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Subcommittee

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

RELIABILITY & PROBABILISTIC RISK ASSESSMENT

SUBCOMMITTEE MEETING

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FRIDAY,

NOVEMBER 18, 2005

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The meeting was convened in Room T-2B3 of  
Two White Flint North, 11545 Rockville Pike,  
Rockville, Maryland, at 8:30 a.m., Dr. George E.  
Apostolakis, Subcommittee Chairman, presiding.

MEMBERS PRESENT:

GEORGE E. APOSTOLAKIS

Chairman

MARIO V. BONACA

ACRS Member

RICHARD S. DENNING

ACRS Member

THOMAS S. KRESS

ACRS Member

ACRS STAFF PRESENT:

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1 ERIC A. THORNSBURY  
2 ACRS Staff, Designated Federal  
3 Official  
4 ASHOK C. THADANI  
5 Deputy Executive Director,  
6 ACRS/ACNW  
7  
8 NRC STAFF PRESENT:  
9 PETER APPIGNANI  
10 RES/DRAA/OERAB  
11 MICHAEL CHEOK  
12 RES/DRAA/OERAB  
13 NILESH CHOKSHI  
14 RES/DRAA/OERAB  
15 DON DUBE  
16 RES/DRAA/OERAB  
17 ELI GOLDFEIZ  
18 RES/DRAA/OERAB  
19 CHAD HUFFMAN  
20 RES/DRAA/OERAB  
21 CHRIS HUNTER  
22 RES/DRAA/OERAB  
23 STEVE LONG  
24 NRR/DRA  
25 DON MARKSBERRY

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RES/DRAA/OERAB

JEFF MITMAN

RES/DRAA/OERAB

DAN O'NEAL

RES/DRAA/PRAB

SELIM SANCAKTAR

RES/DRAA/OERAB

JAMES VAIL

NRD/DRA/APOB

ALSO PRESENT:

ROBERT BUELL

Idaho National Laboratory

JOHN LEHNER

Brookhaven National Laboratory

CHUEN-CHING LIN

Brookhaven National Laboratory

ZORAN MUSICKI

Self-Contractor

JOHN SCHROEDER

Idaho National Laboratory

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C O N T E N T S

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P R O C E E D I N G S

(8:31 a.m.)

CHAIRMAN APOSTOLAKIS: The meeting will now come to order.

This is the second day of the meeting of the Advisory Committee on Reactor Safeguards, Subcommittee on Reliability and Probabilistic Risk Assessment.

I am George Apostolakis, chairman of the subcommittee.

Members in attendance are Mario Bonaca, Richard Denning and Tom Kress.

The purpose of this meeting is to discuss the Standardized Plant Analysis Risk model development program.

The subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full committee.

Eric Thornsbury is the Designated Federal Official for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting, previously published in the Federal Register on November 1, 2005.

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1           A transcript of the meeting is being kept  
2 and will be made available as stated in the Federal  
3 Register notice.

4           It is requested that speakers first  
5 identify themselves, and speak with sufficient clarity  
6 and volume so that they can be readily heard.

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

10           We now proceed with the meeting, and I  
11 call upon Mr. Michael Cheok to being the  
12 presentations.

13           MR. CHEOK: Good morning.

14           Today we are going to talk about the SPAR  
15 model for external events, LERF and low power  
16 shutdown.

17           Before I get into that, though, I would  
18 like to bring one thing up from yesterday. When we  
19 were looking at the SBO charts for all the plants and  
20 the range for all the SBO results for all the plants,  
21 I guess there was a comment made that there were  
22 several plants close to the 10 to the minus five CDF  
23 range. And I guess I'd like to follow up on that.

24           The intent of the SBO rule was to get  
25 plants to be in the - let me read it directly - to

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1 have an average contribution to core damage frequency  
2 from station blackout to be about 10 to the minus five  
3 per reactor U.

4 So I guess the SBO rule in a sense did  
5 work, and it did keep plants for the most part below  
6 10 to the minus five, and only one or two close to 10  
7 to the minus five. So.

8 Okay, back to today's presentations, our  
9 objective for the three SPAR models that we want to  
10 talk about today is to expand the scope of the models  
11 to provide agency staff with tools, PRA tools,  
12 consistent with the guidance in 1.174 and Reg Guide  
13 1.200.

14 We have to keep in mind that unlike the  
15 Revolution 3 models which we talked about yesterday,  
16 these models are still in the developing stage.

17 As a matter of fact, the developments for  
18 the external events is only going on for the last six  
19 months.

20 So what is the general intent for all  
21 these models? We will carry a Q/A process that will  
22 be similar to the Rev. 3 models to the extent  
23 possible. We discussed that a little bit yesterday,  
24 and again today we are going to say that absent  
25 licensee models it's a little hard for us to Q/A the

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1 models. We will have to come up with new strategies  
2 as to how we can QA the models.

3 CHAIRMAN APOSTOLAKIS: I'm sorry, I missed  
4 that.

5 MR. CHEOK: QAing up our models for low  
6 power shutdown, external events, low power shutdown,  
7 it's going to be a little harder for us. Because we  
8 cannot directly go to the licensees and Q/A our models  
9 against their models, unless they have models  
10 themselves.

11 Not all licensees have low power shutdown  
12 models.

13 CHAIRMAN APOSTOLAKIS: And a lot of them  
14 have done bounding analysis, right?

15 MR. CHEOK: They have, right.

16 CHAIRMAN APOSTOLAKIS: And that would be  
17 a big problem?

18 MR. CHEOK: Correct. And you know even in  
19 external events, you are right that there is bounding  
20 analysis and screening analysis. How do we QA  
21 ourselves against those analyses?

22 So it's a challenge we face in these  
23 models that we don't face in the Rev 3 models.

24 CHAIRMAN APOSTOLAKIS: Right.

25 MR. CHEOK: Also, we are in the process of

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1 defining what standardized means in this case. There  
2 are certain things that we want to standardize that  
3 would keep the models somewhat similar. Again it was  
4 a little bit simpler for the Rev 3 models. We will  
5 have to define that a little bit better for our  
6 external events models, low power shutdown models.

7 MEMBER DENNING: Mike, will you also talk  
8 about uncertainty analysis for these? Because I think  
9 that that also is a big challenge, that the  
10 characteristics of uncertainty can be quite different  
11 from this, what we really typically address in model  
12 one?

13 MR. CHEOK: Absolutely. And again, we are  
14 at the stage now that I don't think we have  
15 uncertainty defined at this point. And I think we  
16 will have to define it as we use it.

17 And I think it's critical to keep in mind  
18 today that we QA our Rev 3 models by using the  
19 licensee's QA their PRA models by using them. I mean  
20 you can only look at the models so much, at the  
21 desktop, and keep refining it. You have to use them  
22 in situations, apply them for events analysis, and as  
23 you use them look at the results to see if they make  
24 sense, and then add or subtract or make changes.

25 So our goal basically is to start using

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1 these models, and basically, keep improving on them,  
2 get lessons learned, and provide feedback to the model  
3 development process.

4 So that's our challenge, and by doing that  
5 we can also define, better define, what we mean by  
6 uncertainties, and where we need to characterize our  
7 uncertainties better.

8 The model specifications, for example, the  
9 scope, level of detail, the limitations, et cetera,  
10 will be better defined by the use of models in the  
11 applications. So we will continue to do that.

12 So without too much more intro, I would  
13 like to get Selim Sancaktar up here to talk about the  
14 external events models.

15 MR. SANCAKTAR: Good morning.

16 My name is Selim Sancaktar. I work for  
17 research. I would like to give you a --

18 CHAIRMAN APOSTOLAKIS: Say good morning  
19 again.

20 MR. SANCAKTAR: Okay, good morning for the  
21 fourth time. My name is Selim Sancaktar. I work for  
22 research.

23 I would like to give you a presentation on  
24 SPAR external events effort that we are performing as  
25 we speak, and in the next few years.

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1           Currently, the ASP analysts include  
2 external events that accumulate in their assessments,  
3 and they use whatever methods and information  
4 available to them at this point.

5           ASP analysts also are very much interested  
6 in including a complete view of the risk as opposed to  
7 a limited view, and we've been going into more and  
8 more of actually modeling external events as we  
9 proceed in ASP analysis, and we would like to do that  
10 systematically and in a comprehensive way.

11           So there is already a specific and ongoing  
12 need and effort, and we would like to make it -  
13 provide tools to help it be done systematically and  
14 easily.

15           So looking at the - what I would call a  
16 successful evolution of the SPAR models for internal  
17 events, what I mean by that is, it started with a  
18 limited number of models, and it developed by use, not  
19 theoretically, not in the mental capacities of the  
20 people, but actually by use, and it has been improving  
21 since then, and it continues to improve just like any  
22 other model we use.

23           And we would like to integrate external  
24 events, LERF, and low power and shut down models  
25 naturally into the existing SPAR models. And I am

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1 only limiting myself to external events in core, which  
2 happens to include internal flooding because it wasn't  
3 in the internal events.

4 I'll take the liberty of throwing it in  
5 here, but we realize that it is formally not an  
6 external event.

7 So we are adding them to the existing SPAR  
8 models, so we don't have a separate model; we don't  
9 have a separate tool. Whatever tool we have, we are  
10 expanding it.

11 And to do it, as you can see, there are  
12 almost infinitely many challenges that one has to go  
13 through.

14 What we are focusing on is, if latest  
15 licensee PRA information is available, we try to use  
16 that as a starting point. It's not the end point;  
17 it's a starting point. We are approaching it with a  
18 healthy dose of skepticism, but not with the  
19 tremendous skepticism that would stop us dead in our  
20 tracks.

21 So if possible we try to get information  
22 from the licensees. Actually we have done that for at  
23 least two clients so far, Limerick and Salem, because  
24 NRR had an activity, ongoing activity, to get this  
25 kind of information for SDP purposes.

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1           So we kind of tagged along with them, and  
2 we have received the latest possible information, and  
3 we try to use that.

4           If this information is not readily  
5 available, we will go through the IPs, IPEEEs, and of  
6 course, IP for internal flooding, skim the information  
7 available and try to put it in.

8           And also, STP external events worksheets,  
9 which relate to this first item. This third item is  
10 the one that I mentioned with Limerick and Salem  
11 that's created the need to go to the sites.

12           And next year in 2006 in NRR is planning  
13 to continue their activity here to go to the sites,  
14 and we intend to go with them to get as much  
15 information as possible.

16           And we will be using existing SPAR model  
17 event trees, fact trees, et cetera, as much as  
18 possible. They already are defined for us, the plant  
19 response to certain situations, and then we will of  
20 course customize them to do scenarios, external event  
21 scenarios, as needed, which are briefly discussed.

22           So we are adding basically scenarios. I  
23 am using the word scenario in terms of what you would  
24 expect it to be, just like an initiating event. It's  
25 not really an initiating event, but it has its own

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1 event three, it has its own plant response, and we  
2 keep adding as many of them as possible, and we don't  
3 really have a limit. There is no limit in the  
4 software that you can only add 10 or 20. We can add  
5 10,000 if necessary. But there is a practical limit  
6 in the usability of course.

7 So scenario is defined in terms of its  
8 frequency, type of reactor trip caused which is  
9 already studied in the SPAR model - it might be a  
10 transient, with certain equipment and operator actions  
11 affected. It might be loss of outside power. It  
12 might be something totally different, maybe something  
13 that is not already studied.

14 A prime example of that is of course our  
15 main control room evaluation after a fire is not  
16 studied. There is no counterpart in the current SPAR  
17 model, so we have to make a model for it.

18 CHAIRMAN APOSTOLAKIS: Another major  
19 difference, it seems to me, is that these external  
20 events, most of them anyway, depend heavily on where  
21 the event occurred, location. And so it's not just  
22 the frequency; and location, right?

23 MR. SANCAKTAR: Right, that defines - that  
24 tell us which SSEs are affected.

25 CHAIRMAN APOSTOLAKIS: Right, but that is

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1 a major difference.

2 MR. SANCAKTAR: Yes, so we have to specify  
3 to the software in this scenario what is affected.

4 MEMBER DENNING: Let's talk about that a  
5 little more if we can, this - the difference between  
6 area analysis that is required for many of these  
7 versus the non-area analysis type of events.

8 If you look for example at fire risk  
9 assessments, one has to have a great deal of  
10 information about the location of equipment and this  
11 type of stuff within the plant, and that's the type of  
12 thing that I see that SPAR has been able to avoid in  
13 the internal events, but it seems to be unavoidable  
14 when you think about flooding risk, fire risk, they  
15 are so dependent upon the particular plant layout and  
16 that type of stuff.

17 Does it introduce a major limitation as to  
18 what you can do with SPAR for these events?

19 MR. SANCAKTAR: Well, what you said so  
20 far, your characterization is absolutely true. Now to  
21 answer your question, it - we are going to avoid it at  
22 this point by depending upon already analyzed  
23 scenarios, because as you can appreciate, maybe  
24 millions of dollars went into each of these studies.  
25 And we don't want to, and we cannot, and we will not

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1 start from scratch and build it up.

2 So we have to depend upon available  
3 information, initially, and then as we move forward,  
4 we have to either supplement it or check it to make  
5 sure that it is relevant; it covers the necessary  
6 equipment, but it could have been a problem if we said  
7 that we are going to start with a clean slate.

8 We are not starting with a clean slate.

9 MEMBER DENNING: Again, I think we are  
10 running into a difference between objectives of why  
11 utility should undertake a flooding PRA or a fire PRA,  
12 and what you'll do with your version of a PRA.  
13 Because I think the way - if we look at the kind of  
14 thing you're going to be able to do, you're not going  
15 to be able to really identify vulnerabilities that  
16 really exist in plants. Whereas the tremendous value  
17 of the flooding PRA, or the fire PRA, for the utility  
18 is to identify those vulnerabilities.

19 Do you agree?

20 MR. SANCAKTAR: Yes.

21 MEMBER DENNING: Somehow your objectives  
22 are different.

23 MR. SANCAKTAR: Right. I have to go back  
24 - that is very important, because when we say external  
25 events, when we say the incorporation of external

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1 events, people have different visions. They have  
2 different needs in their minds.

3 If I talk to 10 people from 10 different  
4 branches about this subject, there will be I'm sure in  
5 the back of their minds 10 variations of what this is  
6 and what it should be.

7 So out of these I have to select a sound  
8 ground that I can stand on and move forward and expand  
9 on. And that is a balancing act, and it is not an  
10 easy thing to achieve, and there is a lot of  
11 skepticism and so on that has to go on. That's why I  
12 have to again come back, which I will also - let me  
13 mention -

14 MR. CHOKSHI: I think, Dr. Denning, your  
15 point is very well taken. We have a lot of internal  
16 debate what we can use for, how we can apply from what  
17 incarnation, what we can build. And it is an ongoing  
18 debate until we develop some models, start using them,  
19 and understand the limitations, what kind of  
20 applications are possible.

21 I mean speaking from my perspective, event  
22 assessment is the next part of my objective, to be  
23 able to evaluate.

24 But you are absolutely right. We have to  
25 be very careful, and this is not - we supply this too.

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1 Because we are going to be limited by the information  
2 available, and how much we can really - these are so  
3 plant specific.

4 CHAIRMAN APOSTOLAKIS: Well, but in  
5 addition to the issue of location, I wonder how you  
6 will handle the fundamental logical models that are  
7 involved.

8 As you know this agency and EPRI have  
9 joined forces to develop an updated fire risk  
10 assessment methodology in the seismic area. There are  
11 all sorts of models that one should use for the  
12 occurrence of the earthquake; the continuation of the  
13 wave; and so on.

14 I'm wondering how you are going to handle  
15 that. You can't use just Boolean algebra there. Are  
16 you going to have a subroutine that does the  
17 calculations?

18 MR. SANCAKTAR: I see it as one step at a  
19 time. The way I tried to characterize it in the past  
20 is to try to explain it to people, can't come up with  
21 a Cadillac. I can come up with maybe a Volkswagen bug  
22 or whatever.

23 CHAIRMAN APOSTOLAKIS: But not a Yugo.

24 MR. SANCAKTAR: Hopefully not a Yugo. As  
25 you can see I have a little bit more ambition than

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1 that. But I cannot start with a Cadillac, although  
2 our goal is to go to a Cadillac eventually.

3 And I want to do this within my lifetime,  
4 and I want to do this within a reasonable budget.

5 So I'm trying to work these into the  
6 equation with different constraints, some of which are  
7 technical, others of which are nontechnical. And for  
8 example, coming back to what you were saying, the  
9 NUREG, EPRI/RES NUREG-6850 is a tremendous work as you  
10 all know. I did not bring it here just to make a  
11 point, but it is this thick. It is as thick as the  
12 whole internal events procedure guide, if there was a  
13 recent one.

14 We are certainly referring to it, okay.  
15 In this context, in the context of event analysis.  
16 But the starting point is, we are putting in scenarios  
17 that are already whether we believe in them, whether  
18 they are complete or not, is not the issue yet. But  
19 it will become an issue.

20 We are putting them into the model, so now  
21 the models will give us, when we quantify a plant  
22 condition or an event, it will tell us some new  
23 information, and we will look at it and say, does this  
24 make sense? It will give us a chance to act on it, to  
25 think concretely as opposed to thinking in --

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1 CHAIRMAN APOSTOLAKIS: So Selim, when you  
2 say scenarios, and the way I understand it is, in the  
3 first case, you will go to PEEEs or other sources, and  
4 you will say, okay, for this plant, JACA (phonetic)  
5 found that if there is a fire of a certain magnitude  
6 in this room, this is what's going to happen. And you  
7 are going to put that in your model.

8 MR. SANCAKTAR: Right.

9 CHAIRMAN APOSTOLAKIS: Without questioning  
10 whether it's right or not.

11 MR. SANCAKTAR: Right.

12 CHAIRMAN APOSTOLAKIS: And then after you  
13 gain some experience with these - you are going to  
14 have a hell of a problem as we said earlier with most  
15 of the licensees, because they haven't really done  
16 this work.

17 Then you are going to start questioning  
18 whether a fire occurred in there, is a reasonable  
19 thing to postulate, or what is the frequency of that?  
20 Where else could a fire occur?

21 The other thing, of course, is that I  
22 don't think any licensees have done an analysis of the  
23 impact of smoke, as far as I know.

24 CHAIRMAN APOSTOLAKIS: They have discussed  
25 it.

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1 MR. SANCAKTAR: There is a lot of research  
2 findings. And that is an important initiative or  
3 contributor to the scenario.

4 MEMBER BONACA: There are many inspections  
5 that take place at the plant. Do you have an ability  
6 to communicate with the inspectors if there is an  
7 inspection for fire concerns?

8 MR. SANCAKTAR: Well, one of the things  
9 I'm trying to do is to get this stuff into the hands  
10 of the actual users, the SRAs at the regions, as well  
11 as people in NRR, and let them feel comfortable with  
12 it. Let them look at it.

13 In fact I will mention it in one of my  
14 further slides. One of the most important principles  
15 of this project was, this model should be seamless  
16 with the existing model.

17 So when I take the model and give it to  
18 our existing user who used the internal events, my  
19 instructions are zero. There is no training. I give  
20 it to the person. He or she puts it on the computer.  
21 The SAPHIRE code comes back, you saw. And there is  
22 nothing alien in it. You don't have to learn any new  
23 ways to run it.

24 CHAIRMAN APOSTOLAKIS: I think you are too  
25 optimistic. Because there are unique features of

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1 these events. I mean you can't just say here is the  
2 model. If you go to the eternal event scenarios and  
3 see the impact. No, there is more, much more to it  
4 that that.

5 MR. SANCAKTAR: We'll get to that.

6 CHAIRMAN APOSTOLAKIS: How far - how long  
7 are you here?

8 MR. SANCAKTAR: Well, if I go to a few  
9 more slides --

10 CHAIRMAN APOSTOLAKIS: Why don't you do  
11 that? Yes, let's do it.

12 Don't go backwards.

13 MR. SANCAKTAR: No, we only move forward.  
14 Although sometimes we may appear not to do so, but we  
15 still move forward.

16 I added the extension dash E to include  
17 the external events. But again let me emphasize that  
18 SPAR-EE includes the internal events. They are there  
19 too. It's not like a separate item.

20 And eventually, when all 72 SPAR models,  
21 or maybe all 103 plants, have their own models, we  
22 will drop this EE and it will be SPAR again.

23 Typical, for example, let's say a typical  
24 SPAR-EE model might have 15 to 20 internal event  
25 categories which are already there, five to 10

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1 internal scenarios, 20 to 30 internal fire scenarios  
2 --

3 MEMBER DENNING: Can you help us a little  
4 bit on that, like when you discuss 20 to 30 internal  
5 fire scenarios, would you for example, that would be  
6 fire in the cable spreading around, fire --

7 MR. SANCAKTAR: Fire in the main control  
8 room, fire in the turbine building, and then special  
9 areas that they identified.

10 MEMBER DENNING: Okay.

11 MR. SANCAKTAR: By the way, as we move  
12 forward, we have done six of these, as we move  
13 forward, we see good things in some of the models.  
14 And we try to incorporate it. We try to make it into  
15 a standard.

16 So from that point on we use that.

17 CHAIRMAN APOSTOLAKIS: Do you have access  
18 to the PRAs that have done a detailed job? There are  
19 several PRAs that - like Indian Point, Zion, Seabrook,  
20 and those PRAs have done a very detailed job.

21 MR. SANCAKTAR: Yes, in fact, we've just  
22 done Indian Point three external events, and that was  
23 the best I've seen so far among the six we've done so  
24 far. That was the most comprehensive.

25 And each time we see something and we say,

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1 oh, this is good, this makes sense, I try to make it  
2 into a kind of a step to be followed later on.

3 CHAIRMAN APOSTOLAKIS: There was a lot of  
4 effort in that.

5 MR. SANCAKTAR: Again, there are no limits  
6 here. Like for Salem, we said, let's put everything  
7 in, all the fire scenarios in, so we have like over  
8 100 in there.

9 Now it makes the effort longer. I don't  
10 know if it buys anything or not. But we put them in  
11 just to see if something will break, will it reach a  
12 limit either running time wise or anything.

13 But there is no intrinsic limit at this  
14 point.

15 MEMBER DENNING: But is there - when you  
16 look at things like associated circuits, and you look  
17 at spurious opening of systems that normally wouldn't  
18 be on the event tree, doesn't that give you - say, I  
19 have to really expand well beyond the --

20 MR. SANCAKTAR: Eventually, yes.  
21 Eventually, yes. Yes, just to give you a feeling  
22 about this, for example, recently - you may already  
23 know - Kewaunee had a design issue with internal  
24 flooding. I don't know if you are familiar with that,  
25 a design issue that internal flooding in a

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1 nonthreatening area might go into a safety related  
2 area.

3 And it was not really thought of before.  
4 And now, are we going to catch it with this? No, we  
5 won't. This model will just go through it, will not  
6 even know it where you quantify it. And just like it  
7 did for the last 20 years or whatever, just at the  
8 beginning, it didn't model the scenario.

9 Of course that scenario doesn't exist any  
10 more, because they took care of it. I mean it just  
11 existed up to a point.

12 CHAIRMAN APOSTOLAKIS: But you could,  
13 though, evaluate the significance of such a point if  
14 you had the model?

15 MR. SANCAKTAR: Exactly, once I have the  
16 models, I can tweak them, I can clone them. The user  
17 has now an easier path to making either clones or  
18 small variations.

19 CHAIRMAN APOSTOLAKIS: So what you are  
20 doing now, Selim, obviously you are familiarizing  
21 yourself with what has happened. But let's take  
22 Indian Point that you just finished. Are you going to  
23 try to develop a SPAR model for external events for  
24 Indian Point. Or at this stage are you just  
25 collecting information?

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1 MR. SANCAKTAR: No, we have it. It's  
2 running; we have it. I can show you the six models we  
3 have. They exist.

4 MR. CHEOK: I guess let me clarify a  
5 little bit, George.

6 CHAIRMAN APOSTOLAKIS: The next slide says  
7 what you have, but you don't have the models.

8 MR. CHEOK: Basically, I guess what Selim  
9 is doing and what we're doing is trying to incorporate  
10 as much of the licensee information available right  
11 now into the SPAR models.

12 We are not trying to define the fire  
13 damaged states from each room, or the flood damaged  
14 states. That will come when we review and study more  
15 the Sandia work, and that research work, and that will  
16 help us define the associate circuit probabilities,  
17 what temperatures the rooms would get to, and what  
18 damage states - the different damage states as we have  
19 bigger rooms, the more ventilation or smoke.

20 What we are doing now is just studying the  
21 feasibility of these models, using what we get from  
22 licensee information. You would eventually in the  
23 long term - I don't even foresee us doing room lock  
24 downs of cable tracing to tell you the truth; that is  
25 impossible. We will still have to depend on licensee

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1 information for that purpose.

2 Where we will standardize is in the  
3 methods that we will use from the Sandia slash  
4 research study to standardize our planned damage state  
5 allocations.

6 CHAIRMAN APOSTOLAKIS: So we have to wait  
7 for SPAR-EE draft three, right?

8 MR. SANCAKTAR: Yes, something like that,  
9 yes.

10 MEMBER DENNING: What about SAPHIRE  
11 itself, is it conveniently capable to handle these  
12 overlays of area kind of things?

13 MR. SANCAKTAR: That is an excellent  
14 question, and there are two different answers to that.

15 CHAIRMAN APOSTOLAKIS: Yes and no.

16 MR. SANCAKTAR: I will give you both of  
17 them, and I will certainly accept criticism. This is  
18 my personal point of view; anybody who wants to  
19 criticize it is welcome; I may be wrong.

20 SAPHIRE is a very sophisticated tool as  
21 you may have already noticed in your last days  
22 exposure to it, or before. And it has already been  
23 envisioned like parallel depths, like a second -  
24 another depth - dimension of putting area events,  
25 fire, seismic, and so on.

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1           And when we started this we had a  
2           feasibility study done with Limerick. And there, we  
3           were excited that we should use these capabilities.  
4           And the way we did was, for Limerick, we took the  
5           seismic capabilities built into it, which associated  
6           a seismic failure with a basic event. Like a pump,  
7           and you could associate a seismic failure with it.

8           But you don't really see it. It's very  
9           deep in there. And it is beautiful, it is  
10          intellectual stimulating, and so on. But after  
11          awhile, I looked at it and I said, users will - most  
12          users will just -- will not recognize this, and it is  
13          going to become a burden on them.

14          So the later ones I personally chose to  
15          abandon the use of that, and explicitly put the  
16          seismic failures, so that you can see them. You can  
17          physically as a user look at the model, and you see  
18          how it's modeled, how it's coming in. You can  
19          criticize it, you can relate to it.

20          So we lost the compactness of the model,  
21          the nice features of it. But in return, we have  
22          gained a bit more explicit approach.

23          So I'm trying to put myself in the shoes  
24          of a typical user, and in fact consider myself a  
25          typical user, because on the side I do ASP analyses

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1 just to my hands in the stuff and see what is  
2 happening and why things are happening one way or the  
3 other.

4 So does that answer your question?

5 CHAIRMAN APOSTOLAKIS: Well, the issue  
6 with external events is really that they are a huge  
7 common constraint. So you have to do that. You can't  
8 just bury it.

9 MEMBER DENNING: Yes, but I know that some  
10 tools are very difficult to do these area analyses.  
11 Because it is a complicated tying together of the  
12 causes.

13 MR. SANCAKTAR: For example, in SAPHIRE,  
14 you can mark, if you want, you can mark the equipment  
15 or basic events by area. And then I'm sure there is  
16 a way to say then, fail them all.

17 Which is - theoretically it is a good,  
18 good thing. But as you see in 6850, the new fire  
19 analysis guidelines, people are running away from  
20 massive bounding failure of everything in a given  
21 room, and focusing on more and more realistic  
22 scenarios, depending on where are the ignition  
23 sources, and what can it get and so on.

24 So we are no longer saying, knock out  
25 everything in this room, which to me is very easy. I

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1 don't mind.

2 CHAIRMAN APOSTOLAKIS: So are you going to  
3 show one of these to us?

4 MR. SANCAKTAR: I'd love to, and I can -  
5 or I don't have it here, but I can. Whatever your  
6 wishes or management's directives are.

7 CHAIRMAN APOSTOLAKIS: How long would it  
8 take to do that, Selim?

9 MR. SANCAKTAR: I would load one in --

10 CHAIRMAN APOSTOLAKIS: No, I understand  
11 that. But how long would it take to demonstrate?

12 MR. SANCAKTAR: I don't know if the people  
13 - I'm always ready.

14 CHAIRMAN APOSTOLAKIS: Why don't we go  
15 ahead with your prepared presentation - oh you have it  
16 here?

17 MR. SANCAKTAR: Yes, I have all six here.

18 CHAIRMAN APOSTOLAKIS: So how long will it  
19 take?

20 MR. SANCAKTAR: Five minutes.

21 MR. CHEOK: I tell you, why don't we go  
22 through with his prepared presentation, and while the  
23 next presentation is going on he can load it up, and  
24 we will just break for five minutes later.

25 CHAIRMAN APOSTOLAKIS: But the actual

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1 demonstration is a few minutes, several minutes.

2 MR. SANCAKTAR: As many minutes as you  
3 choose to. I can keep it to five, 10. I am always  
4 willing to show rather than discuss.

5 CHAIRMAN APOSTOLAKIS: Okay, why don't you  
6 finish then your high level presentation.

7 MR. SANCAKTAR: I have only a couple of  
8 slides left anyway.

9 However, let me mention one more thing  
10 that I think is important for me, I don't know again  
11 if other people will agree or not, that is a different  
12 story.

13 When I quantify these things, I really  
14 don't have a CDF objective in mind or anything.  
15 Again, it's commonsense. If we get a 10 to the minus  
16 two at the end, we would look. And we sometimes do.  
17 Something is wrong.

18 Or if you get 10 to the minus eight,  
19 total, something is wrong.

20 But I do not really have a preconceived  
21 idea as to, a plant should have 80 percent internal,  
22 15 percent fire, 3 percent flooding and 2 percent  
23 seismic. It would be nice, but I have no preconceived  
24 ideas.

25 So it doesn't bother me what we get out of

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1 it. I don't try to manipulate it to get something.  
2 Whatever comes out, comes out.

3 So if you see something and say, why is it  
4 90 percent here, and then in another plant it is 10  
5 percent. Maybe it should bother us, but not at this  
6 point. Maybe at the next stage.

7 At this point, I'm going to put them in.  
8 People can look at it. Criticize it, use it, tweak  
9 them, adjust them, and then we try to line them up so  
10 that they are consistent within themselves, and then  
11 also consistent with outside standards, which kind of  
12 is the subject of one of the other slides.

13 Okay, quickly wrapping this up, related  
14 activities. There are a couple of little activities  
15 that kind of support this. One of them is we are  
16 trying to add a few things into SAPHIRE so we can make  
17 and use these models faster and better.

18 We are trying to create some external  
19 event handbooks that are practical for focus - focused  
20 on the analysts making an event analysis, not doing  
21 PRA. We are not trying to repeat, or we are not  
22 trying to replace, existing technical documents. We  
23 are not trying to reinvent the wheel. But simply  
24 simplistic, how would you use this model in this  
25 situation if you had such an event, and so on.

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1           We have - I talked about this coordination  
2 with ongoing NRR site visits, and we will continue  
3 this. I'm going to go to the WOG meeting, and try to  
4 convince them that they should voluntarily give us  
5 their external event information in any form they want  
6 - paper, electronic form, photograph it if they want.  
7 We don't want new analysis. We don't want any  
8 additional effort. Can we get them? And I will try  
9 to explain to them that this is a win-win situation.

10

11           CHAIRMAN APOSTOLAKIS: The best way to get  
12 these, coming back to your earlier point, you start  
13 producing numbers like 10 to the minus two, and you  
14 will see people very willingly give you anything you  
15 want.

16           MR. SANCAKTAR: That is my stick in the  
17 back that I'm not showing, but this is implied, that  
18 if we don't receive - if you don't get the information  
19 - here is what you have. You are using it. If it's  
20 wrong, please tell us what's wrong with it, we'll fix  
21 it.

22           We are not immune to that.

23           Let me wrap this up. I don't want to take  
24 too much of other people's time. Future plans:  
25 complete SPAR-EE models for all plants. And my

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1 original objective was three years. I still think  
2 that it should be three years.

3 We can with a heroic effort we can do it  
4 in three years, but not at the rate we are going.

5 However, I should have also mentioned  
6 something very positive, which I believe is very  
7 positive. Four of those six models I mentioned were  
8 done in house, in house being inside the NRC, with a  
9 joint effort between NRR and RES. So we can actually  
10 produce these in house, and we can do it as a combined  
11 project between divisions.

12 CHAIRMAN APOSTOLAKIS: So you can't really  
13 use the models yet to analyze accident sequences?  
14 That's the plan?

15 MR. STANCAKTAR: As we speak now, Turkey  
16 Point is being done. And we will use it - have events  
17 that we want to use it on. And then we will use at  
18 least two. When I say two - to me two is a very  
19 doable and actually underachievement kind of goal. We  
20 can do more than two if necessary.

21 We also promised to the SRAs, I know that  
22 it is upon us, that if an SRA sees an event that they  
23 want to study, and it needs external events, if they  
24 give us information about the plants, in 30 days we  
25 will make a model and come back and give it to them to

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1 use if they want to.

2 Of course we want to validate the SPAR-EE  
3 models to the same level as SPAR models, and try to  
4 combine, et cetera. Same stuff as you would expect.

5 Challenges: Obtain the latest possible  
6 licensee accelerant models.

7 CHAIRMAN APOSTOLAKIS: We've talked about  
8 all this.

9 MR. STANCAKTAR: We talked about that.  
10 Achieve standardization within - we have to be careful  
11 what this means. I do not think of standardization as  
12 all of them are the same. Because as you just  
13 mentioned, they are dependent on the characteristics  
14 of the plant.

15 Even a single SPAR models, the two units  
16 on the same side, it works with external events, may  
17 need possibly two external events, variations, if  
18 there are locational differences.

19 So we recognize this. Everybody  
20 recognizes it. But so some sort of a standardization  
21 within, and standardization with respect to the  
22 surrounding environment.

23 We also define scope and detail, how much  
24 detail we will go to the agreement of people, and then  
25 we have to understand where we can use it,

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1 specifically recognize where we can use it, where we  
2 cannot use it, and in places where we cannot use it  
3 yet, if you want to go there, how do we go there,  
4 what is involved, et cetera.

5 So I think that is my last slide.

6 MEMBER DENNING: Can I make a comment, or  
7 a couple comments at this point.

8 I think what you are doing is just exactly  
9 what is required at this point. But it is definitely  
10 at an exploratory and a research level, this right  
11 now. I mean I don't think that you can decide at this  
12 point how am I going to go forward to all the plants,  
13 because actually it isn't obvious how you do that. I  
14 mean clearly you can't do what you said you were going  
15 to do in three years, because the plants aren't going  
16 to be able to give you the information. So that there  
17 is clearly a period here of development and  
18 application. And then after that you are going to  
19 have to decide just what are we really going to do in  
20 this area.

21 But no criticism at all of anything that  
22 I heard today. It's just that I think we're going to  
23 want to keep in touch here. Because I don't know  
24 whether it is going to be nine months or a year, when  
25 you will have had a couple of examples and be able to

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1 come back and say how things are going.

2 But I think we would certainly like to be  
3 involved in that. And then I think we'd be involved  
4 in the decisions you are going to have to make as to  
5 just what are our real objectives in this area? Are  
6 we going to do all the plants? And at what level?

7 CHAIRMAN APOSTOLAKIS: Yes, the intent,  
8 Rich, is to have a series of subcommittee meetings.  
9 This is the first one. We will have an overall view  
10 of the programs. And then as necessary in  
11 consultation with Nilesh and his colleagues we will  
12 have other subcommittee meetings where we will discuss  
13 individual projects and progress.

14 And this is certainly one of them. The  
15 other one probably is LERF.

16 MR. CHOKSHI: As I said in the very  
17 beginning, we are in the formative stage. A lot of  
18 judgments involved. A lot of complexities. And I  
19 think that will be wonderful for us to get this  
20 feedback.

21 CHAIRMAN APOSTOLAKIS: So I believe our  
22 next task is to review SPAR-H. And then we will  
23 schedule a subcommittee meeting sometime in the  
24 spring.

25 MR. CHOKSHI: As you said, let us try out

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1 a couple of things to understand ourselves what they  
2 are doing.

3 CHAIRMAN APOSTOLAKIS: We have a model  
4 now, the way we participated in the development of  
5 Regulatory Guide 1.174 that this is a participatory  
6 review, and we are welcoming ideas, and hopefully we  
7 will try to help too.

8 Because this is a huge effort. Okay,  
9 Selim, thank you very much.

10 MR. STANCAKTAR: Thank you very much.

11 CHAIRMAN APOSTOLAKIS: So who is the next  
12 presenter?

13 MR. CHEOK: It's going to John Lehner and  
14 Eli Goldfeiz on LERF.

15 CHAIRMAN APOSTOLAKIS: Okay.

16 MR. GOLDFEIZ: My name is Eli Goldfeiz.  
17 I am the LERF project adviser. Just briefly an  
18 introduction to what we are to be doing here, and I  
19 give it to Dr. John Lehner, if you have any questions.

20 This project started as a request that the  
21 NRS to have the ability to be in completeness  
22 (phonetic) of the PRA. The project start in the mid  
23 of 2001. The first one of the project was developed  
24 in the Liverpool, existing Liverpool LERF model at  
25 that time.

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1           Actually there were a few models built for  
2 the ASP analysis. It wasn't connected to development.  
3 It just was level two for analysts to use.

4           The first two was preparing the detailed  
5 program, and the first three was implementing the  
6 program. We are in the stage - phase three. We  
7 created three models, one for - the models, the way we  
8 build the model is that we went by containment type  
9 reactor.

10           The first model is for large dry  
11 containment like at Comanche Peak.

12           The second model was a BWR, Mark I used at  
13 Peach Bottom.

14           And the third model was ice condenser at  
15 Sequoyah.

16           And the other - we're in the process of  
17 the fourth model, and it is almost completed, under  
18 Dr. John Lehner can explain more about that now.

19           DR. LEHNER: Good morning, I'm John Lehner  
20 from Brookhaven National Laboratory. And we are  
21 working with Eli Goldfeiz on the large orderly release  
22 frequency modeling that was part of the SPAR model  
23 development.

24           I should mention that much of the  
25 technical work was done by C.C. Lin of Brookhaven, and

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1 our consultant, Zoran Musicki, former of Brookhaven,  
2 who are both here today.

3 So as Eli mentioned, the objective here is  
4 to really meet the needs of the SPAR models users  
5 group who need some relatively simple but fairly  
6 thorough analysis tools to make assessments of LERF,  
7 and of course they want that LERF portion to be both  
8 well integrated with the Level 1 model, so basically  
9 as we heard before, seamless with the Level 1 model.

10 We had three phases, I'll skip over this  
11 quickly. As Eli mentioned, the first one was to look  
12 at some previous LERF models that were done on the  
13 SAPHIRE platform but that really were not ideal for  
14 what the SPAR model usually wanted to do with LERF  
15 models.

16 Phase two was preparing a program plan,  
17 and then phase three is implementing the program plan,  
18 that is, developing the actual models.

19 So the first two phases were completed in  
20 2001, and we're now in the implementation part of the  
21 plan.

22 MR. GOLDFEIZ: The main purpose was it  
23 should be traceable to Level 1. If we have a sequence  
24 of Level 1 and go to Level 2, we have to be able to  
25 traceable completely to background, to Level 1.

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1 DR. LEHNER: So in our approach to model  
2 development we wanted to be as up to date as possible,  
3 so we wanted to include the most current information  
4 we could get. That included starting with 1150 type  
5 information, but then of course the IPEs. Depending  
6 on the type of plant we're looking at. We've looked  
7 at some of the documentation of research since then  
8 for evidence on direct-containment heating, lighter  
9 melt-through. A lot of work has been done induced  
10 steam generator tube rupture.

11 We've also tried to look at utility  
12 documents that document some of their findings on  
13 these issues.

14 So we obviously are trying to take the  
15 most recent developments into account when we develop  
16 the Level 2 technology.

17 We also want models, as I mentioned  
18 before, that are not as complicated as the 1150  
19 models, so that they can have better run times and are  
20 more scrutable, but that do have more detail than some  
21 of the simplified models in NUREG/CR-6595.

22 I don't know if you are familiar with  
23 that.

24 CHAIRMAN APOSTOLAKIS: What is that?

25 DR. LEHNER: That is a report, it's

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1 mentioned in the ASME standard for PRA that is  
2 acceptable for a category one type of PRA. And  
3 essentially that report has, for the five different  
4 containments, it has an event tree, a simplified event  
5 tree for each of the five containment types.

6 So it's split fractions are already  
7 provided in there. So if you want a very, well, quick  
8 way of calculating LERF, those are models you can use.

9 MEMBER DENNING: This is the Brookhaven  
10 report?

11 DR. LEHNER: Yes, 6595. That's right.

12 CHAIRMAN APOSTOLAKIS: The reason why  
13 NUREG-1150 was so detailed was that there were  
14 significant disagreements among experts as to what  
15 would happen under certain conditions.

16 And they resorted as you know to expert  
17 opinion, a dissertation, that was a very elaborate  
18 process, the Cadillac really at the time.

19 How are you going to handle that? Are you  
20 going to now settle and say, well, NUREG-1150 settled  
21 on this curve, and we are going to use that curve? Or  
22 is there any other way?

23 Yesterday, I got the impression that for  
24 internal events the SPAR people felt that they really  
25 only had a problem with structural uncertainty, and no

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1 other. I mean there is uncertainty in human  
2 reliability. Well, we'll use SPAR-H and forget about  
3 it.

4 How are you going to handle that?

5 DR. LEHNER: Well, I think that unlike -  
6 you know this goes back to the purpose of the models.  
7 So we're not criticizing 1150 here. We're just saying  
8 that 1150, as you said, was a way to investigate a lot  
9 of different controversial issues and see what the  
10 outcomes would be depending on what weights you put on  
11 the outcomes.

12 I think some of those issues have been  
13 clarified since that time. For instance, I mentioned  
14 direct containment heating. There has been a lot of  
15 work done that's shown that the significance of direct  
16 containment heating in the large dry containments, and  
17 even the ice condenser containments is not as much as  
18 it was in 1150.

19 The same thing is true of Mark 1 lighter  
20 melt-through. There has been quite a bit of work done  
21 there.

22 So the models that we are developing are  
23 - again, the purpose here is not as a research tool to  
24 look at possible new failure modes or unique failure  
25 modes, containment failure modes. We're basically

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1 looking at the consensus, the current consensus, on  
2 what are the important failure modes for the plants  
3 that are out there?

4 And based on that consensus, do a LERF  
5 model that includes those failure modes for that type  
6 of plant.

7 CHAIRMAN APOSTOLAKIS: But is there such  
8 a consensus?

9 DR. LEHNER: There is in many areas. I  
10 think there are some areas where there is still - for  
11 instance, induced steam generated tube rupture I think  
12 is something that the NRC is still spending quite a  
13 bit of effort on to investigate. So there is in some  
14 areas; not in all certainly.

15 MEMBER DENNING: I think we have to get  
16 here to what is the basic definition of LERF.

17 Incidentally, I don't really like LERF,  
18 but it's become a structured way of dealing with  
19 things.

20 But I assume that when the utilities do  
21 LERF, they really use 6595. Is that almost  
22 universally true, that they rely on 6595 to indicate  
23 what the probabilities are for a particular damage  
24 state, as to what the probability is of early  
25 containment failure? Do you know the answer, John?

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1 DR. LEHNER: I can't really speak for the  
2 utilities, but my impression is that they will use  
3 6595, but the answer may be too conservative. In  
4 other words, it may be - they will use 6595 if it is  
5 a quick way of getting an acceptable answer for LERF.

6 But in the IPEs of course the utilities  
7 did develop their Level 2 models. And while those  
8 Level 2 models for the IPEs did not directly calculate  
9 LERF, the better Level 2 models had enough information  
10 in them that they could calculate a LERF equivalent  
11 using those Level 2 models.

12 MEMBER DENNING: Well, I think the basic  
13 concept of a large early release is 20 percent. Is  
14 that the way you look at it?

15 DR. LEHNER: Well, the definition that is  
16 sort of - the definition of LERF is that it's a  
17 release large enough to cause an early fatality at the  
18 site boundary.

19 So the reason that I think the utilities  
20 like to use LERF, and that it's a good tool for the  
21 NRC to use as well is the fact that it simplifies  
22 things by not really calculating force terms.

23 In other words, what you are really doing  
24 is, you're saying, if I have a containment failure, or  
25 a bypass, that is early enough that I am going to

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1 assume I'm going to get an early fatality, and I am  
2 not going to go through all the source term  
3 calculations.

4 MEMBER DENNING: But people don't do the  
5 source term calculations. And of course we recognize,  
6 it really does make a difference whether you are an  
7 800 megawatt electric plant or a 1,500 megawatt  
8 electric plant as to what the implications are of a 20  
9 percent release. And we completely ignore that in  
10 that - for most applications. That is okay within the  
11 range of uncertainties.

12 Where I am headed with this is, I'm trying  
13 to find out, are you getting away from kind of the  
14 underlying concepts of NUREG/CR-6595? How are - when  
15 you think about improving over that, that gets into  
16 the definition of what do you mean by improvement?  
17 What do we really mean by LERF? What is the  
18 definition?

19 And so that is what isn't clear to me is  
20 to how you decide what is an improvement, and in what  
21 sense is it an improvement? Because you are not  
22 going through release saying, do I get early  
23 fatalities or do I not?

24 DR. LEHNER: Well, I think the improvement  
25 is that we're taking more plant-specific factors into

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1 account as to would you actually get to that failure  
2 mode, would you actually get to that bypass? And if  
3 you do, are there mitigating factors that you could  
4 claim would prevent you from having a release large  
5 enough to be a LERF.

6 MEMBER DENNING: So what's the likelihood  
7 of really getting that failure mode?

8 DR. LEHNER: That's right.

9 MEMBER DENNING: And you stylize what the  
10 failure modes are that are associated with early  
11 fatalities, in a sense. But you are going to do a  
12 better job of trying to estimate the - or represent  
13 the probability that you will get it?

14 DR. LEHNER: Exactly. Rather than have  
15 one event tree for all large dry containments, we have  
16 plant-specific information that allows you to get a  
17 more precise estimate.

18 MEMBER DENNING: Thank you.

19 DR. LEHNER: And of course as I mentioned,  
20 we want to link the Level 1 and 2 information, as Eli  
21 mentioned as well, directly, so you can trace the LERF  
22 contributors not just back to the plant damage states,  
23 or the containment failure modes, but to the  
24 initiating events, or any other Level 1 failures that  
25 may play a role.

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1           We want to provide easy adaptation at  
2 other plants in the group, but I'll discuss that more  
3 in the next slide what I mean by that, because we  
4 haven't talked about the plant groupings yet.

5           We also want to construct the models in a  
6 way that you can, if it is so desired at a later date,  
7 that you can expand them to actual Level 2 models so  
8 that you can calculate late failures, not just the  
9 LERF portion.

10           MEMBER KRESS: Let me ask you, is every  
11 failure that is not an early failure a late failure?

12           DR. LEHNER: Well, in terms of --

13           MEMBER KRESS: I want to understand what  
14 the definition of a late failure is. My impression is  
15 that every one that is not an early is a late.

16           MEMBER DENNING: I think that is true,  
17 right?

18           DR. LEHNER: That is true, yes.

19           MEMBER KRESS: So you really get all the  
20 failures in there?

21           DR. LEHNER: It would be a complete Level  
22 2.

23           MEMBER KRESS: And you could call it a  
24 conditional containment failure if you added them up  
25 right?

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1 DR. LEHNER: Yes.

2 MEMBER KRESS: Okay.

3 DR. LEHNER: Whether those late failures  
4 lead to a significant release is another story.

5 MEMBER KRESS: This Committee as, as Rich  
6 said, I don't like it much either, we are leaning more  
7 towards liking the old conditional containment failure  
8 probability for a variety of reasons.

9 It looks to me like that would get you  
10 there.

11 MEMBER DENNING: But recognize that this  
12 Committee never acts as one, and believes the same  
13 thing.

14 MEMBER KRESS: I didn't speak for the  
15 Committee. I never do.

16 DR. LEHNER: And then finally I mentioned  
17 the user-friendly interface, which of course is  
18 actually done by the Idaho National Laboratory. But  
19 we've made some suggestions there in terms of what a  
20 LERF - someone who using LERF might want to see there.

21 Okay, now I mentioned plant groups.  
22 Unlike the Level 1 models, we don't intend to have an  
23 individual LERF model for every plant. Instead we  
24 have as you can see here about 10 groups where we  
25 would develop a LERF model for what we call a lead

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1 plant, a specific plant in that group, and then that  
2 lead plant model can be easily adaptable to the other  
3 plants in the group.

4 And this just shows the lead plan group,  
5 or the grouping that we have. We have the five large  
6 dry models, that include the Westinghouse 2, 3 and 4  
7 loops; the Combustion Engineering, 2 loops; and the  
8 B&W 2 loops.

9 We have an ice condenser model. We have  
10 two Mark I models. One was an isolation condenser,  
11 and one was a RCIC system.

12 And then a Mark II and a Mark III model.

13 So again as Eli mentioned earlier,  
14 currently we've developed a model for a Westinghouse  
15 PWR 4 loop, a BWR 4 with RCIC that has a Mark I  
16 containment; and a PWR with an ice condenser  
17 containment.

18 And when I say these models are completed,  
19 they've undergone internal review by us as developers;  
20 they've undergone NRC review; they have not yet been  
21 benchmarked against utility models, so that is still  
22 a step to be carried out, and we certainly intend on  
23 doing that.

24 This just shows you this idea of having a  
25 seamless model with Level 1.

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1 CHAIRMAN APOSTOLAKIS: Can we have a one-  
2 page picture of this and the next one? Or magnifying  
3 glasses one way or the other.

4 MEMBER DENNING: I think we would like to  
5 get copies too.

6 DR. LEHNER: All we're trying to  
7 illustrate here is that in the usual - the most common  
8 analysis, you go through the Level 1, wind up with  
9 some core damage states that you then use a bridge of  
10 entry to fill in some missing information that you  
11 need for Level 2 analysis and get plant damage states.  
12 And then these plant damage states actually act as the  
13 initiators for --

14 CHAIRMAN APOSTOLAKIS: It's best to point  
15 to the screen, John, or do something, use the cursor  
16 there.

17 DR. LEHNER: Does this work?

18 CHAIRMAN APOSTOLAKIS: Yes, start from the  
19 beginning.

20 DR. LEHNER: Okay. So all we're trying to  
21 illustrate here is that if you have the Level 1  
22 analysis here, which gives you some core damage  
23 states, and then what is usually done is that you then  
24 use a bridge of entry, which is this vertical portion  
25 of the diagram here. The Level 1 information does not

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1 necessarily give you all the parameters you need for  
2 your Level 2 progression.

3 So the bridge of entry then gives you some  
4 additional initial conditions for your Level 2  
5 analysis. And then what is usually done --

6 CHAIRMAN APOSTOLAKIS: Can you read the  
7 labels out of the boxes, on the bridge of entry?

8 DR. LEHNER: Oh, okay. Yes, the bridge of  
9 entry says, core damage states here, then this says  
10 additional level one system status, so in other words  
11 you get the information that is not already in this  
12 Level 1 tree, or Level 1 system --

13 CHAIRMAN APOSTOLAKIS: Such as? An  
14 example of that?

15 DR. LEHNER: Okay, well, Level 1 systems,  
16 I guess containment sprays, since that is what they're  
17 tied to, the injection systems, for instance, what  
18 would be the status? Level 1 you don't care what the  
19 status is.

20 CHAIRMAN APOSTOLAKIS: Containment spray?  
21 What did you just say?

22 MR. CHEOK: The containment spray system.

23 CHAIRMAN APOSTOLAKIS: Yeah, what about  
24 it?

25 MR. CHEOK: That in a Level 1 analysis,

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1 you would not care what the status is of the  
2 containment spray system. So when you get to the core  
3 damage state, it is not necessarily an explicit  
4 status of the containment spray system at that point.

5 CHAIRMAN APOSTOLAKIS: You don't care at  
6 Level 1?

7 MR. CHEOK: Right.

8 MEMBER DENNING: You don't care what the  
9 spray is going, unless you had some tie back to a  
10 failure before core damage.

11 MR. CHEOK: The containment sprays would  
12 be important in things like a large LOCAs, but for  
13 transients, the containment sprays would only be  
14 important in the Level 2 space and lower space.

15 CHAIRMAN APOSTOLAKIS: For large LOCAs, it  
16 would be important, right? In Level 1?

17 MR. CHEOK: It could be important, that's  
18 correct. So they will be in those Level 1 entries.

19 DR. LEHNER: In some cases there will be.

20 CHAIRMAN APOSTOLAKIS: Yes.

21 DR. LEHNER: Sorry. But not in many cases  
22 - well -

23 MEMBER KRESS: What are some examples of  
24 core damage states?

25 DR. LEHNER: Well, these are just - by

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1 core damage states I don't mean - I don't things like  
2 core vulnerable or things like that. These are all  
3 core damage states. It just means that the systems  
4 that have failed to get you there are different,  
5 different end states. That's all I mean by core  
6 damage.

7 MEMBER DENNING: It is just the end states  
8 of the Level 1 PRA?

9 DR. LEHNER: Yes, just the end states of  
10 a Level 1 PRA.

11 MR. CHEOK: I think all John is trying to  
12 say is, if you look at the event trees from yesterday,  
13 we either had core melts or okays.

14 DR. LEHNER: So - and he's referring to  
15 the core melts. So how you got to the core melt, and  
16 you carry over that information to the plant damage  
17 state. But as I said, that information may not be  
18 totally complete for what you need for a Level 2  
19 analysis, so that's where this bridge tree comes in.

20 MEMBER DENNING: Now the bridge tree, is  
21 that a single tree? Or a main conceptual, it doesn't  
22 make any difference at all anyway. But you happened  
23 to break it into two pieces with additional Level 1  
24 system status, and Level 2 system status?

25 DR. LEHNER: It's a single tree.

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1 CHAIRMAN APOSTOLAKIS: But it's a  
2 standardized tree? Or is it unique to the plan damage  
3 state?

4 DR. LEHNER: It's different for different  
5 models, I mean for different plants. Because there  
6 are different systems involved in the status of the  
7 systems.

8 CHAIRMAN APOSTOLAKIS: Absolutely.

9 DR. LEHNER: So yes.

10 CHAIRMAN APOSTOLAKIS: But those are for  
11 different plant damage states, I guess. You have  
12 different branches.

13 MEMBER DENNING: I think he meant for core  
14 damage states. Is that what you meant? For different  
15 core damage states, do you have a common event tree?

16 DR. LEHNER: Yes, I mean it's - basically  
17 - well, you are actually working a little bit  
18 backwards here. You want to know what are the  
19 important system states that are going to be important  
20 in your accident regression.

21 So then you are going to see, what do I  
22 need here to fill in my plant damage information. And  
23 your bridge tree is going to ask those questions that  
24 you need to get those damage states.

25 I have an example --

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1 CHAIRMAN APOSTOLAKIS: I think plant  
2 damage states and core damage states are the same  
3 thing.

4 DR. LEHNER: Well, not quite. They're  
5 close, but --

6 CHAIRMAN APOSTOLAKIS: They are not the  
7 same set. I mean, no, some users use the terminology,  
8 plant damage states, and others core damage states.

9 DR. LEHNER: That's true.

10 MEMBER DENNING: But here he has made a  
11 distinction. Here he does separate it.

12 CHAIRMAN APOSTOLAKIS: Well, some of the  
13 plant damage states do not lead to LERF, I guess. But  
14 a lot of them do. You really have to have serious  
15 core damage, don't you?

16 DR. LEHNER: In a sense, the plant damage  
17 states are like the initiators here. In other words,  
18 they are a snapshot of the plant at the time of core  
19 damage that you start with to how the accident  
20 progression --

21 CHAIRMAN APOSTOLAKIS: So you are making  
22 a distinction then? You are saying the output of the  
23 bridge event tree is the plant damage state?

24 DR. LEHNER: Yes.

25 CHAIRMAN APOSTOLAKIS: Fine, as long as

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1 you make it clear.

2 DR. LEHNER: The distinction is simply  
3 that I don't have all the information here for my  
4 accident progression, so I used a bridge tree to get  
5 that information.

6 CHAIRMAN APOSTOLAKIS: Okay, that's fine.

7 MEMBER BONACA: So you may have more than  
8 one plant damage state for each core damage state?

9 DR. LEHNER: You may, but in general you  
10 will collapse the core damage states into plant damage  
11 states.

12 MEMBER BONACA: I understand. But I'm  
13 saying that you have the potential for that.

14 DR. LEHNER: Yes, certainly a particular  
15 core damage state may fit into several plant damage  
16 states. But a particular core damage state may fit  
17 into several plant damage states. And then a number  
18 of core damage states could be fit into a single plant  
19 damage state.

20 And in the scheme that we have, we filled  
21 the core with bridge tree, but we're attaching the  
22 bridge tree directly to the Level 1 tree, and the  
23 containment event tree directly to the bridge tree so  
24 that we have one continuous tree structure if you  
25 like.

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1           So we've got to pinch down at this point  
2 and start over with plant damage states, we continue  
3 from initiators all the way through.

4           CHAIRMAN APOSTOLAKIS: I don't understand  
5 now. What is the difference between A and B? Oh, the  
6 large event trees are different with a bridge.

7           DR. LEHNER: Well, generally, what's done  
8 is that you bend the core damage states into plant  
9 damage states, and then you start your Level 2  
10 analysis with plant damage states.

11           So you don't explicitly carry all this  
12 information over. You collect it and start over  
13 again.

14           What we're doing is, we just keep going  
15 with a continuous tree so we can have all the  
16 information.

17           CHAIRMAN APOSTOLAKIS: I thought that's  
18 what was done in 1150?

19           DR. LEHNER: No.

20           CHAIRMAN APOSTOLAKIS: No? I remember  
21 them insisting that this was an innovative thing they  
22 did, that they did not collapse the sequences.

23           DR. LEHNER: No, 1150, this was definitely  
24 a pinch point in the 1150, where you didn't --

25           CHAIRMAN APOSTOLAKIS: John, I can show

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1 you the tapes. It is really irrelevant to what you  
2 are saying, but I was impressed when they said that.  
3 And that's why I remember it. They said, we are going  
4 all the way through.

5 DR. LEHNER: As a matter of fact, 1150,  
6 there is another pinch point here where you then  
7 collect your source terms and here your Level 3 --

8 CHAIRMAN APOSTOLAKIS: Anyway, it's a  
9 detail. You do it this way.

10 MEMBER DENNING: Surrogate source terms  
11 are qualitative?

12 DR. LEHNER: Surrogate source terms, you  
13 really need LERF or no LERF.

14 CHAIRMAN APOSTOLAKIS: So that's the last  
15 box, right?

16 DR. LEHNER: Yes.

17 CHAIRMAN APOSTOLAKIS: So you could have  
18 omitted it? What you really want is LERF?

19 DR. LEHNER: LERF, yes, it should really  
20 say LERF or no LERF basically.

21 CHAIRMAN APOSTOLAKIS: Okay, LERF or no  
22 LERF doesn't make sense.

23 DR. LEHNER: LERF and everything else.

24 CHAIRMAN APOSTOLAKIS: Large area release  
25 frequency, yes or no. I mean come on.

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1 DR. LEHNER: You'll see that no LERF in a  
2 bunch of places.

3 Okay, this just gives you a little bit  
4 more insight into what we mean by these plant damage  
5 state parameters. This is for a ice condenser model,  
6 where you would want to know at the beginning of the  
7 Level 2 analysis what is the status of your RCS  
8 pressure. What is the secondary site pressure?  
9 What's the power status? What is the status of  
10 main/auxiliary feedwater? The RCP seal status, and of  
11 course, whether there is a bypass or not.

12 CHAIRMAN APOSTOLAKIS: So there are only  
13 six of them now?

14 DR. LEHNER: For this - this is for the  
15 ice condenser model, yes.

16 So because we've connected the models in  
17 the way we have, we can trace the results. In other  
18 words, how did we get to LERF? By containment  
19 failures modes, or plant damage states, which are the  
20 usual Level 2 parameters you can trace things by. But  
21 you can also trace it by an initiating event, or any  
22 Level 1 parameter really.

23 And the next few slides show some of the  
24 results for the ice condenser model, where this first  
25 one just shows you the total core damage frequency,

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1 and what percentage of that ends in a LERF endstate.

2 And of course as I said, we keep track of  
3 what we call no-LERF here, because we don't throw  
4 those out for two reasons. One is, we want to make  
5 sure that we've captured the total - we've accounted  
6 for the total core damage frequency, but also, as I  
7 said, if we expand these models to be complete Level  
8 2 models, then obviously we want to keep these  
9 sequences in the model so we can develop --

10 CHAIRMAN APOSTOLAKIS: I really think you  
11 should say, no LER, no release. No frequency doesn't  
12 mean anything.

13 DR. LEHNER: That's true.

14 CHAIRMAN APOSTOLAKIS: I'm glad you agree,  
15 John. I mean no LERF. It's really no LER.

16 DR. LEHNER: I can't argue with that.

17 MEMBER DENNING: Now you haven't talked  
18 about uncertainties, and can you?

19 DR. LEHNER: Yes. Very briefly. These  
20 are point estimate models. So you can do sensitivity  
21 studies with them varying parameters. But currently  
22 there is no uncertainty being propagated in the model.

23 CHAIRMAN APOSTOLAKIS: So these are point  
24 models?

25 DR. LEHNER: These are point estimates.

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1 MEMBER DENNING: Well, we know how well we  
2 understand these Level 2 things. And I guess there is  
3 just no uncertainty about it.

4 MEMBER KRESS: Yes, we can pinpoint it.

5 MEMBER DENNING: It does raise a real  
6 question in my mind, really, when I look at what  
7 utilities submit and stuff like that and wonder what  
8 is really behind them.

9 There is a tremendous amount of  
10 uncertainty here, and the question is, should we be  
11 making a better attempt to characterize it.

12 DR. LEHNER: Well, I think that is  
13 certainly something to be considered.

14 MEMBER DENNING: And of course part of it  
15 is just again, what do we mean by LERF? What really  
16 is the definition? And if you get into these  
17 questions of - if you just said, 20 percent release of  
18 iodine, even there there is a tremendous uncertainty  
19 among these things, and do we - and should we be  
20 attempting to capture that in LERF?

21 And the problem that I see is that if you  
22 did try to do it, that the NRC's results would be so  
23 different from the results that are going to come from  
24 the applicant that you can't put the two together.

25 DR. LEHNER: Well, it would be a huge

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1 uncertainty band.

2 MEMBER DENNING: These huge uncertainty  
3 bands and stuff, and the impact that it might have on  
4 your LERFs, I'm not sure that you can then really  
5 compare the apples and apples. And so maybe it is  
6 better to go with a point estimate on LERF. Is that  
7 a horrible thing to say?

8 CHAIRMAN APOSTOLAKIS: Yes.

9 MEMBER DENNING: Good, then I'm glad I  
10 said it.

11 CHAIRMAN APOSTOLAKIS: But I'm sure they  
12 are going to develop a SPAR dash LERF that would  
13 eliminate all modern uncertainty, like they did with  
14 SPAR-H.

15 MEMBER DENNING: Mike, do you have any  
16 comments here as to where they ought to go, or should  
17 they be going anyplace, on uncertainty?

18 CHAIRMAN APOSTOLAKIS: Well, but there is  
19 fuzziness also in the definition of core damage; it's  
20 not just LERF. But I think if there are large area  
21 releases, I remember the definition in 1.174, or the  
22 interpretation, was large unscrubbed releases before  
23 evacuation. That's what it says.

24 DR. LEHNER: Well, in a way it's sort of  
25 - I think it says a large release that will cause an

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1 early fatality before evacuation. In other words --

2 CHAIRMAN APOSTOLAKIS: I don't remember it  
3 saying fatality. It says, unscrubbed, large, before  
4 evacuation. But again, that doesn't get away from  
5 Rich's point. I mean what is large?

6 DR. LEHNER: The definition in the ASME  
7 standard --

8 CHAIRMAN APOSTOLAKIS: But core damage I  
9 think has the same problem. I think we are talking  
10 about, what, 5 to 10 percent release of noble gases,  
11 is that the definition? And being unable to maintain  
12 coolable geometry, a LERF.

13 But uncertainties here are certainly much  
14 more important than Level 1.

15 DR. LEHNER: Well, they are much larger,  
16 certainly.

17 CHAIRMAN APOSTOLAKIS: Much larger.

18 DR. LEHNER: Yes.

19 CHAIRMAN APOSTOLAKIS: So I don't know a  
20 point estimate of  $3.6E-6$  means. I mean could it be 10  
21 to the minus 5? Could it 510 to the minus 5?

22 DR. LEHNER: As I said, you can do  
23 sensitivity studies --

24 CHAIRMAN APOSTOLAKIS: Don't do  
25 sensitivity instead of 170. Why do uncertainty? It's

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1 a tough problem.

2 DR. LEHNER: It is a tough problem.

3 CHAIRMAN APOSTOLAKIS: It's a tough  
4 problem, there is no question about it. But  
5 sensitivity studies will never save you.

6 You see the fundamental problem with  
7 sensitivity is that you start changing things, until  
8 you consider a case where you violate something. And  
9 then you back off without - oh, this is unreasonable.  
10 I mean give us some uncertainty.

11 I'm not talking about you. There is a  
12 fundamental problem with sensitivity analysis. These  
13 are relics of the old way of doing business, when  
14 engineers did not consider uncertainty, and they  
15 changed things a little bit to see what happens.

16 Now we have a very different environment.  
17 Now we are working with probability curves.

18 So I know you have big problems ahead of  
19 you, but you have to keep in mind that uncertainties  
20 here somehow have to be handled.

21 MEMBER DENNING: So if we look at  
22 uncertainties in LERFs that would be presented here,  
23 they really all come from the Level 1 piece; is that  
24 a true statement, or is that not true?

25 DR. LEHNER: Yes. You mean if you looked

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1 at your LERF results here, and you included the  
2 uncertainty in the Level 1, there is no uncertainty  
3 included in the Level 2.

4 CHAIRMAN APOSTOLAKIS: The SPAR Level 1  
5 already has the capability of doing that.

6 MEMBER DENNING: Oh, definitely.

7 DR. LEHNER: There wouldn't be any  
8 uncertainties at the Level 2 phenomena.

9 CHAIRMAN APOSTOLAKIS: Very good.

10 DR. LEHNER: And then this just shows some  
11 more results. This is by containment failure mode.  
12 This is all for the ice condenser model, where we have  
13 the - really the only significant failure mode is the  
14 hydrogen burn. The rest are really various types of  
15 bypass scenarios.

16 Skin tube rupture as an initiator,  
17 interfacing systems LOCA.

18 CHAIRMAN APOSTOLAKIS: Why didn't you put  
19 percentages there?

20 DR. LEHNER: Why didn't we put  
21 percentages?

22 CHAIRMAN APOSTOLAKIS: Yes, the hydrogen  
23 burn seems to be a little more than 50 percent. And  
24 steam generator tube rupture is what? 30, 40 percent?

25 DR. LEHNER: I don't have the actual

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1 numbers in front of me, but if you are interested we  
2 can certainly provide those.

3 MEMBER DENNING: No, we don't need  
4 numbers. It's just an example, right?

5 CHAIRMAN APOSTOLAKIS: And the interfacing  
6 system LOCA, is which one? You used two whites.

7 DR. LEHNER: I'm sorry? Oh, it looks  
8 better on the computer screen that it does up there.  
9 This is the flow chart.

10 CHAIRMAN APOSTOLAKIS: Wasn't that the  
11 major finding of the reactor safety study that this is  
12 a major failure mode? It doesn't look like it's very  
13 important here.

14 DR. LEHNER: Which?

15 CHAIRMAN APOSTOLAKIS: ISLOCA. You are  
16 bypassing containment, right?

17 DR. LEHNER: Yes. Well, I mean these,  
18 these are all really bypasses here. The induced - the  
19 steam generator tube rupture is an initiating event.  
20 The ISLOCA, this is mainly for the RHR system, and  
21 the induce steam generator tube rupture.

22 MEMBER DENNING: Which we didn't even know  
23 about in NUREG-1150.

24 CHAIRMAN APOSTOLAKIS: What is it you  
25 didn't know?

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1 MEMBER DENNING: Induced stem generator  
2 tube rupture. I don't think we did that.

3 DR. LEHNER: And then this is broken up by  
4 initiating event where loss of off-site power is  
5 obviously the - that includes station blackout, if the  
6 water is a contributor, steam generator tube rupture,  
7 initiator. As I said, the ISLOCA initiating the RHR  
8 system, and then the others is just a small portion  
9 over here. This is the ISLOCA.

10 MEMBER DENNING: But that's driven by the  
11 frequency of those initiating - of those point damage  
12 - of those core damage states, right?

13 DR. LEHNER: Yes. But these are the  
14 actual initiating events in a Level 1. Yes, sure.  
15 And then this is just breaking out the station  
16 blackout contributions. This is the station blackout  
17 that was part of the loss of offsite power. And the  
18 slow station blackout, the fast station blackout, and  
19 then all contributors to LERF.

20 So station blackout accounts for a little  
21 more than 50 percent of all the LERF end states.

22 MEMBER DENNING: Was that the hydrogen  
23 burns?

24 DR. LEHNER: Well, yes. I mean the  
25 station blackout means the igniters are not working.

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1 And so that's when your containment is vulnerable to  
2 the hydrogen burns, that's right.

3 CHAIRMAN APOSTOLAKIS: Good.

4 DR. LEHNER: And then this just shows,  
5 because we go all the way back to the initiating  
6 events, we can look at the importance of various basic  
7 events, both from a Level 1 and the Level 2, so this  
8 just gives you a list here of Fussell-Vesely  
9 importance for some Level 2 events, and some Level 1  
10 events.

11 CHAIRMAN APOSTOLAKIS: So you know, there  
12 is quite a number of them that have the same Fussell-  
13 Vesely.

14 DR. LEHNER: Yes.

15 CHAIRMAN APOSTOLAKIS: Did you all do RAW,  
16 the risk achievement worth?

17 DR. LEHNER: We didn't do it --

18 CHAIRMAN APOSTOLAKIS: But you can do it?

19 DR. LEHNER: We could do it, yeah. We do  
20 any of the important measures for LERF that we do for  
21 CDF.

22 CHAIRMAN APOSTOLAKIS: Are you going to do  
23 Birnbaum also?

24 DR. LEHNER: If you like.

25 Okay, so the current status is that we

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1 completed the three models I've talked about. They  
2 still need to be benchmarked against the utility  
3 models.

4 And currently we have a Mark III model  
5 which is almost completed, and we're starting work on  
6 the Mark II model.

7 MEMBER DENNING: And you haven't told us  
8 when everything is going to be done?

9 DR. LEHNER: Everything should be done in  
10 2008.

11 MEMBER DENNING: Isn't that a long time in  
12 the future?

13 CHAIRMAN APOSTOLAKIS: It's a fuzzy  
14 definition of a long time.

15 MEMBER DENNING: But right now, when we  
16 use SPAR in these studies, we also make an estimate of  
17 LERF, don't we? It's just that we don't use this  
18 consistent model. Or in the various applications -  
19 I'm trying to remember. In the station blackout study  
20 that was there, anything done on LERF?

21 MR. CHEOK: On specific studies when LERF  
22 is important the staff will do it on a case by case  
23 basis, translating CDFs to LERFs, using mostly 6595.

24 MEMBER DENNING: Got you, thanks.

25 DR. LEHNER: Now on this last slide, I

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1 just wanted to mention that one of the tasks we're  
2 undertaking this year is to develop this more  
3 automated Level 1 LERF interface, because we're  
4 attaching our LERF model directly to a Level 1 model,  
5 and the Level 1 models are still being updated.

6 Then a user then has to - if one model  
7 changes, the LERF model is no longer good to use with  
8 that changed Level 1 model. So we're trying to get  
9 around that by basically looking at the Level 1  
10 models, grouping them in ways that they have similar  
11 structures that are close enough within a group so  
12 that we can do what we call automated Level 1 LERF  
13 interface, so that if there are some slight changes in  
14 the Level 1 model, it does not affect - the LERF  
15 model, you don't have to go back and redo the LERF  
16 model, that that would be automatically taken care of.  
17 But that's really the last slide I had.

18 MEMBER DENNING: Any major comment?

19 CHAIRMAN APOSTOLAKIS: You have one more  
20 don't you?

21 DR. LEHNER: I don't think so.

22 CHAIRMAN APOSTOLAKIS: No, you don't.

23 Thank you very much.

24 Are there any questions?

25 MEMBER DENNING: I think this is

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1 absolutely right on. I think this is exactly what  
2 ought to be done as an add-on to the SPAR.

3 CHAIRMAN APOSTOLAKIS: Wonderful. Thank  
4 you very much, gentlemen.

5 So at this point we'll take a break until  
6 10:20.

7 (Whereupon, at 10:00 a.m. the proceeding  
8 of the above-entitled event went off the record, to  
9 return on the record at 10:23 a.m.)

10 CHAIRMAN APOSTOLAKIS: Okay, next is Mr.  
11 Mitman.

12 Go ahead.

13 MR. MITMAN: Good morning. My name is  
14 Jeff Mitman. I work for research in the OERB branch.  
15 First thing I wanted to do is hand out a set of large  
16 slides.

17 CHAIRMAN APOSTOLAKIS: This is called  
18 learning from experience.

19 MR. MITMAN: Going to talk about the SPAR  
20 models in the low power shutdown area. These models  
21 were developed by INL for research, and we will go  
22 through and first we'll look at an overview of what  
23 the project is about.

24 The objective of the project is to  
25 develop low power shutdown models to use in event

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1 assessment and support risk informed applications.

2 The goal is to develop a set of plant  
3 models covering all plant classes. That is the  
4 initial step we're working on at this point.

5 The approach is to build on the existing  
6 '72 models, the Rev. 3 internal events model, in  
7 conjunction with some low power shutdown templates  
8 that we have developed.

9 It's got all the standard features of a  
10 typical PRA model, event trees, fault trees. For low  
11 power shutdown, we've had that in plant operating  
12 states, which I'll talk a little bit more about.

13 Initiating event frequencies,  
14 reliability/unavailability data, and HRA/operator  
15 actions.

16 Now the way the models are built is, we  
17 develop special event trees for low power shutdown,  
18 and then as often as possible we link into the  
19 existing models, the internal events models.

20 So we link in the fault trees, the  
21 reliability/unavailability data as applicable, HRA and  
22 other operator actions.

23 MR. CHOKSHI: These models presume you  
24 know the states that the plant is in?

25 MR. MITMAN: The models are structured to

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1 calculate an average outage CDF.

2 MR. CHOKSHI: And you get that average by  
3 what, going back in time and seeing what has happened  
4 with outages before?

5 MR. MITMAN: Well, the models are an  
6 outgrowth of new Reg CRs on Surrey and Grand Gulf that  
7 were doing in the early '90s.

8 MR. CHOKSHI: I remember those.

9 MR. MITMAN: Published in '94.

10 MR. CHOKSHI: Yes, I remember those.

11 MR. MITMAN: And in there they calculated,  
12 they came up with what they considered to be an  
13 average outage.

14 The average outage has evolved. Outage  
15 times have come down significantly since that time  
16 period. So what we have got is a new baseline average  
17 outage. But it is an average outage. It is not a  
18 plant-specific average; it's an industry average. And  
19 it's averaging the POS durations, the equipment  
20 availability/unreliability, everything across the  
21 spectrum.

22 Does that answer the question?

23 MR. CHOKSHI: Yes, I understand what you  
24 are doing.

25 MR. MITMAN: So to date we've got 11

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1 models completed, and we've completed QA on all the  
2 models to different degrees, and we've done onsite QA  
3 reviews of four of the models.

4 The models that have been completed are  
5 listed here. It's 11 models covering, if I'm counting  
6 right, 19 reactors. So almost 20 percent of the  
7 fleet.

8 The scope of the models for PWRs we're  
9 doing hot shutdown, cold shutdown and refueling.

10 For the BWR models we're doing cold  
11 shutdown and refueling.

12 Initiating events covered: There are  
13 really three groups here. There are LOCAs,  
14 traditional LOCA pipe break which leads to loss of  
15 inventory impacting decay heat removal.

16 You also have another class of LOCA called  
17 an HLOCA which is a drain down event which also will  
18 impact, cause a loss of inventory potentially  
19 impacting decay heat removal.

20 We've got a LOOP initiating event, and  
21 then two that affect decay heat removal capabilities  
22 directly. That is the loss of shutdown cooling, and  
23 the shutdown cooling system isolation. Both of those  
24 will cause a loss of decay heat removal.

25 Things that are not in the model, and I'll

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1 talk a little bit about the reasons. LTOP is not in  
2 the model. That is because the probability of having  
3 a vessel or a pipe rupture is very small, so that part  
4 of LTOP has been excluded.

5 Likewise reactivity events are excluded,  
6 again, because of very low probabilities.

7 Spent fuel pool is not currently in the  
8 scope.

9 MEMBER DENNING: Implication that it will  
10 be in the future?

11 MR. MITMAN: Spent fuel pool?

12 MEMBER DENNING: Yes.

13 MR. CHEOK: We haven't really thought  
14 about it, to tell you the truth. We will include it,  
15 I guess, if the agency has a big need for it.

16 CHAIRMAN APOSTOLAKIS: But the others  
17 would be included?

18 MR. MITMAN: LTOP and reactivity?

19 CHAIRMAN APOSTOLAKIS: Yes. Oh, it's low  
20 probability you saw.

21 MR. MITMAN: They are very low  
22 probabilities.

23 MEMBER KRESS: On the spent fuel pool, it  
24 doesn't limit itself to just low power shutdown risk.  
25 It ought to be the whole thing. It looks to me like

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1 it's be almost a separate PRA that you do and just add  
2 it in at the end.

3 MR. MITMAN: The links back to the  
4 internal events model are fairly weak in a lot of  
5 ways. I mean some of the systems are shared between  
6 the two, but there are also a lot of independent  
7 systems.

8 MEMBER KRESS: External events are  
9 currently excluded?

10 MEMBER DENNING: Again, it's a current  
11 question. Fire obviously is something of concern, and  
12 I suspect it's not going to be in the other fire, you  
13 know, in the external events PRA. So it seemed  
14 logical to include fire here.

15 And I've never seen flooding. I've never  
16 seen what the impact of flooding is on these  
17 conditions. But it's another thing to consider.

18 MR. MITMAN: It's another place to  
19 consider. To have complete models you'd want that,  
20 but that's later on down the road.

21 MR. CHEOK: I think eventually external  
22 events and Level 2 will be included in the model. So  
23 you're right, if you look at initiating frequencies  
24 for fires and floods, they tend to be higher during  
25 low power shutdown modes.

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1 MR. CHEOK: It seems to me like if you are  
2 expecting a tornado or a hurricane, you might be  
3 tempted to shut down the reactor, so simultaneous  
4 events of having a hurricane and a tornado, and being  
5 at low power shutdown. It seemed to be highly likely.

6 MR. CHEOK: But I guess one reason we do  
7 that though is that we have already predetermined, I  
8 guess, that it's less risky for the plant to be shut  
9 down during a hurricane or tornado, as opposed to  
10 being at power.

11 But you are right, we still need to  
12 continue to evaluate the risk as the event is  
13 happening.

14 MR. MITMAN: And if you are in an outage,  
15 you - in some ways you can be more vulnerable to  
16 internal and external events. Internal flooding, for  
17 instance, you've got barriers removed.

18 Likewise external events, you've got  
19 transformers out of service for maintenance; you don't  
20 have your main generator as a source of power. So you  
21 can actually be more vulnerable sometimes during low  
22 power shutdown.

23 MEMBER KRESS: You just assume that the  
24 conditional probability of the LERF is one?

25 MR. MITMAN: Here, we don't go that far

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1 even. In BWR Mark I/Mark II containment, the  
2 containment is open while you are moving fuel. So our  
3 primary containment is open while you are moving fuel.

4 MEMBER DENNING: It ought to be a zero,  
5 not a one.

6 MR. MITMAN: As we talked about earlier,  
7 the models build on the BWR and PWR templates, which  
8 again, build on top of the Grand Gulf NUREG/CR-6143  
9 and the Surrey NUREG/CR-6144 studies.

10 CHAIRMAN APOSTOLAKIS: These are 1150?

11 MR. MITMAN: Pardon me?

12 CHAIRMAN APOSTOLAKIS: These are from  
13 1150? Oh, later. They came later, yeah.

14 MR. MITMAN: These studies were published  
15 in '94, I believe.

16 Decay heat levels are typically binned in  
17 four time windows. Typical binning is, as I've shown  
18 here, a little bit different for both BWRs and PWRs.

19 We use weighted average fractions for time  
20 spent in each POS. And the end state that is  
21 evaluated is core damage.

22 The next series of slides, and I've given  
23 you the handouts, are the - I want to go through a  
24 little bit on the event trees, kind of step you  
25 through the overall layout of the model and how things

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1 are described.

2 The first event tree is really an event  
3 tree which selects which POS you're in. You come in  
4 initially with a shutdown question. This is a BWR  
5 model, so we're asking which of the two modes we  
6 evaluate, Mode 4 or Mode 5.

7 We're asking a question about timeframe,  
8 and the timeframe is there to determine if it's before  
9 you've removed spent fuel or after, because the decay  
10 heat levels are different between before and after  
11 reloading fresh fuel.

12 The next question is a question about  
13 pressure. Now we're in cold shutdown, so you might  
14 ask why we're worried about pressure. Well, there is  
15 one state down here where we have high pressure, here,  
16 which is after you've done the reloading of the new  
17 fuel, you've buttoned up and you're doing the vessel  
18 hydro, so there is one point in there where you're at  
19 high pressure.

20 And then you ask a question about what  
21 your water level is in the reactor. Is it normal? Is  
22 it immediately below the main steam lines? Or is the  
23 cavity flooded, the cavity connected to the spent fuel  
24 pool.

25 That is the last question.

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1 Over here we end up with the POS's that we  
2 come out at, and their frequencies in the final  
3 column.

4 Now the example that I'm going to use is,  
5 we're going to come out through the first POS here,  
6 which is cold shutdown. Before refueling we've got  
7 low pressure and water level is normal.

8 CHAIRMAN APOSTOLAKIS: Would you explain  
9 to me the frequencies?

10 MR. MITMAN: The frequencies are inputs  
11 into the model.

12 CHAIRMAN APOSTOLAKIS: I mean this is -  
13 look at the second one, it's 1.125 ten to the minus  
14 one. This is a frequency of what?

15 MR. MITMAN: This is the frequency that  
16 the plant is in that POS during the outage. So if you  
17 sum these, they will add up to approximately one, and  
18 they are the fractions - you can think of them as  
19 split fractions --

20 CHAIRMAN APOSTOLAKIS: Ah, okay, so  
21 they're conditional. Are they conditional?

22 MR. MITMAN: They are the fraction of time  
23 that you are in the POS during the outage.

24 CHAIRMAN APOSTOLAKIS: So you are in an  
25 outage, and this is the fraction of time that you will

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1 be in this POS?

2 MR. MITMAN: Yes.

3 MR. CHEOK: It's the conditional  
4 probability that the plant is in that POS, given that  
5 they are shut down.

6 CHAIRMAN APOSTOLAKIS: Yes.

7 MR. MITMAN: Let me qualify that just a  
8 little bit, that they're shut down and in a refueling  
9 outage, because there are other models for other  
10 outage types.

11 We go on to refine the POS a little bit.  
12 As I said --

13 CHAIRMAN APOSTOLAKIS: Would you remind me  
14 what Mode 4 is and Mode 5.

15 MR. MITMAN: Mode 4 is cold shutdown, and  
16 Mode 5 in a BWR is refueling. So the distinction  
17 between the two is that the head is off.

18 We come in with the initial question  
19 asking which POS we're in, and the previous event tree  
20 selected this one. Now we have a selection just on  
21 time window. And again, there are four time windows  
22 that were used. They're just basic cut times in the  
23 model, and they're used to take into consideration  
24 things such as decay heat levels, time for operator  
25 response, and success criteria.

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1           And then the final question that's asked  
2           is the traditional initiating event. And as I  
3           discussed earlier, they are the five initiators that  
4           we're looking at.

5           And then we come out of here and we come  
6           into a more traditional event tree.

7           CHAIRMAN APOSTOLAKIS: So what you have  
8           defined so far with the previous event tree, and part  
9           of this one, is the initial conditions of the  
10          accident?

11          MR. MITMAN: The initial condition of the  
12          plant.

13          CHAIRMAN APOSTOLAKIS: Okay.

14          MR. MITMAN: And then this one looks at  
15          what initiators you can have in this particular  
16          condition.

17          CHAIRMAN APOSTOLAKIS: Okay.

18          MR. MITMAN: I want to use as an  
19          illustration a loss of offsite power.

20          So we come in again with the initiator.  
21          We ask a question about the availability of onsite  
22          emergency backup power, and then a question about  
23          recovery of the offsite power during the event.

24          There are essentially two endstates that  
25          come out of here: shutdown cooling system recovery;

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1 and if we can't recovery shutdown cooling, then we  
2 have to go to a second-tier defense, which are ECCS  
3 systems.

4 CHAIRMAN APOSTOLAKIS: What do you mean by  
5 "AC Power Recovery During Shutdown"?

6 MR. MITMAN: Well, the initiator is a loss  
7 of offsite power. So the first response that you are  
8 going to have is to start the diesels, and power the  
9 four Kv buses from the diesels.

10 But you also have the possibility of  
11 recovering the lost offsite power, and that's what the  
12 second question is asking about.

13 CHAIRMAN APOSTOLAKIS: But the "during  
14 shutdown" part I don't understand. Why does it have  
15 to be during shutdown? It has to be before something  
16 bad happens. Isn't that what we're doing the event  
17 tree for the power operation?

18 MR. MITMAN: No, this is a lower power  
19 shutdown.

20 CHAIRMAN APOSTOLAKIS: I understand what  
21 it is.

22 MEMBER DENNING: But it's redundant. The  
23 term, during shutdown, is redundant. It doesn't add  
24 anything to this, because we know we're shutdown.

25 MR. MITMAN: You are correct. The whole

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1 model is based on low power shutdown.

2 CHAIRMAN APOSTOLAKIS: Shouldn't it be AC  
3 power recovery before --

4 MR. MITMAN: Field damage?

5 CHAIRMAN APOSTOLAKIS: -- field damage or  
6 core recovery or something like that?

7 MR. MITMAN: Something like that.

8 CHAIRMAN APOSTOLAKIS: Before something  
9 bad happens.

10 MR. MITMAN: Agreed, it should be. The  
11 nomenclature should be clearer.

12 The next event tree we're looking at is a  
13 recovery of RHR in traditional shutdown cooling.

14 So the first question we evaluate is, can  
15 we recovery the faulted shutdown cooling previously  
16 running RHR train? If that is not available, then we  
17 can go to the second train, see if we can recover it.

18 Then the third question is to evaluate any  
19 alternate shutdown cooling systems that might be  
20 available.

21 MEMBER DENNING: Including exotic things  
22 like fire?

23 MR. MITMAN: No, those will be evaluated  
24 down here in the ECC tree.

25 Things that you might have here, a couple

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1 of BWRs have an alternate decay heat removal systems.  
2 More traditional systems that are closer in design to  
3 a decay heat removal system versus an injection  
4 system.

5 And if we can't recover RHR, then we go to  
6 the ECCS tree. And here we get into more traditional  
7 things that you are used to seeing in a out power  
8 event.

9 Again we come in on the initiator. There  
10 is a question about depressurizing the reactor. If  
11 you're in a hydro, you have to depressurize before any  
12 low pressure systems can inject.

13 CHAIRMAN APOSTOLAKIS: And you are going  
14 to use SPAR-H for that?

15 MR. MITMAN: We're going to use SPAR-H  
16 throughout, yes.

17 MR. CHEOK: We have actually tested SPAR-H  
18 out for low power shutdown. As a matter of fact, the  
19 latest update to SPAR-H was to update it for lower  
20 power shutdown conditions.

21 MR. MITMAN: The next question is about  
22 suppression pool level, and adequacy of that for  
23 source of injection.

24 Then we go ask a question about the  
25 availability of low pressure core spray. Low pressure

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1 core injection. High pressure core spray. And  
2 finally a question about availability of fire water.

3 Essentially if you have one or more of  
4 those systems available, you are going to come out  
5 okay if you go through this whole sequence, and you  
6 can't establish anything, you are going to end up here  
7 at core damage.

8 MEMBER BONACA: Try to walk through it  
9 when it would be a success, in both cases.

10 MR. MITMAN: Yes. Let me qualify that, as  
11 long as you depressurize.

12 MEMBER BONACA: Yes.

13 MR. MITMAN: I want to talk a little bit  
14 about future plans. Our plans are to complete an  
15 additional four models during 2006. We will do our  
16 internal reviews on all the models that we develop  
17 this year, and we'll do some onsite comparisons as we  
18 can.

19 There are some issues with that. One is  
20 that availability of the PRA staff of licensees, and  
21 also, availability in the low power shutdown area  
22 we're running into issues, problems, with plants not  
23 having detailed low power shutdown models. So in some  
24 cases there is not a lot to compare it against.

25 Other thing we'll be doing this year is to

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1 develop low power shutdown internal events guideline.

2 That's all I had. Any additional  
3 questions?

4 CHAIRMAN APOSTOLAKIS: Okay, thank you.

5 MR. CHEOK: We'll have Selim no come up  
6 and give you the demonstration.

7 I guess we will have to go find him first.

8 Let me summarize while you are waiting the  
9 takeaways that I heard this morning.

10 I think what I heard was, in the external  
11 events models, that we should consider more what  
12 Sandia slash research are documents, guidance, as  
13 saying, and how we can incorporate that better into  
14 our SPAR models, or how we can consider those guidance  
15 in helping us to define better plant damage states,  
16 which would then become our initiating event  
17 frequencies in our SPAR models.

18 Right now what we are doing is using  
19 frequencies that we obtain from the licensees and  
20 damaged state definitions from the licensees. We can  
21 refine that a little better by looking at the Sandia  
22 documents.

23 Second takeaway I think I got from this is  
24 from the low power shutdown models is that perhaps we  
25 should consider things like external events and LERFs

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1 to tack on to the end of the low power shutdown  
2 models. And we will definitely consider that.

3 Whether we will come up with models to tack onto the  
4 end or not, I guess we will have to study and see if  
5 there is a reason why we should or should not have  
6 those models.

7 MEMBER DENNING: I don't think we really  
8 need to do anything in the LERF area yet at this  
9 point.

10 MEMBER KRESS: I think that can wait  
11 awhile yet.

12 I wondered about the use of the average  
13 shutdown state. You have an average for different  
14 plant types? Or you have just one average?

15 MR. MITMAN: The only way we've split it  
16 so far is to distinguish between a PWR and a BWR.

17 MEMBER KRESS: I think that is going to be  
18 highly plant specific, and you might want to think  
19 about refining that some way. I don't know how you  
20 get an average for an plant, because you don't have  
21 enough - you'd have to go back to all their past  
22 shutdowns, and then maybe extrapolate into the future.

23 MR. CHEOK: It's not easy. And you are  
24 right, it is so plant specific, and it's so shutdown  
25 specific for the same plant, they could have the same

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1 --

2 MEMBER KRESS: Yes, each shutdown is  
3 different from the previous one.

4 MR. CHEOK: Absolutely.

5 MEMBER KRESS: And so I don't know another  
6 way to deal with that yet.

7 MR. CHEOK: It's not easy. I think if you  
8 look at the two objectives of the low power shutdown  
9 models, one was to help evaluate events during low  
10 power shutdown. And that we can do.

11 MEMBER KRESS: That we can do because we  
12 know what the condition is.

13 MR. CHEOK: That is correct. We can  
14 define what it is. On the other hand if you are  
15 trying to use those models to do - to evaluate if  
16 something is more risky at power versus shutdown, then  
17 you have to make very well known what your assumptions  
18 are in terms of what you are talking about in terms of  
19 shutdown, because there is no such thing as a typical  
20 shutdown.

21 MR. STANCAKTAR: How much time do you  
22 have? How many minutes?

23 CHAIRMAN APOSTOLAKIS: You said five  
24 minutes.

25 MR. STANCAKTAR: Okay, what would you like

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1 to see specifically?

2 CHAIRMAN APOSTOLAKIS: Walk us through it.  
3 I don't know.

4 MR. STANCAKTAR: Okay, I have the models  
5 here, and documents.

6 MEMBER BONACA: You can spend more than  
7 five minutes.

8 MR. STANCAKTAR: Do you want to look at  
9 them all, or do you want to look at the documents?

10 CHAIRMAN APOSTOLAKIS: Why do we want to  
11 look at the documents?

12 MR. STANCAKTAR: Because it will give you  
13 an immediate access to some output. The other one  
14 will start from the beginning. It doesn't matter. It  
15 will all come to the same thing.

16 Okay, this is the Indian Point 3, based on  
17 Version 3.12 of SPAR. These versions keep changing.  
18 So one of our challenges is to quickly --

19 CHAIRMAN APOSTOLAKIS: 3.12?

20 MR. STANCAKTAR: 3.12. Not 312. So one  
21 of our challenges is to make sure that when we make a  
22 model and the font is changed, we don't keep forever  
23 changing two sets of models. So we want to quickly  
24 convert, and have only one set of models.

25 This is, as you can see here, three

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1 external events based on 3.12 of SPAR. It's the same  
2 software. And the starting point is here.

3 If you look at the corresponding SPAR  
4 model - these are event trees - all you will see are  
5 these event trees minus these two tornado sequences.

6 So these are internal initiating event  
7 trees, except these two tornadoes. The rest of them  
8 up here are all new scenarios as for external events.  
9 So each one is like an initiating event. It has its  
10 own event tree. And so on.

11 We are using a convention, like EQK refers  
12 to an earthquake. And FLI refers to internal  
13 flooding. FRI refers to internal fire. And TOR is  
14 tornado. High wind is here, HWD.

15 These are the scenarios I resurrected from  
16 Indian Point 3, even if some of them were attempted to  
17 be screened out. But I kept them, because their  
18 CCDP's were not really that small. I mean they were  
19 seriously close to one.

20 So in the future if we have an event where  
21 initiating our frequency is affected, the same area is  
22 affected, it might have a considerable shift in plant  
23 risk. So I include it.

24 So we don't throw out things because they  
25 are screened out necessarily.

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1           Here are main control room scenarios.  
2           Like this one is the evacuation. This one is main  
3           control room fire.

4           CHAIRMAN APOSTOLAKIS: So can you show us  
5           what you did there?

6           MR. STANCAKTAR: Oh, sure. For example,  
7           I'll show you - we'll start with that little one here,  
8           okay? Now here we call this stub event trees. They  
9           take you out from this initiating event as defined to  
10          an event tree that is already defined in the internal  
11          events.

12          So this one fire in the main control room  
13          fails nonsafety equipment. We are sending it to loss  
14          of main feedwater transient event tree with certain  
15          failures of course, additional failures and so on.

16          Originally we were copying event trees and  
17          just sticking them in here. But that really was a  
18          problem when you update in the future, and you have to  
19          come here and update a zillion event trees.

20          This way we are saving some effort,  
21          because if somebody updates the loss of main feedwater  
22          event tree, we don't have to go into 30 different  
23          places and update it.

24          MEMBER DENNING: Now there is a fault tree  
25          at this branch here?

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1 MR. STANCAKTAR: This one?

2 MEMBER DENNING: Yes.

3 MR. STANCAKTAR: This one really is in  
4 this particular place, this is nothing but a flag that  
5 sends you here, and it doesn't even show in the code  
6 sets, because it's a flag that's set to true. So it  
7 goes down this way.

8 But yes, the answer is, there is a fault  
9 here. It is nothing but a flag.

10 CHAIRMAN APOSTOLAKIS: Under what  
11 conditions would you go to okay?

12 MR. STANCAKTAR: Never. This is zero.  
13 This is just a way to transfer to the design point  
14 without bringing the whole event tree in here.

15 So this is just a model convenience, but  
16 explicit. You can just see it here. So it goes here.

17 MEMBER BONACA: Can you get back to the  
18 one on the control room evacuation?

19 MR. STANCAKTAR: Sure, the control room  
20 evacuation in this case goes to its own event tree  
21 which is a new one. So let's go there and look.

22 It could have been developed here too.  
23 This does not necessarily need a stub tree, because  
24 it's a new event tree. But we did it in this case to  
25 be symmetric so people will recognize a pattern.

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1           So if you go - okay in this case, it goes  
2 to transient, and then things are taken care of in the  
3 transient event tree, with switches.

4           But I want to show you, this one doesn't  
5 have its own. Let me show you one that does have its  
6 own main control room scenario. That's why I brought  
7 different ones.

8           Go back here, go to for example Wolf  
9 Creek. Here's the event tree, control room is here,  
10 go here. Okay.

11           This one is more representative. So this  
12 one is based on the Appendix R kind of response with  
13 fueling equipment available. So this plan cannot  
14 really handle a small LOCA or a LOCA from a shutdown  
15 panel. That is the assumption.

16           Whether this assumption is conservative or  
17 not will be further discussed. But in general the  
18 examples we saw, people are retaining their Appendix  
19 R assumptions.

20           So you come out of the control room, and  
21 you can cannot handle if there are LOCAs. Otherwise,  
22 you can survive.

23           So anytime you RCP LOCA or LCOA, this says  
24 you won't be able to survive.

25           This would be an interesting actually

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1 point in assessing the plant risk, when Appendix  
2 assumptions are really too conservative, whether it's  
3 a good strategy or not.

4 CHAIRMAN APOSTOLAKIS: Do you have an  
5 example where you have a fire that fails a number of  
6 equipment?

7 MR. STANCAKTAR: Sure.

8 CHAIRMAN APOSTOLAKIS: When you go to the  
9 event tree and input that as a common cause failure.

10 MR. STANCAKTAR: Here. All of them have  
11 these flat files.

12 CHAIRMAN APOSTOLAKIS: Well, let's look at  
13 one. Do you have fires spreading in the control room?  
14 It sounds too simple to me. Something is missing.

15 MR. STANCAKTAR: Not yet, because you will  
16 see the details.

17 Okay, like in this scenario, loss of  
18 service water event has occurred.

19 CHAIRMAN APOSTOLAKIS: How come? Why did  
20 it occur?

21 MR. STANCAKTAR: Because of the initiating  
22 event. So the scenario says that if this happens on  
23 this occasion --

24 CHAIRMAN APOSTOLAKIS: This is a Level 1  
25 event tree?

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1 MR. STANCAKTAR: No, no, these are flags  
2 that failed equipment. So this is a place where you  
3 put your failures.

4 CHAIRMAN APOSTOLAKIS: What I got in mind  
5 is this, you have a fire say in a location, in the  
6 spreading room or somewhere else. It causes an  
7 initiating event, and at the same time it affects the  
8 performance of the safety systems.

9 Okay, let's walk through this.

10 MR. STANCAKTAR: In this one, in this  
11 event, the loss of offsite power is caused by the  
12 process ACP-NB02 and NG02 are failed.

13 CHAIRMAN APOSTOLAKIS: So where is the  
14 fire?

15 MR. STANCAKTAR: The fire is the  
16 initiating event. It's in the event tree.

17 CHAIRMAN APOSTOLAKIS: But where did it  
18 occur to do this?

19 MR. STANCAKTAR: It occurred in Area C10.

20 CHAIRMAN APOSTOLAKIS: Which is --

21 MR. STANCAKTAR: Wherever it is. I don't  
22 have it written out here.

23 CHAIRMAN APOSTOLAKIS: Fine, so let's go  
24 back to the tree.

25 MR. STANCAKTAR: Back to here?

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1 CHAIRMAN APOSTOLAKIS: Yes. Here.

2 MR. STANCAKTAR: These are the properties  
3 of the scenario are captured here.

4 CHAIRMAN APOSTOLAKIS: But again, the fire  
5 is an initiator. I want to see a fire that does both,  
6 creates an initiating event, and disables part of the  
7 safety systems that are there to contain that  
8 initiator.

9 MR. CHECK: I think that is what Selim is  
10 trying to show you. The fire is initiating in C10.  
11 Now it causes all these, the first two processes to  
12 fail in that event. And so he is setting those events  
13 to true in this particular event tree so that they are  
14 failed.

15 CHAIRMAN APOSTOLAKIS: What he's saying is  
16 that the fire causes the loss of the buses. It leads  
17 to the loss of offsite power. Right?

18 MR. STANCAKTAR: That isn't necessarily  
19 exactly the interpretation.

20 CHAIRMAN APOSTOLAKIS: The third entry  
21 there is looped, right?

22 MR. STANCAKTAR: Looped.

23 CHAIRMAN APOSTOLAKIS: So the fire has  
24 caused the loss of offsite power. Everything you have  
25 there has nothing to do with fire.

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1 MR. STANCAKTAR: It does, because  
2 recoveries are not possible in this event. You cannot  
3 recover.

4 CHAIRMAN APOSTOLAKIS: Are not possible?

5 MR. STANCAKTAR: Yes, all these recoveries  
6 are also turned off. Normally, in a route you have  
7 recovery possibilities. Here, due to the event, you  
8 cannot recover.

9 CHAIRMAN APOSTOLAKIS: So why can't you  
10 recover offsite power in four power?

11 MR. STANCAKTAR: Because they burnt the  
12 buses.

13 CHAIRMAN APOSTOLAKIS: The buses?

14 MR. STANCAKTAR: Actually, it is not a  
15 true loop. It is - even if you have power at the  
16 yard, you bring it in, and you cannot bring it to  
17 these two buses.

18 CHAIRMAN APOSTOLAKIS: Okay, so this is an  
19 impact. That is true.

20 MR. STANCAKTAR: This is an example of  
21 something you were trying to envision.

22 CHAIRMAN APOSTOLAKIS: Because I remember  
23 when we were doing Indian Point and Zion, that was the  
24 major effort, you know. If you have a fire in your  
25 location, in the cable spreading room, where redundant

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1 trains come the closest. As I recall I was four feet.

2 And then you try to figure out, what is  
3 the initiating that would be caused by this, and which  
4 bumps or bottles and so on would be disabled.

5 So you see to have done this?

6 MR. STANCAKTAR: Yes, absolutely. That's  
7 why I was trying to show you, asking you initially  
8 whether you wanted to see the --

9 CHAIRMAN APOSTOLAKIS: Let's see.

10 MR. STANCAKTAR: -- if you wanted to see  
11 the report.

12 CHAIRMAN APOSTOLAKIS: Well, let's look at  
13 the report.

14 MR. STANCAKTAR: Because in the report,  
15 there is a crucial file there. Like if somebody said,  
16 show me only one thing in the report, this is what I  
17 would show them.

18 CHAIRMAN APOSTOLAKIS: Okay.

19 MR. STANCAKTAR: Okay, this is the summary  
20 matrix of the scenarios. And in fact one of the ideas  
21 we are having now is, have the code read this kind of  
22 information, and make the scenario event trees and the  
23 logic, just read it off here as though somebody was  
24 actually trying to make trees and so on.

25 So here is the type of information. The

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1 rupture of normal ASW header. Here is a name, here is  
2 the initiating event frequency. This information is  
3 just for additional information; it has nothing to do  
4 with our model.

5 Equipment losses are HR pumps and normal  
6 emergency service water. Normal emergency service  
7 water is lost because of the event. RHR pumps are  
8 lost because of the consequence of the event. They  
9 are wet.

10 And initiating event caused with an  
11 ascendant transient with these conditions.

12 CHAIRMAN APOSTOLAKIS: So what is the  
13 external event in this scenario?

14 MR. STANCAKTAR: It's internal flooding,  
15 FLI, at the AB55a. This is a name given by the plant  
16 so we can go find and read about it.

17 So IPEEE says, here is a scenario. They  
18 studied it. They gave down. And they said, finally,  
19 here is the scenario frequency. Here is the equipment  
20 lost. And here is the initiating event that is  
21 generated.

22 Now, so the thing is to represent this  
23 information in terms of the existing model. Tell the  
24 model this information.

25 CHAIRMAN APOSTOLAKIS: All you are doing

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1 here, Selim, is copying scenarios you have found in  
2 the sources you have looked at?

3 MR. STANCAKTAR: Yes. Right.

4 CHAIRMAN APOSTOLAKIS: Doing it is not  
5 easy. This is a shock.

6 MR. STANCAKTAR: Once you get in this and  
7 this, is the place where you spent an enormous amount  
8 of energy.

9 CHAIRMAN APOSTOLAKIS: Now in Level 1 SPAR  
10 models you developed your own, and then you compared  
11 them to regular utilities. Here you don't seem to be  
12 doing that. And maybe we ought to think about it a  
13 little bit.

14 I appreciate it how difficult it would be  
15 to do your own. But on the other hand relying blindly  
16 on what the licensee has done may not be such a good  
17 idea either.

18 MR. CHEOK: I think that's why I mentioned  
19 earlier that the next stage would be to study the  
20 Sandia report a little better.

21 CHAIRMAN APOSTOLAKIS: Which Sandia report  
22 is this?

23 MR. CHEOK: This is the most recent one?  
24 What's the number, Selim?

25 MR. STANCAKTAR: On what?

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1 MR. CHEOK: On phenomenology of fire, and  
2 how you define the different fire damage states, how  
3 you define hot shots and things like that.

4 CHAIRMAN APOSTOLAKIS: So this is just an  
5 enumeration of what other people have found?

6 MR. STANCAKTAR: Yes.

7 CHAIRMAN APOSTOLAKIS: Oh, it's a very  
8 good thing to do, no question about it.

9 MR. STANCAKTAR: Think about this when you  
10 go home.

11 CHAIRMAN APOSTOLAKIS: Right, that's what  
12 I'm going to do, Selim.

13 MR. STANCAKTAR: If I sit in my room with  
14 five people from the NRC for two months I will have  
15 figured out this scenario without a lock down or some  
16 other information.

17 Tornado strikes, auxiliary boiler feed  
18 pump building. I mean that is an important thing that  
19 they have figured out, and they have studied it.

20 CHAIRMAN APOSTOLAKIS: This is really very  
21 informative, very informative. I'm glad you did this.

22 My question is whether we should have a  
23 separate subcommittee meeting on this stuff. Because  
24 this is extremely - or maybe a part of a subcommittee  
25 meeting.

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1 MEMBER DENNING: On which? Do you mean  
2 the --

3 CHAIRMAN APOSTOLAKIS: Just on the  
4 external events.

5 MEMBER DENNING: Yes. I think that we  
6 have to give them a little more time to work on that.  
7 But I think we absolutely do.

8 CHAIRMAN APOSTOLAKIS: I don't mean next  
9 week, sure.

10 MEMBER DENNING: My impression is that it  
11 isn't really practical, that this clearly limits what  
12 they can do with that external event, in the external  
13 event area. And it certainly makes their reliance on  
14 what we get from the plants that much higher.

15 MEMBER KRESS: And I think we ought to  
16 have an extra subcommittee on low power shutdown, and  
17 make sure Dana is here.

18 CHAIRMAN APOSTOLAKIS: Okay, thank you  
19 very much, Selim.

20 MR. STANCAKTAR: Can I just say one thing  
21 more?

22 CHAIRMAN APOSTOLAKIS: Sure, sure.

23 MR. STANCAKTAR: If a plant doesn't have  
24 a main control room fire, they screen it off, we give  
25 them one, there is some minimum standard that has to

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1 exist. So we give them one.

2 MEMBER KRESS: You take one you had for a  
3 similar plant?

4 MR. STANCAKTAR: This is what they have.  
5 And the ability to know should be there regardless of  
6 what their argument was to drop it.

7 CHAIRMAN APOSTOLAKIS: There are many,  
8 many issues here. As you know a lot of the licensees,  
9 as part of the IPEEE program use the FIE methodology,  
10 which is similar to the seismic screening methodology.

11 And there are so many assumptions there.  
12 But also, if you want to do a more rigorous analysis,  
13 I will be the first one to admit that there are many  
14 assumptions there as well.

15 And I don't know, something bothers me.  
16 I think what you have done is very useful, but knowing  
17 what it takes to actually do the analysis for fire, I  
18 see a big gap.

19 So maybe after you guys have a chance to  
20 think about it, and start finding out how to attack  
21 it, we can get together again and see if we can agree.

22 MEMBER DENNING: One possibility, George,  
23 is that there is this structure they provide that  
24 relies heavily on the applicant. But then when they  
25 are going to use this to do an independent evaluation

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1 of some specific thing, then of course they could go  
2 into the depth and do the tweaking on the model and  
3 then it fits in within the structure that they put  
4 together.

5 CHAIRMAN APOSTOLAKIS: That might be one  
6 possible way to go. But I certainly agree with Mike  
7 that they need some time to study whatever literature  
8 there is.

9 Very good. Thank you very much.

10 Nilesch and Mike, you want to make some  
11 closing comments?

12 MR. CHEOK: Yes, I guess we'd like to  
13 thank the committee members for spending the time with  
14 us. I think it was very useful.

15 I think we found out, like you said  
16 yesterday, George, that during the 1.174 process we  
17 engaged the committee early, and we got a lot of good  
18 feedback, and I think that is one reason why we got  
19 such great documents for this.

20 And we think the SPAR models are important  
21 tools for the Agency. And we think that getting  
22 committee feedback at an early stage is important for  
23 this process also.

24 Thank you.

25 CHAIRMAN APOSTOLAKIS: I think you will go

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1 far, Mike.

2 Any comments from the members? Well, we  
3 will plan on having a full committee meeting. The  
4 earliest can be now February, because the December  
5 meeting has been seconded.

6 MR. CHOKSHI: And you are going to let us  
7 know what you think at this stage what we want to  
8 present to the full committee?

9 CHAIRMAN APOSTOLAKIS: Yes, we'll discuss  
10 that.

11 So I don't know, Eric, February or March?

12 MR. THORNSBURY: February is already  
13 fairly full. But it's not set yet. Things shift  
14 around.

15 CHAIRMAN APOSTOLAKIS: All right, so maybe  
16 we can go around the table and see how people feel  
17 about this. Rich, you want to start?

18 MEMBER DENNING: You know, I already said  
19 so many things that I don't have anything else.

20 CHAIRMAN APOSTOLAKIS: Could you remind me  
21 of a few important ones?

22 MEMBER DENNING: A reminder of the  
23 important things? I think that - well, general  
24 impression is very favorable. I think that this is  
25 all very important.

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1 I think that I understand better what some  
2 of the limitations of SPAR are now as to what its  
3 objectives are and ought to be. And I think that  
4 those could probably be written down, at least for the  
5 internal events, relative to what the utility does  
6 with its own PRA models.

7 I think particularly in the area of  
8 external events that the objectives are going to be  
9 limited, still well worth doing but limited. I guess  
10 that's about it.

11 CHAIRMAN APOSTOLAKIS: Okay. Tom?

12 MEMBER KRESS: Well, I too think this is  
13 really good stuff, and I'm glad to see it going out.  
14 And I was awfully glad to see that there is a  
15 potential later on to go to Level 2-like things that  
16 are not just LERF but are conditional containment  
17 failure probability.

18 Eventually, I know this is a dream for the  
19 long run, I'd like to see Level 3 in the SPAR models  
20 too. But you know, that is down the road I'm sure.

21 I particularly like their QA procedures on  
22 the Level 1, and I hope they can figure out some way to  
23 do a Level 2 - do Level 2 stuff too.

24 That was good stuff. I just - you know,  
25 congratulate the guys on doing a good job, and look

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1 forward to reviewing more of the stuff.

2 I'm a little concerned about the low power  
3 shutdown risk average. I think it is more plant  
4 specific. But I think just what they needed to do at  
5 this stage for that.

6 CHAIRMAN APOSTOLAKIS: Mario?

7 MEMBER BONACA: Well, first of all I  
8 voiced the opinion already heard from the other  
9 members. This is a great project. I've always been  
10 supportive of the SPAR project from the beginning, but  
11 now we have a demonstration of the importance of it to  
12 really inspection and to the people in the field.

13 There are cross comparisons here that are  
14 as valuable as they can be. Even for the external  
15 events, though I see the limitation that Richard was  
16 pointing out.

17 You know there are some similarities among  
18 some sites, from which, with time, there will be  
19 lessons learned about certain configurations, certain  
20 phrases that have been assumed in certain places and  
21 not in others, and they should have been - so again,  
22 it's a tool where there is a unique opportunity to  
23 share information that nobody else has. I mean that  
24 is the only one that has this way of using the same  
25 data to look at at the same time.

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1 I am still a little concerned about what  
2 you do with the dates. I mean plants oftentimes  
3 change significantly from one outage to the next  
4 outage, and it may take many years of manpower to  
5 update in detail. There has to be a way maybe in the  
6 future that some of these critical changes can be  
7 retrieved without having to go begging around the  
8 licensees for the information. If there are  
9 substantive changes, maybe, you are proposing another  
10 5059 for reporting those changes, is certainly  
11 something that would allow staff to maintain this  
12 basic capability and insight into the individual  
13 plants.

14 In general, I think that this is a great  
15 project. I think the committee has to learn more  
16 about it.

17 CHAIRMAN APOSTOLAKIS: And I think second  
18 that view. I think it's really a great program. And  
19 in addition to the content, I also want to  
20 congratulate both leadership of the project and the  
21 presenters, who are really being concise and giving  
22 good presentations.

23 This was very good, and we will follow up.

24 And now if we meet with - if the full  
25 committee takes up this issue say, February or March

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1 - oh, before I go on, I really thought that the QA  
2 process you guys established for Level 1 was  
3 excellent.

4 And one thought that occurred to me was  
5 that that process contributes to improving, enhancing  
6 the safety culture and knowledge of both the licensees  
7 and NRC staff. And usually when we talk about safety  
8 culture, which as you know is a sensitive issue -  
9 there are a lot of people who tend to think in terms  
10 of psychology and people's attitudes and so on - I  
11 mean here is a good practical way of raising safety  
12 culture, I think.

13 Now you might ask me, prove it. I can't  
14 prove it. But it seems to me that the details of the  
15 give and take that is taking place when you guys argue  
16 with licensees is just great. It's just great.

17 Now in terms of presentation to the full  
18 committee, I would certainly emphasize the - well, of  
19 course you give an overview first. But I would  
20 emphasize this quality assurance process with the  
21 licensees for Level 1, and then perhaps give a short  
22 - you will not have more than an hour, right? And as  
23 usual you have to really be prepared to use only 45  
24 minutes. So and then the external events and low  
25 power shutdown, maybe you shouldn't emphasize them

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1 that much at that meeting, and say that it's a work in  
2 process, and that the committee will review individual  
3 pieces of it later.

4 I thought you know both - I mean all  
5 three, John Leonard and Jeff Mitman and Selim, they  
6 should be given the chance to give the committee the  
7 flavor of what they are doing, because it is very  
8 good. Even though it is preliminary, I think it's  
9 very good.

10 Now, the major risk with that is that you  
11 may start an interminable debate on various issues.

12 MEMBER BONACA: That's why I think it may  
13 be worthwhile if we communicate to the committee to  
14 have half a day before the full committee.

15 CHAIRMAN APOSTOLAKIS: To have a  
16 subcommittee meeting with the full committee?  
17 Subcommittee with the whole committee, that's what  
18 you're saying? Well, we did that doing the 1.174  
19 development.

20 MEMBER BONACA: Because I think we're  
21 really going to need more than four hours.

22 CHAIRMAN APOSTOLAKIS: Maybe we can do  
23 that.

24 MEMBER BONACA: Two hours doesn't do it  
25 justice.

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1 CHAIRMAN APOSTOLAKIS: Well, let's think  
2 about it. We will talk with the planning and  
3 procedures committee members, and see. But that would  
4 be another good way.

5 This is of such central importance to the  
6 Agency that we may very well do that.

7 Fareed, did you want to say something?

8 MEMBER DENNING: No.

9 MR. CHOKSHI: And we will coordinate with  
10 Eric.

11 CHAIRMAN APOSTOLAKIS: Absolutely. Or  
12 maybe we will decide to surprise you.

13 So are there any other comments from the  
14 members? Chuck, you had something?

15 MR. THADANI: Yes, George, I think as you  
16 said, this is really outstanding work, and very  
17 important to the Agency.

18 And I'm just wondering if for some modest  
19 resources can the staff use SPAR models to understand  
20 - for some selected, one or more plants, the impact of  
21 increasing power level by 20 percent?

22 Is that - it may be something that might  
23 be very useful to the Agency, it seems to me, to pick  
24 one or two plants, and see what does it really mean in  
25 terms of increase in risk.

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1                   And I would include the source term part  
2 certainly in that. This is a thought.

3                   CHAIRMAN APOSTOLAKIS: In other words have  
4 pilot plants.

5                   DR. THADANI: Something like a pilot,  
6 where the staff actually does the work to understand  
7 what it means.

8                   CHAIRMAN APOSTOLAKIS: But then they  
9 interact with the licensee?

10                  DR. THADANI: Yes, they will have to.

11                  CHAIRMAN APOSTOLAKIS: That is a good  
12 idea.

13                  MEMBER DENNING: I don't see this as a  
14 SPAR-centered - I think it would be a good idea.  
15 Because I don't think we really have a good  
16 appreciation of that, and it challenges the  
17 capabilities of PRA, which SPAR is at the edges of  
18 challenging the PRA. But even these things like - I  
19 won't get into all of it.

20                  So it would be worthwhile, and maybe it  
21 would start with SPAR mobiles. I don't know. It's  
22 not a SPAR extension activity.

23                  MEMBER KRESS: Unfortunately, the real  
24 impacts of power outage is a Level 3 issue.

25                  DR. THADANI: You will need to satisfy

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1 your criteria obviously. But it seems to me that some  
2 interaction with licensee information, this might be  
3 not a task - a task that might not be so resource  
4 intensive.

5 MEMBER KRESS: One other comment. You  
6 know we don't often do this, but I thought the support  
7 from INL and Brookhaven was very good also. You know  
8 we just talked about how good the staff is.

9 CHAIRMAN APOSTOLAKIS: Now if we have a  
10 four-hour subcommittee meeting with all the members  
11 present, we still need one hour and a half for a full  
12 committee before we write a letter, right?

13 MR. THORNSBURY: Yes.

14 CHAIRMAN APOSTOLAKIS: We can't just write  
15 a letter. Because even then, even if everybody is  
16 here, we are still gathering information.

17 MR. THORNSBURY: Right, you're still just  
18 being a subcommittee. But it can be - we can schedule  
19 it for an hour and a half, and if it takes less that's  
20 okay, just to kind of formally put everything out for  
21 the record.

22 CHAIRMAN APOSTOLAKIS: Yes, if we have a  
23 four-hour subcommittee meeting, then maybe we have  
24 only an hour.

25 It's going to be hard to schedule, though,

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1 I really think it is going to be hard.

2                   Anyway, this was very good. Any other  
3 parting remarks?

4                   Thank you very much. That is all, and  
5 this meeting is adjourned.

6                   (Whereupon at 11:22 a.m. the meeting of  
7 the above entitled Commission was adjourned)

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