what your upper limits and lower limits are going to be on it. So you may not get the precision you're looking for, but you will have --

CHAIRMAN APOSTOLAKIS: I'm not looking for precision.

MR. SCHNEIDER: Right.

CHAIRMAN APOSTOLAKIS: I don't know how

many times I have to say it.

MR. SCHNEIDER: But the thing is what you will get is the engineering judgment that, basically, says that the selection of what we're going to be using for the sensitivity is based on risk. It's based on what we expect a probabilistic tail to be, a reasonable location, and trying to put a reasonable estimate on it, and trying to move away from the arbitrary selection of those values.

CHAIRMAN APOSTOLAKIS: But you are getting away from the arbitrary selection of these values by saying if you choose my values, then we're not arbitrary anymore. That's exactly what you're saying, that in 5069 the NEI argument was that 3 to 5 is reasonable, a factor of 3 to 5 is reasonable. Nobody challenged it, so it must be reasonable, but why was it 10 before?

MR. SCHNEIDER: I think what we're saying is we will justify and support the value using it for sensitivity studies based on analyses and based on --

CHAIRMAN APOSTOLAKIS: The sensitivity studies that Doug showed earlier in the sense of how much does the core damage frequency or does the CDF increase by using -- these are legitimate sensitivity studies. I am understanding. I'm trying to understand how sensitive my results are to certain things I have done, you know, and this is the whole idea of raw and fossil vassalage, raw especially in other contexts. That's perfectly all right. I think it's fine. I gain insights. I understand this.

The other thing about, you know, the mean value and the 95th percentile, a factor of 2, that's great. You are working in risk space and you're changing things. You're looking at things, trying to understand what is going on. But when you say we do the point values and then do sensitivity analysis and then go on, that's where you lose me, because now you are switching back to the old way of doing business.

Now, on the other hand, this is too high level discussion here. We will never convince each other, but I'm afraid --

MR. TRUE: I don't think we're understanding each other, because I don't know that I understand that there is a change even.

CHAIRMAN APOSTOLAKIS: You are doing sensitivity studies on what?

MR. TRUE: On a particular issue.

PARTICIPANT: Modeling.

MR. TRUE: Modeling uncertainty issue.

CHAIRMAN APOSTOLAKIS: Okay. So let's

take human error, okay? There are five models.

MR. TRUE: Let's not take human error. Let's do grid stability, grid stability.

CHAIRMAN APOSTOLAKIS: Okay. Grid stability.

MR. TRUE: Okay. That's an issue. Every model has in it a loss of off-site power initiating event and I think every model now has a conditional probability that the grid is lost following a plant trip.

CHAIRMAN APOSTOLAKIS: Okay.

MR. TRUE: Okay? But there is a lot of variation in what the results could be that may or may not be well represented in a distribution for those point estimate values. And so what we would expect is that the analyst would go back and look at their particular plan design and say well, based on what I know, it could be -- you know, it couldn't be any worse than this. It might be reasonably in this range or better than this.

CHAIRMAN APOSTOLAKIS: What might be? What?

MR. TRUE: The likelihood that I will lose the grid --

CHAIRMAN APOSTOLAKIS: Well, the guy is

quantifying his state of knowledge. I have no problem with that. You are in the probability space. That's fine. That's not what I understood by this.

MR. TRUE: Well, maybe that's why we're just not communicating, because that's exactly what we're --

CHAIRMAN APOSTOLAKIS: Well, you are having pilot studies?

MR. TRUE: I will do another. Yes.

CHAIRMAN APOSTOLAKIS: So at some point, we will be briefed on those.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Okay. Maybe that will be better.

MR. TRUE: Another example might be battery life. This is a little more oblique.

CHAIRMAN APOSTOLAKIS: Yes.

MR. TRUE: Okay. We, you know, typically will have a design calc of some kind. We'll say batteries will last for four hours in the event of a station blackout. Well, what we found through various things is that if the diesel runs for maybe an hour, that will cover a lot of the loads that the battery would actually have to carry, and that battery life might go from four hours now to eight hours, because after that first hour, all it's doing is carrying instrument loads and those kind of things.

So we treat all of our modeling as failures occur at T equals zero, generally. So all those contributions from diesel failure to run occurrences get lumped in as it happened at T equals zero. Therefore, we have a four hour battery life. For doing some applications, you may find that that's not a reasonable assumption, that really you're more likely to have battery life for eight hours, and then that changes your -- it could change your event restructure. It could change your probabilities. It could change all kinds of things about the way you have modeled it.

CHAIRMAN APOSTOLAKIS: And will the analyst then say I think it's eight hours and then go ahead as if it's eight hours or would he say I really think it's greater? So maybe, you know, there is a distribution between five and nine, ten hours. See, that's where I think there is a difference. He gives me arguments that it's not four anymore, perfectly reasonable arguments.

MR. TRUE: Right.

CHAIRMAN APOSTOLAKIS: And he thinks it's eight and he goes with eight or he gives some distribution that it might be eight or nine or ten or six or seven, so I have some better feeling. It depends how critical the time is, of course. Otherwise, it doesn't really make that much difference.

MR. TRUE: Right, it would have to be something that was important to the --

CHAIRMAN APOSTOLAKIS: Yes. But that's, I think, what the analyst should do. It's perfectly all right to say this is my judgment, my state of knowledge, because then we can disagree or agree, you know, the usual stuff, rather than saying I think it's eight and go with it. I have seen that. Some people claimed 11, I thought.

MR. TRUE: Well, some actually can do that.

CHAIRMAN APOSTOLAKIS: Yes.

MR. TRUE: Because they don't have a lot of --

CHAIRMAN APOSTOLAKIS: Yes, but they will claim just 11 and that, you know, is not a judgment.

PARTICIPANT: But they put in a probability for that 11.

MEMBER SIEBER: No, you can calculate. For example, you can calculate --

MR. TRUE: No, it's just a single statement. It's just a single statement.

MEMBER SIEBER: -- how much the charger is using the battery and how much you are not taking out of it by virtue of having it supplied from the diesel, and then the uncertainty comes from the fact that the battery may be brand new or it may be old.

CHAIRMAN APOSTOLAKIS: That's right.

MEMBER SIEBER: And from the manufacturer you get its internal resistance and you can compute that, too. So you could actually, with a little bit of work, a day's work rather than a year's work, you can get rid of most of the uncertainty around that kind of a calculation.

CHAIRMAN APOSTOLAKIS: And that's fine with me.

MEMBER SIEBER: That's really what ought to be done rather than the sensitivity stuff, you know.

CHAIRMAN APOSTOLAKIS: I agree. I fully agree with that, when you can do it and in this case you can.

MEMBER SIEBER: Well, the big problem is trying to model things that you don't know anything about. You don't even know if it occurred. You haven't defined the phenomenon. That's where the problem comes in and that's where the largest, in my view, source of uncertainty is.

CHAIRMAN APOSTOLAKIS: All these reports should have chapters with the title "Everything we know about things we don't know anything about."

MEMBER SIEBER: Right.

CHAIRMAN APOSTOLAKIS: That should be the longer chapter.

MEMBER SIEBER: Right. We know less and less about more and more until you know nothing about everything.

CHAIRMAN APOSTOLAKIS: Anyway, let's move on. I think there is a record now, you know. I think it has to be a specific example to understand really what you mean by all of this.

MR. TRUE: Okay.

CHAIRMAN APOSTOLAKIS: I mean, this thing with the batteries, you understood my concern. John gave us a different perspective that in this particular case, you can actually do deterministic calculations to figure out what it is, which is fine.

MEMBER SIEBER: Well, you get the distribution.

CHAIRMAN APOSTOLAKIS: If you can do that, great.

PARTICIPANT: I mean, he does have his formulate sensitivity studies formulate logical models. I mean, there is a place in here where he's thinking about, you know, why he's choosing these. Now, again, you know, there's always this battle about why it's easier to choose a sensitivity study than it is to come up with a distribution.

MEMBER SIEBER: It's easy.

PARTICIPANT: Well --

CHAIRMAN APOSTOLAKIS: No.

PARTICIPANT: It's calculable, yes.

CHAIRMAN APOSTOLAKIS: Why this and not that?

MR. TRUE: It's manageable actually. It's part of the -- that's the pragmatic part of it. The reality is that it's --

CHAIRMAN APOSTOLAKIS: What is RS? RS is what?

MR. TRUE: The risk of the sensitivity study compared to the base risk. So I do a sensitivity study on less than or not less than the acceptance guideline, but I am within a factor of 2. Normally, you wouldn't kick into that with a key modeling uncertainty, but without key modeling uncertainties but, I mean, I still ask that question. If you're at a factor 2, then you're kicked out, the same logic as before.

Then the more controversial maybe one is if now you have done a sensitivity, you're more than a factor of 2 and you are above the acceptance guideline, we believe that it doesn't necessarily mean that the decision is unacceptable, because you --

CHAIRMAN APOSTOLAKIS: The only place where the word uncertainty appears is when it doesn't matter. Uncertainty does not impact. You know, that's the only place where in this chart I see the word uncertainty. You dismissed it without doing anything about it.

MR. TRUE: We started with an uncertainty and did a sensitivity study. Maybe I should have put a box on there to start the focus.

CHAIRMAN APOSTOLAKIS: Maybe you should have.

MR. TRUE: It might have been a better way to start the flow chart here.

CHAIRMAN APOSTOLAKIS: What would be wrong with saying, you know, somewhere up front try to quantify your state of knowledge in terms of probabilities, and if you can't, go ahead and do these things or in the process of doing this, do some sensitivity analysis, do this, do that, you know?

In other words, put it in the context that the really desirable result is some uncertainty quantification. Then we recognize in a pragmatic approach that you can't always do this and here are other ways of handling it. Then I could be with you 100 percent. What's wrong with that? There is nothing wrong with that. I mean, you still preserve everything you're saying.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: I think we should move on though.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: We only have 30 minutes.

MR. TRUE: Okay. All right. So now we're back to parametric uncertainty. We're going to leave the subject of model uncertainty. The situation is that many PRA calculations, risk-informed applications and such are based on point estimate analysis and, in fact, all the tools that are currently used by licensees for doing PRAs, the importance measures are based on point estimate results. And we did some work and we talked to you about that a year or so ago, looking at that for 5069.

PARTICIPANT: Just before we leave though, the 2 is again this argument that you're probably a factor of 2 away from the 95th percentile, so you're --

MR. TRUE: It's that and the raw 2 argument and the fact that you have parametric -- you have basic events with parametric uncertainties that exceed factor of 2. It's all three of those kinds that caused us to converge on 2.

So our tools are, basically, oriented towards point estimates. We can do uncertainty analyses, and there may be cases where those point estimates are not good estimates of the true mean value. So what we wanted to do was to some additional work to look at when those point estimate calculations can be used for comparisons to mean values, and look at the treatment of the whole state of knowledge correlation issue. And so we're trying to look for places where it's significant.

So I'm going to go through some background and then get to some results. This chart just shows the same. There is no news here. This is just the same mean value of 10^{-4} and a log normal cumulative distribution function for that mean value. And what is significant about the log normal distribution, and I'm sure you all know this, is that the black tail, which is the largest error factor, extends further and further out.

And so when you're sampling from that distribution, you will pick values that are far up that tail and when that happens and it occurs for a parameter that is in more than one event and it cuts it, you get sort of a multiplicative effect of picking that high value. And if there are two basic events that cuts that that have the same state of knowledge and you sample at the high end, you get the square of that high end value. At the other end it doesn't matter, because the value is so low, you square it and it's still zero. So it's picking those ones way on the far end.

And so as a means to kind of explain this, we went through and basically took the cumulative distribution function and weighted it by the square of the X value. So we took the PDF, took the weight in that area, squared it based on that value, and if we go through these you can see how, as the error factor gets larger --

CHAIRMAN APOSTOLAKIS: That's state of knowledge uncertainty.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Yes,

MR. TRUE: Yes, right. Okay. And what you see is that error factors of 3 and 5 was not a particularly large impact, but as we get up to larger and larger error factors, 10, 30 or 100, the distribution shifts very significantly.

This chart, this is partly to explain to utilities, licensees, what's going on with state of knowledge. So what we did was we took all the data and said well, if we look at just the median value, because they are pretty well behaved distributions, what is the ratio of the median value with X and X squared? And so for an error factor of 3, it only changes the median by a factor of 1.6.

CHAIRMAN APOSTOLAKIS: So let me understand this.

MR. TRUE: But for a larger error factor, it's much larger.

CHAIRMAN APOSTOLAKIS: Let me understand this, Doug.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: The ratio is between --

MR. TRUE: It's between the dotted line.

CHAIRMAN APOSTOLAKIS: The correct value of the mean square.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: And in the denominator if you have a square.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Of the mean?

MR. TRUE: Yes, yes.

CHAIRMAN APOSTOLAKIS: A square of the mean versus the mean of the square?

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Actually, the other way, the mean of the square over the square of the mean, right?

MR. TRUE: Yes, right, right.

CHAIRMAN APOSTOLAKIS: Okay.

MR. TRUE: It's basically the ratio between these two, the 50^{th} percentile value on these charts.

CHAIRMAN APOSTOLAKIS: You are testing the assertion, which is true, that the mean of the function is not equal to the function of the mean.

MR. TRUE: Right. Okay. And the impact can be quite significant, particularly for the cases where we have large error factors. Like I said, nothing new here.

CHAIRMAN APOSTOLAKIS: Do you use error factors over 100 often, Doug?

MR. TRUE: No. That's why there's no graph for 100. You know, it stops at 30.

CHAIRMAN APOSTOLAKIS: How unlikely is it?

MEMBER SIEBER: Isn't that the best PRA to use?

MR. TRUE: I think there are some results that were in that range. So we know, based on all that that state of knowledge correlation effects can be significant and we know or believe that the impact on the risk increases as the error factor goes up, as the fraction of the risk metric impacted increases. So the larger fraction of, for example, the core damage frequency is contributed by cuts that containing these correlated events.

If that fraction goes up, the impact on the overall result is going to be greater. So if it only occurs in very, very low cut sets, it's not going impact the overall result, but if it's in larger or occurs in many cut sets or in a larger single contributor, then it can be bigger.

And also, the number of coincident correlated variables increases. That makes it worse, because if squaring was bad, then cubed is really bad. So we set about to try and investigate that by creating some simple models using log normal distribution and looking at how that played out.

We also noted that if you follow the ASME standard and you have identified common cause groups for your significant basic events that are plant-specific and you have all the significant basic events are those with fossil vassalages greater than .05 and raws greater than 2, you have to have plant-specific data.

So as you do that, you find fewer and fewer cases, essentially, where you would have correlated variables in the same cut set. So the standard is actually driving us in a direction that reduces the impact of the state of knowledge correlation if you follow it with the standard ASME requirement.

So we also wanted to look at what happens if you have a common cause group in the model, because what's going on there is you have got two basic events, say they are 10^{-3} failure rates, but prior to those is 10^{-6}, the mean is 10^{-6}, but the common cause term itself might be 10^{-4} or 3 times 10^{-5}, something like that, a lot larger. So that tends to kind of shield you from the impact of the correlated variables. So we investigated how common cause plays into this, too.

And we were trying to come up with some rules, some simple rules, to help us identify where in the state of knowledge the correlation would be significant, significant enough that it really needed to be played out in the decision part.

CHAIRMAN APOSTOLAKIS: And this is in an effort to justify doing just point estimates?

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Because computation, I think, I can do this with Monte Carlo, and I don't care.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: I sample correctly and I get the results.

MR. TRUE: Yes. Except for the fact that we do many, many applications, including many, many applications for online maintenance and other things where you will be doing many tens of calculations.

CHAIRMAN APOSTOLAKIS: Computations, you mean at the plant?

MR. TRUE: Yes, at the plant.

CHAIRMAN APOSTOLAKIS: At the plant.

MR. TRUE: And using the PRA.

CHAIRMAN APOSTOLAKIS: Not to request changes of licensing?

MR. TRUE: No, not licensing.

CHAIRMAN APOSTOLAKIS: Okay.

MR. TRUE: Or the maintenance, no.

CHAIRMAN APOSTOLAKIS: Okay.

MR. TRUE: But also --

CHAIRMAN APOSTOLAKIS: No, I understand now.

MR. TRUE: But also for those. I mean, and particularly when we get into a situation where now we're looking at all these modeling uncertainties, we're doing sensitivity studies on all those and we have to go through parametric uncertainties on top of all that.

CHAIRMAN APOSTOLAKIS: Yes.

MR. TRUE: Every single time we do a calculation.

CHAIRMAN APOSTOLAKIS: Would you mind changing the nomenclature here instead of state of knowledge correlation just to a epistemic correlation or you think the licensees will get thrown off? It's now epistemic.

MR. TRUE: The reason that we used this

was it ties to an ASME standard requirement that talks about state of knowledge correlation.

PARTICIPANT: Which ties to --

MR. TRUE: Which ties -- it's now a random B that Gareth and I have been working on. It ties to --

CHAIRMAN APOSTOLAKIS: Which ties to my youth.

MR. TRUE: Okay.

CHAIRMAN APOSTOLAKIS: Maybe in parenthesis someplace you can say now all epistemic.

MR. TRUE: We do have a section in the report that talks about all the different epistemic and aleatory, you know, how all these --

CHAIRMAN APOSTOLAKIS: Yes.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: But make sure people understand it's the same thing.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: State of knowledge. Boy, you're doing great with time, Doug, I must say.

MR. TRUE: I'm actually amazed.

PARTICIPANT: I'm shocked.

MR. TRUE: The last, this slide takes the results of a whole bunch of different analyses that we did and tries to boil it down into one simple table. Basically, what this tries to show is that it identifies the fraction of the risk metric CDF or LERF that is contributed by cut sets that have two correlated variables in them, that is the value in the table, and the error factor for those correlated variables and the change in risk metric. And if you want to determine that an acceptable -- I'm willing to live with a 10 percent difference in my risk metric, then the answer is in the first column. 50 percent is in the right hand column.

So I will skip the error factor of 3 for a second, because it's pretty uninteresting. Let's go to error factor of 10. If I have 13 percent .13 fraction of my risk metric has cut sets containing two correlated variables, and they have an error factor of 10, I can know that the change in the risk is about a 10 percent change in risk. If, on the other hand, it's 60 percent of my CDF, then it would have had a 50 percent impact on my calculated CDF.

If I have an error factor of 3, as what is present in these correlated variables, it doesn't matter. I can have 100 percent of the cut sets have correlated variables in them and it won't change my result by even 10 percent.

So this kind of gives the field of play, so to speak, for utilities to be able to go back, do an inspection of their cut sets, see where they have these occur, tally up the fraction and as long as they are within these guidelines, they can know that their parametric or their point estimate values are tracking their correlated results from the true mean.

Those have been turned into some guidelines, we have them for two correlated variables and three correlated variables, basically have to do with, you know, that chart I just showed you, and we had it based on a 10 percent change in your mean value.

CHAIRMAN APOSTOLAKIS: Very good.

MR. TRUE: And I'm going to jump to the summary. So we're at a point now where we have got this technical basis document in EPRI publication process. It's going to be made available to the NRC in support of the work that Mary has going on.

CHAIRMAN APOSTOLAKIS: What does it mean guidance document now? Is that one of those documents that the NRC staff will have to bless?

MR. TRUE: We haven't gotten to the point where we have decided whether it's appropriate for that to be endorsed by the NRC. We're really doing this to help the utilities know how to meet the ASME standard. I skipped over this, but there are 30 supporting requirements or high level requirements in the ASME standard that say you have to do this, you have to address, identify key sources of uncertainty and key assumptions.

And so there is a practical problem right now in that we have a standard out there and we have no process to find out how to meet that standard, so this is kind of a how-to to meet that standard. And then it kind of also then flows over into the application side, obviously, because we talked about how to interpret those results in applications.

So the application guide, we'll kind of see where the staff goes and where our application guide ends up and next year sometime we'll make some decision about whether it fits into the overall plan and deserves to be endorsed.

CHAIRMAN APOSTOLAKIS: Yes.

MR. TRUE: But we're developing it anyway for use in the industry.

CHAIRMAN APOSTOLAKIS: Good.

MEMBER SIEBER: Another approach is to modify the Standards Committee. I don't know.

MR. TRUE: Yes. The problem with the

Standards Committee is that the standards folks have drawn a line that the standard defines what to do not how to do it.

MEMBER SIEBER: Yes.

MR. TRUE: And this is really how to do it. Now, the standards folks will probably need to look at it to make sure that it's an appropriate implementation to what they expected, but the Standards Committee is us so, I mean, not just us, but industry, so that will be played out through --

CHAIRMAN APOSTOLAKIS: Standards Committee, you mean the ASME standards?

MR. TRUE: Yes, ASME standards.

CHAIRMAN APOSTOLAKIS: Another editorial comment.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: We used to call them modeling uncertainties, and a lot of people said well, gee, modeling uncertainties, you are modeling uncertainties? Can you call them model uncertainties rather than modeling uncertainties? I mean, it's still early in the process. Maybe you can do that.

MR. TRUE: Yes, we'll look at that.

CHAIRMAN APOSTOLAKIS: Because modeling uncertainties, you know.

MR. TRUE: Yes, you're right. It does imply that it's modeling problems.

CHAIRMAN APOSTOLAKIS: It does imply.

MR. CANAVAN: It's an action word.

MR. TRUE: Yes.

CHAIRMAN APOSTOLAKIS: Sorry?

MR. CANAVAN: It's an action word.

MR. TRUE: Yes.

MR. CANAVAN: Modeling is doing the action.

MR. TRUE: So the process that we created now uses the sensitivity cases to identify and address those key uncertainties, point estimate mean work as compared to the parametric uncertainty. And as Ken mentioned up front, the completeness uncertainty is a whole other area. We believe that the standards in 1.200 and other reg guides for implementing the applications help a lot in addressing completeness within the things that we know. There is always the things that we don't know. That's why we have a risk-informed process and not a risk-based process.

CHAIRMAN APOSTOLAKIS: Any comments from the Committee Members? We don't need to go around the table, I don't think, because we're going to write a letter.

PARTICIPANT: Right.

CHAIRMAN APOSTOLAKIS: But I, at least, am very pleased to see the industry doing things like that and when Doug wants to do something he does a good job.

MR. TRUE: Thank you.

CHAIRMAN APOSTOLAKIS: The question is when does he want to do something? No, this is really very, very, very, very good. I mean, we can argue about the details like we did earlier, but I think you're on the right track and we've got a lot of useful insights.

MEMBER SIEBER: I think there are more sophisticated ways to do it, but I think this is practical from the standpoint of coming out with a reasonable product.

CHAIRMAN APOSTOLAKIS: Yes.

MEMBER SIEBER: Without spending as much money as you would spend on getting the point.

CHAIRMAN APOSTOLAKIS: Although the --

MR. TRUE: The soft --

MEMBER SIEBER: The main point is --

CHAIRMAN APOSTOLAKIS: The software available now allow you to do a lot of stuff that was unimaginable 15 years ago. I mean you can do uncertainty analysis and all that, but I understand Doug's point that, you know, in the applications the ability really was, I think, sweeping. And the factor of 1.2 or 2.3 here and there really doesn't matter to the decisions they are making, like compilation control and all that. So I think it's a very pragmatic approach, as promised.

Any comments from the members? Mike, any comments?

MR. SNODDERLY: I guess maybe if we could go just quickly back to Mary's last letter and just talk about, I guess, what's the next step. I mean, when do -- what's the next part we would review? I mean, because, obviously, we're not -- we're interested and we would like to have a copy of the EPRI Guideline, but we won't be reviewing that. I guess Mary is going to come up with her NUREG and eventually we will review a draft of that.

CHAIRMAN APOSTOLAKIS: Yes.

MR. SNODDERLY: I'm just trying to get a feel for when, in time frame.

MS. DROUIN: You know, our goal is to work together as much as possible with what industry is doing, whether that means that we take what they do and endorse it or we just take advantage of their work. I mean, those are the details that you need to work out. But the main point is that we want to take advantage of what the --

CHAIRMAN APOSTOLAKIS: Absolutely.

MS. DROUIN: Well, that's in our plan. It's nice that they're a little bit out before us, so we can see what they are doing and map our work and try and work that out. Our schedule, we're still on schedule to have something ready for -- to give to the different parts of NRC like Charlie here at the end of December.

CHAIRMAN APOSTOLAKIS: But are we getting it then, too, or parts of the NRC to review?

MS. DROUIN: Well, they are to look at it and then I don't think I'll come in January. I'll need January and February at least, we could come in.

CHAIRMAN APOSTOLAKIS: Okay. Are we going to see you again Doug?

MR. TRUE: Any time you would like.

CHAIRMAN APOSTOLAKIS: Well --

MR. TRUE: If you would like.

CHAIRMAN APOSTOLAKIS: Well, what can I say? No, actually, I'm very much interested in the pilots of what you're doing.

MR. TRUE: Okay. Those will be later in

the year.

CHAIRMAN APOSTOLAKIS: Absolutely.

MR. TRUE: They'll be given a start early in the year.

CHAIRMAN APOSTOLAKIS: But, you know, to see how these ideas were implemented and what lessons you learned and all that, I think that will be great.

MR. SNODDERLY: Well, I guess, all this is being done as part of the phase approach to PRA quality, and so just remind me, what was the -- I guess you guys made a commitment to the Commission to provide this guidance by a certain date. And then I guess you would request our review of the guidance prior to saying hey, Commission here is the guidance on how to treat on some of these.

MS. DROUIN: I'm going to go back and look at the face plan. I don't remember what date this actual job is committed and comes up to being done. What we are trying to do is, because there are so many things that are being developed, but time is needed to convert and they are all put in for later. So the next update we're having of 1.200, this document, our two primary works that we're trying to convert.

MR. SNODDERLY: Well, then I'll ask that, you know, just let us know when that schedule takes place, you know, firms up and so we can coordinate. Because it is difficult to get all these, you know, people, folks together.

MS. DROUIN: I would think we would come back to you more than once.

MR. SNODDERLY: Yes.

MS. DROUIN: And you know --

MR. SNODDERLY: George said probably after the pilot maybe, you know. This has got to be put out in December. It will be piloted maybe, you know, in the summer.

CHAIRMAN APOSTOLAKIS: No, the pilots are ongoing, aren't they?

MR. TRUE: No, they will be out the first of the year.

MR. SNODDERLY: So it will probably be late summer or even fall before.

MR. TRUE: No, the pilot won't be an actual misconformed license application change.

MS. DROUIN: Asking about before the summer.

PARTICIPANT: There is a possibility that it could be.

PARTICIPANT: Maybe one of the 1.200 pilots.

PARTICIPANT: Okay. Let us know when you are ready. We're in discussion.

MS. DROUIN: Yes.

CHAIRMAN APOSTOLAKIS: Okay. Vic?

MEMBER RANSOM: Well, I've been quite impressed with this long parametric statistical approach to evaluating uncertainties and thermal hydraulic codes and things of that type. It impressed me that the 5046 and you have that kind of basis, it's a much more powerful way of making a decision. I'm wondering does that have any role here?

CHAIRMAN APOSTOLAKIS: They are not addressing 5046 issues.

MEMBER RANSOM: No, I understand that.

CHAIRMAN APOSTOLAKIS: But you are right, in 5046, I mean, you want to know the uncertainty from the thermal hydraulic codes, right? That's the best estimate.

MEMBER RANSOM: Well, as well, I'm wondering can't that be extended to other uncertainties in the process?

MEMBER SHACK: He wants to take, you know, 5046 --

PARTICIPANT: Even circles from all the distribution, talk about and, you know, get a 95th percentile.

PARTICIPANT: Right.

CHAIRMAN APOSTOLAKIS: Why should you penalize to do it?

MEMBER SIEBER: It's like 72.

MEMBER RANSOM: Then you have a good statistical basis for making that decision.

CHAIRMAN APOSTOLAKIS: Well, I don't know about that, but maybe we can discuss it when 5046 comes up again. Because I don't think it is relevant. Any other comments?

Well, thank you very much. This was very, very enlightening --

PARTICIPANT: Thank you.

CHAIRMAN APOSTOLAKIS: -- to see what you guys are doing.

PARTICIPANT: Thank you for your time.

CHAIRMAN APOSTOLAKIS: And on this happy note, the subcommittee meeting is adjourned.

(Whereupon, the meeting was concluded at 2:42 p.m.)