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1 UNITED STATES OF AMERICA
2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

6 496TH MEETING, DAY 2

7 + + + + +

8 FRIDAY,

9 OCTOBER 11, 2002

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11 ROCKVILLE, MARYLAND

12 + + + + +

13 The Committee met at the Nuclear
14 Regulatory Commission, Two White Flint North, Room
15 T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. George
16 E. Apostolakis, Chairman, presiding.

17 COMMITTEE MEMBERS:

18 GEORGE E. APOSTOLAKIS Chairman

19 MARIO V. BONACA Member

20 F. PETER FORD Member

21 THOMAS S. KRESS Member

22 GRAHAM M. LEITCH Member

23 DANA A. POWERS Member

24 WILLIAM J. SHACK Member

25 JOHN D. SIEBER Member

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1 COMMITTEE MEMBERS: (CONT.)

2 VICTOR H. RANSOM Member

3 STEPHEN L. ROSEN Member

4 GRAHAM B. WALLIS Member

5

6 ACRS STAFF PRESENT:

7 JOHN T. LARKINS Director

8 SHER BAHADUR Associate Director

9 HOWARD J. LARSON Special Assistant

10 SAM DURAISWAMY Technical Assistant

11

12 OTHER NRC STAFF PRESENT:

13 PATRICK BARANOWSKY

14 JOHN FLACK

15 CHRISTOPHER GRIMES

16 N. PRASAD KADAMBI

17 SCOTT NEWBERRY

18 PATRICK O'REILLY

19

20

I-N-D-E-X

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Opening Remarks by the ACRS Chairman

Dr. George Apostolakis

Program Plan for Low-Power Shutdown (LPSD)

Standardized Plant Analysis Risk (SPAR) Model

Development and Cancellation of Revision 4i of
SPAR Models

Mr. Dana Powers

Dr. Patrick O'Reilly

Guidance for Performance-Based Regulation

Mr. John Flack 78

Mr. Prasad Kadambi 80

Reconciliation of ACRS Comments and Recommendations

Dr. George Apostolakis 124

Dr. Tom Kress

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

8:33 a.m.

CHAIRMAN APOSTOLAKIS: The meeting will now come to order. This is the second day of the 496th meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the committee will consider the following: Program Plan for Low-Power Shutdown Standardized Plant Analysis Risk Model Development and Cancellation of Revision 4i of SPAR Models, Guidance for Performance-Based Regulation, Reconciliation of ACRS Comments and Recommendations, Future ACRS Activities/Report of the Planning and Procedures Subcommittee, Report Regarding Recent Operating Events, Proposed ACRS Reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee act. Mr. Sam Duraiswamy is the Designated Federal Official for the initial portion of the meeting.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's session. A transcript of a portion of the meeting is being kept, and it is requested that the speakers use one of the microphones, identify themselves, and speak with

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1 sufficient clarity and volume so that they can be
2 readily heard.

3 Any comments from members?

4 (No response.)

5 CHAIRMAN APOSTOLAKIS: Okay, so we go move
6 on to the --

7 MR. BAHADUR: Mr. Chairman.

8 CHAIRMAN APOSTOLAKIS: Yes.

9 MR. BAHADUR: I just wanted to mention that
10 --

11 CHAIRMAN APOSTOLAKIS: Who are you, for the
12 record?

13 MR. BAHADUR: Sher Bahadur from the ACRS
14 staff. Just to add one thing, that we will not be
15 having the reports regarding recent operating events.

16 CHAIRMAN APOSTOLAKIS: Yes.

17 MR. BAHADUR: We had it yesterday, and I
18 don't think we want to continue that.

19 CHAIRMAN APOSTOLAKIS: Okay. So the first
20 item on the agenda, the Opening Remarks of the ACRS
21 Chairman, we did that.

22 (Laughter.)

23 CHAIRMAN APOSTOLAKIS: The second one is
24 the SPAR model development, and Dr. Powers again. You
25 led us yesterday, you're leading us today.

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1 MEMBER POWERS: A chilling thought, isn't
2 it. Let's see, a little background on this particular
3 issue. The first background is of course that the ACRS
4 has -- just about every time it writes a research
5 report asks for information about the SPAR modeling
6 activities.

7 They also ask for it at points in between
8 research programs. The staff was reviewing its budget
9 plans with the Commission and indicated to
10 Commissioner McGaffigan that they were going to sunset
11 Revision 4i on the SPAR models.

12 Mr. McGaffigan asked if they had discussed
13 it with the ACRS, and they indicated that they were
14 fixing to, and this is the fixing. When George asked
15 me to take the lead on this program, I said, "That's
16 great George. What is Revision 4i?"

17 And he says, "Well, that's your first
18 chore, to find out what Revision 4i is."

19 And to date I've been unsuccessful in
20 finding out what Revision 4i is, but I have learned a
21 wealth about Revision 3i. The staff sent me really a
22 quite nice topical report prepared by INEEL called
23 Low-Power Shutdown Operations Standardized Plant
24 Analysis Risk Model Template for PWRs.

25 However, the staff did label this one

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1 Sensitive Homeland Security Information, not for
2 Public Disclosure, and when you work for an NSA
3 laboratory and you carry such a document around, you
4 get an unending amount of attention from the security
5 forces. May not be entirely welcome.

6 But it was a useful and interesting
7 document. In addition, Pat Baranowsky sent us really
8 a very nice memorandum outlining what he thought the
9 needs were for development of SPAR models to treat the
10 low-power and shutdown issues, and that memorandum is
11 enclosed in your notebook here, and that's really a
12 quite useful document to read to understand their
13 needs.

14 Our objective here, I believe, is to
15 respond to Commissioner McGaffigan on the wisdom of
16 sunsetting this Revision 4i, if we ever find out
17 exactly what it is. But I suspect what we're going to
18 learn is a lot more about the SPAR modeling,
19 especially for the low-power and shutdown.

20 That's been a great interest to this
21 committee as a whole, and in particular to Mr. Rosen
22 and I. With that introduction, I don't know who I turn
23 to first. Pat are you going to lead it out?

24 MR. BARANOWSKY: Okay, that's a good
25 introduction, and what we're going to do today is

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1 first, Dr. O'Reilly from my branch who's the head of
2 the SPAR development will give the briefing.

3 He's going to cover the low-power shutdown
4 SPAR model development, because I know that's been an
5 item of interest, and not much has been made available
6 except for that report that we recently sent to you.

7 Then the second thing is we are going to
8 cover what we mean by "4i" which was a little bit
9 nebulous, maybe to us even.

10 (Laughter.)

11 MEMBER POWERS: We're dying to know how you
12 sunset a program that never started.

13 MR. BARANOWSKY: Well, yes. Why don't I
14 cover that when we get to that exact point. Save
15 myself from trouble.

16 MEMBER POWERS: Oh, I doubt it will save
17 you trouble Pat.

18 (Laughter.)

19 MR. BARANOWSKY: Well, with that I'd like
20 to turn it over to Dr. O'Reilly.

21 DR. O'NEILL: Thank you Pat. I'm Pat
22 O'Reilly from the Operating Experience Risk Analysis
23 Branch in the Office of Research. My presentation
24 today consists of three parts, and I'll try and get
25 through the first two so we can get to the heart of

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1 the matter, the one that Dana is so interested in.

2 MEMBER POWERS: No, no. Make it very clear,
3 I am much more interested in the first two than I am
4 in the third.

5 (Laughter.)

6 DR. O'NEILL: Oh, good, we've given the
7 right weight to the right topics here. Well, we'll go
8 over a high level --

9 MEMBER POWERS: Sometimes Professor
10 Apostolakis is a bit out of focus.

11 (Laughter.)

12 DR. O'NEILL: Well, it's Friday morning and
13 it's 8:30, so.

14 MEMBER POWERS: Who's bright-eyed and
15 bushy-tailed now?

16 DR. O'NEILL: After I cover the program
17 plan, we had an opportunity in August to do an on-site
18 QA review of the low-power shutdown SPAR model for the
19 Surry plant against the plant's shutdown PRA.

20 I'll give you a brief summary of what we
21 found out from that review, and then we'll get to the
22 big topic, cancellation of the Revision 4i SPAR models
23 development effort.

24 The first thing I'm going to address is
25 the low-power shutdown SPAR model development plan.

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1 But before I do that, it's probably best to give you
2 just a little bit of background of where this effort
3 came from.

4 In Fiscal Year 1996, the first low-power
5 shutdown SPAR model development project that was
6 initiated produced a PWR, a low-power shutdown SPAR
7 model, that was based on the Detailed Surry Shutdown
8 PRA.

9 MEMBER POWERS: You know, this is the point
10 at which we get a bit confused.

11 DR. O'NEILL: Sure.

12 MEMBER POWERS: Because when I speak to the
13 authors of this particular document, they describe it
14 as a scoping and exploring model shutdown PRA for
15 Surry, and say that -- and emphasize its proximate
16 nature and limitations associated with it.

17 You have given it capital "Detailed". Now
18 is this just a difference in the perspectives?

19 DR. O'NEILL: Probably a difference in
20 perspective, Dana, but when I get to the results of
21 our review of the Surry low-power shutdown PRA that we
22 conducted in August, you'll see that perhaps the
23 authors that you were talking to sort of downplayed
24 what they did.

25 In essence, the Surry shutdown --

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1 MEMBER POWERS: It would be the first time
2 they ever downplayed.

3 (Laughter.)

4 DR. O'NEILL: I understand that. I know who
5 you're talking about. The shutdown PRA for Surry that
6 was performed by BNL back then, it turns out is the
7 basis for the current Surry shutdown PRA, and we were
8 rather surprised at that.

9 So that tells me that the approach that
10 Brookhaven took and the technical bases were quite
11 robust, in spite of what you might have heard by way
12 of disclaimer.

13 MEMBER LEITCH: Say Pat, I think you're
14 maybe a little ahead of where I am in this.

15 DR. O'NEILL: Sure.

16 MEMBER LEITCH: Could you just step back a
17 little bit and say a word about SPAR? I'm not sure --
18 I mean, I know the acronym, but just exactly what is
19 a SPAR model. What are we using it for? Can you just
20 give me a little bit of the background on it?

21 DR. O'NEILL: Okay, all right. I don't have
22 a slide for this.

23 MEMBER LEITCH: Oh, that's fine.

24 DR. O'NEILL: I'm going to give a
25 presentation at the Nuclear Safety Research Conference

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1 at the end of this month on the history of the SPAR
2 model development program, but the SPAR model
3 development program goes back to the days when the
4 accident sequence precursor program was first
5 established.

6 Joe Mennorick (phonetic) and Oak Ridge
7 National Laboratory were doing the analyses. The
8 ancestors of the SPAR models are really those of event
9 tree-based models that Mennorick and company used in
10 the ASP analyses.

11 They've evolved over the years, and I wish
12 I had -- I have a slide that would point that out,
13 that there are certain milestones in that chronology.
14 A good place to read up on it is NUREG/CR-4674, the
15 various volumes that were published on the ASP program
16 annually, up until 1998.

17 CHAIRMAN APOSTOLAKIS: Are they mini-PRAs?
18 Is that what they are?

19 DR. O'NEILL: No. You mean --

20 CHAIRMAN APOSTOLAKIS: The SPAR model, is
21 it a mini-PRA?

22 DR. O'NEILL: Well, when we get to Revision
23 4i, George, that's exactly what we'd be talking about,
24 in so many words. Yes.

25 CHAIRMAN APOSTOLAKIS: For the benefit of

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1 Mr. Leitch --

2 MEMBER WALLIS: I think for the benefit of
3 several of us, and for the benefit of the record. It
4 would help if you would answer his question.

5 DR. O'NEILL: I'm getting there, I'm
6 getting there.

7 MEMBER WALLIS: Well that's where they are.

8 DR. O'NEILL: It's a long journey. They
9 started out as very simple event tree-based models.
10 They had -- I believe there was one set for PWRs and
11 one set for BWRs. They modeled about two or three
12 initiating events for both types of reactors.

13 They evolved later into -- they had, I
14 believe, six or seven for PWRs, and three or four for
15 BWRs. They were still event tree-based. About the
16 middle '80s, they got a little bit more complicated,
17 because they developed some modules for handling and
18 treating losses of off-site power that led to station
19 black-out situations, in conjunction with the station
20 black-out rule that Pat Baranowsky and company were
21 shepherding at that time.

22 So they were combined -- So the were still
23 event tree-based until the early 1990s. At the same
24 time that this was taking place, NRR was also working
25 on the prompt assessment of operational events, so

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1 that they then could inform senior management at NRR
2 what type of risk-significance would be associated
3 with a particular event or condition that was
4 discovered, so that NRR management could take the
5 appropriate regulatory action.

6 These two efforts came together. When they
7 came together, NRR had taken the event tree-based
8 models from the ASP program, and they had started
9 doing custom modeling, adding fault trees for the
10 systems in the appropriate places, with some of the
11 models.

12 This was on a case-by-case basis now. When
13 the two programs got together, we decided that it
14 would be more efficient use of staff resources and
15 funding if we would develop a set of models that could
16 be used consistently throughout the agency for doing
17 these kinds of analyses.

18 These involved into a simplified event
19 tree, fault tree link type model, which would be
20 plant-specific to a certain degree down to the train
21 level, and that's how the SPAR model effort got
22 started as SPAR models.

23 CHAIRMAN APOSTOLAKIS: And these are
24 computerized?

25 DR. O'NEILL: They're computerized. They're

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1 made to run with the SAPHIRE suite of PRA codes. We've
2 developed an interface, we call it a Graphical
3 Evaluation Model Interface, that makes a lot of the
4 analyses transparent to a novice user.

5 A PRA analyst who has got quite a bit of
6 experience would not have any problems with it, but
7 they're now being used, developed for use by staff
8 analysts in all types of regulatory activities.

9 I have another 15-minute presentation that
10 I could give you on that.

11 MEMBER LEITCH: Among those activities are
12 the significant determination process?

13 DR. O'NEILL: Correct. Phase Three analyses
14 and the significance determination process to be
15 exact. Now, in the beginning, the models covered only
16 full power operation and later they were expanded,
17 because of needs expressed by staff analysts to get
18 into other areas, such as low-power shutdown, external
19 events.

20 I'm talking now about floods, flooding,
21 fires, seismic events, and Level Two and large early-
22 release frequency, LERF. So we now have model-
23 development efforts going on in each one of those
24 areas.

25 I mean, that's a quick --

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1 MEMBER LEITCH: That's fine, I appreciate
2 that.

3 CHAIRMAN APOSTOLAKIS: Why simplified
4 models and not the complete one?

5 DR. O'NEILL: Why so many?

6 CHAIRMAN APOSTOLAKIS: Simplified.

7 DR. O'NEILL: Simplified? Ah, George, I
8 said it was simplified originally.

9 CHAIRMAN APOSTOLAKIS: Oh, now they are
10 completely?

11 DR. O'NEILL: Yes, the Rev 2 models were
12 simplified, but in order to add support systems and
13 some other things that the analysts said they needed
14 in order to do their work more efficiently, the word
15 "simple" doesn't appear in the description.

16 CHAIRMAN APOSTOLAKIS: So where are we now,
17 Rev 3?

18 DR. O'NEILL: We're at Rev 3. Rev 3i. The
19 "i" stands for "interim".

20 CHAIRMAN APOSTOLAKIS: Ah, okay.

21 DR. O'NEILL: We have a two-part quality
22 assurance program, and until a model has completed the
23 entire program, we call them "i" for "interim". That
24 means you've got to use them with very great caution,
25 because they haven't been QA'd completely, especially

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1 against the licensee's PRA model.

2 CHAIRMAN APOSTOLAKIS: So right now we are
3 in Rev 3?

4 DR. O'NEILL: We're at Rev 3. Right.

5 CHAIRMAN APOSTOLAKIS: It has completed --
6 It has gone through the review process.

7 DR. O'NEILL: We're going through the
8 review process. We have, out of 72 models, we have 65
9 models produced. We have 41 of those models have
10 received an on-site QA review, and probably about 35
11 of them right now we call Revision 3.

12 We've said that they meet our QA
13 acceptance criteria.

14 MEMBER BONACA: And those 72 have
15 consistent methodology?

16 DR. O'NEILL: Correct. Across the board.

17 MEMBER BONACA: And that's an advantage.

18 DR. O'NEILL: Right, we believe that we've
19 captured about 80 to 85 percent of the total CDF for
20 the plant.

21 CHAIRMAN APOSTOLAKIS: Speaking of
22 methodology, you know, Dr. Kress and I were at the --
23 and Baranowsky -- we were at the PSA conference
24 earlier this week, PSA '02, and there was a software -
25 - there were software exhibits, and we saw something

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1 interesting.

2 I don't know if you saw it, but the ABS
3 one. One of the consultant firms --

4 MR. BARANOWSKY: I heard about it.

5 CHAIRMAN APOSTOLAKIS: Yes, and they're
6 using now, they're converting their computer models to
7 binary decision diagram-based models, BDDs, which --
8 They are claimed to solve the fault trees and event
9 trees exactly, without the need of rare event
10 approximations and cut-off levels for frequency.

11 That has been a perennial problem from day
12 one, you know, where do you truncate -- yes, the
13 truncation. It can be -9 or 10. Anyway, those models
14 solve the -- this approach solves the problem exactly.

15 They had a -- Well, of course, they picked
16 an example that was a little bit impressive. It was a
17 service water system for a plant, and it was a four
18 train system. So you have higher levels (phonetic).

19 And they found that with the old way of
20 doing business, you get a certain unavailability. With
21 the BDDS, you get something that's about 35 to 40
22 times larger.

23 MEMBER ROSEN: Times?

24 CHAIRMAN APOSTOLAKIS: Yes, just because
25 there is no cut-off frequency, truncation. So that's

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1 something to investigate, it seems to me, because if
2 it's true, it's a pretty significant change.

3 MEMBER BONACA: It seems surprising.

4 MEMBER ROSEN: It's not believable.

5 CHAIRMAN APOSTOLAKIS: Well, the guy was
6 there demonstrating it and insisting that that's
7 correct.

8 MEMBER BONACA: Was the truncation being
9 done correctly?

10 CHAIRMAN APOSTOLAKIS: In the new method
11 there is not truncation.

12 MEMBER BONACA: I understand that, but you
13 know, when you are doing truncation you also have a
14 lot of verification of that which you can lose.

15 CHAIRMAN APOSTOLAKIS: Obviously, we did
16 not dig in --

17 MEMBER ROSEN: With the fast computers we
18 have now, truncation -- You probably don't even have
19 to truncate. The only reason we truncated was because
20 it went too long. And now with these very fast
21 computers, you go to the -- you can go to the 10^{-12}
22 even, and --

23 CHAIRMAN APOSTOLAKIS: There is a move now
24 to convert all these programs to BDDs. It's not just
25 our company.

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1 MEMBER KRESS: Well, it's more than
2 truncation.

3 CHAIRMAN APOSTOLAKIS: Yes. There are all
4 sorts of approximations which we have been using
5 because computers were not very fast.

6 MEMBER ROSEN: Sorry I was so late, so I'm
7 jumping in here. Let me ask a question that may have
8 already been asked.

9 CHAIRMAN APOSTOLAKIS: Go ahead.

10 MEMBER ROSEN: These -- All you're doing
11 now. Do you think your answers are converging on the
12 licensee? I mean, are you getting closer and closer
13 together?

14 DR. O'NEILL: Actually, in some cases we
15 are able to reproduce the results exactly.

16 MEMBER ROSEN: So why do it? Why not just
17 use the licensee model, if that's where you end up?

18 DR. O'NEILL: That's a question that's been
19 asked. One of the reasons is is they haven't undergone
20 a thorough review, and they differ from plant to
21 plant.

22 We have all kinds of quality out there.

23 CHAIRMAN APOSTOLAKIS: Well, there may be
24 situations where you disagree with the licensee.

25 DR. O'NEILL: Absolutely, and when I said

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1 that, I said we have the capability. If we use the
2 licensee's numbers, we can reproduce the licensee's
3 results.

4 I'm not saying I agree with the licensee's
5 numbers.

6 MEMBER BONACA: And the approach --

7 MEMBER POWERS: Mr. Chairman, if I could.
8 I need some guidance here. I look at the package of
9 slides of which we're on the background right now, and
10 the fact that I have many, many to go through before
11 I ever find out what 4i is, and a 10:00 drop dead date
12 here.

13 If we want to go into this kind of detail
14 on this subject, I wonder if it might be more
15 appropriate to schedule a PRA subcommittee meeting to
16 explore Revision 3i in exhausting detail and the
17 theory behind it.

18 CHAIRMAN APOSTOLAKIS: With that threat, I
19 would rather reduce the questions.

20 (Laughter.)

21 MEMBER POWERS: What I would like to do is
22 fit this within the allotted time slot.

23 CHAIRMAN APOSTOLAKIS: I guess these are
24 general questions. Anyway, what I wanted to say is
25 that maybe the staff should investigate this BDD

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1 business.

2 MR. BARANOWSKY: Well, I talked to you a
3 little bit about this at the meeting, and we're aware
4 of it and looking at it.

5 MEMBER ROSEN: Notwithstanding Dana's
6 comment, I don't think I got a fair answer to my
7 question.

8 MEMBER POWERS: Well, I don't mean to cut
9 you off. It's just that he yelled at me yesterday when
10 I went ten minutes over schedule, and I don't want him
11 to yell at me again today.

12 CHAIRMAN APOSTOLAKIS: Well, as long as we
13 got you once. We won't go for a second time.

14 MEMBER POWERS: But I want to find out what
15 4i is.

16 CHAIRMAN APOSTOLAKIS: Oh we will, we will,
17 and maybe, Pat, as you go on you can skip some of
18 these slides. We don't need all of them, but I think
19 you should give an answer to Mr. Rosen.

20 DR. O'NEILL: Well, my answer to that is
21 simply if we knew what we had when we approached a
22 licensee's PRA model, it might be different, but the
23 quality of those PRAs varies all over the place. There
24 is no standard.

25 There's a draft standard that's out there,

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1 but it hasn't been accepted both by the industry and
2 by the NRC.

3 CHAIRMAN APOSTOLAKIS: But your end state
4 is not necessarily the licensee's PRA?

5 DR. O'NEILL: That's correct. We have data,
6 operational, that we've taken from actual operational
7 experience, and some cases, in order to have a
8 consistent set of models, right now we're using pretty
9 much average values from reviews of data across the
10 industry.

11 If we have enough licensee plant-specific
12 data, we can put those into our models. Another big
13 area of disagreement usually is the human reliability
14 analysis method that's used.

15 Again, those methods vary from place to
16 place, and we have a consistent methodology that we
17 apply within our models.

18 MEMBER ROSEN: Is yours right and theirs
19 wrong?

20 DR. O'NEILL: I didn't say that. I wouldn't
21 go either way. We have used the best parts, we feel,
22 of various recognized HRA methodologies. We haven't
23 developed our own. This is nothing -- we haven't done
24 anything original here.

25 MEMBER ROSEN: Well, I guess I'm just

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1 making a general point here. I was always curious why
2 the staff and the licensees couldn't work together on
3 this.

4 DR. O'NEILL: That's a question I can't
5 answer.

6 MEMBER ROSEN: The staff -- The licensees,
7 at least the ones I know, are really trying to do the
8 very best job they can.

9 DR. O'NEILL: And there are some.

10 MEMBER ROSEN: And there are some.

11 DR. O'NEILL: Yes.

12 MEMBER ROSEN: -- who would be delighted to
13 have the staff have their model and work with them if
14 they have a question about a human reliability
15 analysis parameter or a maintenance parameter.

16 I mean, using judgments, ultimately
17 reasonable men can come to the same answer, or if not
18 at least you know what the difference is. It seems to
19 me a much better way than to develop a fully
20 independent model so that later on you can yell at
21 each other and speak different languages and never
22 come to a conclusion.

23 MR. BARANOWSKY: Well, excuse me, let me
24 just interrupt here. There's no yelling that actually
25 goes on, and the models -- I think you might have

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1 missed some of the evolutionary discussion -- started
2 out quite simplified and different, and over time
3 evolved into a fairly, much more complicated models
4 that were of somewhat comparable depth, but not quite
5 the same depth.

6 They're also standardized in the way that
7 they're developed, and the way that we're able to use
8 them. We have to be able to let our staff not learn a
9 different methodology plant to plant, and then
10 different types of assumptions that go on from utility
11 to utility, so that we can have a consistent way of
12 doing our business.

13 While there are some cases where we can
14 produce exactly the same results as the licensees,
15 quite a few times when we've taken our best cut at the
16 plant, we get some significant differences.

17 In some cases, we think it's the way that
18 we've done the modeling, and in other cases, we've
19 discussed it with the licensees, and they've
20 determined that they need to make some changes too.

21 So if we hadn't had these, where would we
22 be? Well we wouldn't certainly have that checked. So
23 one of the things that's being talked about now is
24 what kind of value there is in having this independent
25 set of models that was derived quite differently from

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1 the way the licensees derived theirs.

2 But it does give us a standard set that
3 allows staff with certain level of expertise to learn
4 how to use them, and that's where we are. Now, maybe
5 someday there will be one model, but I can tell you
6 that most of the French, the German, the Swiss, the
7 Swedes, they're all -- the regulators have their own
8 models, they're doing about the same thing we're
9 doing, except their models are even more extensive
10 than ours.

11 MEMBER ROSEN: Well, I think that's a fair
12 answer. I'm not sure I agree with it, but at least
13 it's an answer.

14 CHAIRMAN APOSTOLAKIS: Pat, I really want
15 to see you exercise judgment and skip slides.

16 DR. O'NEILL: Okay, it's not a problem. All
17 right, I'll skip the first three. The first three
18 slides can be skipped, because we ended up at the
19 point where we were in Fiscal 2001 with two PRA SPAR
20 models for low-power shutdown.

21 One was a BWR (Grand Gulf). It was based
22 on the Sandia report, NUREG/CR-6143, and with one for
23 Surry. We then took those two models and developed
24 from them some standardized low-power shutdown SPAR
25 templates.

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1 The one for BWRs we based on the Surry
2 low-power shutdown model, and basically what it is.
3 It's a working low-power shutdown PRA that has all the
4 plant-specific system fault tree information deleted
5 and replaced with undeveloped events. That's, in a
6 nutshell, what that is.

7 In order to create a low-power shutdown
8 SPAR model from a template, you have to expand those
9 undeveloped events. I'll spend just a couple of
10 minutes and talk to you about those.

11 CHAIRMAN APOSTOLAKIS: So where are you
12 now? Which --

13 DR. O'NEILL: I'm just now getting into
14 expansion of templates and to low-power shutdown SPAR
15 models, lead plants. Because at this point --

16 CHAIRMAN APOSTOLAKIS: Can you put it up
17 there?

18 DR. O'NEILL: Sure. We have --

19 MEMBER WALLIS: First you put numbers on
20 the graphs.

21 CHAIRMAN APOSTOLAKIS: Deus ex machina.

22 DR. O'NEILL: We take the template and we
23 expand it by adding the system fault trees from the
24 Revision 3i or 3 model for the plant. And in doing so
25 you have to go through some other steps which are all

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1 spelled out.

2 They're in that report that we provided to
3 Dana to give to the committee. We're now at the point
4 where --

5 CHAIRMAN APOSTOLAKIS: So this is the
6 essence of it?

7 DR. O'NEILL: There we go.

8 CHAIRMAN APOSTOLAKIS: Oh, this is the
9 essence.

10 DR. O'NEILL: We have divided the plant
11 population, now, into eight plant classes. This
12 classification is consistent with the same
13 classification that we're using for the full-power,
14 the Revision 3/3i SPAR models.

15 Right now, tentatively, we have a list of
16 lead plants. We would solicit the committee's input on
17 this, if you have any information that will help us.
18 What we'd like to do is have a lead plant in a plant
19 class that has a shutdown PRA.

20 We know of several that have a shutdown
21 PRA per se. We know of other plants that have a risk
22 monitor, they have EOS, they have something on that
23 nature.

24 MEMBER POWERS: I simply want to remark
25 that the South Texas project is not included in your

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1 list of lead plants.

2 DR. O'NEILL: Right.

3 MEMBER POWERS: But they are reputed to
4 have a quintessence of excellence of all PRA models.
5 I also note that San Onofre is not on this list, and
6 they too claim to have a quintessence of excellence of
7 all PRA models.

8 MEMBER ROSEN: Well, if you're trying to
9 use South Texas as a lead plant to represent other
10 plants, it doesn't work very well. Its design is so
11 different, even though it is quintessential in many
12 respects.

13 DR. O'NEILL: Okay, that's a good point.
14 Right now, the lead plant for the later generation of
15 CE design plants is Palo Verde. We know that they have
16 a PRA also, shutdown PRA.

17 So any of the plants that you know of that
18 have one, we'd just appreciate if you'd let us -- drop
19 us a note or something, because we're still searching.
20 We have set up arrangements with several of the
21 licensees for these plants to review our low-power
22 shutdown SPAR model, and we will go there and compare
23 our model with theirs, and do an on-site review
24 sometime in the future, probably early next year.

25 MEMBER BONACA: So Seabrook -- I'm

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1 surprised Seabrook is not there.

2 DR. O'NEILL: Seabrook? Do they have a --
3 See we have a problem, in that Seabrook and Millstone
4 3, Diablo, they're all in the same plant class. We can
5 only pick --

6 We may have enough funding to support
7 doing one or two other models, in which case we could
8 consider Seabrook.

9 CHAIRMAN APOSTOLAKIS: So what is the point
10 now, that each lead plant SPAR represents a class of
11 plants. So you will not have unit-specific SPAR
12 models?

13 DR. O'NEILL: What we would have --

14 CHAIRMAN APOSTOLAKIS: Is that what it
15 means?

16 DR. O'NEILL: We would have class-specific,
17 but we would provide as much information as we have
18 available to us in a tabular form that would enable a
19 fairly adept analyst to take the lead plant's model
20 and convert that over to a model for another plant.

21 Because they would have the Revision 3
22 SPAR model for that plant, so they would have the
23 system-specific fault tree information, George, that
24 they would need to bring into the template to create
25 the model.

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1 CHAIRMAN APOSTOLAKIS: Now I'm confused.
2 Let's pick one plant that belongs to the class of
3 Millstone 3.

4 DR. O'NEILL: Correct.

5 CHAIRMAN APOSTOLAKIS: Give me one. X.
6 Plant X.

7 DR. O'NEILL: Okay, Diablo.

8 CHAIRMAN APOSTOLAKIS: Now, I have to do a
9 Phase 3 SDP for X.

10 DR. O'NEILL: For low-power shutdown?

11 CHAIRMAN APOSTOLAKIS: Yes. What do I have
12 for X right now? Do I have the Millstone 3 --

13 DR. O'NEILL: You would have the -- We have
14 a draft Millstone 3. It has not been reviewed. But we
15 have -- You would have the Millstone 3 low-power
16 shutdown model and you would have the PWR template,
17 which we have reviewed.

18 CHAIRMAN APOSTOLAKIS: And?

19 DR. O'NEILL: And you also have the
20 directions, or the instructions, within the template
21 itself on how to make that into a detailed low-power
22 shutdown model.

23 CHAIRMAN APOSTOLAKIS: I see.

24 DR. O'NEILL: So with a --

25 CHAIRMAN APOSTOLAKIS: And after I do that,

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1 do I store that someplace so next time I don't have to
2 do it again?

3 DR. O'NEILL: Yes. .

4 CHAIRMAN APOSTOLAKIS: So I will then have
5 a SPAR model for X?

6 DR. O'NEILL: Correct. Once you've done
7 that, you won't have to go back and do it again.
8 That's right.

9 MR. BARANOWSKY: But there -- When you
10 think about shutdown, I think there's also going to be
11 some amount of modeling that has to be done because of
12 the unique situations that arrive during shutdown,
13 which is why they're taking this approach, versus the
14 full-power, where it's almost push-button in nature.

15 Couldn't quite do that for shutdown. So
16 what they did was, through the example PRAs,
17 identified the states that could be modeled within a
18 plant class, and then the deviations that have to be
19 taken into account through custom modeling case by
20 case.

21 DR. O'NEILL: Right. There are about 16
22 plant operating states during shutdown.

23 CHAIRMAN APOSTOLAKIS: Okay.

24 DR. O'NEILL: We've taken what we consider,
25 and based on the work that Brookhaven did, the most

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1 risk-significant during low-power shutdown operation,
2 and we've modeled them.

3 CHAIRMAN APOSTOLAKIS: Okay, I understand
4 now. Let's go on.

5 DR. O'NEILL: Okay.

6 MEMBER POWERS: One particular aspect of
7 the -- what I would call the scoping studies, maybe
8 the detailed studies of shutdown. Where they went
9 through and broke the operating states down into those
10 that they thought were risk-significant and those that
11 aren't.

12 It has always bothered me, because it
13 strikes me that one of the worst shutdown events we've
14 had from a conditional core damage probability
15 occurred within a state that was judged to have low
16 risk-significance, because it occupied so little time.

17 Why wouldn't you just hold the operating
18 state?

19 DR. O'NEILL: I'm not sure I understand
20 your question, Dana. Are you asking why didn't we do
21 all of them?

22 MEMBER POWERS: Yes.

23 DR. O'NEILL: It's a matter of, number one,
24 resource and budget considerations, and number two,
25 the more you go into that, the more plant-specific you

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1 get, and so you're going to end up doing a plant-
2 specific low-power shutdown PRA for every plant.

3 I'm not sure that the funding is there to
4 support that kind of an effort.

5 MR. BARANOWSKY: We don't miss those cases
6 in the accident sequence precursor program, nor would
7 we, I think, in the SDP process. It just means that
8 we're going to have to do more custom model work,
9 which we have done.

10 I mean, we've analyzed a number of
11 shutdown events in the accident sequence precursor
12 program by taking the original three SPAR 3 models,
13 making a lot of adjustments, a lot of changes to the
14 event and fault trees, and it takes a lot of effort.

15 So what we're trying to do is put models
16 together here that cut down on the amount of custom
17 work that you have to do, so we can do them more
18 quickly.

19 But I don't think we can have every
20 possible state and scenario represented. But if there
21 was enough information from prior risk analyses that
22 we should expand the models in those areas, we would.
23 Right?

24 DR. O'NEILL: Right. In the case you're
25 talking about, for a particular plant design, Dana,

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1 that specific configuration is very risk-significant,
2 then yes, we would make a special effort to go do that
3 for that particular instance.

4 MEMBER POWERS: The problem I always have
5 with that kind of approach is the disaster has to
6 either occur or be approached to know to do these
7 things.

8 DR. O'NEILL: That's true.

9 MEMBER POWERS: And it doesn't strike me as
10 an optimal strategy.

11 MEMBER SIEBER: One of the plants that
12 could be on the list perhaps is Limerick. But it is
13 one might say not only identical to Peach Bottom, and
14 it started out that way from the nuclear steam supply
15 system, almost, to be identical to Peach Bottom, but
16 yet when you go into the next level of detail there's
17 a whole lot of dissimilarities.

18 I mean, it would be very significant in
19 this approach. I mean, they're different in the number
20 of diesel generators, they're different in the
21 arrangement of the service water system, the ultimate
22 heat sink, all those kinds of things.

23 So, you know, just picking similar nuclear
24 steam supply systems doesn't necessarily assure a
25 similar outcome.

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1 DR. O'NEILL: That's true to some extent,
2 but if the event trees are similar in structure,
3 that's the important thing here. Because the system
4 information that you're talking about would come in
5 from the plant-specific Revision 3 or 3i SPAR model.

6 The success criteria and the system fault
7 tree structure, obviously, would be different, but the
8 event tree structure might be similar, in which case
9 we could use Limerick rather than Peach Bottom.

10 MEMBER KRESS: I see how these models will
11 be very useful for something like ASP and the
12 significance-determination process, but how do you see
13 them being useful for, say, a 1.174-type application?

14 DR. O'NEILL: Well, for 1.174 you would
15 have to couple these to a LERF model. We're working on
16 LERF SPAR models right now, and we will have the
17 capability to link the two.

18 MEMBER KRESS: What I had in mind is 1.174
19 is supposed to represent an average risk over the
20 lifetime of the plant, and in the lifetime of the
21 plant you have future shutdowns, which are both
22 planned and unplanned, and of somewhat unknown
23 configuration.

24 How do you account for unknown
25 configurations of unknown time periods during

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1 different states for future shutdowns?

2 MR. BARANOWSKY: Really, do we have a
3 baseline risk number for shutdown like we do for full-
4 power?

5 MEMBER KRESS: That's extrapolate --

6 MR. BARANOWSKY: That we can just average,
7 that we can work from.

8 MEMBER KRESS: That's extrapolatable into
9 the future.

10 MR. BARANOWSKY: And I don't think we do.

11 MEMBER KRESS: No.

12 MR. BARANOWSKY: We don't have a -- This is
13 not -- That's something that should be clear. This is
14 not going to generate a shutdown risk estimate that's
15 going to be able to analyze the implication of being
16 in different configurations or failures during
17 shutdown.

18 Or at least, we'd have to do something
19 quite different.

20 MEMBER KRESS: I think that was my point.
21 There is something for research to work on.

22 MR. BARANOWSKY: That would be a shutdown
23 risk study, which you could use these models to do
24 some of that.

25 MEMBER KRESS: That would be a starting

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1 point for it.

2 MR. BARANOWSKY: Yes.

3 DR. O'NEILL: One other point I'd like to
4 make before we move on is that another part in the
5 expansion of the templates into a plant-specific model
6 consists of you have to, also, modify the human error
7 probabilities, because you have longer times, both to
8 take action and also conditions are evolving much more
9 slowly than they would be during full-power operation.

10 The QA of the model that you would produce
11 once you have expanded the fault trees, you have
12 modified the human error probabilities and done the
13 other actions that the instructions tell you to do.

14 Two parts. First, we have an internal QA
15 of the model at the contractor, and this is Idaho
16 National Engineering and Environmental Laboratory that
17 is developing these models for us.

18 You review the event trees, the fault
19 trees, the basic event data, the common cause failure
20 modeling, the GEM and GEMDATA. That's the graphical
21 interface that does the calculation for the staff
22 analyst using the SAPHIRE engine.

23 You look at human reliability and
24 recovery. You maintain a log of revisions that have
25 been made to the model, but you have to do this both

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1 with the model and also you have to make sure that the
2 documentation of the model is in agreement with the
3 graphical model.

4 Event trees are standardized for a plant
5 class, so there's not much that has to be reviewed
6 there. The fault trees, as I said, most of them are
7 plant-specific.

8 Some of them are generic, because every
9 plant has the same kind of configuration for a
10 particular system. There aren't too many of those.
11 Basic event data, that is plant-specific for the most
12 part.

13 Common cause failure modeling, just like
14 the revision --

15 MEMBER KRESS: Let me ask you, basic event
16 data. Do you have a plant-specific database for how
17 plant's past shutdowns, where you have what equipment
18 was out of service and how long, and during which
19 operating phase of the shutdown, and you know, just a
20 database from what all of the past shutdowns looked
21 like?

22 DR. O'NEILL: I have two answers to your
23 question. There's a short-term answer and there's a
24 longer term answer. The short-term answer is, no, we
25 don't have one.

1 We would use -- right now, for a PWR, we'd
2 use the information that was obtained and compiled for
3 the Surry shutdown PRA as a surrogate. During the on-
4 site review that we perform, that's one of the pieces
5 of information that we go after to see if we can get
6 that information updated for the specific plant that
7 we're looking at.

8 MEMBER KRESS: Do plants keep that
9 information in a log somewhere?

10 MR. BARANOWSKY: Not always. You have to go
11 through the logs.

12 MEMBER ROSEN: Some of them that have used
13 the Sentinel, for example, and have been integrated to
14 where they manage the outage, have become quality
15 records. They're kept in great detail.

16 DR. O'NEILL: Good, because that's
17 information that we would need in order to make these
18 models more plant-specific.

19 MEMBER ROSEN: And I would say that it's
20 very important that you recognize the major difference
21 in duration of outages plant to plant. Some plants
22 run, except when they have major modifications, like
23 a steam generator replacement, but for a normal --
24 just a refueling outage, some plants run with 20- or
25 22-day outages.

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1 Some plants seem incapable of getting
2 below 30 or 35 days, and that's a huge difference in
3 duration. Now if the duration difference between those
4 two plants I just mentioned is actually in a low-risk
5 state, it won't matter much.

6 But some plants spend much more time, for
7 instance, in hot-early mid-loop than others, and
8 that's the most risk-significant plant operating state
9 for a PWR.

10 So there can be very big differences plant
11 to plant, and the risk that the outages represent.

12 DR. O'NEILL: This was an iterative
13 process, and we recognize that, and that's why we'll
14 put that in as a placeholder and we'll go and try and
15 get as much information as we can.

16 That's a good piece of information to
17 know, because the only experience we have right now
18 with an on-site review is with Surry, and we already
19 had most of that information already. So we'll put
20 that in the protocol for the on-site review. Thank
21 you.

22 MEMBER KRESS: That may be one criteria for
23 how you choose the lead plants.

24 DR. O'NEILL: That's true. That's true. We
25 certainly would like to have as a lead plant one that

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1 has a robust PRA as well as a very well organized and
2 documented --

3 MEMBER ROSEN: Could tell you the history
4 of every outage since it began and how much time it
5 spent in each operating state.

6 DR. O'NEILL: Right.

7 MEMBER ROSEN: And what the risk per unit
8 time was.

9 DR. O'NEILL: Right, because that's very
10 important. We could adjust our model accordingly.

11 MEMBER KRESS: What systems were out of
12 service and unavailable, and how long --

13 MEMBER ROSEN: That's how you get the risk
14 per unit of time.

15 DR. O'NEILL: Okay, the second part of our
16 QA process consists of a review of the draft low-power
17 shutdown SPAR modeling against the licensee's low-
18 power shutdown PRA.

19 We took the QA procedure that we've
20 developed for the Revision 3 SPAR models, and it has
21 been used extensively, because we've performed over 40
22 of these reviews by now.

23 We cover items such as the event tree
24 structure, success criteria, the dependencies, various
25 plant operating states, operating state groups. Now,

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1 the plants themselves would not have operating state
2 groups.

3 We've done that within the context of the
4 standardized templates to simplify the effort. The
5 time windows, as Rosen pointed out, that's very
6 important, because some plants spend more time in the
7 more risk-significant operating states.

8 MEMBER KRESS: Do you plan to compare these
9 plants with the AMSE standard when we get it for low-
10 power shutdown?

11 MEMBER ROSEN: That's ANS.

12 DR. O'NEILL: That's ANS for low-power
13 shutdown, right.

14 MEMBER KRESS: For low-power, that's right.

15 CHAIRMAN APOSTOLAKIS: Well, it's a chicken
16 and egg. Maybe they are writing the standard based on
17 this.

18 DR. O'NEILL: Actually, we would like for
19 our models to meet the standard, not necessarily the
20 same option as a plant PRA would be expected to meet.
21 We're looking at Option 2.

22 MR. BARANOWSKY: All of the SPAR work right
23 now is being done in light of the ASME standard, even
24 if it's not finalized. I think the main area we've
25 determined we need to improve on is some of the

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1 documentation.

2 DR. O'NEILL: That's one.

3 MR. BARANOWSKY: We're doing all the kind
4 of QA and verification checks, but I'm not sure all of
5 it's fully documented according to the standard. So
6 we're going back and looking at what we have to do.

7 MEMBER ROSEN: Have you ever considered
8 inviting a peer review team from the industry in to
9 look at your model?

10 MR. BARANOWSKY: I guess we thought that by
11 going plant to plant we were getting somewhat of the
12 equivalent of that. Also, I think we send some of
13 these to the owners' groups, so we don't have a
14 specific peer review --

15 DR. O'NEILL: That's right.

16 MEMBER ROSEN: You might want to consider
17 that, because the peer review teams are getting very
18 robust, and it's, you know, you want to pick a time
19 when you feel like you've gotten up on a plateau.

20 So that for the input to get yourself to
21 the next plateau, if you had a peer review of this,
22 they come off a little different than the ones that
23 they're doing in the industry for specific plants. But
24 I think it could give you good insights on where
25 you're weak.

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1 Just a thought.

2 MR. BARANOWSKY: Good thought. Thanks.

3 DR. O'NEILL: I'd like to spend a minute
4 here on the HRA methodology.

5 CHAIRMAN APOSTOLAKIS: So the reason why
6 you're going over all this is you are setting the
7 stage for explaining what 4i was?

8 DR. O'NEILL: Yes.

9 MR. BARANOWSKY: Also to satisfy queries
10 that were raised about low-power shutdown program,
11 which actually were raised at the last ACRS meeting I
12 think we were at --

13 MEMBER POWERS: We've been badgering you
14 about them for years.

15 MR. BARANOWSKY: Yes, we've been badgered
16 a lot.

17 MEMBER POWERS: Well, I mean this stuff is
18 great, except there's a pent-up demand for these
19 slides that's inconsistent with our time schedule
20 right now.

21 MR. BARANOWSKY: Well we're trying to make
22 progress.

23 MEMBER SHACK: Just before you -- You
24 mentioned comparison with the ASME standard. I heard
25 a category 2, is that where you think SPAR is at?

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1 DR. O'NEILL: We think that would be
2 appropriate. That's the goal that we had set.

3 MEMBER SHACK: Well, occasionally it's been
4 mentioned in this room that SPAR was category 0.5 I
5 think was the number I heard.

6 DR. O'NEILL: It didn't come from us. I
7 don't know who made the statement or what context it
8 was made in.

9 CHAIRMAN APOSTOLAKIS: So category 2 is
10 what, your standard baseline PRA, right? Category 3
11 is the shiny, normal --

12 MEMBER SHACK: That's where you think
13 you're at.

14 DR. O'NEILL: That's what we're shooting
15 for. We're not quite there yet. We have a couple of
16 areas where we need to improve, and we're working on
17 them right now.

18 But I think when we get finished we should
19 be at a Category 2. The HRA methodology was first
20 developed back in 1994 for use in the accident
21 sequence precursor program.

22 It was later revised in 1999 to
23 incorporate desirable aspects of other HRA methods and
24 sources, and was tailored specifically to SPAR model
25 usage. It takes parts of universally recognized HRA

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1 methods, and puts them together in a form that can be
2 used readily by the analysts.

3 Some of the programs that it borrows from
4 are ASEP, THERB, CREAM, HEART, ATHENA, just to name a
5 few. But basically what it consists of is a three-page
6 worksheet where the analyst rates a series of
7 performance-shaping factors and dependency factors and
8 arrives at a screening level of human error
9 probability for a given task.

10 The three-page worksheet consists of three
11 parts. It looks at diagnosis task, it looks at actual
12 action, and finally, any dependencies. By starting
13 with a baseline value for each of the -- probability
14 for the diagnosis and for the action, it increases or
15 decreases that value based on the performance-shaping
16 factor ratings.

17 The performance-shaping factors cover a
18 number of things, such as the time available to do a
19 task, the stress level, complexity of the task,
20 experience and training of the operator, the quality
21 of the procedures that they're using, fitness for
22 duty, and finally, work processes.

23 Now, the full-power HRA we checked out.
24 They were developed on a sequence-specific basis. We
25 used the tech training center facilities in

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1 Chattanooga to do some exercises that checked out the
2 performance-shaping factors.

3 But we didn't have an explicit application
4 for low-power shutdown, because as I pointed out
5 before, the times that are available to take actions
6 may be much longer than those at full power.

7 The work processes may be much different,
8 because there are a lot of things going on during a
9 plant's shutdown mode of operation. So we are in the
10 process of upgrading our HRA methodology to take that
11 into account.

12 MR. BARANOWSKY: But just to clarify, most
13 of the times when we get into an analysis that has any
14 significant HRA, we have to get a lot of information.
15 Because we can start out with a baseline, but the
16 specifics of each incident become important.

17 I know you did a lot of work recently on
18 that.

19 DR. O'NEILL: Right. It can boil down to
20 taking the specific procedures that the operators were
21 either supposed to use or were using and going through
22 them step by step and doing an HRA evaluation on that
23 type of --

24 CHAIRMAN APOSTOLAKIS: So who's doing this
25 now?

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1 DR. O'NEILL: Idaho. Dave Gertman
2 (phonetic).

3 CHAIRMAN APOSTOLAKIS: Well, Dave Gertman
4 is doing the development.

5 DR. O'NEILL: Right.

6 CHAIRMAN APOSTOLAKIS: But I mean, the
7 user.

8 DR. O'NEILL: The user? Okay. The user,
9 George, would be the staff analyst in the PRA branch
10 in NRR.

11 CHAIRMAN APOSTOLAKIS: So somebody
12 understands these tools?

13 DR. O'NEILL: Correct. We also -- The SRAs
14 in the regions, to some extent.

15 CHAIRMAN APOSTOLAKIS: Or the SDP.

16 DR. O'NEILL: Right.

17 MR. BARANOWSKY: But we're usually going
18 and consulting with an HRA specialist, because --

19 CHAIRMAN APOSTOLAKIS: This is not trivial.

20 MR. BARANOWSKY: -- we don't have that kind
21 of -- No, it's not trivial.

22 DR. O'NEILL: It's not trivial. You're
23 right.

24 CHAIRMAN APOSTOLAKIS: Very good, very
25 good. Are we getting close to 4i?

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1 MR. BARANOWSKY: Getting close.

2 DR. O'NEILL: Yes. I wanted to say a couple
3 of words about the on-site QA review for Surry. All
4 right. I won't --

5 CHAIRMAN APOSTOLAKIS: Is this for Mr.
6 Rosen's benefit?

7 DR. O'NEILL: I won't dwell on that, but we
8 went there on the 15th of August. We were there in
9 conjunction with NRR's review of the low-power
10 shutdown SDP analysis tool that they've developed to
11 perform a Phase 2 analysis of low-power shutdown
12 issues.

13 The participants are listed there. Again,
14 we went over the normal scope of the review. The next
15 page, plant-specific review insights. In general, we
16 found that there was good agreement between the low-
17 power shutdown SPAR model, and the Surry low-power
18 shutdown PRA.

19 Not surprising, because both of them were
20 based on NUREG/CR-6144. The Surry low-power shutdown
21 PRA uses the same initiating event frequencies that
22 were in that report.

23 CHAIRMAN APOSTOLAKIS: How many studies
24 have been done for Surry? Does anyone keep track?

25 DR. O'NEILL: Good question.

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1 MEMBER POWERS: But George, the distressing
2 thing is that every time they do a new one, they find
3 something.

4 DR. O'NEILL: The low-power shutdown SPAR
5 model for Surry is a little different from the
6 licensee shutdown PRA, because we separate out loss of
7 HRH that's caused by a loss of level control.

8 The reason for that is basically, NRR has
9 a lot of low-power shutdown-related inspection
10 findings that deal with this, and their low-power
11 shutdown analysis tool separates it. So we wanted to
12 be consistent with their approach.

13 We did find a number of generic review
14 insights. I won't go through those.

15 MEMBER KRESS: Let me ask you about the
16 first one. You know, the reason the sump gets plugged
17 up, sometimes you're having an accident which you're
18 depressurizing, and all that high-pressure steam and
19 water comes out and tears things up, and transports it
20 to the sump.

21 Now during low-power shutdown, you don't
22 have that driving force. Why would you have concluded
23 that just because there's an increased level of
24 personnel activity, you would have a higher likelihood
25 of a sump plugging?

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1 DR. O'NEILL: Just basing that on what we
2 saw in the Surry PRA. We hadn't really given that much
3 consideration until that time. Now, is that an
4 anomaly? I don't know, because we've only done one of
5 these reviews.

6 If we do another one or two and we find a
7 similar tendency, then yes --

8 MEMBER KRESS: That really would have
9 surprised me.

10 DR. O'NEILL: What the basis for that is,
11 I don't know.

12 MEMBER ROSEN: I'll try and answer it for
13 you. You've got the bullet there, due to increased
14 level of personnel activity in the containment during
15 low-power shutdown.

16 It's not just people, but it's what they
17 bring into the containment.

18 DR. O'NEILL: And what they leave there.

19 MEMBER ROSEN: And what they leave. Should
20 there be an accident or radiation release which tells
21 them to exit the containment as quickly as possible,
22 they can't take all the materials that they brought in
23 to do a job.

24 There may be drop cloths, they may be
25 painting, who knows what.

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1 MEMBER KRESS: Yes, but that stuff doesn't
2 have much potential for blocking the sump.

3 MEMBER ROSEN: I guess I disagree. All
4 kinds of things can be brought in, and there's
5 probably no central authority that says, 'That's too
6 much because of plugging concerns of the sump.'

7 DR. O'NEILL: We'll have a better feel for
8 it as we do more of these reviews and see how they're
9 going. The summary, the evaluation of the review
10 results, unfortunately it was inconclusive relative to
11 our QA acceptance criteria.

12 Reason being is that the licensee's
13 contractor was not available for this meeting, and it
14 was difficult to get a lot of detail as a result of
15 that.

16 So further discussion with the licensee is
17 planned on this particular plant model. So I really
18 don't have a lot of conclusions yet.

19 MR. BARANOWSKY: Okay, you ready?

20 DR. O'NEILL: Are you ready?

21 CHAIRMAN APOSTOLAKIS: And we have 26
22 minutes.

23 MEMBER POWERS: This is just the
24 cancellation, I want to see -- Take the "Cancellation"
25 part off and say "Plans for Revision 4k".

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1 MR. BARANOWSKY: Maybe we should just say,
2 "Are there any other discussions?"

3 (Laughter.)

4 CHAIRMAN APOSTOLAKIS: Okay, let's go on.

5 MEMBER ROSEN: Dana, are you saying you
6 have a prejudiced for this already?

7 MEMBER POWERS: I have no prejudice
8 whatsoever here. Commissioner McGaffigan just wants to
9 know if we go along with cancellation of this 4i. But
10 I don't know what it is. I can't answer his question.

11 DR. O'NEILL: Okay. I will now attempt to
12 tell you. The second bullet on the first slide says
13 that the Revision 3 SPAR models were developed by
14 improving the Revision 2.

15 Well, what the Revision 4 SPAR models
16 consist of would be further improvements and
17 embellishments and enhancements to the Revision 3
18 models, which is what you normally would anticipate in
19 an evolutionary process such as the SPAR model
20 development program.

21 We would add even more initiating events
22 to the Revision 3 coverage than we have right now. To
23 get --

24 CHAIRMAN APOSTOLAKIS: Now when you say
25 "Revision 3" you mean those seven or eight lead

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1 going to show you something about cost of this. This
2 sort of goes back to the issue that Steve Rosen
3 raised.

4 This is the point at which we're not sure
5 it's practical anymore for us to have the kind of
6 expenditure for NRC-specific models to capture that
7 extra 10 to 15 percent for all the plants that have it
8 sitting there.

9 Now we can modify any of the SPAR 3 models
10 for a fairly modest cost if an issue comes up in that
11 10 to 15 percent by our own experience, plus looking
12 at the licensee's PRA, and still have an independent
13 analysis.

14 DR. O'NEILL: Absolutely right.

15 MR. BARANOWSKY: But we just drew the line
16 at that point and said, 'That's the point where it's
17 probably not practical.'

18 MEMBER ROSEN: It's getting asymptotic.

19 MR. BARANOWSKY: Yes, and it can always get
20 more and more detail in there, but --

21 CHAIRMAN APOSTOLAKIS: So 4i, or 4, 4 would
22 not have been the ultimate state. Then it would have
23 been followed by a 5?

24 DR. O'NEILL: Yes. They just keep
25 developing, George, and the question is, 'Where do you

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1 plants?

2 DR. O'NEILL: No, no. I'm now talking full-
3 power George. This is full-power. This is not low-
4 power shutdown.

5 CHAIRMAN APOSTOLAKIS: So now we are
6 talking about full-power.

7 DR. O'NEILL: Full-power. Right.

8 CHAIRMAN APOSTOLAKIS: So this is' every
9 single unit?

10 DR. O'NEILL: Every single -- We have 72
11 full-power level one Revision 3/3i models right now.
12 We would be taking them to Revision 4i. In a nutshell
13 what that would be is we're talking about a mini-PRA
14 for every plant.

15 When I get through enumerating all the
16 things we'd add to it, that's what you'd have. We'd
17 add more initiating events. We could do things like
18 low-voltage AC. We could do other support systems that
19 aren't covered right now by the Revision 3 models.

20 Revision 3 models cover support systems,
21 but a limited scope of them. We have service water,
22 we've got component-cooling water, we'd go even
23 further.

24 MR. BARANOWSKY: We capture 80 to 85
25 percent of the internal events right now, and he's

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1 reach the point of diminishing return, from a cost-
2 benefit standpoint?'

3 MEMBER ROSEN: From a regulatory
4 perspective.

5 DR. O'NEILL: Yes.

6 CHAIRMAN APOSTOLAKIS: So, I don't
7 understand now. We don't plan to move on then?

8 MR. BARANOWSKY: No. What we're going to
9 have is -- is that in here anywhere?

10 DR. O'NEILL: Yes, the last slide.

11 MR. BARANOWSKY: Okay, he's going to cover
12 that. We're not just standing still doing nothing, but
13 we're not going to go and put all these models
14 together for every possible thing.

15 In other words, the equivalent of a San
16 Onofre or a South Texas type PRA, just not practical
17 for us to do that. Maybe you can explain it here.

18 DR. O'NEILL: The estimated total cost of
19 Revision 3 SPAR model development is roughly \$3.8
20 million. It turns out that on an average per model
21 basis we're talking about \$35,000, that's rough.

22 In order to develop Rev 4 would require
23 that we do on-site visits. We would have to do walk-
24 downs of systems. We'd have to go over plant
25 procedures. We estimated that it would be at least

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1 twice as much per model as the Rev 3, maybe even more
2 in some cases.

3 MEMBER POWERS: It sounds like a bargain,
4 no matter -- I mean, \$35,000 a model versus \$70,000 a
5 model sounds pretty cheap to me.

6 MR. BARANOWSKY: I guess it's relative.

7 DR. O'NEILL: It's relative.

8 MR. BARANOWSKY: But we're not sure that
9 the pay-off is there. If we can make an argument for
10 it in terms of the amount of usage that we would get
11 out of that extra accuracy, I think we would do it.

12 But right now, we think that by -- I think
13 he's got a line on here on maintaining existing SPAR
14 models.

15 DR. O'NEILL: Right.

16 MR. BARANOWSKY: As we find factors through
17 operating experience or other licensee analyses that
18 we think need to be incorporated, we'll make small
19 changes, and not call them --

20 DR. O'NEILL: Revs.

21 MR. BARANOWSKY: That would be Rev 3, but
22 they'll be (a), (b), (c), something like that.

23 DR. O'NEILL: Right.

24 CHAIRMAN APOSTOLAKIS: So you have 3ia?

25 MR. BARANOWSKY: No, "i" will be gone.

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1 We're going to get rid of the "i"s in the not-too-
2 distant future.

3 DR. O'NEILL: "i" goes away by the end of
4 the fiscal year.

5 CHAIRMAN APOSTOLAKIS: So you're still
6 talking about full-power, right?

7 DR. O'NEILL: Correct.

8 CHAIRMAN APOSTOLAKIS: So a 4i refers to
9 full-power?

10 DR. O'NEILL: Yes.

11 CHAIRMAN APOSTOLAKIS: Now you mentioned,
12 Pat, that you would have to go and do walk-throughs
13 and look at the procedures. So you haven't done any of
14 that for the existing Rev 3 models?

15 DR. O'NEILL: Not walk-throughs, per se,
16 George. On a specific case, we may have had to go to
17 the site, get the resident inspector to track some
18 things down for us, because we had questions about
19 certain items.

20 But that would be regular.

21 CHAIRMAN APOSTOLAKIS: You don't have
22 internal floods and fires.

23 DR. O'NEILL: Not right now, no.

24 CHAIRMAN APOSTOLAKIS: Because it's much
25 more important then.

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1 DR. O'NEILL: Yes. We have an external
2 events modeling effort that we're going to get started
3 with --

4 CHAIRMAN APOSTOLAKIS: So what is it, what
5 effort was competing with this, and won? I mean,
6 instead of spending --

7 MEMBER POWERS: George, I'm more lost than
8 that. I don't even understand what the effort is in 4.
9 I mean, there is no list that says, here, 'In 4, I
10 would do this, this, this, this.'

11 I see statements that say, 'Gee, we've got
12 the SPAR models capped for 80 to 85 percent of the
13 internal events.' That doesn't sound very good to me.

14 MEMBER BONACA: The thing that surprises
15 me, the exclusion right now is for the component-
16 cooling water. That's a medium and large LOCAs on the
17 models right now. I don't understand.

18 DR. O'NEILL: No. We have that now. We
19 would go beyond that.

20 MEMBER BONACA: Oh, okay, I'm sorry.

21 DR. O'NEILL: We would have every
22 initiating event that the licensee has in its PRA, as
23 an example. That's probably where we would go.

24 MEMBER BONACA: Why don't you give me some
25 example of some initiators you do not model right now?

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1 DR. O'NEILL: Plant steam line break.

2 MEMBER BONACA: Okay.

3 CHAIRMAN APOSTOLAKIS: Isn't that
4 important?

5 MEMBER POWERS: My understanding is they
6 don't have core cooling water here. I mean, that's the
7 way I read the draft.

8 MEMBER BONACA: No, I just --

9 MEMBER ROSEN: To come back to the point of
10 80, 85 percent. If you've already got that much, and
11 whether that's good enough. We talk about PRAs being
12 accurate sometimes within orders of magnitude or a
13 factor of five, maybe.

14 But to say that it's within ten or 15
15 percent and want to do better than that seems
16 excessive.

17 MEMBER POWERS: It doesn't say it's within
18 ten or 15 percent. It says it's captured 80 to 85
19 percent of the internal event.

20 MEMBER ROSEN: Well, that's within ten or
21 15 percent. Or 20 percent.

22 MEMBER POWERS: No it's not.

23 MR. BARANOWSKY: The results don't have
24 that kind of consistency. That's of the sequences,
25 right?

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1 DR. O'NEILL: Correct.

2 MR. BARANOWSKY: And I think I could add
3 onto that that we aren't missing any dominant
4 sequences.

5 DR. O'NEILL: No. That's right.

6 MR. BARANOWSKY: But I wouldn't be
7 surprised to see a factor of two, three, four, even
8 five difference in the total core damage frequency.
9 Probably two is more typical, I think.

10 MEMBER ROSEN: Difference between what and
11 what?

12 MR. BARANOWSKY: What we would get and what
13 the licensee might get.

14 DR. O'NEILL: Right.

15 MEMBER KRESS: That's not what the bullet
16 says. On the previous slide, it says it captures 80
17 percent of the CDF.

18 MEMBER POWERS: No, it says "of internal
19 events".

20 DR. O'NEILL: Internal events.

21 MEMBER KRESS: CDF has to be on there for
22 some reason.

23 MR. BARANOWSKY: Maybe it's a little bit
24 deceptive wording.

25 MEMBER POWERS: Well, I guess the question

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1 I would ask is how well do you think you estimate
2 things like Fussel-Vesely with this kind of approach?

3 MR. BARANOWSKY: Well, we think we do
4 pretty well, and we're testing it out now against the
5 number of licensee's PRAs as part of a pilot project
6 that's going on.

7 DR. O'NEILL: We checked those out on the
8 on-site QA review, Dana. We look at the rods.

9 MEMBER POWERS: Yes, but you're not going
10 to share it with me?

11 MR. BARANOWSKY: I guess, you could
12 tabulate the information.

13 DR. O'NEILL: Yes, we could give you a
14 tabulation of those that we've done thus far.

15 MEMBER BONACA: Well, why don't you
16 consider to go 100 percent on one plant, and see what
17 it brings in for that particular plant with respect to
18 the 3 and get a sense of that. That may support your
19 conclusion which you're trying to do --

20 DR. O'NEILL: Well, I can give you a
21 specific example, because I participated in it
22 personally, and that was at San Onofre. When we got to
23 San Onofre, we ran the SPAR model in a number of
24 scenarios, and the licensee ran their PRA model for
25 the same scenarios.

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1 We compared the results, and we had --
2 from a CDF standpoint, the internal events CDF, we had
3 within a factor of three agreement with the baseline
4 CDF.

5 However, the contributors that we had were
6 somewhat different than those the licensee had. So,
7 that then became the point of starting out on our
8 technical discussion.

9 We went into the sequence by sequence
10 differences, and we discovered that the configuration
11 of the plant's support system, specifically the salt
12 water and service water systems, had changed since we
13 were last aware of the system design.

14 This was post-IPE, and it was actually
15 post-first update of their IPEs, so we made those
16 changes. We re-ran the scenarios and lo and behold, we
17 started coming closer to agreement.

18 We finally determined that the reason for
19 the disagreements at the end of this exercise were
20 twofold. One was the equipment failure probabilities
21 that had been input to some of the systems, and the
22 other one was the human error probabilities.

23 When we took the equipment failure
24 probabilities that the licensee used, and the human
25 error probabilities, put them into the SPAR model for

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1 San Onofre, we got the same CDF with the same dominant
2 contributors in the same order.

3 CHAIRMAN APOSTOLAKIS: But I think the
4 issue, though --

5 MEMBER ROSEN: That's a spectacular story.
6 Very interesting.

7 DR. O'NEILL: Doesn't always happen though.

8 CHAIRMAN APOSTOLAKIS: I want to understand
9 something. We have put you in a position now where you
10 are really defending the technical adequacy of what
11 you have done.

12 But what I would like to understand is,
13 was the budget dictated to you and you did the best
14 you could with it, or if you had the budget, you would
15 actually go ahead and develop good models?

16 MR. BARANOWSKY: We think we have good
17 models, and --

18 CHAIRMAN APOSTOLAKIS: Well, I don't mean -
19 - Complete models.

20 MR. BARANOWSKY: The budget -- It was up to
21 us to make a proposal on the budget. We went through
22 and looked at this and amongst ourselves, we said,
23 'We're not sure it's really worth going forward.'

24 Now maybe it will be sometime in the
25 future, but right now, we don't see it, and it was

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1 planned for whatever fiscal year.

2 DR. O'NEILL: It started in '05.

3 CHAIRMAN APOSTOLAKIS: Now if a licensee
4 did this though, would we criticize them? If they
5 said, 'Well, gee, we think we covered 80 percent of
6 the CDF.'

7 MR. BARANOWSKY: Depends on what he's going
8 to use it for. Remember, I'm not trying to establish,
9 necessarily, the baseline risk for the plant. That's
10 already been done, mostly by the licensee.

11 Now we may have some disagreements about
12 certain factors. The human reliability numbers and
13 things that give you moderate differences. But that's
14 done. We need to use this for other things:
15 significance determination and accident sequence
16 precursors, that kind of activity.

17 MEMBER KRESS: And risk-informing the
18 regulations.

19 MR. BARANOWSKY: And to the extent that the
20 models cover the things that we're doing, we can do
21 that. If they don't, we believe we can go and make
22 changes, or use insights from these models and the
23 licensee's PRA at this time.

24 When that becomes cumbersome, and we need
25 a more extensive model, we'll either look at using the

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1 licensee's model, if it's been QA'd through, say, ASME
2 standards, or, if we have to, we'll expand our models.

3 But what if the licensees all do go
4 through the ASME process, and they become good models
5 in 2005 or '06.

6 CHAIRMAN APOSTOLAKIS: I think it's more
7 likely they will go through the NEI process.

8 MR. BARANOWSKY: Whatever certifies them.

9 MEMBER ROSEN: Let me clarify. The ASME
10 process references the peer certification process, the
11 NEI process. They're really the -- They're linked.
12 What I'm told is all but two licensees have gone
13 through that peer certification process.

14 MEMBER POWERS: Mr. Chairman --

15 MEMBER ROSEN: There's a lot of
16 misinformation here. Just to clarify.

17 MEMBER POWERS: Mr. Chairman, I will not
18 yield, compose, any kind of response to Mr. McGaffigan
19 about this question, based on the information I've
20 heard today.

21 CHAIRMAN APOSTOLAKIS: Well, what else
22 would you like to know?

23 MEMBER POWERS: I'd like to know what's in
24 4i, what was to be in 4i.

25 CHAIRMAN APOSTOLAKIS: Can you answer that

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1 Pat?

2 DR. O'NEILL: I thought I did.

3 MR. BARANOWSKY: I think the problem is we
4 didn't spec out the 4i in detail. What we were going
5 to do was, by observation, we looked at what we're
6 missing and in order to do the kinds of tasks that Pat
7 O'Reilly identified, that would expand the models to
8 capture, say, 99 percent, we estimated it would at
9 least double the amount of cost to do it.

10 We haven't gone and charged the contractor
11 to go and do a feasibility study, if you will, which
12 would give us the kind of, I think, detail you might
13 be talking about.

14 MR. NEWBERRY: Scott Newberry. Pat mention
15 the timing of 4i again so the committee understands
16 when we would have started the activity?

17 MR. BARANOWSKY: Well, we would start the
18 planning activity in 2004 and implementing it in 2005.

19 MEMBER POWERS: Right now what I'm going to
20 say, and in any kind of draft response is going to
21 read something like, 'They got this kind of
22 interesting SPAR activity underway. They are
23 continually improving the model. They're up to
24 Revision 3. They were thinking about 4.

25 'Since they had no idea how good it had to

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1 be for the applications, they couldn't justify going
2 to the cost for 4 and so they canceled it.'

3 MR. BARANOWSKY: I think that might be
4 slightly unfair --

5 MEMBER POWERS: It'll be more unfair if I
6 actually thought about the wording.

7 (Laughter.)

8 MR. BARANOWSKY: Keep in mind what we've
9 done is we've made a judgment call that a SPAR model
10 maintenance project would allow us to make what I
11 might call focused revisions to the SPAR 3 models at
12 a more efficient cost."

13 You may want to disagree with that, but
14 that's our judgment, and I think that should be taken
15 into consideration.

16 MEMBER BONACA: Now, if you, for example,
17 did a verification of some 1.174 application, San
18 Onofre, and now you know already that you have some
19 difficult agreements, so you have the means of
20 performing an independent evaluation, and have
21 credibility for the absolute body of CDF.

22 Now conversely you might find another
23 plant where you go, there is an application, you find
24 large differences at the end of the process. Do you
25 feel that you still would be able to identify the

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1 sources of those differences?

2 DR. O'NEILL: Yes, definitely.

3 MEMBER BONACA: You would? So, what you're
4 saying is that the model that you have allows you to
5 support your regulatory evaluation?

6 MR. BARANOWSKY: The SPAR 3 full-power
7 models are way, way more advanced than anything else
8 that we have. I'd like to put more effort into the
9 level 2 LERF models, the shutdown model, and the
10 external events, so that I can at least get them up to
11 some reasonable --

12 CHAIRMAN APOSTOLAKIS: That's what I asked
13 you earlier. This was competing with what in cost?

14 MR. BARANOWSKY: Okay, it's competing in my
15 branch with that activity because I have so many
16 people and roughly so many dollars I can start
17 planning with.

18 But no one came up to me and said, 'You
19 have to keep your budget at X for 2005.' I was asked
20 what do I think I need? And I got a look at what's
21 realistic in terms of staff that's going to be
22 available and what our needs are.

23 And our needs are much more in these other
24 areas right now. We need to get that -- And that's
25 going to run several years before we get those models.

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1 DR. O'NEILL: The priority, George, has
2 been determined by the user's needs as they expressed
3 them. We asked them, 'Okay, we have these areas. What
4 are your highest priorities here?' and the full-power
5 revision 3 models came out on top.

6 MEMBER POWERS: George, I'm coming to the
7 point that I think we should not respond to this
8 question, and for a couple of reasons. It seems to me
9 that the decision that has been made is a legitimate
10 function of the management, and outside of our domain.

11 It's a judgment call they made based on
12 their expertise as managers, which we don't pretend to
13 compete with. What we are better suited at doing is
14 looking at this overall strategy they have, and all
15 these other things, and saying, 'Is this what you
16 really need here?' rather than this question of
17 keeping or not keeping 4i.

18 CHAIRMAN APOSTOLAKIS: Sure, and I, you
19 know, if you were to ask me, should I improve on 3 at
20 the expense of not having a fire SPAR model I would
21 say, "No."

22 I would say go ahead and build something
23 on fires. So it doesn't sound to me like this decision
24 was off-base.

25 MEMBER ROSEN: From what I've heard I think

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1 you've got it right exactly.

2 CHAIRMAN APOSTOLAKIS: But why did you
3 advertise 4i? I don't understand.

4 MR. BARANOWSKY: You know the way the
5 budget process goes. You have to start looking many
6 years ahead, and you forecast, okay? And that's what
7 we did. That 4i was in place I think before I was
8 Branch Chief in charge of the SPAR stuff.

9 MEMBER BONACA: But are you saying the 4i
10 will never happen?

11 MR. BARANOWSKY: No. I'm saying --

12 MEMBER ROSEN: Be careful about saying
13 "never".

14 MEMBER BONACA: No, I'm asking that
15 question.

16 MEMBER ROSEN: That's a very good point.

17 MEMBER BONACA: I understand. I'm saying so
18 therefore, you're saying that at this time --

19 CHAIRMAN APOSTOLAKIS: It's better to bring
20 fire and earthquakes up to speed.

21 MEMBER BONACA: And then maybe later on
22 you'll do this next step.

23 MR. BARANOWSKY: Well, I'm not putting it
24 on the books for the future either, unless there's a
25 need for it.

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1 CHAIRMAN APOSTOLAKIS: See, that's the
2 point that we are falling into the pitfall that many
3 other people are also falling into when they defend
4 PRA. You shouldn't be defending 4i versus 3.

5 You should be saying, 'Instead of 4i, I
6 want to do this.'

7 MEMBER BONACA: At this time.

8 CHAIRMAN APOSTOLAKIS: Now. Then it's a
9 different story.

10 MEMBER ROSEN: Later, who knows. Maybe
11 we'll improve something else. The value of a PRA
12 process is it allows you to continuously improve, and
13 keep the PRAs in the plants living PRAs.

14 That's what you found at San Onofre. You
15 went out there and you found that the model had
16 changed. Why? They'd made some modifications, and they
17 had better estimates of the unavailabilities and
18 reliabilities of their equipment.

19 So they were keeping it up. That's what
20 most plants are doing. That's what the standard
21 requires. That's what the peer certification checks.
22 So that's a good thing. That's exactly the same thing
23 the staff should be doing with its models.

24 CHAIRMAN APOSTOLAKIS: So, speaking of the
25 peer review, for example. Let's say this had gone for

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1 a peer review and gotten a few Bs and Cs. Instead of
2 fixing those, they are saying, 'I would rather go and
3 develop something for fire and earthquake.'

4 MEMBER KRESS: Yes, but we don't want to
5 lose sight of the fact that 4i eventually would be
6 desirable. And this just postpones it.

7 MEMBER ROSEN: I think it goes too far to
8 say it's desirable. It's a piece of work that could be
9 done, and it has to always be assessed in the context
10 of everything else.

11 MEMBER KRESS: Well, that context is what
12 eventually will SPAR models all be used for. I
13 envision more expanded use in helping craft risk-
14 informed regulations, and there I think, for really
15 crafting risk-informed regulations, I think you need
16 4i.

17 CHAIRMAN APOSTOLAKIS: Amen. I agree with
18 you 100 percent.

19 MEMBER KRESS: So, eventually it would be
20 needed. Maybe not now. So I hope it's just postponed,
21 and maybe would come about in an incremental way
22 somewhere --

23 MR. BARANOWSKY: Well, I think that's
24 possible. But before we would put together a big
25 project to add a new element of detail to these

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1 things, we'd want to make sure that the use had some
2 value.

3 MR. NEWBERRY: Scott Newberry from the
4 staff. I think the committee finally came around to
5 the point where you were simulating the discussion by
6 management on 4i, with one possible exception.

7 That is if you look at Pat's resources,
8 both dollars and staff, the other thing that he does
9 is to help the agency move ahead on the programs. That
10 is, not just coming up with tools, but to help NRR
11 work on improving risk-based performance indicators,
12 the new performance indicator process, better
13 analysis, better actual decision-making.

14 So those were the things that were also
15 competing with 4i, not just tool-development. I just
16 wanted to --

17 MEMBER BONACA: There's always going to be
18 a limitation anyway, to the degree to which you are
19 going to be able to reflect plants, because the plants
20 change.

21 It takes years, many years of work to
22 update the PRAs.

23 MEMBER POWERS: But Mario, the change
24 cannot be very fast, because if they go and they use
25 the shutdown models that were done back in the late

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1 '80s for Surry, and they find good agreement, this is
2 not heroic changes.

3 MEMBER BONACA: No, no, I'm talking about -
4 - I'm looking forward and saying, there are going to
5 be 100 plants, each one of them is going to have a
6 full-power PRA. Even if you had SPAR models that well
7 represent those plants, every outage they go through,
8 these plants have modifications, and if you had to --

9 So there is a limit to how much, probably,
10 the staff can keep up. So I think you have to make a
11 judgment on what you need to perform a good comparison
12 and ask intelligent questions of the licensee.

13 The licensee is probably going to have
14 good answers for the differences. But it gives a
15 platform for the NRC to ask intelligent questions. I
16 think that's an important point to look at.

17 MEMBER POWERS: Well, I mean -- I have to
18 say that I have an enthusiasm for this program. I
19 think it's doing an outstanding job, and what I know
20 from talking to the senior reactor analysts out in the
21 region is they're extremely enthusiastic about getting
22 more and more and more --

23 And they use this stuff. This is used
24 material, and whatnot. I guess I am coming down on
25 saying you've got no right intruding into this

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1 judgment of balancing resources decision, because it's
2 a management decision.

3 But I haven't got a clue what your
4 development plans are for this code. I mean, there are
5 huge numbers -- there's an infinite amount that could
6 be done, and a lot of it seems to me to be desperately
7 needed.

8 Like being able to do good fire analyses
9 and things like that are -- I mean, people hunger for
10 that in the regions. I would really enjoy listening to
11 a grand strategy for the next ten years for the
12 development of this. With a little work to do.

13 I mean, I enjoyed your memorandum on what
14 you needed --

15 CHAIRMAN APOSTOLAKIS: Has Commissioner
16 McGaffigan asked the ACRS? He asked the staff has the
17 ACRS reviewed.

18 MEMBER POWERS: Yes.

19 CHAIRMAN APOSTOLAKIS: Are we under any
20 obligation to write a letter to him? I mean, he didn't
21 ask us.

22 MR. DURAISWAMY: Well, George, the same
23 question was asked. He asked the ACRS too.

24 CHAIRMAN APOSTOLAKIS: When?

25 MR. DURAISWAMY: The same time he asked the

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1 staff.

2 CHAIRMAN APOSTOLAKIS: There's no SRM is
3 there?

4 MR. DURAISWAMY: No, he asked -- The
5 question was posed, I think, after he reviewed the
6 budget and a proposal, I think he asked the question,
7 sent the question to the staff. At the same time it
8 was sent to the ACRS too.

9 CHAIRMAN APOSTOLAKIS: Okay.

10 MEMBER POWERS: It seems to me that the
11 best advice I can give Pat here is why don't you hit
12 him up for some bucks and some time to develop a grand
13 strategy on this thing, rather than doing it each
14 budget cycle and whatnot.

15 MR. BARANOWSKY: It's not quite like that.
16 We do have a program plan that takes us through 2005,
17 and the strategy is one that's derived at by Office of
18 Research, discussing with NRR, and regional folks, in
19 terms of what their priorities are.

20 But it doesn't go beyond --

21 MEMBER POWERS: 2005 I probably -- It would
22 be fascinating to read. I mean, you can send it to me
23 and let me read it, and you won't have a bunch of
24 questions.

25 MR. BARANOWSKY: If you want, if there's

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1 something else we can give you, we'll send you that
2 document and whatever else.

3 MEMBER POWERS: Because, I mean this is
4 really an important undertaking as you well know from
5 our visits to the regions. These guys, I mean all they
6 want is more, and they use it all the time. They're
7 full-time, busy, and I notice you had lots of user-
8 friendly things on there.

9 They're hungry for that, trust me. And
10 being able to address more topics like fire and
11 earthquakes is probably more important to them, I take
12 it, than to be able to get that last 15 percent. I
13 mean I think that's true.

14 But I mean, I don't know what we'd do as
15 a final response. My advice to you is to go back to
16 McGaffigan and say, 'The ACRS doesn't think it's any
17 of their business to make management decisions.'

18 I mean, you guys get big bucks for doing
19 that.

20 CHAIRMAN APOSTOLAKIS: What did you say?
21 Doesn't think it's any of your business or its
22 business?

23 MEMBER POWERS: ACRS' business.

24 CHAIRMAN APOSTOLAKIS: Oh, ACRS' business.

25 MEMBER POWERS: I mean we just don't do

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1 that. I mean, we shouldn't be asked to do that. We
2 can't possibly know all the pressures you're under.

3 CHAIRMAN APOSTOLAKIS: Okay. So anything
4 else that we need on this?

5 MEMBER POWERS: Well, I think -- I want to
6 compliment the speaker for a very information-packed
7 set of view-graphs, and apologize for him that the
8 forum was just too short to go into those in detail.

9 I want to thank you guys for sending me
10 what you did send, because I found it fascinating
11 reading. I could probably quibble with you for more
12 than two days on your template, but it was still
13 fascinating reading, and very informative.

14 Again, I think it's extraordinarily
15 important work that you're doing.

16 MR. BARANOWSKY: Thank you.

17 DR. O'NEILL: Thank you.

18 CHAIRMAN APOSTOLAKIS: Okay, thank you,
19 gentlemen. We'll recess until 10:20.

20 (Whereupon, the foregoing matter went off
21 the record at 10:05 a.m. and went back on the record
22 at 10:26 a.m.)

23 CHAIRMAN APOSTOLAKIS: The next slide I
24 think is mine, and it has to do with Performance-Based
25 Regulation and the Guidelines the staff has prepared.

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1 We wrote a letter on this back in September of 2000 to
2 the Executive Director essentially supporting the
3 staff's proposal to develop the guidelines and making
4 a few comments regarding the level at which the
5 monitor parameters should be set and so on.

6 So today Mr. Prasad Kadambi will bring us
7 up to date. Right Prasad? Thank you.

8 MR. KADAMBI: I sure hope so, Mr. Chairman.
9 Thank you very much. I'm joined in the presentation by
10 the Branch Chief for the Regulatory Effectiveness and
11 Human Factors branch, John Flack.

12 Technical assistance on this project has
13 been for some years -- we have received quite a bit
14 from Bob Youngblood of ISL, so if I have any questions
15 of detail I'll call on Bob.

16 John, did you want to?

17 MR. FLACK: Yes, again I'm John Flack, the
18 Branch Chief of Regulatory Effectiveness and Human
19 Factors branch. We have the research responsibility
20 for the performance-based regulatory initiative in
21 developing the guidance document, which you'll hear
22 about today.

23 There's a larger initiative, coherence,
24 which you'll hear about next month. Chris Grimes from
25 NRR has the lead on that particular initiative. So

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1 we're talking about a certain piece of that overall
2 initiative.

3 What we'd like to do is walk you through
4 the document today, show you some illustrative
5 examples. Really the document, what it does is it has
6 one ask questions, which is very important in the
7 process.

8 Basically they stem from the three "why,
9 what, how" questions. Why do we have this regulatory
10 concern? What are the ways we can deal with it and
11 look at performance base as one of the alternatives
12 and options in that? Then, how do we go about
13 implementing that initiative or that option?

14 Again, as Prasad had mentioned, the
15 objective is to get the committee's views via a letter
16 and feedback and to reach closure on this part of the
17 process, which is the guidance document.

18 CHAIRMAN APOSTOLAKIS: John, you mentioned
19 the letter. What is the question? Is the question to
20 release the document as a NUREG report or what?

21 MR. FLACK: Yes, that's exactly right.

22 CHAIRMAN APOSTOLAKIS: And what happens if
23 you release it as a NUREG report? I mean, other
24 offices begin to use it?

25 MR. FLACK: It's something to point to as

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1 part of the implementation of the performance-based
2 initiatives, as this is a process about how to go
3 about working performance-based approaches as part of
4 regulatory decision-making.

5 CHAIRMAN APOSTOLAKIS: But if you don't
6 publish it, they will still go ahead and do these
7 things, right?

8 MR. FLACK: That's right. There's still --

9 CHAIRMAN APOSTOLAKIS: They will just lack
10 this guidance.

11 MR. FLACK: That's right. Hopefully, this
12 guidance will support that initiative and set --

13 CHAIRMAN APOSTOLAKIS: So this is the
14 question. Should this be published?

15 MR. FLACK: Yes.

16 CHAIRMAN APOSTOLAKIS: And of course, if we
17 have technical comments we can also make those.

18 MR. FLACK: Absolutely.

19 CHAIRMAN APOSTOLAKIS: Are you done John?

20 MR. FLACK: Okay, yes.

21 MR. KADAMBI: Thank you, Mr. Chairman. The
22 outline of my speech is up there. I just want to point
23 out that the report that you received a few weeks ago
24 has a different illustrative example than the one that
25 I will use.

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1 I wanted to use for this presentation the
2 latest information, and the ones that would clarify
3 the guidance best in our judgment. I want to begin by
4 summarizing what I hope will be the message from my
5 presentation, which is that at this point, the
6 research and development effort on performance-based
7 approaches, I believe, is over.

8 We have developed the necessary
9 infrastructure and now it's time to move on to the
10 implementation and execution. The guidance document
11 provides the broad architecture for more case-specific
12 applications.

13 It is meant to apply to all three arenas
14 of agency activity, reactors, materials and waste. As
15 you know, we've been working on this for some years
16 now at the Office of Research, and personally I
17 believe that the sum total of this work shows that the
18 commission's direction on risk-informed performance-
19 based approaches was the right way to go.

20 The direction and the strategic plan and
21 the white paper on the risk-informed and performance-
22 based approaches provided very high-level direction,
23 which, as we have applied in specific cases, and put
24 into practice, we find does provide definite
25 improvement.

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1 Of course, the strategic plan also has
2 some cautionary notes on using performance-based
3 approaches where appropriate, and that is also to be
4 noted. Now, on regulatory coherence that John
5 mentioned, the ACRS did get a little bit of a briefing
6 on it in July.

7 To cut to the chase on this, it's
8 basically the performance-based initiative will become
9 part of the overall risk-informed and performance-
10 based activity, eventually.

11 Of course, as you mentioned Mr. Chairman,
12 the ACRS has been involved in this activity for some
13 time. The high-level guidelines were approved and some
14 recommendations were made two years ago.

15 So right now it is important that we get
16 the feedback from the committee to know that we are on
17 the right track closing out this activity, as it were.

18 I don't want to spend too much time on the
19 historical background. As you all are well aware, it
20 goes quite a ways back into DSI-12, et cetera, but
21 we've been issuing just about every year a commission
22 paper that brings the commission up to date on what
23 has been happening.

24 Right now, there is a status report to the
25 commission with the EDO, and it reports on the

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1 milestones that we had developed last year, and the
2 pilot projects that we were looking at.

3 We did make a commitment to develop user-
4 friendly guidance, and that's essentially what we have
5 done now. A communications plan was issued in April of
6 this year.

7 I'd like to begin by addressing really why
8 we need a guidance document. The high-level guidelines
9 that we developed two years ago pose the question,
10 what does a performance-based approach to a regulatory
11 issue look like?

12 What are the attributes? And it drew from
13 the white paper that the commission had issued. But it
14 didn't offer very much guidance to people involved in
15 specific projects on what kind of actions they should
16 take in order to get from here to there.

17 What we have tried to do is use the theory
18 that has been developed in the formal approaches to
19 decision methods, and to apply it in order to really
20 search for a systematic -- to put together a
21 systematic search for performance parameters that will
22 address the safety needs of a particular regulatory
23 issue.

24 The first attempt we made at this turned
25 out to be a highly formal and overly general

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1 presentation of decision theory, and not sufficiently
2 user-friendly.

3 So we went back, and what you have with
4 you is really our second cut at this. But I believe
5 that it is still based on the theory that has been
6 developed, and is fully consistent in terms of
7 terminology with the background theory.

8 What we intend to do with this document is
9 make it a companion document to the regulatory
10 analysis guidelines, which is a key supporting
11 document to rule-making.

12 But the regulatory analysis guidelines
13 also provide support to any new development of
14 regulatory requirements. So we believe that when it
15 becomes a companion document in the Management
16 Directive 6.3, then it will provide the necessary
17 framework within which staff would look into
18 performance-based approaches for their activities.

19 The guidance document really provides an
20 approach to regulation. As John mentioned, it focuses
21 on asking certain questions. The information developed
22 by answering these questions provide the basis for
23 making regulatory decisions.

24 Now, the way the questions and the steps
25 have been set up, we believe that it represents an

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1 internally self-consistent way of meeting the
2 objectives that the commission has set out in the
3 risk-informed and performance-based approach.

4 I would note that the actual content of
5 the guidance bears strong resemblance to formal
6 decision theory, but there is a lot of flexibility in
7 terms of how much formality and how much
8 quantification would be required in going through
9 these steps.

10 But the nature of the information is such
11 that it naturally integrates risk-informed and
12 performance-based regulation. It uses terminology that
13 is really part of the literature, and so it should be
14 able to be applied quite widely.

15 Now, the fact that the guidance document
16 is somewhat simplified is not an impediment, we
17 believe, because most of the regulatory issues that we
18 believe the staff would undertake would be covered by
19 the guidance document.

20 Now I'm going to use for illustration
21 purposes three activities of the staff. At least two
22 of them I'm sure the committee is much more aware of
23 and much more knowledgeable about than I am.

24 But I don't want to become too absorbed in
25 the examples themselves. I just want to use these to

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1 clarify some of the guidance steps. The reactor
2 oversight process is risk-informed and performance-
3 based.

4 It covers one part of the regulatory
5 framework. Another example that I'd like to call on is
6 the rule-making that the staff has undertaken in
7 50.44, and that incorporates a specific performance-
8 based approach for hydrogen monitoring.

9 This is in the proposed rule package that
10 is out for public comment. I would also like to use as
11 an example a rule-making package that is now out for
12 10 CFR Part 72. It has to do with independent spent
13 fuel storage installations and monitored retrievable
14 storage facilities.

15 This rule has to do with doing geological
16 and seismological analyses for siting of these
17 facilities.

18 MEMBER LEITCH: Are you contrasting here
19 between the reactor oversight process being risk-
20 informed than performance-based, and the hydrogen
21 monitoring as being just performance-based? Isn't that
22 also risk-informed?

23 MR. KADAMBI: Well, the rule-making itself
24 is risk-informed and performance-based. I'm only
25 trying to clarify certain of the steps in the guidance

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1 document to show how we used the -- in the hydrogen
2 monitoring aspects of this rule-making, certain
3 performance-based aspects.

4 MEMBER LEITCH: I'm just trying to
5 understand why in your first bullet you have risk-
6 informed and performance-based, and on the second
7 bullet you omit the words "risk-informed". I wondered
8 if there's some significance to that?

9 MR. KADAMBI: No, I didn't mean to have any
10 extra significance to that. It's just that one is much
11 more developed. The others are sort of in process, as
12 it were.

13 MEMBER LEITCH: Okay.

14 MR. KADAMBI: But I would categorize all of
15 these examples as risk-informed and performance-based.

16 MEMBER LEITCH: Okay, thanks.

17 MR. KADAMBI: These and other examples have
18 shown us that in order to pursue a performance-based
19 approach, there isn't any magic formula or cookbook
20 necessarily.

21 But what it involves is a systematic
22 search for less prescriptive measures. But during this
23 type of a search, the formalism that is provided by
24 the high-level guidelines and the steps laid out in
25 the guidance document we believe would be helpful to

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1 bring about consistent application of the performance-
2 based concepts.

3 Now in developing the actual steps of the
4 guidance process, what we have tried to do is reflect
5 on the life cycle of a regulatory issue. In a sense,
6 a regulatory issue exists only after it has been
7 assigned within the staff organization.

8 That implies that a certain arena,
9 reactors, materials or waste, and within the arena the
10 particular staff organizational elements. While
11 management considers these aspects of it, there would
12 also be some thought given to the performance goals
13 that would be supported by the activity.

14 Generally, the instructions given to staff
15 would capture the preliminary identification of
16 performance goals and what are the end products. In
17 theory, it could involve rule-making or any of the
18 elements of the regulatory framework which the
19 commission has identified in the strategic plan as
20 covering a wide range, all the way from rules down to
21 inspection and enforcement guidance procedures.

22 So, the basic idea is that some initial
23 thought is given to, you know, what are the types of
24 activities involved in the regulatory issue and its
25 context?

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1 The step two would be to identify the
2 specific safety functions that would assure that, for
3 example, that the maintain safety aspect of the
4 staff's performance would be observed carefully.

5 In something like the reactor oversight
6 process, the work that has gone on in terms of
7 developing a structured approach I believe makes this
8 easier to use. It represents something that could be
9 applied to any reactor regulatory issue.

10 Now for something like hydrogen monitoring
11 in the 50.44 rule-making, the kind of thinking that
12 went into identifying the safety functions was part of
13 looking into where in the framework the particular
14 aspect that was chosen for a performance-based
15 approach would best fit.

16 What we decided was that it fits best in
17 the regulatory guidance, for example. So that's where
18 the hydrogen monitoring is, in fact, captured.

19 For something like the ISFSI, the concern
20 over there is related to what could happen under
21 earthquake situations, because that's the central
22 issue that was being dealt with, siting and
23 considering seismological factors.

24 The kinds of safety functions that were
25 considered, stability again, soil liquefaction,

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1 sliding of the casks, and displacement, those were the
2 sorts of things that went into identifying the safety
3 functions.

4 CHAIRMAN APOSTOLAKIS: Well, I have a
5 question here, Prasad. It seems to me that the
6 definition of the safety functions is critical here,
7 because your safety margins in the next step are tied
8 to this. Right?

9 MR. KADAMBI: Certainly, yes.

10 CHAIRMAN APOSTOLAKIS: And then the
11 performance parameters and so on. So this is really
12 critical. As you know, the term "safety function" is
13 not well-defined.

14 I mean, a safety function is cooling the
15 core, or a safety function could be hydrogen
16 monitoring, right? All these are under the general
17 term of safety function.

18 I wonder whether you should draw people's
19 attention to this fact, or maybe become a little more
20 specific, because the safety margins, especially, that
21 you mention later --

22 Maybe I should let you cover that, too,
23 and then I'll make my comment. Go to the next slide.
24 Safety margin could be, you know, how much margin do
25 I have before I have core damage?

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1 Or it could be, how much time do I have
2 before I lose some minor system? In fact, in your
3 example in the guidance, you mention the spent fuel
4 pool, how much time do I have before the water starts
5 boiling away?

6 Well, yes, that could be an objective, or
7 a safety function, or something later. When the ACRS
8 in the earlier letter said that the performance levels
9 and the parameters should be set at the highest
10 practical level, I think that recommendation is tied
11 to this comment.

12 What is a safety function? What margins
13 are we going to be dealing with? I mean, is it core
14 damage? Is it reactors losing the ability to cool the
15 core? Or is it before that losing high-pressure
16 injection?

17 I mean, the whole thing -- I mean,
18 defining those would make a big difference, would it
19 not?

20 MR. KADAMBI: If I may draw your attention
21 at this point to the guidance document itself under
22 step two, what it says is --

23 CHAIRMAN APOSTOLAKIS: Page? Page? Tell us
24 what page.

25 MR. KADAMBI: Oh, that's page nine.

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1 CHAIRMAN APOSTOLAKIS: Page nine. That's in
2 the document now. That's tab nine? You said what page,
3 I'm sorry?

4 MR. KADAMBI: Page nine.

5 CHAIRMAN APOSTOLAKIS: Nine, yes. That's
6 where my questions are.

7 MR. KADAMBI: It says, step two is
8 identifying the safety function, and the purpose is to
9 identify the safety functions and systems that affect
10 the regulatory issue.

11 So, the attempt over here is to focus in
12 on the particular nature of the level at which the
13 regulatory issue has arisen, and to consider the
14 safety functions at that level.

15 But it doesn't mean that the other levels
16 will not be considered. For example, if you look at
17 the reactor oversight process, it would be which
18 cornerstone would be affected. And what are --

19 MEMBER WALLIS: It's still very vague. It's
20 still verbal. What you really need is a metric for the
21 safety function and you need a mapping of that metric
22 onto risk.

23 You need something like, if you maintain
24 the level in the core, you need a measure of that
25 level, and you need to say what's the risk implication

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1 of having the level of a certain amount? That's what
2 you need.

3 This document is good, but it's still at
4 a qualitative, verbal level.

5 CHAIRMAN APOSTOLAKIS: I thought the intent
6 was one of saying if I rely on a performance-based, by
7 the time I find a degraded performance, I still have
8 margin.

9 MR. KADAMBI: Exactly. That is what I'm
10 sort of getting to, but before we start even looking
11 at margins and what performance parameters will give
12 us assurance of the margin, we want to be much more
13 clear on what are the safety functions that we are
14 most concerned about in dealing with this regulatory
15 issue.

16 So, I mean, I take your point that the
17 level -- and by this I don't mean the water level,
18 necessarily. It is the level in the hierarchy of the
19 value --

20 MEMBER WALLIS: No, I was not confusing the
21 two levels.

22 MR. KADAMBI: Oh, okay. I wasn't sure if I
23 understood you.

24 MEMBER WALLIS: No, no, I understand the
25 hierarchical level and the water level.

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1 MR. KADAMBI: Okay. Well, that's why in
2 step two, it's more of a general characterization of
3 the regulatory issue itself, and identifying the
4 equipment systems, what procedures are affected and
5 things like that.

6 So we haven't really gotten into the
7 exploration of the performance-based --

8 MEMBER WALLIS: But the margin is a very
9 waffly sort of term. If you're standing on the edge of
10 a cliff, and you've taken a step forward of one foot,
11 then you go over the cliff.

12 But if it's a slippery slope, with an
13 increasing slope then it's a different definition of
14 how far you can go without getting into trouble. You
15 have to define these things in some more than just
16 "word" way in order to know what you mean by "margin".

17 MR. KADAMBI: Right. The one thing that is
18 very clear about margin is that it is very context-
19 specific. That's why considering that this is a
20 document that is meant to apply to all three arenas of
21 regulatory activity, one doesn't want to get too
22 specific about it.

23 But what is important, I believe, is to
24 communicate the concepts. What I've drawn on is the
25 direction in the white paper that, you know, you have

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1 to set up your performance-based approach in such a
2 way that even if you violate a parameter, you don't
3 get into an immediate safety concern.

4 So that is how close you are to a cliff.

5 MEMBER WALLIS: Yes I had a bit of trouble
6 with that criteria, and what you meant by it.

7 MR. KADAMBI: Okay, the way I have
8 integrated that for the purpose of this guidance is to
9 say that there are two kinds of margins. There's a
10 physical margin and there's a temporal margin, where
11 you have time to take corrective action.

12 In other words, if you have certain
13 parameters that you would be monitoring, and you have
14 made sure ahead of time that there is margin within
15 that parameter, and if you find that whatever
16 criterion you've set has been violated there's still
17 time to back away.

18 MEMBER WALLIS: But that probably isn't the
19 cliff either. I mean, to say the operator has 30
20 seconds to take an action doesn't really reflect what
21 would happen if he took 31 seconds. The consequence of
22 it.

23 So I guess you have to look at -- If you
24 want to be more elaborate, at a deeper level of
25 understanding or specification, you'd have to look at

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1 those sorts of things.

2 MR. KADAMBI: I fully agree with you that
3 when you're dealing with things where 30 and 31
4 seconds may make a difference. It's a different kind
5 of situation than --

6 CHAIRMAN APOSTOLAKIS: Let me give you
7 another example. Several years ago someone argued that
8 this agency is charged by Congress to protect the
9 health and safety of the public.

10 So this agency really should focus on
11 level 3 PRAs, individual risk, and societal risk. What
12 happens inside the plant is none of its business. As
13 long as the individualist level is kept up --

14 And of course that view was rejected
15 outright. But why not? Why? I mean, that's a margin.
16 I can always measure how much time I have before I
17 kill somebody.

18 Why isn't that a reasonable way to
19 proceed?

20 MR. KADAMBI: I believe that whatever
21 margin there might be would be too difficult to
22 monitor from a regulatory standpoint.

23 CHAIRMAN APOSTOLAKIS: For that particular
24 objective. Okay, so, we go down then to core damage
25 frequency. Why can't the core damage frequency be the

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1 margin for reactors? I mean, the objective.

2 MR. KADAMBI: Well, I mean, to some extent
3 it can be and I believe it is used in many ways for
4 the reactor oversight process. But it is used in
5 conjunction with other performance parameters also.

6 Whether it's performance indicators or the
7 whole inspection program and you know --

8 CHAIRMAN APOSTOLAKIS: You mentioned the
9 cornerstones. Why can't we say the reactors -- it's
10 the cornerstones. You should measure your margins from
11 the cornerstones.

12 If we made such a blanket statement, what
13 would be wrong with that?

14 MEMBER BONACA: Well, the way I see it,
15 it's the thresholds, in fact, represent the
16 performance-based criteria. They give you a measure of
17 the margin. The more you get to a certain degradation
18 level, your margin has been reduced enough that you
19 say it's not good enough.

20 So, to some degree it does that.

21 CHAIRMAN APOSTOLAKIS: Well no, that's not
22 margins, that's peer comparison. That's not margins.
23 The margin is on the SDP. The SDP really measures the
24 margins, the significance-determination ones, from
25 core damage.

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1 MEMBER BONACA: Yes, well, you get to 20
2 SCRAMs or 23 SCRAMs... I'm only saying you have a
3 measure there.

4 CHAIRMAN APOSTOLAKIS: But that's a measure
5 of peer performance, how well you're doing with
6 respect to your peers. It's not a margin. The
7 significance-determination process is a margin.

8 MEMBER BONACA: The way the evaluation
9 data, it is --

10 CHAIRMAN APOSTOLAKIS: That's why it's
11 wrong.

12 MR. GRIMES: Dr. Apostolakis, my name is
13 Chris Grimes, and I would like to emphasize that this
14 guidance is developed in order to assist the staff in
15 developing requirements.

16 As Prasad pointed out, there's a context-
17 sensitivity to that, and he's provided a nice range of
18 examples of how the margin is relative to the purpose.
19 We would like, in a risk-informed and performance-
20 based environment, to be able to look at the
21 particular regulatory need that's being served.

22 We do look at margins to core damage, or
23 to LERF, when we're talking about the oversight
24 program and we're looking across a very broad program
25 for which we have performance measures directly to the

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1 agency's performance goals.

2 That is, to maintain safety, to be
3 efficient and effective, to reduce unnecessary
4 burdens. So the cornerstones provided us with that
5 link at a very high level.

6 But then if you go down to the specific
7 circumstances where the commission directed us to take
8 action, for combustible gas control requirements, in
9 that instance we're looking at examples of --

10 The margins associated with measuring
11 hydrogen and what does that mean? Ultimately they need
12 to be related back to containment function. Because
13 that is the safety function associated with
14 combustible gas control and its import to the overall
15 public health and safety.

16 So, for the purpose of a process
17 guideline, this guidance is necessarily flexible in
18 terms of reminding the user that it's their
19 responsibility to go look at the regulatory purpose
20 they're trying to serve, in much the same way that
21 NUREG/BR-0058 provides regulatory analysis guidelines
22 on how one does a cost-benefit calculation relative to
23 averted person-rem exposure.

24 So I think that we appreciate that there
25 are margins and there are margins, and that part of

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1 the responsibility for the user of this guidance is to
2 make sure that they're being very clear about what
3 margin they're talking about.

4 CHAIRMAN APOSTOLAKIS: I understand that,
5 but the question is, if you have such flexibility
6 regarding the objectives, then is it reasonable to
7 have this requirement that you should have sufficient
8 margins?

9 I mean, if I define an objective at the
10 very low level, why should I have sufficient margin?
11 The whole idea of the original definition of
12 performance-based regulation was that you don't want
13 to define your performance criteria at the level so
14 that if they are violated you are in trouble.

15 MR. GRIMES: Right.

16 CHAIRMAN APOSTOLAKIS: Right. So I can see
17 that with core damage and maybe LOCA, you really don't
18 want to say, 'Gee, we didn't perform well and a LOCA
19 is imminent.'

20 No, I don't want that, because LOCA is at
21 a certain level. But if I go down and I have other
22 objectives at a fairly low level, I don't see why I
23 should have sufficient margins for those.

24 If they're violated it's no big deal. See
25 that's the interplay.

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1 MR. GRIMES: I understand, and I think that
2 that actually argues in favor of there needs to be a
3 necessary flexibility in terms of the user might
4 conclude that you don't need a lot of margin. You may
5 not need any margin.

6 CHAIRMAN APOSTOLAKIS: Can we make that
7 clear in the document, though? That's what I'm saying.
8 I mean, I'm not really -- I think the steps you have
9 already is enough.

10 The things that the user probably will
11 have to scratch his or her head at all trying to amend
12 this, and then it has to be made clear that at
13 sufficient margin it's something that is also flexed.

14 It depends on where the objective is.

15 MR. KADAMBI: I think the reactor oversight
16 process in many ways reveals the kinds of issues that
17 you're raising, because of its structure, and because
18 of the ability to observe how margins that are set at
19 a low level do, in fact, get reflected in other
20 metrics higher up.

21 In a sense, the success of the reactor
22 oversight process shows how that kind of a structured
23 approach should be practice elsewhere, and really
24 that's what this is driving at.

25 Developing the appropriate kinds of

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1 metrics --

2 CHAIRMAN APOSTOLAKIS: Not all of us are
3 convinced that it is a successful process. Especially
4 in light of the developments over the last several
5 months at the particular plant.

6 So I don't know that I'm buying the
7 argument that the success of the process shows. I have
8 doubts about it. But I agree with you that this is
9 probably the only process in the agency that has
10 stated explicitly what its objectives are.

11 That's probably a true statement.

12 MR. KADAMBI: And that's really what I'm --

13 CHAIRMAN APOSTOLAKIS: With the
14 cornerstones -- You're right there, there's no
15 question about it.

16 MEMBER WALLIS: That's a profound
17 statement. It's the only process in the agency that
18 has stated its objective?

19 CHAIRMAN APOSTOLAKIS: That's what I think.
20 Now making statements like that is always risky.

21 MEMBER WALLIS: That's a dangerous
22 statement.

23 CHAIRMAN APOSTOLAKIS: Because I remember
24 how much effort it took to have the staff develop the
25 hierarchy, you know, that goes down to the

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1 cornerstones.

2 I'm sure the objectives are not unwritten,
3 but this is probably the only place where they're
4 actually explicitly stated. Well, I personally would
5 like to see some elaboration, maybe a paragraph,
6 reflecting this discussion.

7 Is that out of the question?

8 MR. FLACK: I think we could --

9 CHAIRMAN APOSTOLAKIS: That's all I'm
10 saying. I mean, it's not -- But some -- Help the user,
11 in other words. There are issues here, and what margin
12 means is not always well-defined. It's tied to the
13 level of the objective.

14 Because remember, one of the reasons of
15 desiring to move towards performance-based regulation
16 is to give flexibility to the licensee. So if you say,
17 'Well, we had a problem before, but then we asked them
18 to do this, and this and that. Now how do I preserve
19 this, this, and that, but not call it performance-
20 based?'

21 Maybe you're defeating the purpose. You
22 have to go higher, right? Like the maintenance rule on
23 availability.

24 MR. KADAMBI: Well, there are competing
25 objectives over here. As I mentioned that our first

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1 attempt at this didn't turn out to be quite a success
2 because, as I recall, we started with constructing a
3 value tree, because that's where you start to think
4 about some of these things.

5 When you think about making a user-
6 friendly process, we have tried to avoid getting the
7 user sort of faced with terminology that they may not
8 be familiar with in their day-to-day work, and
9 therefore unable to apply the guidance at all.

10 So, I mean, this is an attempt to --

11 CHAIRMAN APOSTOLAKIS: I think that's fine.
12 All I'm saying is, we've had this discussion.

13 MR. KADAMBI: Sure, sure. I think we will
14 certainly do what we can to --

15 CHAIRMAN APOSTOLAKIS: There may be these
16 issues as you try to identify safety margins and
17 safety functions, that it's not a straightforward
18 thing.

19 MR. KADAMBI: Oh, absolutely.

20 CHAIRMAN APOSTOLAKIS: Maybe in reactors
21 they have an advantage over the rest of the agency,
22 because they have already defined certain things. But
23 this is something that is not --

24 Like, I'll give you another example. When
25 Quad Cities came up with five or six tenth to the

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1 minus three core damage frequency because of that fire
2 analysis they did. Everybody reacted immediately. The
3 agency sent people there, and the utility ordered a
4 shutdown of the plant.

5 It turned out that the analysis was off a
6 little. But that's the information we had at the time,
7 right? We had to act on that. I'm really thinking
8 about the margins, though. Really think about it.

9 Even if it is $5/10^{-3}$. That means that over
10 a year, right, on the average, I have 200 years before
11 I get into trouble. I get the inverse.

12 MEMBER WALLIS: With one particular plant.

13 CHAIRMAN APOSTOLAKIS: Yes, it's about 200
14 years. Now that doesn't sound to me like it's an
15 imminent disaster. And yet we all reacted, and you
16 know why? Because we're biased.

17 We're all thinking in terms of CDF, and
18 the moment you see 10^{-3} you think that disaster is
19 hitting you next week. But really if you look at it
20 with a cool eye, you say, you know, okay I have to do
21 something, but I don't have to fly out --

22 MEMBER ROSEN: Yes, I agree with you
23 George, but there's also the question of uncertainties
24 and how one deals with that.

25 CHAIRMAN APOSTOLAKIS: Okay, so instead of

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1 200 years, maybe under conservative assumptions it's
2 50? It's still something that's not imminent.

3 MR. GRIMES: But -- this is Chris Grimes.
4 I agree with you, and from my perspective, as we try
5 to look at how are we going to integrate the risk-
6 informed guidance to the staff, and how they go about
7 trying to improve on the Reg Guide 1.174 thinking, and
8 the performance-based guidance to the staff, which
9 really fits better into the rule-making process where
10 we talk about the way that requirements are
11 constructed.

12 There is a construct to where is this
13 guidance about treatment of margins and the importance
14 and values associated with the particular regulatory
15 issue at hand, which is what this guidance speaks to.

16 Where does that best fit so that it's
17 recognized by the user? I could argue that we could
18 put it almost anywhere. We could put it in a risk-
19 informed guidance, we could put it in the performance-
20 based guidance, or we could put it in the rule-making
21 process handbook that's going to try and bring the two
22 together.

23 That's why we said that we felt it was
24 important to put coherence around all this stuff and
25 explain how these things work together. Quite frankly,

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1 I think that in the long run, the explanation that
2 you've just described needs to be articulated, and
3 will be, it's just a matter of --

4 And where will do that in the best
5 possible way?

6 CHAIRMAN APOSTOLAKIS: Anyway, my comment
7 was maybe some elaboration would be helpful to the
8 user.

9 MR. FLACK: Yes, we'll take that --

10 CHAIRMAN APOSTOLAKIS: By the way, John,
11 what it comes down to is really bias. It's very
12 interesting, human perceptions. It's very interesting,
13 the Nobel Prize in Economics was awarded to Professor
14 Kahneman yesterday who wrote the pioneering paper,
15 "Biases," in 1974.

16 I think we have a tremendous bias here. We
17 think that if the core damage frequency goes to $3/10^{-3}$
18 boy, we were really about to die, without thinking
19 that we're talking about a rare event. It's still a
20 rare event.

21 MR. FLACK: That's a bigger issue, though.

22 CHAIRMAN APOSTOLAKIS: It is a bigger. We
23 will not resolve that here. Mentioning Nobel prizes is
24 an achievement already. So the other thing is, two,
25 three and four, the steps are really tied together.

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1 MR. KADAMBI: Yes, they are, and in fact,
2 going from two to three to four, is where we get into
3 implementing the recommendations of the ACRS, which is
4 basically if you know that margin exists, and that the
5 margin is verifiable through performance parameters at
6 the appropriate level in the hierarchy, then some
7 degree of flexibility should be considered as part of
8 resolving this regulatory issue.

9 That's really what the staff would be
10 drawn into by these steps.

11 CHAIRMAN APOSTOLAKIS: One other thing,
12 Prasad. Should there be any discussion in connection
13 with the parameters of how easy it is to confirm that
14 margins have been exceeded and so on? Wouldn't that be
15 an issue?

16 MR. KADAMBI: I think that would be an
17 issue in terms of a more formal treatment of where you
18 would identify the parameters and what are the trade-
19 offs involved in the specific level that you would
20 choose.

21 The thing is I'm still trying to deal with
22 the broad range of issues that cover most of the
23 staff's activities, and again, I keep getting drawn
24 into having the perfect not become inimical to
25 accomplishing what I believe we can.

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1 CHAIRMAN APOSTOLAKIS: It's not a matter of
2 perfection, it's a matter of drawing attention to the
3 issues. This is really not a trivial matter.

4 MR. KADAMBI: No, it is not.

5 CHAIRMAN APOSTOLAKIS: I don't know, maybe
6 you do that already, but I didn't --

7 MR. FLACK: Well, I think it's part of the
8 process. I mean, when you come up with the target,
9 performance, and it's not meeting its target, either
10 you've chosen the wrong target, performance-level, or
11 there's something wrong that needs to be fixed.

12 I think that's part of the whole process.

13 CHAIRMAN APOSTOLAKIS: Well what I'm saying
14 is you have on page 10 three bullets, step four. The
15 middle one says can objective criteria be developed
16 either indicative of process and permit corrective
17 action.

18 There, perhaps, you can ask, can it be
19 clearly demonstrated that the objective criteria have
20 been met or not? Draw attention to the fact that
21 confirming that may not be a trivial matter. That's
22 all.

23 MR. FLACK: You have to think about that.

24 CHAIRMAN APOSTOLAKIS: Yes, you have to
25 think about that. In some instances, if it's a

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1 deterministic calculation, it's probably okay, but
2 when you bring in now uncertainties, it's something
3 that you want to think about.

4 MR. FLACK: Okay.

5 CHAIRMAN APOSTOLAKIS: So now that we
6 almost destroyed your presentation, you want to go
7 back to it?

8 MR. KADAMBI: Well, no, actually I mean --

9 CHAIRMAN APOSTOLAKIS: You're done?

10 MR. KADAMBI: The purpose of the
11 illustration is served by the examples that you have
12 brought up. I believe it clarifies the specific steps.

13 CHAIRMAN APOSTOLAKIS: Right. Now, another
14 thing that's fascinating here is you say that there's
15 NUREG report someplace that is really decision theory-
16 based?

17 MR. KADAMBI: Well, we are in the process
18 of --

19 CHAIRMAN APOSTOLAKIS: Did you do that just
20 to make me write a good letter here, or is it really
21 true?

22 MR. KADAMBI: Well, I mean, if it brings
23 about a good letter I will not complain.

24 (Laughter.)

25 MR. KADAMBI: But the fact is that we've

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1 been working on this. As I mentioned, our first
2 attempt at preparing one document got sort of side-
3 tracked, because it turned out to be too difficult.

4 Now what we see is that formal decision
5 methods also has applicability elsewhere in the kind
6 of work we are doing in the Office of Research. And so
7 trying to capture all of this methodology in one NUREG
8 document that would be applicable to the sorts of
9 activities in the Office of Research and elsewhere in
10 the agency seems like the right way to do it.

11 Anyway, if I could just keep going. Step
12 five is, of course, the deliverable of the whole
13 process in the sense this is where the output of the
14 guidance document results in an alternative that can
15 be compared with other alternatives that might be
16 developed using other approaches and subjected to the
17 kind of decision-making choices.

18 MEMBER BONACA: I had a question on that,
19 the chart in figure one? The flow chart? The way it's
20 put together gives the impression that you get into
21 one of four possible alternatives and you evaluate all
22 of them.

23 It seemed to me that the traditional
24 approach would be almost the default approach. What I
25 mean is that you're attempting to move from a

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1 traditional approach to risk-informed and performance-
2 based, or risk-informed, or performance-based.

3 If they are not viable because of not
4 enough margins or whatever, you would default to the
5 coordinate approach?

6 MR. KADAMBI: Yes, certainly. That's the
7 way it was meant to work.

8 MEMBER BONACA: It doesn't convey that
9 message, and I think the text probably does, but I
10 would assume the traditional approach not put together
11 with those. I would have liked to see it more as a
12 default approach, which is, if none of the others are
13 viable then you stay with what you've got.

14 MR. KADAMBI: Well, okay, that's the intent
15 then. If it needs to be clarified --

16 MEMBER BONACA: Well, it's just a
17 suggestion.

18 CHAIRMAN APOSTOLAKIS: And since you're on
19 the figure, I have a couple of comments on the figure
20 myself.

21 MR. KADAMBI: Sure.

22 MEMBER BONACA: Just to complete, because
23 I think the intent of this is to go performance-based
24 and risk-informed, right?

25 MR. KADAMBI: Yes. I mean that's the

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1 direction of the commission --

2 MEMBER BONACA: Absolutely.

3 MR. KADAMBI: -- is to pursue --

4 MEMBER BONACA: So, yes. It's a suggestion.

5 I would have liked -- Yes. Anyway.

6 CHAIRMAN APOSTOLAKIS: At the top, you have
7 four boxes. On page 8, tab 9. Operating Experience,
8 Commission Directions, Stakeholder Suggestions, Staff
9 Initiatives.

10 I can understand how the last three lead
11 to the NRC identifying their modification, but the
12 operating experience itself would not do that. The
13 operating experience will do it through staff
14 initiatives or commission direction.

15 So I would suggest that you drop that box.
16 Operating experience is just information, right?

17 MR. KADAMBI: Well, maybe it's something
18 that feeds into --

19 CHAIRMAN APOSTOLAKIS: It feeds into stuff,
20 yes. But it's not at the same level. And also I don't
21 understand the last arrow back from Define Proposed
22 Modification near the bottom?

23 You have an arrow that goes back to this
24 box that contains three other boxes.

25 MR. KADAMBI: Well, the idea of the shaded

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1 box is really to point out stakeholder involvement. In
2 other words, if there is a --

3 CHAIRMAN APOSTOLAKIS: So that's an
4 economic process, that's what you want to say.

5 MR. KADAMBI: That's right. That's all.

6 CHAIRMAN APOSTOLAKIS: I mean, the way it
7 is now it means that you're going there forever.
8 Whereas, on the left, where you have another arrow
9 going back, you have a box the selected option does
10 not meet.

11 So when it doesn't I go back. But here I
12 don't know when I'm going back and when I proceed down
13 to Developing Regulatory Framework. Under what
14 conditions do I keep going down and up then back?

15 Some explanation --

16 MEMBER BONACA: I think Stakeholder
17 Involvement should be attached to that arrow back up.

18 CHAIRMAN APOSTOLAKIS: If necessary, or if
19 there are still disagreements with the stakeholders,
20 or something.

21 MR. KADAMBI: If I may, Mr. Chairman, this
22 picture has come up in two other papers before. In
23 fact, it first came up in the paper in the year 2000,
24 SECY-00-191, and then it came up again in one of the
25 risk-informed regulation implementation plans that --

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1 There was more guidance offered in those,
2 perhaps, so I'm sort of relying on a continuing thread
3 of, you know, here's roughly the way things are --

4 CHAIRMAN APOSTOLAKIS: Well, typically
5 though, hewn you have an arrow that takes you back,
6 there is some explanation why. Otherwise, it is no --

7 MEMBER SHACK: There's a decision box.
8 What is the decision?

9 CHAIRMAN APOSTOLAKIS: Yes, exactly. What
10 is the decision? I mean, the stakeholders are unhappy,
11 or something.

12 MR. FLACK: We'll put a smiley face in
13 there.

14 CHAIRMAN APOSTOLAKIS: Okay.

15 MR. KADAMBI: But anyway, as I mentioned,
16 developing the performance-based alternative based on
17 the information that we have developed is the whole
18 point of it.

19 At the end of it, this alternative would
20 be compared with other, perhaps, it could be a
21 traditional approach, but that also offers an
22 alternative.

23 CHAIRMAN APOSTOLAKIS: And of course, you
24 had to bring defense in depth into this, right?

25 MR. KADAMBI: Well, that is definitely part

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1 of considering --

2 CHAIRMAN APOSTOLAKIS: So at which line
3 here you are asking what if I am wrong?

4 MR. KADAMBI: Well, yes, I mean it really
5 begins with have you defined the safety functions
6 correctly? It is meant to be an iterative process.
7 It's not just marching through the steps.

8 Anyway, this brings me to where we are in
9 the process that was started two years ago with the
10 high-level guidelines that we developed, we published.
11 We have tried to maintain fidelity what was done
12 through public interaction then.

13 At that time, if you recall, we proposed
14 that there be two groups of guidelines. Viability
15 guidelines, which basically address whether a
16 performance-based approach can be developed.
17 Assessment guidelines considering whether it's
18 worthwhile to do it.

19 Then sort of a check on, you know, let's
20 look at all the commission's principles and just make
21 sure that we're not doing something inadvertently.
22 What we've said is that the only changes we are making
23 from that structure that we published is that because
24 of the importance of the margin, if you look at the
25 formal guidelines in Appendix A in the document, it

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1 puts margin first, and it used to be last, in the
2 first publication of it.

3 The other thing that we've done
4 differently is that we've given much more prominence
5 to the possibility of having qualitative attributes
6 considered within the performance parameters.

7 Other than only look at measurable or
8 calculable, which is what the white paper said. So
9 other than that, it's basically the same.

10 CHAIRMAN APOSTOLAKIS: But isn't that going
11 against the idea of performance-based? What do you
12 mean by that?

13 MR. KADAMBI: Well, I mean if you can use
14 parameters that can be sufficiently, clearly
15 constructed.

16 CHAIRMAN APOSTOLAKIS: Oh, the structure.
17 Yes, yes, yes. I see what you mean.

18 MR. KADAMBI: So, anyway, it's basically
19 just going through the various steps in order to
20 arrive at a judgment on the net benefit, and propose
21 an alternative based on that.

22 So let's see. In conclusion, really, the
23 point that I'd like to make is that we are really at
24 the stage where we ought to be much more broadly
25 implementing performance-based approaches.

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1 We are looking for ACRS support in this.
2 We believe that the regulatory coherence activities
3 will be the place where all of these will come
4 together. There is an interoffice group called the
5 Risk Management Team, which will have oversight
6 responsibility in this.

7 For many of the tougher issues that are
8 perhaps not covered by this guidance document, we do
9 intend in FY '03 to develop this NUREG document. So
10 that's my presentation, Mr. Chairman, and any
11 questions.

12 CHAIRMAN APOSTOLAKIS: Any questions from
13 the members? Okay, well, there are a couple of things
14 that I don't understand in the report. Like --

15 MEMBER WALLIS: Well, I guess I have a
16 question for you. I think this is a very useful
17 document, but presumably it's driven by some need.
18 You've got this figure one which shows Operating
19 Experience, Commission Directions, Stakeholder
20 Suggestions, Staff Initiatives, initiating all this
21 effort.

22 What is the magnitude of this driving
23 force? I mean, is it likely to come up with requests
24 for 100 performance-based regulations to appear next
25 year or one or zero or what? What's the size of this?

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1 MR. KADAMBI: Well, the commission has said
2 in the strategic plan that in each of the arenas we
3 should consider risk-informed --

4 MEMBER WALLIS: I know they said that, but
5 what's the reality of whether it's going to happen or
6 not?

7 MR. KADAMBI: Well, I mean, up to now what
8 we have heard is that these concepts of risk-informed
9 and performance-based regulation presents certain
10 difficulties which has prevented more of the
11 regulatory activities being covered by this.

12 We still see in the regulatory activities
13 plan a number of activities identified as risk-
14 informed and performance-based, so hopefully at least
15 those will then come under the purview of this.

16 MEMBER WALLIS: So there are a few in the
17 pipeline?

18 MR. KADAMBI: Yes. I mean, they have been
19 identified already.

20 MEMBER WALLIS: There isn't a great clamor
21 from next door for you to get on with it and do more
22 of this, or is there?

23 MR. KADAMBI: Well, I mean, I guess I am
24 not in a position to answer that question.

25 MR. GRIMES: This is Chris Grimes. I'll

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1 venture an observation. I think the drivers for
2 regulatory change aren't going to be substantially
3 effected by this guidance.

4 I think that the guidance is going to be
5 more useful and better served in the rule-making
6 process and in the regulatory guide process. By
7 pointing the staff to a better way to come up with
8 criteria, it's conceivable that when this guidance is
9 published, some of our traditional petitioners might
10 be stimulated to think of some new and better ways to
11 do things.

12 But I don't see it doubling or tripling
13 our petition workload. I think that the staff
14 initiatives are going to continue to be driven largely
15 by commission direction and the review of operating
16 experience.

17 MR. KADAMBI: Well, thank you very much Mr.
18 Chairman.

19 CHAIRMAN APOSTOLAKIS: Thank you. It was
20 very useful. Well, we have a couple of minutes. I
21 really need advice from the members what to put in the
22 letter.

23 So what is your -- Should it be a short
24 letter endorsing it and making a few comments, or
25 what?

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1 MEMBER SHACK: Yes, I mean I think the
2 process -- I think we're all in general agreement with
3 the process. It seems to me the guidance is useful and
4 I think the difficulty will always come with specific
5 application.

6 We've been on a performance-based steam
7 generator regulation for as long as I've been on the
8 ACRS, and we'll probably be going on with it when I
9 leave.

10 CHAIRMAN APOSTOLAKIS: But this will help
11 a little bit of course.

12 MEMBER SHACK: It'll help, yes.

13 MEMBER SIEBER: It's not cast --

14 CHAIRMAN APOSTOLAKIS: It's just a new --
15 So we will improve as --

16 MEMBER SIEBER: I think they're in a
17 learning process now. Let them learn.

18 MEMBER SHACK: I think it will have more
19 important implications as we think ahead to future
20 reactors, where we're not so -- We're pretty well
21 fixed now, but you know, in our whole discussion
22 yesterday, I think that to me it will be very useful
23 in the way we ought to think about future reactor
24 regulation.

25 But to go back and -- Regulatory stability

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1 is a quantity that we frequently unappreciate on the
2 ACRS. We're too rationalist, even those of us who are
3 structuralists.

4 (Laughter.)

5 CHAIRMAN APOSTOLAKIS: Any other comments
6 from the left? Graham?

7 MEMBER WALLIS: Well, I think it's a useful
8 document. I think it's a good start. I sort of agree
9 that we need to see more examples of the
10 implementation.

11 We've got a few examples, but not really
12 enough. But I think it's a good thing to do at this
13 stage.

14 CHAIRMAN APOSTOLAKIS: Vic?

15 MEMBER FORD: I agree, assuming the
16 commission wants to have it. This could be a regular -
17 - by the time we got some --

18 The commission have said that this is the
19 way we should go, I think it's a great way to go.
20 About time we had some regulations and actions. The
21 quicker the better.

22 CHAIRMAN APOSTOLAKIS: Steve?

23 MEMBER ROSEN: I have nothing to add.

24 CHAIRMAN APOSTOLAKIS: Okay. But you
25 gentlemen would not object to saying these nice things

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1 and then saying we also suggest or recommend that the
2 staff emphasize the issue of the definition of
3 margins, that this would be a difficulty, especially
4 since they are planning to cover all the agency
5 activities.

6 Maybe some discussion would be justified
7 at this point, but we'll add more as we do it. And the
8 other is the issue of demonstrating that the criteria
9 have been met or violated. That needs some discussion.

10 I wouldn't go into the figure unless you
11 insist, because that's a -- you know, they got the
12 message.

13 MEMBER WALLIS: Keep it short.

14 CHAIRMAN APOSTOLAKIS: The letter will be
15 short, yes. I'm not even sure it's worth putting
16 bullets with conclusions and discussions. I mean, it
17 would be just like the old letters, two or three
18 paragraphs.

19 Any other comments? It is not necessary to
20 have comments.

21 MEMBER POWERS: We'll probably have added
22 comments.

23 CHAIRMAN APOSTOLAKIS: Why? Yes sir.

24 MEMBER SIEBER: I think it would be
25 interesting to observe how the staff identifies what

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1 margin they have, because I don't think that they know
2 in every case.

3 CHAIRMAN APOSTOLAKIS: Exactly. And now we
4 don't need to see this document again, right? We're
5 just making comments, and it's up to the --

6 MEMBER SHACK: We'll see the fruits of it,
7 I suspect, again and again.

8 CHAIRMAN APOSTOLAKIS: Yes. We don't need
9 to see it again, but we trust that you will take this
10 into consideration, the comments.

11 MR. FLACK: We certainly will.

12 CHAIRMAN APOSTOLAKIS: Good. So,
13 essentially it seems that we have a letter that will
14 be along these lines. Okay? So I'll try to draft
15 something with Gus' help.

16 I don't know if we can come back to the
17 committee later today. If it's a short letter,
18 probably we will. Definitely tomorrow, because I can't
19 come to you two days from now.

20 MEMBER SIEBER: One last question.

21 CHAIRMAN APOSTOLAKIS: Yes.

22 MEMBER SIEBER: What do the initials "B.R."
23 stand for on the -- ?

24 CHAIRMAN APOSTOLAKIS: Brand something.
25 B.R.?

1 MR. KADAMBI: That is supposed to stand for
2 Brochure, actually, abbreviated B.R. That's what the
3 formal guidance on documents from the commission says.
4 But the sense in which I'm using it is to say that it
5 is a companion to the regulatory analysis guideline,
6 which has a NUREG/BR notation on it.

7 So it is just to keep it in the same
8 notation.

9 MEMBER SIEBER: So the linkage is tenuous.

10 CHAIRMAN APOSTOLAKIS: Okay, thank you very
11 much gentlemen. Appreciate it. Now the next item is
12 really very short, so let's do it. Reconciliation, I
13 think there is only one reconciliation.

14 Is that yours, Tom?

15 MEMBER POWERS: Mr. Chairman?

16 CHAIRMAN APOSTOLAKIS: Okay, what?

17 MEMBER POWERS: I have two items that
18 perhaps would be of interest to the committee. I have
19 pictures of a fire that went on Monday at Watts Bar.
20 I don't know any of the details, except that it's
21 burning.

22 MEMBER KRESS: That was a Watts Bar
23 hydroelectric plant.

24 MEMBER POWERS: Hydroelectric plant, yes.
25 It looks like it's over on the switch yard someplace.

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1 MEMBER ROSEN: Not in the nuclear yard.

2 MEMBER KRESS: That's inside the operating
3 building.

4 MEMBER POWERS: Is it?

5 MEMBER KRESS: Yes.

6 MEMBER SIEBER: It's about 30 miles away or
7 something like that.

8 CHAIRMAN APOSTOLAKIS: And the second one?

9 MEMBER POWERS: And the second item is,
10 I've gotten some word on the schedule for the
11 (phonetic) workshops, that they will hold for the ACR
12 reactor. The core physics and fuel channel workshop in
13 the first week of December will be at Chalk River.

14 Thermal hydraulics will be held at
15 Winnipeg, pending the level of interest in touring the
16 full-scale test facility. The rest of the sessions
17 they're planning to have in Rockville or the
18 Washington, D.C., area.

19 MEMBER FORD: Winnipeg in the middle of
20 winter?

21 MEMBER POWERS: A guy that lives in Vermont
22 cannot complain about that.

23 CHAIRMAN APOSTOLAKIS: When you say you
24 have pictures of the fires, so will you just pass it
25 around?

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1 MEMBER POWERS: Okay.

2 CHAIRMAN APOSTOLAKIS: And we can do this
3 at the same time. We can do two things at the same
4 time. And if you give us a piece of gum, we do that
5 too. Okay, tell us what you want to do.

6 MEMBER KRESS: All right, this
7 reconciliation has to do with our letter on the risk
8 metrics and criteria for re-evaluating the technical
9 basis of the pressurized thermal shock groove.

10 And we in our letter had made a couple of
11 comments. Mainly it was that the proposed options that
12 they chose for the acceptance criteria did not
13 properly reflect the potential impact of an air
14 oxidation source term on risk.

15 And they basically agreed with us and
16 said, "Yes, we agree." They're going to go plan to
17 make additional studies, the outcome of which we'll
18 learn about later. So, as far as I'm concerned, that's
19 acceptable.

20 CHAIRMAN APOSTOLAKIS: Okay.

21 MR. BOEHNERT: Mr. Chairman?

22 CHAIRMAN APOSTOLAKIS: Yes.

23 MR. BOEHNERT: Do you want this on the
24 record? I think the woman's still recording over
25 there.

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1 CHAIRMAN APOSTOLAKIS: Let me think. There
2 is nothing in the afternoon that should be recorded,
3 right?

4 MR. BOEHNERT: Yes, but you're being
5 recorded right now, too. I don't know if you want
6 that.

7 CHAIRMAN APOSTOLAKIS: I know. So we are
8 done with the recording. Thank you.

9 (Whereupon, the foregoing matter went off
10 the record at 11:38 a.m.)
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CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on
Reactor Safeguards, 496th
Meeting

Docket Number: N/A

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

15/ Matthew Needham
Matthew Needham
Official Reporter
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LOW POWER/SHUTDOWN SPAR MODEL DEVELOPMENT



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PRESENTATION TO ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

OCTOBER 11, 2002

OUTLINE OF PRESENTATION

- **Low Power/Shutdown (LP/SD) SPAR Model Development Program Plan.**
- **Onsite QA Review of LP/SD SPAR Model for Surry 1 & 2.**
- **Cancellation of Revision 4i SPAR Model Development.**

**LOW POWER/SHUTDOWN (SDP/SD) SPAR MODEL
DEVELOPMENT PROGRAM PLAN**

BACKGROUND

FY 1996:

- **Produced PWR (Surry) LP/SD SPAR Model:**
 - **Based on Detailed Surry Shutdown PRA Developed by NRC/BNL (NUREG/CR-6144).**
 - **Developed for use with DOS version of SAPHIRE.**
 - **Not user-friendly.**
 - **Not peer reviewed.**
 - **Adapted Human Reliability Analysis (HRA) methodology from full power (Revision 3) SPAR model development effort for use in LP/SD SPAR models.**

BACKGROUND (Continued)

FY 2001:

- **Produced BWR (Grand Gulf) LP/SD SPAR Model**
 - **Based on Detailed Shutdown PRA Developed by NRC/SNL (NUREG/CR-6143).**
 - **User-friendly.**
 - **Compatible with Windows-based SAPHIRE/GEM.**
 - **Internal peer review of model.**

- **Developed LP/SD SPAR Model Specification, Prototype Templates, and Associated Guidelines for Developing Other LP/SD Models**
 - **Received technical guidance from interoffice SPAR Model Users' Group (SMUG).**

 - **Determined usefulness of current LP/SD models originally developed for ASP Program for current applications.**

BACKGROUND (Continued)

FY 2001:

- **Reviewed LP/SD events analyzed in ASP Program to determine if model content was sufficient to address these event types; identified necessary changes.**
- **Met with SMUG and key model users to identify users needs and desired model characteristics.**
- **Developed and Demonstrated Prototype Templates to SMUG:**
 - **All PWRs.**
 - **BWR 5/6s.**
 - **BWR 4s.**

LP/SD SPAR MODEL TEMPLATE FOR PWRs

- **Starting Point for Developing a Plant-Specific LP/SD Risk Model That Includes Core Damage Risk Resulting from:**
 - **Loss of RHR events.**
 - **Loss of offsite power events.**
 - **Loss of inventory events.**

- **Essentially a Working LP/SD Model with No Plant-Specific Fault Tree Logic**
 - **Event trees generally applicable to all PWRs.**
 - **Some fault trees also generally applicable to all PWRs.**
 - **Remaining fault trees include undeveloped events in place of the logic required to model system failures at any particular plant.**
 - **To expand the model to represent a particular plant - expand undeveloped events into appropriate fault tree logic.**

EXPANSION OF TEMPLATES INTO LP/SD SPAR MODELS

Lead Plants

- **Identified Lead Plants in Eight Plant Classes (Classification Consistent with Revision 3i SPAR Models):**
 - **Millstone 3**
 - **Byron 1 & 2**
 - **Oconee 1, 2, & 3**
 - **Millstone 2**
 - **Palo Verde 1, 2, & 3**
 - **Peach Bottom 1 & 2**
 - **Surry 1 & 2**
 - **Grand Gulf**

- **Start with Existing LP/SD SPAR Model Template**
 - **PWR**
 - **BWR 5/6**
 - **BWR 4**

EXPANSION OF TEMPLATES INTO LP/SD SPAR MODELS

Lead Plants (Continued)

- **Add All System Fault Tree Logic from the Corresponding Revision 3i SPAR Model.**
- **Add All Basic Event Information from the Revision 3 SPAR Model.**
- **Revise LOOP and EDG Recovery Probabilities to Reflect Longer Recovery Times during LP/SD.**
- **Modify System Logic so that System Configuration is Properly Represented in Each Plant Operating State Group (POSG).**
- **Review System Success Criteria.**
- **Add New Test and Maintenance Events and Modify the Values to Reflect LP/SD Conditions.**

EXPANSION OF TEMPLATES INTO LP/SD SPAR MODELS

Lead Plants (Continued)

- **Revise the Recovery Rules as Necessary to Consider New Technical Specification-Disallowed Maintenance Combinations in Effect during LP/SD.**
- **Modify Human Error Probabilities (HEPs) to Reflect Longer Action/Recovery Times Available during LP/SD Operation.**
- **To Develop a LP/SD SPAR Model for Another Plant in the Same Class:**
 - **Follow same steps as those identified above for the lead plant.**
 - **Document development process and incorporate in Users Manual - include assumptions.**

INTERNAL QA REVIEW OF DRAFT LEAD PLANT MODEL

MODEL AND DOCUMENTATION REVIEW

- **Review:**
 - **Event trees.**
 - **Fault trees.**
 - **Basic event data.**
 - **Common cause failure modeling.**
 - **Graphical Evaluation Module (GEM) and GEMDATA.**
 - **Human Reliability and Recovery.**
 - **Revision log.**

- **Model Testing:**
 - **Perform appropriate (PWR or BWR) suite of tests.**
 - **Document results of model testing in prescribed format.**

ONSITE QA REVIEW OF DRAFT LP/SD SPAR MODEL AGAINST LICENSEE'S LP/SD PRA MODEL

- **QA Procedure Developed from Procedure Used for Onsite Review of Rev. 3 SPAR Models.**

- **Areas Covered by Review:**
 - **Event Tree Structure.**
 - **Success Criteria.**
 - **Dependencies.**
 - **Plant Operating States (POSs).**
 - **Plant Operating State Groups (POSGs).**
 - **Time Windows (TWs).**

- **Documentation of Onsite Review**
 - **Reported in separate appendix to revised Users' Manual.**

SPAR HRA METHODOLOGY

- **First Developed for NRC by INEEL in 1994 for Use in Accident Sequence Precursor (ASP) Program.**
- **Revised in 1999 to Incorporate Desirable Aspects of Other HRA Methods and Sources and Tailored to SPAR Model Usage.**
- **Uses a Three-Page Worksheet to Rate a Series of Performance Shaping Factors (PSFs) and Dependency Factors to Arrive at a Screening Level Human Error Probability (HEP) for a Given Task.**

UPDATED HRA METHODOLOGY AND DOCUMENTATION FOR SPAR MODELS

- **Purpose of Improvements:**
 - **Ensure that methodology and documentation comply with proposed ASME Standard on PRA.**
 - **Provide a referenceable document on SPAR HRA methodology.**
- **Add Uncertainty Analysis Capability**
- **Review Existing Full Power PSFs ; Identify Needed Changes.**
- **Add Specific Application to Analysis of LP/SD Events/Conditions.**
 - **Review insights regarding PSFs during LP/SD operation obtained from other LP/SD work.**
- **Document Improved Methodology in a NUREG/CR Report.**

ONSITE QA REVIEW OF LP/SD SPAR MODEL FOR SURRY

ONSITE REVIEW OF LP/SD SPAR MODEL FOR SURRY

- **Conducted August 15, 2002.**
- **Held in Conjunction with NRR's Review of LP/SD SDP Analysis Tool.**
- **Participants: NRC HDQ Staff, Region II SRA, INEEL Staff, BNL Staff, Licensee's PRA Staff.**
- **Scope of Review of LP/SD SPAR Model:**
 - **Event tree structure.**
 - **Success criteria.**
 - **Dependencies.**
 - **Plant Operating States (POSs).**
 - **Plant Operating State Groups (POSGs).**
 - **Time Windows.**

ONSITE REVIEW OF LP/SD SPAR MODEL FOR SURRY (Continued)

PLANT-SPECIFIC REVIEW INSIGHTS:

- **In General, Found Good Agreement between LP/SD SPAR Model and the Surry LP/SD PRA.**
 - **Both based on NUREG/CR-6144.**
 - **Surry LP/SD PRA uses IE frequencies taken from NUREG/CR-6144.**
 - **LP/SD SPAR model also uses NUREG/CR-6144 IE frequencies.**

- **LP/SD SPAR Model for Surry Separates Out Loss of RHR Caused by Loss of Level Control from Loss of RHR Initiating Event Group.**
 - **Differs from treatment in Licensee's LP/SD PRA model.**
 - **Based on implications of recovering RHR - from NRR review of LP/SD-related inspection findings.**
 - **Consistent with NRR's LP/SD SDP Analysis Tool.**

ONSITE REVIEW OF LP/SD SPAR MODEL FOR SURRY

(Continued)

GENERIC REVIEW INSIGHTS (Consider in Future Model Development)

- **Potential for containment sump plugging during LP/SD operations appears to have a higher likelihood compared to that at full power.**
 - **Due to increased level of personnel activity during LP/SD.**
- **Some plants operate in mid-loop with the RCS closed.**
- **Reflux cooling is only possible when RCS is closed, and can be modeled as a passive phenomenon.**
- **If the RCS is depressurized, some losses of inventory are self-terminating.**
 - **Any losses of inventory caused by over-draining will only drain to the bottom of the hot leg.**

ONSITE REVIEW OF LP/SD SPAR MODEL FOR SURRY (Continued)

- **At some plants, preferred method of RCS makeup (given a loss of inventory during LP/SD) is gravity feed from the RWST.**
- **When considering the possibility of gravity feeding the RCS from the RWST, the analyst should consider the need to make up to the RWST.**
- **The analyst should consider the possibility of crediting the accumulators for makeup to the RCS.**
 - **Might increase available time for recovery.**

EVALUATION OF REVIEW RESULTS:

- **Inconclusive Relative to SPAR Model QA Acceptance Criteria.**
- **Further Discussion with Licensee Planned.**

**CANCELLATION OF PLANS FOR REVISION 4i SPAR
MODEL DEVELOPMENT**

CANCELLATION OF PLANS FOR REV. 4i SPAR MODELS

- **Current and Future Plans for SPAR Model Development and Associated Budget Specify Plans for Developing Level 1 Models for Full Power and Low Power/Shutdown Operations, Level 2/LERF Models, and External Events (e.g., fires, flooding, seismic, etc.) Analysis Capability.**
- **Revision 3 SPAR Models Developed by Improving Revision 2QA Models To:**
 - **Add more initiating events (e.g., med. & large LOCAs, sec. system IEs).**
 - **Model other support systems (SWS,CCW, etc.) besides emergency ac power.**
 - **Enhance treatment of CCFs.**
 - **Add uncertainty analysis capability (for equipment performance).**
 - **Add new HRA methodology (currently being enhanced to add uncertainty analysis capability).**
- **Revision 3 SPAR Models Capture ~80-85% of Internal Events CDF.**

CANCELLATION OF PLANS FOR REV. 4i SPAR MODELS

(Continued)

- **Est. Total Cost of Revision 3 SPAR Model Development = \$3.8 million.**
 - **Produce/conduct onsite QA reviews of 72 models.**
 - **Project on schedule.**

- **Consequences of Canceling Development of Set of Rev. 4i SPAR Models.**
 - **No extensive effort to revise Rev. 3 SPAR models.**
 - **Line items in future SPAR Model Development Program budget:**
 - **Maintain and improve existing SPAR models.**
 - User-Friendly front-end Interface for SDP**
 - Staff/contractor monitor technical issues - model revisions**

 - **Provide technical support to model users.**

Briefing for ACRS

on

Guidance for Performance-Based Regulation

N. Prasad Kadambi, NRC/RES/REAHFB

October 11, 2002

OUTLINE

- Summary
- Historical Background
- Why “Guidance?”
- General characteristics of process.
- Illustration of process through example.
- Revised high-level guidelines.
- Conclusions.

Summary

- The developmental phase of the NRC's performance-based regulatory initiative is now complete with the availability of a suitable guidance document.
- The research work on the principles of performance-based regulation, and the applications on specific projects, have given us confidence that a broader range of activities should be encompassed by this work.
- The staff's plans to incorporate performance-based regulation within the scope of "regulatory coherence activities" will enable wider application of the concepts, including exploration of areas of research that may benefit from formal decision methods.
- If ACRS supports the staff's approaches and actions so far, the agency will have come closer to realizing the goals of the Commission's White Paper on risk-informed and performance-based regulation which is to have an integrated regulatory process.

Historical Background

- DSI-12, Commission White Paper on “Risk-Informed and Performance-Based Regulation”, and Strategic Plan
- SECY-99-281, “The Vision of the RES Role”:

*“To achieve the agency’s goals to maintain safety while reducing unnecessary burden through realistic assessments, RES will: ...
coordinate agency efforts to become more risk-informed and performance-based;”*

- SECY-00-191, “High-Level Guidelines for Performance-Based Activities”, and NUREG/CR-5392, “Elements of an Approach to Performance-Based Regulatory Oversight” were published after Advisory Committee reviews
- SECY-01-0205, “Status Report on Performance-Based Approaches to Regulation”
- Actions and milestones:
 - An integrated process in accordance with White Paper (on-going)
 - Pilot projects (individual milestones)
 - User friendly guidance document -- FY 2002
 - Communication Plan -- Mid-FY 2002

Why “Guidance”

- Feedback from Performance-Based Regulation Working Group [PBRWG] indicated that high-level guidelines are at too high a level. They articulate attributes, but do not provide direction on implementation.
- Staff’s first attempt at developing implementation guidance resulted in a highly formal and overly general presentation of decision theory. Hence, the staff has adopted a two-step process in which the simplified guidance is expected to be sufficient in most cases, and a more formal approach pursued if necessary.
- Although the White Paper on “Risk-Informed and Performance-Based Regulation” provided definitions for all important terms, including “Performance-Based Approach”, a consistent application for “performance-based regulation” (PBR) is not being realized (eg. see “Rulemaking Activities Plan”). Feedback indicates the need for user friendly guidance.
- Instead of a Management Directive, staff informed Commission in SECY-01-205 that a user friendly guidance document would be developed as a companion to NUREG/BR-0058 “Regulatory Analysis Guidelines”.

General Characteristics of Process

- Guidance document completes the developmental phase of the staff's PBR efforts.
- It represents an internally self-consistent approach to regulation originating from the "White Paper" and applicable to the three arenas of regulatory responsibility.
- Process aspects of "Guidance" bear strong resemblance to formal decision theory with the flexibility for varying degrees of formality and quantification.
- Guidance naturally integrates "risk-informed" with "performance-based" regulation.
- It fulfills expectation expressed in SECY-01-205, and substantially responds to commitment made to ACRS:
 - "Eventually, an integrated process is expected that, in accordance with the Commissions's White Paper, combines the "risk-informed" and "performance-based" elements to regulatory decision-making."
 - Uses terminology employed by the published literature in the area of formal methods for decision-making.
- Expected to meet the needs for including PBR alternatives in majority of regulatory issues.

Illustration of “Guidance” Process

- Illustration of steps in the guidance process will be based on recent performance-based actions:
 - The Reactor Oversight Process (ROP) is demonstrably risk-informed and performance-based.
 - The proposed rulemaking on 10 CFR Part 50.44 incorporates a performance-based approach to hydrogen monitoring.
 - The proposed rulemaking on 10 CFR Part 72 relative to ISFSI and MRS facilities incorporates a performance-based approach to cost-beneficial geological and seismological analysis for the regulatory analysis.
- Pilot projects show that finding performance-based elements in a regulatory action requires, not a formulaic approach, but a systematic search for less prescriptive measures.
- The formalism provided by the high-level guidelines and the guidance steps helps maintain consistency and coherence.

Illustration of “Guidance” Process (continued)

- *Step 1: Define regulatory issue and its context:*
 - Arena is generally clear, but sub-arena may require internal discussion
 - Potentially addresses all four NRC performance goals.
 - Expected outcome is to provide appropriate regulatory requirements and supporting framework.

- *Step 2: Identify safety functions:*
 - ROP structure provides benefit not available for the other examples.
 - The rulemaking on 10 CFR 50.44 identified hydrogen monitoring as the safety function for application of a performance-based approach.
 - For the ISFSI, example safety functions were identified as stability against soil liquefaction during vibratory motion, and cask sliding and resulting displacements during an earthquake event.

Illustration of “Guidance” Process (continued)

- *Step 3: Identify safety margins:*
 - Safety margins in ROP are expressed as DCDF from inspections or PIs.
 - Performance targets for hydrogen monitoring function are based on reliability, availability and capability. Comparison with observed performance through servicing, testing and calibration provides a measure of safety margin.
 - Safety margins for ISFSI are substantial because casks are designed for challenges of handling and transportation.

- *Step 4: Select performance parameters and criteria:*
 - The level at which performance will be evaluated is considered here.
 - ROP may institute time at risk-significant configuration as a performance parameter at shutdown. This is an example of setting a high-level parameter. The criterion would have more considerations than risk model computations.
 - The regulatory analysis application for ISFSIs is an example of a performance-based approach to cost effective implementation of a regulation.

Illustration of "Guidance" Process (continued)

- *Step 5: Formulate a performance-based alternative:*
 - The considerations inherent in the staff's responses in Steps 1-4 would have decided the viability of a performance-based approach. If it is viable, the information developed includes candidate performance parameters.
 - The context of the regulatory issue (including consideration of defense-in-depth) determines which parameters are selected and how they are used in a regulatory action. Eg: Level of detail for analysis supporting siting of ISFSI.
 - The resolution of the regulatory issue should consider optimization within the regulatory framework, using prescriptive elements as needed. Eg: Regulatory guidance incorporating hydrogen monitoring into the maintenance rule program.
 - Any flexibility provided by a regulatory action may include consideration of appropriate licensee incentives to perform in a superior manner. Eg: ROP approach to risk significant shutdown configurations.

Revised High-Level Guidelines

- Three groups of guidelines maintain substantial similarity to those discussed in public and stakeholder interaction:
 - Viability guidelines (*Can a performance-based approach be developed?*)
 - Assessment guidelines (*Is it worthwhile to develop a performance-based change?*)
 - Guidelines for consistency with regulatory principles (*Are we being consistent with basic regulatory principles?*)
- Viability guidelines are same as “White Paper” definition with rearrangement to put margin first and include qualitative measures.
- Assessment guidelines include consideration of NRC’s performance goals, assessment of net benefit, and optimal use of regulatory framework.
- Regulatory principles include defense-in-depth considerations, Option 3 framework, and RG 1.174 philosophy.
- Formal treatment of defense-in-depth will be incorporated into later document.

Conclusion

- Staff requests a letter that provides ACRS views on the approach taken by the guidance document, and on the completion of the developmental phase of the performance-based regulatory initiative with the guidance document (subject to finalization).
- Staff plans to incorporate its PBR efforts into “regulatory coherence activities”. This will enable more rapid progress toward increasing the use of performance-based approaches in a broader range of activities.
- An inter-office group, the Risk Management Team, will coordinate and provide policy direction to implementation of PBR activities.
- RES will develop a NUREG document in FY-2003 that provides more detail on formal decision methods as applied in support of performance-based approaches as well as other applications of such methods.