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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

3 + + + + +

4 MEETING

5 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

6 (ACRS)

7 SUBCOMMITTEE ON FIRE PROTECTION

8 + + + + +

9 TUESDAY,

10 SEPTEMBER 9, 2003

11 + + + + +

12 ROCKVILLE, MARYLAND

13 + + + + +

14 The Subcommittee met at the Nuclear Regulatory

15 Commission, Two White Flint North, Room T2B3, 11545

16 Rockville Pike, at 8:30 a.m.., Stephen L. Rosen,

17 Chairman, presiding.

18

19 COMMITTEE MEMBERS:

20 STEPHEN L. ROSEN, Chairman

21 GRAHAM B. WALLIS, Member

22 THOMAS S. KRESS, Member

23 DANA A. POWERS, Member

24 JOHN D. SIEBER, Member

25

1 ACRS STAFF PRESENT:

2 MARVIN D. SYKES

3 NRC STAFF PRESENT:

4 JOE BIRMINGHAM

5 SUZANNE BLACK

6 DAVID DIEC

7 RAY GALLUCCI

8 JOHN HANNON

9 J.S. HYSLOP

10 NAEEM IQBAL

11 PAUL LAIN

12 ERASMIA LOIS

13 PHIL QUALLS

14 MARK HENRY SALLEY, P.E.

15 SUNIL WEERAKKODY

16 ALSO PRESENT:

17 H. DOUG BRANDES, Duke Power

18 FRED EMERSON, Nuclear Energy Institute

19 DENNIS HENNEKE, Duke Power

20

21

I-N-D-E-X

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

8:33 a.m.

CHAIRMAN ROSEN: The meeting will now come to order.

This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Fire Protection. I am Steve Rosen, Chairman of the subcommittee.

ACRS members in attendance are Jack Sieber, Tom Kress, Dana Powers, Graham Wallis.

The purpose of this meeting is to discuss a number of the fire protection issues which include 10 CFR 50.48 rulemaking which would permit licensee to voluntarily adopt National Fire Protection Association Standard 805, performance based standard for fire protection for light water reactor electric-generating plants as an alternative to existing fire protection requirements.

Number two, the staff's approach for resolution of issues related to post-fire safe shutdown circuit analysis.

Number three, development of fire dynamics tools for inspectors, and;

Number four, the staff's proposed rulemaking for post-fire manual actions.

We will be hearing from representatives from the Office of Nuclear Reactor Regulation, the Nuclear Energy Institute and Duke Energy will be making presentations during this meeting.

The subcommittee will gather information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full committee. Marvin Sykes is the cognizant ACRS staff engineer for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the *Federal Register* on August 19, 2003.

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

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

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

1 We will now proceed with the meeting. I
2 call upon Mr. John Hannon of the Office of Nuclear
3 Reactor Regulation to begin.
4 MR. HANNON: Good morning. I'm John
5 Hannon, plant systems branch chief. And with me
6 this morning is Suzie Black, the division director
7 for DSSA.
8 We have been working very diligently
9 behind the scenes to prepare for this session. We
10 appreciate the opportunity to meet with the ACRS
11 Subcommittee on Fire Protection.
12 Let me now turn over to Sunil
13 Weerakkody, he's the section chief in charge of the
14 fire protection section
15 MR. WEERAKKODY: My name is Sunil
16 Weerakkody. I'm the section chief of fire
17 protection. I assumed this position June of this
18 year.
19 What I'd like to do first is as part of
20 the old, we'll introduce the key elements of the
21 presentations that Office of Nuclear Reactor
22 Regulation and the Research Office would present.
23 And also identify the case staff members who make
24 those presentations.
25 The first presentation would be 10 CFR

1 50.48(c) which is rulemaking. It is also called
2 NFPA 805 rulemaking, and it's in its final stages.
3 The key people who would make the
4 presentations are from the rulemaking branch, Joe
5 Birmingham and then from my staff I have Paul Lain
6 sitting somewhere. Paul Lain and J.S. Hyslop will
7 speak to how the Office of Research is supporting
8 that effort. And what they will do is since I am
9 told that we have not meet with you for about a
10 year, so we will give you an update of what we have
11 accomplished over the last year and the status, and
12 then there's a number of another elements that we
13 would be discussed pertaining to the rule.
14 The second topic will be risk-informing
15 associated circuits. That presentation would be made
16 by myself and Mark Salley who is in my staff. And we
17 have a number of accomplishments that we have made
18 as a branch. We have gone as far as we can go in
19 this area.
20 Just a quick background on this topic.
21 About 3 years ago we stopped the inspections on
22 circuits because of a number of issues. And over
23 the last 3 years we have done a lot of work in this
24 area including a number of experiments, including
25 creating a new inspection guidance that helped

1 inspectors identify that are risk significant.
2 Again, I'll leave the details to the presenter. That
3 will be our second presentation.
4 The third presentation would be made
5 Naeem Iqbal on the development fire dynamic tools.
6 And I think here you have shared the NUREG 1805
7 which is a draft document. I think you have shared
8 with the ACRS members. And what we have done there
9 is a number of things were purely qualitative many
10 years ago. We have developed some screening
11 quantitative type tools for the use of the
12 inspectors. And Naeem would go into how and when
13 these tools would be used in our regulatory process,
14 and then go into some details of what the tools do.
15 And our final presentation would be on
16 manual action rulemaking. That will be presented by
17 David Diec of the Rulemaking branch and he would be
18 supported by Ray Gallucci and Phil Qualls from the
19 Fire Protection and also by J.S. Hyslop from
20 Research.
21 And I also understand there is one other
22 key element that you would be hearing from our
23 parent branch, that's on the fire protection
24 significant determination process.
25 One of the things before the oral

1 presentations start, I want to sort of give you a
2 very quick overview of the common thread, so to
3 speak, that I have recognized as the common thread
4 that runs all these issues. I was able to take an
5 outside look at the fire protection issues just
6 because I'm new to the area. And what I am finding
7 is there's a legacy issues. What I mean there is
8 that because of the regulations, the reg guides, the
9 information notices there are some confusions out
10 there in terms of the licensing basis, what is real
11 licensing basis, what is outside licensing basis.
12 And in all of these efforts that you would be
13 hearing today one common thread you would find is
14 that we are looking for creative ways to achieve
15 safety without undue burden to stakeholders. The
16 reason I state it this way is one of the easiest
17 solutions if both us and the industry had unlimited
18 resources is to say, you know, spend a lot of
19 resources clarifying what the licensing basis is and
20 get the licensees to address all compliance issues.
21 We are not going down that path. The path that we
22 are going down is a path where we use the
23 performance basing and risk-informing as the nexus
24 or as the main approach.
25 That is my last slide. I just want to

1 make sure that I take a few moments to thank you for
2 giving us the opportunity to come to you. And we
3 are going to sit down here and listen to your
4 questions, take your feedback and determine how or
5 whether we need to change the direction we are
6 heading in the fire protection area.
7 Finally, if after our presentation if
8 you feel that the fire protection we aren't going in
9 the right direction, we would appreciate your
10 endorsement of that. Because, as I said, the legacy
11 issues to solve the number of issues that we
12 confront, the whole agency has to work together and
13 your endorsement of the overall direction can help
14 us achieve that end.
15 Thank you very much.
16 CHAIRMAN ROSEN: Well, thank you very
17 much, Sunil, for that useful introduction. We
18 certainly will do our best to provide you with the
19 support you have requested.
20 MR. LAIN: Hello. My name is Paul Lain.
21 I'm a fire protection engineer with the plant
22 systems branch.
23 This briefing on NFPA 805 rulemaking is
24 going to be done by three people. We have on sort
25 of the technical support Joe Birmingham's in the

1 rulemaking branch and he's the project manager for
2 the rulemaking. And then J.S. Hyslop will tell us
3 how Research is assisting in the 805 rulemaking.
4 We've briefed the ACRS annually for the
5 last 4 years. I think the last one was June. Maybe
6 the whole committee. It was June of last year with
7 Eric Weiss. We've had a lot of people changing. But
8 I just wanted to quickly review some of these items.
9 This is sort of the briefing here.
10 I'll go over the first four sections,
11 background advantages and structures and Joe will be
12 going over the rule structure and the status of the
13 rulemaking and then J.S. will come back in with the
14 related Research side.
15 Background. I think all of you are very
16 probably familiar with a lot of these items.
17 Appendix R came in in 1980 and then the
18 agency got very involved with the PRA in the late
19 '90s. We came in our different SECYs, one to work
20 with industry to develop the fire protection
21 standard, the rulemaking plan in 2000. And NFPA 805
22 was published in 2001 and we went out with the
23 proposed in 2002.
24 Just to quickly go over some of the
25 advantages of 805. One is to reduce regulatory

burden, you know. One way it does that, there's going to be with the circuit analysis which you're going to hear about later, I think there's going to be a lot of issues. And this is going to be one way that licensees can use this approach to sort of reduce the exemption process and be able to ferret out the risk significant issues versus the non-risk issues and deal with them themselves versus coming into headquarters with a lot of exemptions.

It also endorses the National Technology Advancement and Transfer Act of 1995 and encouraged agencies to endorse consensus standards. I think that was probably one of the lead pieces why we went this way.

We've also involved industry in the development of the standard, plus also we've helped to develop the guidance for the implementation guidance.

It will be voluntary, so then licensees that take a look at this and feel that they don't necessarily gain a lot economically won't be forced into going this way. But if they feel they can, I think we've got some indication, we've got at least 15 plants I think looking at going this way. So the number is increasing as to the rulemaking.

1 MR. SIEBER: So you aren't going to
2 allow picking and choosing?
3 MR. LAIN: No. It's going to be the
4 whole facility will have to sort of switch and
5 become an 805 plant.
6 MR. SIEBER: You either buy it or you
7 don't? Right.
8 CHAIRMAN ROSEN: Would you characterize
9 those 15 plants without naming them? Are they the
10 older plants, the new plants, the bigger plants, the
11 smaller plants? Is there anyway to characterize
12 them?
13 MR. LAIN: Doug Brandes might be able to
14 tell, but I know his facilities are looking into it.
15 I think a lot of them are the pre-'79 plants. But,
16 Doug, would you like to comment?
17 MR. BRANDES: Yes. Can you hear me now?
18 I'm the one that came up with the number
19 15, so I thought I'd volunteer to explain a little
20 bit.
21 There are a number of utilities who are
22 currently working to update their fire protection
23 program, primarily the safe shutdown program. And
24 our thinking was that these guys are right now under
25 pressure from their respective regions to press

1 forward. But if they have the opportunity to delay
2 their update until the new rule was available to
3 them, they would probably benefit from adopting it.
4 So this is a combination of older and newer plants.
5 CHAIRMAN ROSEN: So it's plants that
6 have found the need to update their fire protection
7 licensing basis, that would be a way to characterize
8 it?
9 MR. BRANDES: Yes, primarily their safe
10 shutdown program.
11 CHAIRMAN ROSEN: Safe shutdown program.
12 Okay. Thank you.
13 MR. BRANDES: Thank you.
14 MR. LAIN: Something 805 does, it does
15 set specific performance goals and criteria which we
16 don't have in Appendix R. And you can focus in on
17 your risk significant issues and then prioritize
18 your issues and spend your resources in the most
19 significant way and all the while maintaining safety
20 margin and defense-in-depth. I think those are
21 going to be some key hurdles within the
22 implementation that you basically have to go over as
23 you maintain sufficient safety margin and defense-
24 in-depth.
25 DR. WALLIS: Do you have a measure of

1 what the safety margin is or something to be --

2 MR. LAIN: Right now it's qualitative.

3 We are working with the implementation guide to sort

4 of confirm it.

5 DR. WALLIS: So how do you know that

6 you've maintained a safety margin?

7 MR. LAIN: That's a good question, I

8 don't have an answer for you.

9 DR. WALLIS: The same thing goes for

10 defense-in-depth? I mean, these are good words.

11 MR. LAIN: Yes.

12 DR. WALLIS: But without some kind of a

13 hard measure or something quantitative or definite

14 or tangible.

15 MR. LAIN: Yes. Yes.

16 Doug, you have a comment?

17 MR. BRANDES: Yes. Again, Doug Brandes.

18 And I'm involved with this. I chaired

19 the NEI task force working with this rulemaking so

20 I'd like to at least offer some insights.

21 One of the fundamental premises in

22 transitioning to a risk-informed licensing basis

23 based on 805 is that the plant is safe today, safe

24 tomorrow. So that the way we're structuring it is

25 that existing licensing basis can be dropped in as a

1 point of departure with the caveat that we're
2 recommending that licensees look back at any
3 engineering analysis to be sure that all the
4 historical engineering analysis for fire protection
5 meet the quality of our expectation for current day
6 engineering analysis. And with that concept in safe
7 today/safe today makes sense.
8 We also have a provision for any change
9 to the licensing basis. We run through a change
10 evaluation process essentially based on the reg
11 guide 1.174 to be sure that you maintain safety
12 margins.
13 DR. WALLIS: So this is so you can look
14 at your PRA?
15 MR. BRANDES: I'm sorry?
16 DR. WALLIS: You use the PRA then as --
17 MR. BRANDES: If available, either the
18 PRA or the whatever IPEEE analysis is available.
19 MR. LAIN: I think Fred may be getting
20 into this a little bit later. His presentation will
21 follow us and he'll probably be talking about the
22 implementation guide in depth. Is that correct,
23 Doug?
24 MR. BRANDES: That's my presentation.
25 MR. LAIN: Okay. Okay.

1 Yes, sir?

2 DR. POWERS: You've addressed maybe the

3 issues in margin, but the issue of defense-in-depth,

4 unlike many aspects of reactor safety, defense-in-

5 depth is a fairly tangible specific thing within the

6 area of fire protection.

7 MR. LAIN: Yes.

8 DR. POWERS: I mean it has a definition?

9 MR. LAIN: Yes.

10 DR. POWERS: And we know what the layers

11 of defense are. I mean, it's pretty transparent

12 whether you have that or not have that. I mean, at

13 the end of the day after you've done everything you

14 either have that or you don't. It's not a judgment

15 call.

16 MR. BIRMINGHAM: Paul? Joe Birmingham,

17 Office of NRR.

18 And briefly what NFPA 805 does it

19 carefully defines what defense-in-depth is and then

20 it talks about if you make a change to a plant, then

21 you review the defense-in-depth. And if you've

22 changed anyone of the three typical things that we

23 have that if you've reduced one, then you'd better

24 look at the other two carefully to see if you

25 either: (a) increased those to preserve an adequate

1 amount of defense-in-depth or that you haven't
2 reduced that one level of defense-in-depth to a
3 point where it's not tenable.
4 DR. POWERS: Well I mean it seems to me
5 if you've reduced any one of the layers to the point
6 it's not tenable, then you don't have defense-in-
7 depth?
8 MR. BIRMINGHAM: Absolutely.
9 DR. POWERS: It seems to me that the
10 more crucial thing is that you may have rendered
11 them not independent of each other. That would be
12 the more difficult thing, I think. Because imbedded
13 in the concept of defense-in-depth is one layer
14 doesn't impact the other.
15 MR. BIRMINGHAM: Right. 805, we
16 basically describe it as integrated and then the
17 assessment is an integrated assessment of defense-
18 in-depth. And your point is a good description of
19 the way 805 approaches it.
20 DR. WALLIS: Yes. You need some kind of
21 a mathematical formula that says you have to have
22 all three up to a certain level. As you approach
23 that limiting level in any one of them, some kind of
24 a measure goes off scale. I don't know what the
25 measure is. I could probably construct a formula

1 that would have that characteristic.

2 MR. BIRMINGHAM: Yes. And as you

3 pointed out, you cannot reduce any one of the levels

4 below where it's no longer useful.

5 DR. WALLIS: Less than minimum level.

6 And do you know what that is? Is it specified?

7 MR. BIRMINGHAM: Each level -- I mean,

8 it really is a specific -- you have to approach each

9 application on a specific basis. For example, in

10 fire protection defense-in-depth you start off with

11 --

12 DR. POWERS: Detect fires. Prevent

13 fires.

14 MR. BIRMINGHAM: -- prevent fires and

15 detection and mitigation, suppress, mitigation and

16 so on. If, for whatever reason, you reduce one you

17 need to ensure that the others have complete

18 adequacy.

19 DR. POWERS: Let's explore the first, as

20 well as this description of this just a little bit.

21 You have to prevent fires. Okay. I

22 mean, it's pretty hard to know. If you're

23 successful, it's hard to know that you're

24 successful. If you're not successful, it's very

25 obvious you're not successful. So I'm not sure how

1 you rendered that into a mathematical formula.

2 MR. BIRMINGHAM: It makes it a difficult

3 thing to do. And if you go into a fire area and you

4 decide for whatever reason this fire area is

5 difficult to prevent fires, it has more oil pumps

6 and so on that are in there, therefore more

7 combustibles, you have to look at your mitigation

8 systems. Are those going to be adequate should we

9 have a fire?

10 If you go into a fire area and you're

11 able to say this area has none and we're going to

12 prevent the introduction--

13 DR. POWERS: Now I understand what you

14 were talking about reducing things. You're saying

15 it's not so much you're reducing things, that things

16 are reduced just be it's function.

17 MR. BIRMINGHAM: Correct.

18 DR. POWERS: And so now you have to

19 bolster something else because it's impossible to

20 change the function of this facility.

21 MR. BIRMINGHAM: Yes.

22 DR. POWERS: This particular region.

23 CHAIRMAN ROSEN: Let me recognize a

24 member of the public.

25 MR. HENNEKE: I'm Dennis Henneke with

1 Duke Power, and I'm a PRA guy. And I was on NFPA
2 805 committee in circuit analysis and I'm working
3 with implementation guide with NEI.
4 Defense-in-depth and safety margins is
5 one of the key areas that we recognize in the
6 implementation guide that really needs to be better
7 defined out of 805. 805 does define it and because
8 fire protection has something you wrap your hands
9 around about ignition frequencies and, you know,
10 likelihood of a fire, suppression capability and
11 safe shutdown that people feel comfortable that
12 defense-in-depth can be measured and maintained. But
13 in actuality when you start looking at it it's as
14 complex as any other defense-in-depth argument. And
15 so we're trying to look at specifics in the
16 implementation guide.
17 And you talk about formula for it, the
18 PRA is a formula for defense-in-depth. It is a
19 defense-in-depth model because it takes all the
20 attributes of defense-in-depth and measures it. So
21 one would think that you could measure low risk and
22 you've maintained a measure of defense-in-depth.
23 However, the PRA's uncertain and so you have to look
24 at defense-in-depth in a qualitative standpoint and
25 you have to put some guidelines out there.

1 One of the aspects, for example, that
2 we've had with the staff, say, in the circuit
3 analysis you can't have circuit analysis issues
4 where the conditional core damage probability is
5 1.0. And we'll argue back and say well, first, you
6 have a spurious operation probability but if you
7 look at defense-in-depth, you can fail an attribute
8 of defense-in-depth like safe shutdown, which is a
9 core damage of 1, as long as the other attributes
10 are strong.
11 So if you had a likely fire with a
12 conditional core damage of 1, then that would be
13 insufficient defense-in-depth. If you had an
14 unlikely fire and you had suppress but you still had
15 a core damage of 1, that would maybe be okay as long
16 as your risk is shown to be low.
17 So there's still things about defense-
18 in-depth we have to define, and we've made an
19 attempt in our draft and implementation guide to do
20 that. But it is one area I've talked to Paul about
21 that really the NRC needs to look at and make sure
22 that we've taken a shot to define it better, take a
23 look at it and make sure that that's kind of what we
24 were thinking and make sure that's strong. Because
25 that's definitely an area going forward if we're

1 going to safe today/safe tomorrow, that's where
2 we're going to validate that that's true.
3 DR. WALLIS: Can I ask if we're going to
4 see this implementation guide then?
5 MR. LAIN: What was the question?
6 DR. WALLIS: Are we going to see this
7 implementation guide? Are we going to have a
8 presentation on it or does --
9 MR. LAIN: Yes, you'll be having a
10 presentation on it. And I think it was also, did we
11 not provide you a copy of that?
12 DR. WALLIS: But it's a draft, isn't it?
13 MR. LAIN: Okay.
14 DR. WALLIS: But that may be where the
15 real issue gets faced?
16 MR. LAIN: Yes.
17 DR. WALLIS: Okay. Thank you.
18 MR. SYKES: Let me correct that. You
19 may have provided a copy of it, but the Committee
20 members have not gotten a copy of it. I'm not sure.
21 I need to go back and check my files, but I don't
22 recall getting a copy of it.
23 MR. LAIN: It was a fairly thick
24 document.
25 MR. SYKES: Okay.

1 CHAIRMAN ROSEN: I would have to speak
2 up for the PRA branch of the ACRS which would point
3 out the PRA doesn't introduce uncertainty. The
4 uncertainty is there. The PRA simply takes a shot
5 at attempting to quantify it.
6 DR. WALLIS: And then DID or defense-in-
7 depth is a way of taking care of the uncertainty.
8 So look at the worse thing and say how do we defend
9 against that, even if we are wrong about bits of the
10 PRA, we still got some defense. So they are
11 intertwined.
12 MR. BIRMINGHAM: Joe Birmingham, NRR
13 again.
14 The process for NFPA 805, the analysis
15 that it goes through, is an engineering analysis
16 that uses quantifying the risk. But then when you
17 get done, it then purposely takes a look at defense,
18 did we preserve defense-in-depth adequately, did we
19 preserve safety margin. And it follows that formula.
20 DR. POWERS: Without wanting to delay
21 the procedures, I will not contest my fellow
22 member's use of PRA as the quantifier of defense-in-
23 depth.
24 DR. KRESS: Although you would like to.
25 DR. POWERS: I'll reserve that for

1 either later in the proceedings or tonight.

2 It's not that I disagree with the

3 utility of PRA as a way of assessing. I just don't

4 believe that defense-in-depth is solely a

5 manifestation of PRA and uncertainties identified in

6 the PRA. I believe it addresses more.

7 DR. KRESS: I think that would be one

8 aspect of it.

9 DR. POWERS: It is one aspect of it.

10 DR. KRESS: Yes, but there is an

11 additional aspect that I agree --

12 DR. POWERS: An additional aspect of it

13 that says there are things --

14 DR. KRESS: You just don't know the

15 quantitative side.

16 DR. POWERS: -- that we don't know how

17 to do.

18 DR. KRESS: That's right.

19 MR. LAIN: Okay. A quick overview of

20 the 805 structure. It has a core fire protection

21 program, fundamental program within it. It also has

22 sort of a parallel structure. It has a deterministic

23 side and a performance based side where you can

24 transition into the deterministic side and then use

25 the change control process to change your facility.

1 I think it was designed that way to make transition
2 not as hard.
3 It requires to establish your
4 fundamental fire protection program to go back and
5 do a reevaluation to transition and to modify, I
6 guess we're modify your existing fire protection
7 program to conform to 805. But it also it allows
8 including existing exemptions in Generic Letter 86-
9 10 of type evaluations to be able to sort of
10 grandfather your existing program into 805.
11 It also provides guidance on performing
12 your nuclear safety analysis, fire modeling and fire
13 PRAs.
14 To quickly go over the core fundamental
15 program, I'm not going to hit each one of these
16 points, but this contains a lot of what sort of
17 Appendix R also has, but it's your design elements,
18 your design requirements. If you have a sprinkler
19 system, it says it needs to follow NFPA 13, your
20 fire brigade needs to follow NFPA 600; it has those
21 types of items. It has some deterministic
22 requirements like you need to 5 fire brigade
23 members.
24 DR. POWERS: That's one that has been a
25 curiosity to me because of the interface with OSHA

1 rules on entry where if you have two lines of attack
2 on a fire, you haven't got enough people to comply
3 with OSHA with 5 member team.
4 MR. LAIN: Yes.
5 DR. POWERS: Have you run into a problem
6 with that?
7 MR. LAIN: Not that I've heard. I sort
8 of get the feeling that they would like to even less
9 than that 5 person team, I think. I think there's a
10 history on it. I'm not that familiar with the
11 history, but I think they fought for at a minimum of
12 having a 5 member team. And I see where you're going
13 here that it's --
14 DR. POWERS: Yes. If you have 2 people
15 entering into a hazardous area, OSHA wants 2 people
16 outside.
17 MR. LAIN: Yes.
18 DR. POWERS: That pretty well consumes
19 your team.
20 MR. LAIN: Yes.
21 DR. POWERS: And so 2 lines of attack on
22 a fire, which is a pretty common strategy, you
23 haven't got enough folks. I mean, how does that
24 interface with OSHA work?
25 MR. LAIN: I don't have the background

1 on that particular topic. I don't know if anybody
2 else here does.
3 DR. POWERS: I mean, it seems like we've
4 got to.
5 MR. LAIN: Yes.
6 DR. POWERS: I mean, 805 says minimum of
7 5 members on a team. Okay.
8 MR. LAIN: It doesn't say you can't have
9 ten.
10 DR. POWERS: But it says a minimum of 5.
11 But it seems like a minimum of 5 runs counter the
12 common strategies for attacking of fires. Now, 805
13 doesn't say you have to have two lines of attack,
14 but if you look at the fire protection plan at
15 plants, it's not uncommon for them to have --
16 MR. LAIN: To have more.
17 DR. POWERS: -- a strategy of two lines
18 of attack on a fire.
19 DR. KRESS: Where does the local fire
20 department other than the plant personnel fit into
21 that?
22 DR. POWERS: You know, I'm not sure how
23 it does, Tom. Because I mean the local fire
24 department is going to have a two line of attack
25 approach on every fire.

1 DR. KRESS: That's what I mean. That's
2 why I mentioned it.
3 DR. POWERS: I mean every fire they're
4 going to have this two line of attack. But --
5 MR. LAIN: Their response time is a
6 little bit longer And it's sort of they're called
7 in afterwards, after the initial fire brigade.
8 DR. POWERS: Okay.
9 DR. KRESS: So it's the response time
10 that would prevent that?
11 MR. LAIN: Yes.
12 DR. POWERS: I mean this a question
13 that's come up to me every since the first draft of
14 805 came out, but I don't see how it -- I mean, it
15 just seems like it has to at least say something to
16 somebody about this OSHA requirement.
17 MR. QUALLS: Paul, may I ask a question?
18 MR. LAIN: Yes. Sure. I remember it
19 being discussed before I joined the branch. This is
20 Phil Qualls from the plant systems branch.
21 MR. QUALLS: Hi. My name is Phil Qualls.
22 I've inspected a ton of fire drills. I was an
23 inspector in Region V for a lot of years before they
24 closed it.
25 What you typically see during the fire

1 drills is actually the fire brigade leader making
2 the decision to attack it from one side based on the
3 size and the location of the fire which leaves
4 actually 4 members to make that approach. There are
5 two approaches to every fire area, typically, in the
6 pre-fire plan such because the fire is perhaps in a
7 location where you have to approach it from one of
8 two directions. But typically there is one fire
9 brigade making the approach in one direction based
10 on the location and the type of fire which allows
11 you 2 people to make the first entry and 2 people
12 free and a fire brigade leader to satisfy the OSHA
13 needs.
14 DR. POWERS: And what you're saying is
15 the practicality of the matter is that in the event
16 of a fire the attack is really from one direction?
17 MR. QUALLS: Typically, yes, because
18 they have two approaches because that's the pre-fire
19 plan. So there's going to be two approaches. But it
20 depends generally on the location and the type of
21 fire as to which approach is used.
22 DR. POWERS: Well then it seems to me
23 that what you've got to say in your plant plan is
24 the fire brigade leader will select a line of attack
25 from the two options that he has and attack it only

1 in one direction and not claim that you're going to
2 take a two direction attack.
3 MR. QUALLS: Well, that's what you
4 usually see in the drills, is attack from one
5 direction based on the size and location of fire.
6 DR. POWERS: But that's not what you see
7 in the plan. I can't say universally true, but it's
8 not uncommon.
9 MR. QUALLS: I usually see the option.
10 DR. POWERS: You always had the option
11 to attack in only one direction.
12 MR. QUALLS: But that's what I see
13 during the drills. And that's certainly --
14 DR. POWERS: What you're telling me is,
15 is that it's common to attack it on one direction,
16 and I accept that.
17 MR. QUALLS: Well, see, most fires that
18 would require--
19 DR. POWERS: Here it looks like to me
20 that you're stuck. If you can only attack it in one
21 direction, then you got to make a decision.
22 CHAIRMAN ROSEN: Well, in the beginning.
23 Later on, I mean after your reinforced by the off-
24 site fire --
25 MR. QUALLS: In the incipient --

1 DR. POWERS: Yes, once you're
2 reinforced, then you got enough.
3 MR. QUALLS: If it's too large that they
4 can't put it out from one direction, my experience
5 has always been that the fire brigade leaders are
6 ready to recommend off-site assistance. I haven't
7 seen any hesitancy about that.
8 DR. POWERS: Well, we have lots and lots
9 of examples of whether there's been hesitancy in the
10 combating of fires.
11 MR. QUALLS: I've seen some of that,
12 too, but not in getting off-site assistance.
13 CHAIRMAN ROSEN: All right Paul.
14 MR. LAIN: Okay. Next slide.
15 Some items in NFPA 805 some differences
16 from Appendix R. One is cold shutdown. You guys
17 might be familiar with this. Basically the fuel
18 needs to be brought to a safe sable condition,
19 meaning hot standby.
20 The lighting requirement, there's not a
21 specific 8 hour emergency lighting requirement. What
22 is in 805 is within the nuclear safety analysis and
23 Appendix B is some guidance that sufficient lighting
24 needs to be available to perform the intended
25 actions. So that's going to be one of those

1 inspection items where they go in and they make sure
2 that they have sufficient lighting to do all their
3 manual actions or other items that they do.
4 The term alternate and dedicated --
5 DR. POWERS: Does that give you a
6 problem on the lack of specificity? We've had in
7 the last 5 years I bet you have seen a dozen
8 complaints about the lack of emergency lighting at
9 plants for fire protection. And here the inspector
10 is looking against a fairly objective criterion. Now
11 he's going to look with something that's more
12 amorphous, it becomes more contentious here. Is
13 that going to cause you a problem?
14 MR. LAIN: Well, I think the history is
15 that they've allowed in a lot of exemptions that
16 they've allowed to use portable lighting and the
17 light. I'm not exactly sure why it didn't
18 necessarily get in 805 or not.
19 MR. SIEBER: Candles.
20 MR. LAIN: No. Hopefully, no candles.
21 Any help from the gallery back here?
22 MR. BIRMINGHAM: One of the observations
23 in 805 is that you're basically advocating a
24 performance based approach. And the deterministic
25 approach says we need 8 hours to go to cold

1 shutdown. In 805 you only need to go to hot
2 shutdown to be in a safe stable condition typically.
3 And you can achieve that much, much more rapidly
4 than getting to cold shutdown. So the amount of time
5 you need is far less.
6 So to say, for example, an 8 hour would
7 be excessive--
8 DR. POWERS: But if I look at the
9 history of things that have come to me, whether
10 there was lighting or not?
11 MR. BIRMINGHAM: Whether there was
12 lighting or not. And we have complaints under our
13 existing Appendix R --
14 DR. POWERS: Yes.
15 MR. BIRMINGHAM: -- the deterministic
16 requirement.
17 DR. POWERS: Yes. These are all
18 Appendix R or its branch technical position
19 alternative and things like that. And technically it
20 was you didn't have enough lighting to work the
21 alternate shutdown panel. I mean, is there lighting
22 or not? It's not whether you had 8 hours of
23 lighting. And clearly it's a judgment, but they're
24 reducing this now to a judgment call. And the guy
25 says yes, I can put it out with the pen light. I can

1 run the shutdown panel with the penlight on my key
2 chain versus the inspector that says now you need 50
3 lumens per square foot or something like that.
4 MR. LAIN: I think we're going to find a
5 lot of those items within the performance base.
6 DR. POWERS: I bet you do. And
7 especially in 805.
8 MR. LAIN: Inspecting them is going to
9 be --
10 MR. BIRMINGHAM: I'm going to take just
11 one small objection to the judgment call. The
12 judgment call is supposed to be based on engineering
13 analyses, which sometimes get real close to a
14 judgment call.
15 DR. POWERS: Yes, it's real close.
16 MR. BIRMINGHAM: But I agree. It does
17 force them at least to look at it and make that
18 call.
19 DR. POWERS: I think my overall point is
20 when looking at 805 I think we need to look at where
21 our history of difficulties has been and say are we
22 going to make this worse or are we going to clear up
23 some of these things in a way that both the licensee
24 and the regulator can look at it and say, yes, we
25 understand what's required here. And we're reducing

1 the requirement to make judgment.

2 But we got a lot of these things. I

3 mean --

4 CHAIRMAN ROSEN: But the best example is

5 not the dedicated shutdown panel. Because these are

6 operators operating within a procedure at a facility

7 that they've been trained on and all they really

8 need is a powerful flashlight. I don't think a

9 light on your key chain is what's anticipated, but

10 with a powerful flashlight or a lantern it seems to

11 me fairly obvious. This is not a hard judgment for

12 me as an engineer to make and a trained operator

13 with a powerful flashlight operating on a small,

14 effectively small panel can usually do the job.

15 Now, there are lot harder engineering

16 than that is my point.

17 MR. BIRMINGHAM: Thank you.

18 MR. WEERAKKODY: This is Sunil

19 Weerakkody again.

20 Dr. Powers, I think your observation, I

21 would say we could even somewhat generalize in that

22 what you're saying is since we are going to a

23 performance based risk-informed rule let's look at

24 the performance history and let that guide us. So

25 if we have any really caveat I would add is there

1 may be a lot of performance issues out there, but we
2 got to take the substantive performance issues that
3 can have an impact on the key goals and the
4 performance criteria. You know, that's my take of
5 that.
6 DR. POWERS: I mean, that's my
7 generality. The lighting sort of thing is just an
8 example of where -- you know, and there's a dozen of
9 them that have come in over the last 5 years. And
10 you're going from a fairly specific requirement to
11 one that's a lot more nebulous here.
12 You know, I can understand why you might
13 well want to do that, because as Mr. Rosen points
14 out, the requirement to have fixed emergency
15 lighting versus a strong flashlight is one that I
16 think is suspectable to analysis. And it would
17 probably come out the way he says it is, that you
18 have a strong flashlight, it's perfectly good
19 enough. But my point is that this history, that we
20 ought to use when we're looking at this 805.
21 MR. WEERAKKODY: Yes, I will agree. And
22 this is very consistent with, let's say, maintenance
23 rule. You can't performance based without a
24 precision of the past performance, or that's what
25 it's coming down to.

1 MR. HENNEKE: Paul?

2 MR. LAIN: Yes.

3 MR. HENNEKE: Yes. Dennis Henneke, Duke

4 Power.

5 My understanding is 805 still requires

6 emergency lighting similar to Appendix R. And so if

7 you have an action, a manual action or working on,

8 say, a shutdown facility, emergency lighting is

9 still required. It's just not the 8 hours.

10 It says, for example, if you have a fire

11 within 10 minutes you perform an action and you can

12 perform that with certainty within 15, then

13 performance requirements would say you have

14 emergency lighting that's 15 minutes long. There's

15 no provision in there to take exceptions for

16 flashlights at this point. So that still has to be

17 something somewhere now as far as a deviation or

18 something of that sort.

19 CHAIRMAN ROSEN: You're saying that's

20 what 805 now requires?

21 MR. HENNEKE: Yes, it still requires

22 emergency lights, it's just a matter of time.

23 MR. LAIN: Yes, it's under a guidance

24 under the nuclear safety guidance that basically you

25 have to have sufficient lighting to be able to do

1 your analyzed shutdown.

2 MR. HENNEKE: That's right. So there's

3 really no difference, it's just no timing of 8

4 hours.

5 MR. LAIN: Well, it's a realization that

6 you don't have to have fixed 8 hour emergency if

7 you're going to have a shutdown.

8 MR. HENNEKE: And in fact, we've looked

9 at cases where you may be running emergency shutdown

10 for 24 hours, you have to have 24 hour lighting. I

11 mean, there may be cases where it actually may be

12 more strenuous. But the timing is based on the

13 actual timing of the expected action. And I think

14 that's the only difference, there's nothing in there

15 that says you can't have it.

16 CHAIRMAN ROSEN: Okay. Will you move

17 on.

18 MR. LAIN: The terms alternate,

19 dedicated I think are not necessarily spelled out.

20 I think people are going to have to document their

21 analyzed shutdown method. And it could be the same

22 sort of concepts that, you know, you have an

23 alternator, you have a redundant safe shutdown

24 train. You know, it talks about protecting your one

25 shutdown train.

1 One thing 805 does allow is sort of feed
2 and bleed for pressurized water reactors. And I
3 think we take an exception to that in the rulemaking
4 and don't necessarily allow that as your sole safe
5 shutdown method.
6 Recovery action. Recovery actions, I
7 guess, are defined are actions outside the control
8 room or outside your other control panel. And the
9 deterministic approach says you basically can't use
10 recovery actions and if you do use recovery actions,
11 then they have to be analyzed and that puts you into
12 the performance based approach is what 805 talks
13 about.
14 And then an addition requirement or
15 criteria is 805 has added a radiation release
16 criteria for areas like waste processing.
17 So our implementation strategy, one of
18 them is working with NEI on the implementation
19 guide. We're also talking about having a regulatory
20 guide, a performance based fire protection
21 regulatory guide. It's a deterministic regulatory
22 guide, which is 1.189 and we've decided, I guess, to
23 put together a reg guide that will have the NEI
24 implementation guide, also the NEI circuit analysis.
25 We are in the middle of reviewing rev D

1 of the implementation guide. Joe will probably talk
2 about that a little bit more. We've participated on
3 their two pilots. They had a change control process
4 pilot in Farley and a transition pilot in McGuire.
5 I think both of those went very well. I think
6 everybody on the teams learned a lot and I think the
7 implementation guide is going to benefit from this.
8 You'll probably hear a little bit more
9 about the circuit analysis here in the next
10 presentation.
11 License amendment SRP, we are developing
12 a SRP to take a look at the first couple of
13 submittals. We expect them to be extensive to kind
14 of put together a template on how to do or how a
15 transition should do. And then we're developing a
16 standard review plan to review those initial SRPs.
17 We expect the follow ons to be more administrative
18 and have the ROP process review those changes to the
19 805 plans.
20 We are also looking into enforcement --
21 CHAIRMAN ROSEN: The ROP process? You
22 mean the normal inspection process?
23 MR. LAIN: Yes, the normal inspection
24 process.
25 And we're looking into having

1 enforcement discretion during the transition
2 process. We don't necessarily want to penalize
3 somebody for doing a lot of self analysis and
4 finding any problems and documenting problems. So
5 we're looking into not necessarily writing
6 violations for any new found items or old design
7 issues that come up during the transition process.
8 And then I guess in the future also
9 we'll be developing inspection procedures for the
10 inspectors as to how to review these 805 plans.
11 We'll probably get a lot of that out of the audit,
12 the SRP type work to figure out what needs to be
13 reviewed and then how to review it. I think that's
14 going to be probably a lot of work in 2004 for us.
15 MR. WEERAKKODY: Again, this is Sunil
16 Weerakkody.
17 One comment I'd like to add is for some
18 of these items that we are considering we may have
19 even a need to go to the Commission level to get
20 approval.
21 MR. LAIN: This is on the enforcement
22 discretion?
23 MR. WEERAKKODY: Yes. Because anytime
24 we have to use a process other than the one we
25 currently have to give usually for the licensees to

1 find and fix issues, sometimes that need arise. And
2 so we're looking on those, too.
3 MR. LAIN: Yes.
4 CHAIRMAN ROSEN: Now, how is that done?
5 What regulatory process is it through which you
6 request the Commission to grant you authority to use
7 enforcement discretion?
8 MR. WEERAKKODY: If you take the case of
9 manual lighting, there I think we sort of stayed
10 ahead of the game in the sense that when you send
11 the proposed through for Commission work, we attach
12 the enforcement description also for their work.
13 In the case of manual action what we are
14 considering doing is working with the other offices
15 in the agency and their branches to come up with the
16 change we need and use a SECY for a notation board
17 to send it up to the Commissioners.
18 MR. LAIN: For 805 and circuit analysis.
19 CHAIRMAN ROSEN: You would use a SECY
20 and wait for the Commission to come back with an SRM
21 or --
22 MR. WEERAKKODY: Yes. Yes.
23 MR. LAIN: Okay. I would like to turn
24 it over to Joe Birmingham, the project manager for
25 the rulemaking.

1 MR. BIRMINGHAM: Good morning. I'm Joe
2 Birmingham. I'm going to talk to you a little bit
3 about the rule structure.
4 NRR looked at and made an assessment
5 that we needed to modify the rule for 10 CFR 50.48
6 in order to adopt 805. Specifically what we did is
7 we are going to incorporate NFPA 805 2001 edition
8 into 10 CFR 50. So 805 will actually become part of
9 the rule.
10 Within the rule structure we've
11 identified six exceptions to the standard. It will
12 probably -- actually, I think we're going to end up
13 with seven because we're going to add an exception
14 that allows license amendments for those things in
15 Chapter 3.
16 Some of the examples of other exceptions
17 are 805 will allow a manual process in lieu of
18 seismic standpipes and hoses for some plants that
19 can't meet that requirement. We, as an agency, are
20 going to insist if that's in your licensing basis,
21 you need to comply with your licensing basis.
22 The rule structure requires a license
23 amendment to adopt 805 including identifying any
24 license revisions or any tech specs that need to be
25 changed at the time that the license amendment is to

1 be granted.

2 The rule structure also requires

3 licensees to complete a plant wide evaluation. This

4 is the integrated evaluation. It's a fire area-by

5 fire area evaluation that's built into 805 before

6 changing any of the fire protection program element.

7 Under the rule structure licensees will

8 document this evaluation and retain the records on

9 site. It's not purposeful. We're trying to make

10 this as easy as possible to adopt this new program.

11 Rather than send volumes of stuff to the staff,

12 we're going to allow licensees to maintain it on

13 site, the site wide evaluation, and then we will as

14 part of the reactor-oversight process come in and

15 selectively look at parts of that.

16 Those alternatives to means of complying

17 with 805, alternatives to 805 and changes in Chapter

18 3 elements, as I mentioned before, we're going to

19 require a license amendment. We look at Chapter 3

20 as a core of fire protection program elements that

21 gives us kind of a transition to a risk-informed

22 performance based approach. It won't be so

23 radically a change that we won't have time to

24 adjust, yet at the same time we wanted to allow

25 licensees to be able to make changes to these over

1 time. And we think for now this is the right
2 structure to go through.
3 We made a determination that NRC
4 proapproval of methods will not be required. This is
5 a consideration that certain methods such as fire
6 modeling, fire PSA currently are not developed or to
7 the point where NRC could review and approve them,
8 yet at the same time we don't want to restrict
9 licensees from taking benefit of these models when
10 they become available as part of their risk
11 arguments. The change I'm making, one I want to
12 input as much information as I can into this change
13 from fire modeling then I would like to quantify the
14 risk in using a fire PRA would help from that.
15 DR. POWERS: Let me ask a question of
16 this third one. I'm operating from memory, but
17 doesn't 805 say you can use methods approved by the
18 regulatory authority having jurisdiction or whatever
19 language they use?
20 MR. BIRMINGHAM: Yes.
21 DR. POWERS: And you're bathing out on
22 this?
23 MR. BIRMINGHAM: Let me clarify very
24 carefully. What 805 requires is that licensees use
25 methods that are acceptable to the authority having

1 jurisdiction. And acceptable means it's something
2 that we as an agency looked at and can accept. We
3 may not have completed the review and approval
4 process, for example, but licensees need to make an
5 assessment that is going to be acceptable to us.
6 DR. POWERS: Here's the difficulty I'm
7 running into with this collection of things here. A
8 guy goes through and he uses something that has some
9 currency in 5 methodologies and things like that.
10 And he has all the documents on the site and he
11 sends you notes, and says I've done all this. And
12 you say great, I'll get around to checking you.
13 Okay. There are what? Sixty-eight sites or
14 something like that; you check them at the rate of
15 about 4 a year. So it could be 15 years before this
16 guy gets checked, right? And he's hacked it up
17 completely.
18 MR. BIRMINGHAM: I'm not the inspection
19 expert, but I will point out that we do triennial
20 inspections. And one of the things we're trying to
21 do is work with the regions, work with the IPM, work
22 with the inspection branch on focusing the triennial
23 inspection to take an overview look of how they've
24 implemented the change, too.
25 You know, if we've got 15 of 16 plants

1 transferring to 805 over the next 3 or 4 years, you
2 know, the rate that they will get looked at is much
3 more frequent than you are conjecturing there.
4 DR. POWERS: When I visit the regions
5 there are a few things consistent in their comments
6 to me. One, they hate the significance
7 determination process and the second one is they
8 don't have enough expertise to help the in fire
9 protection.
10 MR. BIRMINGHAM: I think I've heard that
11 point expressed a few times about the IPA. I think
12 it's a thing where they're growing to learn to
13 appreciate certain aspects of it.
14 Obviously when you change from I have a
15 clear violation licensee, you must correct it
16 because it's a violation versus licensee at you're
17 not in compliance and it goes into your corrective
18 action program. And then under the corrective action
19 program it may turn out that I can do something else
20 that brings itself back into compliance.
21 DR. POWERS: I understand that. But my
22 point is here, the one I'm trying to pursue, is do
23 you really understand how quickly these things -- I
24 mean you said the plants are transitioning into 805
25 at a measured pace.

1 MR. BIRMINGHAM: Yes. We guess about 4 a
2 year.
3 DR. POWERS: Four a year. And you can
4 run about 4 inspections a year?
5 MR. LAIN: Within each region.
6 MR. BIRMINGHAM: We don't have specific
7 plans to inspect each plant specifically as it
8 transfers.
9 MS. BLACK: Excuse me. This is Suzanne
10 Black, division director. Excuse me.
11 Our current plan is the first triennial
12 after transition would be kind of a baseline
13 inspection like we did after maintenance to look at
14 how they implemented it. And we would have a
15 specific inspection procedure for that. And then
16 they would routinely go back to the triennial
17 inspections that we do, the next round.
18 DR. POWERS: But the question is who
19 inspects all this stuff? Is it going to be the
20 regions that inspect it? Because they're
21 complaining to me that they can't do it.
22 MS. BLACK: Well, the regions, we had
23 planned on having the regions do it with an
24 inspection procedure and training that would help
25 them. And, of course, if they needed assistance, we

1 could look into providing either contractor,
2 headquarters --
3 DR. POWERS: It is a fairly subtle
4 thing, especially in the methods.
5 MS. BLACK: Right. And I agree. I mean,
6 the maintenance rule we had the same problem because
7 you're sending inspectors out there to look at
8 something they've never looked at before. And it
9 takes some training and some good inspection
10 procedures.
11 CHAIRMAN ROSEN: I think this is similar
12 but more complex than the maintenance rule.
13 MS. BLACK: Yes, definitely.
14 CHAIRMAN ROSEN: Because if they're
15 doing fire modeling --
16 MS. BLACK: Right.
17 CHAIRMAN ROSEN: -- then they're using
18 computer code and all kinds of assumptions and the
19 details of that modeling are significant.
20 MS. BLACK: But you'll hear some more
21 about that later this afternoon about what kind of
22 guidance we're putting out on that.
23 CHAIRMAN ROSEN: Okay. Good.
24 MR. HANNON: This is John Hannon.
25 If we were in a perfect world, we would

1 have approved fire models, approved fire PSA. But
2 we're not there yet. And to the extent that any of
3 these items are available to be approved by the time
4 we issue the reg guide, we would intend to endorse
5 those in the reg guide. But that's not likely just
6 due to the time.
7 DR. POWERS: But you see what the
8 difficulty you've got is on the one hand -- you're
9 right. There are a lot of ways of do these things
10 now. Nobody has ever come up and said, ah, this way
11 is perfect. This is the good way. Consequently,
12 people are doing things in an imaginative way,
13 trying to do a good job, but people make mistakes.
14 It seems to me you should be looking much closer at
15 that than if you had one that everybody said yes
16 this is the way to do it, they went to school, they
17 learned how to do it and it would be oversight, at
18 best, for making a mistake. Now they can make a
19 mistake just because it's easy to make mistakes in
20 fire analyses.
21 MS. BLACK: One of the things that
22 Research is doing is they're looking at different
23 fire models. And we're going to put out a guidance
24 document that says you can use a fire model in this
25 way, but this is where it's inappropriate to use it.

1 And with that kind of guidance, we think it would be
2 easier for the inspectors to look at it and say well
3 this doesn't look like it's within the requirements
4 of its use or the area where it's appropriate to use
5 it.
6 MR. BIRMINGHAM: I think your
7 observation is that, you know, it's a challenge for
8 the regions, that they're going to need some
9 training, that they need to be brought up to date on
10 the changes that 805 introduces. That it is easier
11 when you're doing a new process such as introducing
12 fire modeling that these things are a little more
13 subtle than they have a deterministic requirement
14 and go out to see if the licensee meets it. And we
15 need to work with the regions.
16 I think you may or you may not hear, but
17 I believe the industry has already pointed out that
18 we need to work with the regions. They've asked us
19 to work with the regions to get a comprehensive
20 approach to this. And I believe the implementing
21 guidance is one of the areas we're going to do that
22 in.
23 The thing that's a little in our favor,
24 there won't be all that many plants immediately.
25 We'll have a chance to --

1 DR. POWERS: Well, I mean, you got a lot
2 of things going in your favor. I mean, if nothing
3 else the NEI's fire protection forum is just an
4 excellent vehicle for the transmission of knowledge
5 and understanding and where difficulties come up. I
6 mean, that's one of the best forums, I think, for
7 people making the transition to go to and whatnot.
8 So, I mean, there are a lot of advantages, but this
9 does seem to be a rough spot.
10 MR. BIRMINGHAM: Okay. Thank you.
11 My last bullet was on approval methods.
12 The NRC is not going to do prior approval, although
13 when these methods are submitted, we plan to review
14 them for approval.
15 Decommissioning plants may also comply
16 with the NFPA 805. There's a section of 805 that's
17 set up for that. And this is just a follow on once a
18 plant has changed over to 805, they can continue
19 complying with it as they go into decommissioning.
20 DR. POWERS: When the fuel is removed
21 from the plant, then they can switch to something
22 else? I think that's what it is. I mean, I think
23 you have a rule that says that.
24 MR. BIRMINGHAM: The way 805 is
25 structured, basically the emphasis which is from,

1 say, shutdown to radioactive release control. And
2 the emphasis -- I mean, that's an appropriate --
3 once you've actually entered decommissioning you
4 take the fuel out, so that's the appropriate.
5 I wasn't quite sure, you said they could
6 switch to something else. And I didn't know if --
7 MR. LAIN: They can go from 50.48(c) to
8 50.48(f) I think in the requirements. Then there's
9 also items within 805, I guess, that is the
10 emphasis.
11 DR. POWERS: Well, I think there's a
12 different NFP standard they go to once the fuel is
13 gone.
14 MR. BIRMINGHAM: Oh, I understand what
15 your question. No. There's a different portion
16 within the standard for it, it's Chapter 5. Yes.
17 DR. POWERS: Okay.
18 CHAIRMAN ROSEN: What about future
19 plants?
20 MR. BIRMINGHAM: Good question. The
21 NFPA people have already thought about future plants
22 and there's NFPA 804 that has been developed for
23 future plants. I don't have a lot of knowledge
24 about it myself, but that was something they had
25 already looked at.

1 MR. LAIN: We are pushing them to try to
2 make a performance based standard for advanced
3 reactors right now. 804 right now is pretty
4 deterministic and we are the committee, and we sent
5 a letter in requesting them to work on a performance
6 based.
7 CHAIRMAN ROSEN: Is there something
8 about future plans that would make them different to
9 where a risk-informed performance based method would
10 not be --
11 MR. LAIN: Well, we're going to try to
12 look at other plants besides the light water reactor
13 plants.
14 CHAIRMAN ROSEN: I understand there may
15 not be light water reactor, but the only part of it
16 that seems apparent to me is there is will be very
17 little performance basing for future plants when
18 there have been none built.
19 DR. POWERS: If MIT has its way, there
20 aren't any future plants so we don't have to worry
21 about it.
22 CHAIRMAN ROSEN: Well, I don't have any
23 comment whether MIT will have its way or not.
24 But just thinking about future plants
25 and fires, fires are going to be relatively more

1 important in future plants than they were in past,
2 in my view, simply because LOCAs are going to be
3 relatively less important. So core damage will
4 likely be more likely to occur from fire in future
5 plants than they were in the current plants,
6 relatively speaking.
7 MS. BLACK: This is Suzanne Black.
8 In my opinion, and there are opinions
9 I've heard of others, is that if you had known what
10 you know about fire protection before you built the
11 plants, you could have routed cables and separates
12 things much so that it should be a much less risky
13 situation due to fire if you properly design the
14 plant. But to try to retrofit these plants after the
15 Browns Ferry Fire and even as far as future plants
16 that were built after that, they were already pretty
17 well designed. And so I think that's one thing
18 that's being taken into account in advance of
19 building it that should help the situation.
20 CHAIRMAN ROSEN: Well, I think we have
21 to competing effects in the future plants. Future
22 plants will have a lower core damage frequency from
23 internal events, first.
24 MS. BLACK: Right.
25 CHAIRMAN ROSEN: And as you suggest

1 they'll also have a lower core damage frequency for
2 fire. The only thing we're discussing here is which
3 one will be, of these two lower peaks will be
4 higher?
5 MS. BLACK: Right.
6 CHAIRMAN ROSEN: And in my view the fire
7 one will still stay higher, even though as you
8 suggest, those plants will be specifically designed
9 with separation and all of advanced kind of ideas
10 that were built in, for instance, to the later
11 plants of this generation.
12 I was simply wondering why a risk-
13 informed standard would a priori not apply to or be
14 more difficult to apply to future plants than
15 current plants? Thus, it's not apparent to me why.
16 MR. HENNEKE: Yes. This is Dennis
17 Henneke, Duke Power.
18 804 was actually written before 805 as
19 kind of the first shot. And they had some new
20 aspects, but didn't have a lot of PRA input and
21 risk-informed input. And then they wrote 805 and
22 were intending to go back and rewrite 804. But 805
23 took a tremendous amount of effort by a lot of
24 people, including the staff and the industry and,
25 you know, a committee of 30 people working for a

1 couple of years with contract help and everything.
2 So, going back and rewriting 804, they
3 can use 805 but there's still a tremendous amount of
4 work to do that and there really hasn't been any
5 push at this point to rewrite 804 until 805 bugs are
6 all worked out.
7 CHAIRMAN ROSEN: Right. But what I hear
8 you saying, Dennis, is that it's clearly the intent
9 of the committee to do so and to provide that
10 alternative to designers of future plants.
11 MR. HENNEKE: Yes. Sure.
12 DR. WALLIS: Well, there must be some
13 limits, however, to the scope of something like 804.
14 I mean, you're not considering a situation where the
15 entire core catches fire?
16 CHAIRMAN ROSEN: It's made of
17 combustible materials.
18 DR. WALLIS: Yes. But that's beyond the
19 scope.
20 DR. POWERS: So are the light water
21 reactors.
22 DR. WALLIS: That's beyond the scope of
23 NFPA. That's a major accident and that's not
24 covered by the thing we're talking about today,
25 surely.

1 How do you decide? What's the limit of a
2 fire? I mean, how big a fire are you considering in
3 these sorts of standards?
4 MR. SIEBER: It consumes all the
5 combustible material.
6 DR. WALLIS: Well, the whole core.
7 MR. SIEBER: Yes.
8 DR. WALLIS: That's not within the scope
9 of this standard.
10 MR. BIRMINGHAM: I think we probably
11 addressed the original question. And the question of
12 what we do for future reactors, which is beyond 805,
13 certainly is a good subject that we could expand on.
14 CHAIRMAN ROSEN: Well, the staff isn't
15 prepared to discuss future plants. But the ACRS is.
16 MR. BIRMINGHAM: Thank you. I understand
17 that.
18 CHAIRMAN ROSEN: We're always prepared.
19 Please continue on the current plans.
20 MR. BIRMINGHAM: Okay. The last thing I
21 want to mention in the rule structure is that it
22 does allow NRC to review new risk-informed,
23 performance based methods as they are introduced in
24 the future. The structure has a -- we've introduced
25 10 CFR 50.48(c), at paragraph (c) as an alternative

1 basically to paragraph (b), which is sort of
2 Appendix R. We are considering whether or not there
3 ought to be a paragraph (d) that introduces things
4 such as -- it would be placeholder for things like
5 manual actions. A placeholder for future risk-
6 informed methods to be placed under rather than
7 going back and modifying 10 CFR 50.48(c), but we
8 haven't really made up our minds on that. But this
9 is 10 CFR 50.48(c) alternative to (b).
10 Any questions on the structure? Okay.
11 Next I want to go into a little bit of
12 what is our current schedule. The proposed rule was
13 issued in November 2002. We had a 75 day comment
14 period, which ended January 2003. We've developed
15 comment resolution and worked that out pretty much
16 with OGC at this point.
17 The *Federal Register* notice package is
18 in concurrence with OGC.
19 As has already been noted, we have
20 received Revision D of the implementing guidance
21 that was provided to the NRC in April 2003. The
22 staff has reviewed it and had comments on it,
23 benefits probably from the pilots. And one of the
24 things that I think that we were concerned about is
25 what appeared to us as an attempt to introduce a

1 lot of risk or risk-informing of the Chapter 3
2 elements in those. That's probably some of our
3 major comments.
4 Staff has prepared comments on Revision
5 D and we will be transmitting those to NEI for their
6 review shortly.
7 Office concurrence's plan for October of
8 2003. We would like to present the final rule to
9 the ACRS, CRGR in December of 2003. We say December,
10 but actually we'd like to try for November. When I
11 prepared this I slated December for the outlier.
12 And I really would like to try to get it into
13 November.
14 DR. WALLIS: When we see this, can we
15 see the implementation guidance as well?
16 MR. BIRMINGHAM: Well, certainly we can
17 give you that revision.
18 DR. WALLIS: And that will be the final
19 version of implementation guidance?
20 MR. BIRMINGHAM: No.
21 DR. WALLIS: Would it still be a
22 flexible document that's going to change after the
23 rule comes out?
24 MR. BIRMINGHAM: Revision D was given to
25 the staff. It's a full version, but it was a version

1 for comment. And the staff feels we have substantial
2 comments on it. And NEI does plan to provide us an
3 additional revision of it that will follow later
4 than the rule follows.
5 DR. WALLIS: Don't the two go together?
6 I mean, you can't very well have a rule which can't
7 be implemented.
8 MR. BIRMINGHAM: I don't expect
9 licensees to implement the rule without the
10 implementing guidance. It's just that in this case
11 the rule is probably going to be finished up a few
12 months in advance of the implementing guidance.
13 DR. WALLIS: You see what I'm getting
14 at? I mean, they're just sort of a package. The
15 two go together. But there's some hitch in how it's
16 implemented. Maybe the rule itself has to be fixed.
17 If you have a rule which you cannot implement for
18 some reason, then you go back and have to change the
19 rule, presumably, even though it sounds like a good
20 idea on paper. So I'm suggesting that we see them
21 both together. Perhaps you can work that out.
22 MR. BIRMINGHAM: Well, as I said, our
23 plan is to provide you with the version of the
24 implementing guidance and you'll have a chance to --
25 DR. WALLIS: I'm not anticipating any

1 difficulty.

2 CHAIRMAN ROSEN: Well, I am.

3 DR. WALLIS: You are, are you?

4 CHAIRMAN ROSEN: In a sense that I think

5 -- in the schedule.

6 DR. WALLIS: Oh, in the schedule.

7 CHAIRMAN ROSEN: I think we'll likely

8 need another subcommittee meeting to look at the

9 implementing guidance and that means that the

10 November would be very challenging. Possible

11 December, but November I don't -- it's already

12 September.

13 MR. HANNON: Joe, this is John Hannon.

14 Just one point on your schedule there.

15 You don't identify that there will be an

16 accompanying reg guide with it which would provide

17 the endorsement of the implementation guidance. I

18 agree with the comments being made by the ACRS that

19 they have to be -- it has to be a packaged deal. The

20 rule needs to have the implementation guidance with

21 it in the form of a reg guide endorsement.

22 DR. WALLIS: Well, what's the progress

23 in this reg guide?

24 MR. LAIN: I think we're working on the

25 implementation guide right now. And once we have an

1 acceptable implementation guidance, we see the reg
2 guide being very short as just endorsing the
3 implementation guide. So --
4 DR. WALLIS: So it will take a week?
5 MR. BIRMINGHAM: I think -- yes. Our
6 original version of the rule was it's an enabling
7 rule. And as such, we wanted to write the rule
8 carefully to allow licensees to take advantage of
9 the future methods, etcetera, and also develop the
10 implementation guidance at the same time. The
11 implementation guidance takes the rule and just
12 quantifies and gives licensees a process by which to
13 do the actual implementation.
14 I think we would like to move forward
15 with the rule and get the rule issues as an enabling
16 rule, get it looked at, get any comments that we can
17 and then move forward with the implementation guide
18 shortly thereafter.
19 We have a version of it which the staff
20 with the comments and exceptions and things that we
21 see in it that we would like to change. We think
22 the implementation guidance will work, it's just
23 that, as I said, that we are uncomfortable with some
24 aspects of it as far as what we think our attempts
25 to risk-inform Chapter 3 elements which to us are

1 the core program.

2 So, I'd like to kind of keep that clear

3 that that's -- our original intent was to separate

4 the rule from the implementation guide somewhat.

5 CHAIRMAN ROSEN: But as Dr. Wallis

6 points out, it's hard for us to do that to agree to

7 the rule without understanding that there are

8 methods that we believe are possible to implement

9 and come up with reasonable answers available. So

10 if you want endorsement from the subcommittee and

11 the full ACRS, possibly thereafter, we kind of need

12 a package. And I think that's what John was saying.

13 DR. WALLIS: Yes.

14 CHAIRMAN ROSEN: But I understand the

15 implementing guidance is available. And the ACRS

16 staff will be providing that to members shortly.

17 And we can get started, at least with our review.

18 MR. BIRMINGHAM: Back to schedule. We

19 were hoping to present the final rule to the

20 Commission in the spring of 2004. And then follow

21 it by publishing the rule one month after, assuming

22 them approving it is issued. That's pretty much

23 standard. We would incorporate any comments from

24 the Commission.

25 The Commission seemed to be pretty --

1 they gave quite a bit of approval to the proposed
2 rule. The caveat that they gave us was that they
3 wanted us to explore ways to reduce the number of
4 license amendment requests to adopt methods. And
5 we've accomplished that. We feel that it wasn't
6 necessary to require prior approval or a license
7 amendment for a licensee to use in their methods,
8 particularly once that method if it's ever -- when
9 that method has NRC approval, it didn't seem to be
10 necessary to have a license amendment to adopt it.
11 That concludes my part of the
12 presentation.
13 CHAIRMAN ROSEN: Before you get away,
14 let me ask you one question. There is an ACRS letter
15 which people on the ACRS read, I don't know whether
16 the staff reads them. But we read them. And one of
17 the things that our letter said about this was that
18 we were issued a cautionary note that the real value
19 of the work accrues when licensees voluntarily adopt
20 the standard and begin to revise their fire
21 protection programs. Where do you think you are on
22 getting real interest from the licensees? Is this
23 really going to move or the ACRS was worried that we
24 would create such barriers to entry in the
25 implementation guidance or in the rule itself that

1 people would just throw up their hands and say I'll
2 with it as it is now.
3 MR. BIRMINGHAM: What we've worked with,
4 and it's been a back and forth thing with industry,
5 we've requested from industry their point of view as
6 far as what the things about NFPA 805 the way you
7 see it that would be obstacles in your way to
8 adopting it. And basically they provided us with
9 what they thought were the obstacles.
10 Sometimes we refer to, you know, what
11 are the incentives we can give, come up to make it
12 easier to adopt 805 and make it more useful. And the
13 primary things were the expenditures in reviews of
14 license amendments requests was one of the primary
15 things, but there were a few other things. They
16 wanted to be able to use methods as they became
17 available without having to wait, because let's face
18 it. NRC review and approval can take an additional
19 2½ to 3 years to review a method. And that method
20 may have been developed by NRC and industry, and
21 basically it's already been looked at as something
22 that is acceptable to both sides.
23 The key to what your question is was
24 brought up earlier. And I'm going to ask industry,
25 probably Doug Brandes, if he would just go back over

1 what he said earlier about there are many licensees
2 out there who feel that 805 does hold out some
3 really good benefits for them.
4 They're reviewing their fire protection
5 program. They see things in there that will benefit
6 them. This is a great time for them to adopt it.
7 And with that, if Doug would be willing to talk a
8 little bit about that?
9 MR. BRANDES: Yes. A couple of things I
10 would like to say.
11 Doug Brandes with Duke Power Company.
12 A couple things is, the first point I'll
13 offer is that the NEI Fire Protection Information
14 Forum is scheduled for next week, and on the agenda
15 is a panel discussion on the risk-informed rule.
16 And I'm moderating that panel, so I was tasked with
17 finding the speakers.
18 One session I've structured is an
19 industry individual to talk as a proponent for
20 adopting the rule. And then as a counterpoint, an
21 industry professional speaking against adopting the
22 rule.
23 And there's a lot less reluctance by
24 industry professionals to consider adopting the rule
25 today than there was just 2 years ago. And my

1 personal view is I've characterized this as
2 evolution, and I predict that eventually the
3 majority of the industry will adopt it. It's a
4 matter of, perhaps, timing and perhaps understanding
5 and there may be some that it just doesn't make
6 sense for them to go forward.
7 I will say right now the biggest
8 hesitation is that we don't know what the final rule
9 will look at. We don't know fully the staff's
10 objection or concerns with the implementing
11 guidance. And, you know, until we really know what
12 it looks like and what's acceptable, nobody's going
13 to volunteer to go forward. But my opinion is that
14 if it comes out the end of the pipe essentially as
15 the rule has been published and the implementing
16 guidance submitted and the NEI 00-01 circuit
17 analysis guidance have been submitted, that that if
18 I were in the process, and a lot of utility in the
19 process of rebaselining our program, it would make a
20 lot of sense to use the risk-informed approach. And
21 I'm going to talk about that a little bit during my
22 presentation later this morning.
23 CHAIRMAN ROSEN: Well, good. That's all
24 very hopeful stuff. Thank you very much.
25 With that, we'll go on to the next.

1 MR. BIRMINGHAM: Thank you again.

2 MR. HYSLOP: My name is J.S. Hyslop, and

3 I'm from the Office of Nuclear Regulatory Research.

4 The Office of Research is providing support to NOR

5 in this area of the risk-informed fire protection

6 rulemaking. I've provided a couple of slides, the

7 first of which is the one on the projector. The

8 second slide I'll hold until the circuit analysis

9 discussion occurs, since that's what the topic of

10 the second slide is in my package.

11 Research has agreed to develop review

12 guidance to support evaluations that would be part

13 of a licensee's submittal. That evaluations

14 constitute reviews of fire models, inputs to fire

15 models and fire risk analysis methods, tools and

16 data.

17 In particular under fire models, we've

18 agreed to do a verification of and validation of

19 several fire model codes. The first two codes, the

20 Five Revision 1, that's an EPRI code. The second is

21 the fire dynamics tools, which is the NRR Plant

22 Systems tools. Those both rely heavily on empirical

23 equations to predict temperature.

24 We've also agreed to V&V other codes.

25 Those two codes are NIST codes, that's CFAST and

1 FDA, the fire dynamics simulator.

2 As you move from left to right on that

3 top line you go to more rigorous fire models. You

4 begin solving more of the conservation equations and

5 with FDS you can get quite local effects because it

6 is the computational fluid dynamics code which

7 allows you to overlay a grid on the area of

8 interest.

9 We intend to use an ASTM Standard to

10 perform that V&V. The Standard is 1355-97. That is

11 standard developed specifically for V&V of fire

12 models. As a result, it indicates that the V&V is

13 to be done on a scenario bases.

14 These scenarios which we will be

15 analyzing are going to be provided by NOR from their

16 experience in the inspection arena and the other

17 challenges they find need to be addressed, they're

18 going to be providing us those scenarios for us to

19 include into our V&V process.

20 Now regarding inputs to fire models, you

21 know of course a fire model evaluation has to

22 approve the input. One of the inputs in particular

23 that's been challenging in the past is heat release

24 rates. It's been quite controversial. And many

25 analyses there was a lack of treatment of the low

1 probability/high consequence fires that resulted
2 from heat release. And we'll be remedying that in
3 our review guidance.
4 The last type of review guidance will be
5 fire risk analysis methods, tools and data. And
6 they have indicated some of the areas; frequency,
7 severity, circuit analysis, detection and
8 suppression.
9 The basis for these V&V and fire models
10 are the international benchmark exercising that
11 we're doing on cable tray fires. There's some
12 analyses of pool fires and some comparisons that are
13 going on. And we're doing some testing. There's
14 some testing that has occurred at the National
15 Institute of Standards and Technology, and we have
16 other testing planned or potentially planned.
17 And then there's some testing at France
18 on the DIVA facility, which is a fairly large scale
19 multi-compartment facility that we intend to do some
20 testing to give us confidence in the V&V process.
21 The basis for the fire risk analysis
22 methods, tools and data are the joint NRC EPRI fire
23 risk re-quantification studies which we've talked to
24 the ACRS about last year.
25 And so what I've done in the slides,

1 I've focused review guidance. But in actuality these
2 processes are developing guidance on how to perform
3 an analysis, namely the fire risk re-quantification
4 studies are identifying guidance and procedures on
5 what to do. And the V&V, of course, identifies the
6 acceptable of fire models.
7 So in a sense we're in the background
8 sort of developing how to do an analysis. We feel
9 like we're in a better position to then review
10 guidance having that knowledge in hand. So, you
11 know, we're providing substantial support to NOR in
12 this rulemaking effort.
13 DR. WALLIS: But you're not going to
14 present any of the details today?
15 MR. HYSLOP: No, we were asked to do
16 that. We were just asked to identify how we were
17 supporting NOR.
18 MR. LAIN: Is there a meeting next week?
19 MR. HYSLOP: It's penciled in.
20 That concludes my presentation.
21 CHAIRMAN ROSEN: Thank you J.S.
22 DR. POWERS: Maybe just a word.
23 MR. HYSLOP: Sure.
24 DR. POWERS: On what's entailed in V&V
25 especially for a CFD code.

1 MR. HYSLOP: Well, the ASTM standard is
2 a process standard. It involves performing an
3 analyses and comparing the results of that analyses
4 with data.
5 Moni Dey is doing this. I'm not. So I'm
6 up here representing Moni Dey.
7 Certainly, that's one of the things
8 that's common to all these V&V processes, the
9 scenarios that we identify and that we choose to V&V
10 against.
11 At this point we haven't developed any
12 specifics on exactly how we're going to be V&Ving
13 these codes. Certainly the FDS can characterize
14 local phenomena much better than the other codes, so
15 there will be an emphasis on that. But I don't have
16 a complete answer to your question at this point.
17 DR. POWERS: I mean, as you go from left
18 to right it becomes more and more possible to
19 compare against data.
20 MR. HYSLOP: Yes.
21 DR. POWERS: And more and more able to
22 do so. Technically challenging to do so.
23 MR. HYSLOP: More of a burden to get the
24 data.
25 DR. POWERS: I mean a 5 comparison to

1 data, I'm not exactly sure what that would mean
2 since 5 is a bunch of empirical bounding kinds of
3 analyses, empirical equations. So I suppose if you
4 got data that exceeded the prediction of 5, you'd be
5 distressed. But --
6 MR. HYSLOP: Yes.
7 DR. POWERS: -- the fact that 5 over
8 predicted wouldn't surprise you at all?
9 MR. HYSLOP: Yes. And 5 provides you,
10 you know, a very coarse description of the area and
11 you're looking at temperatures from the plume and
12 certainly it's more limited than what you can do
13 with a more complicated FDS code.
14 MR. IQBAL: Excuse me. Five is -- FDS is
15 a detail --
16 DR. POWERS: Yes, I know. I just don't
17 know how you compare 5 against data.
18 MR. IQBAL: What they are doing there,
19 they are taking the data from a NIST test and
20 they're comparing with a CFAST and FDS and the
21 French test. And then they will provide us a
22 document. We have the document. Okay. These
23 models are good with the data and these aren't.
24 DR. POWERS: What you're saying I think
25 is you can see a 5 is qualitatively correct as a

1 string --

2 MR. HYSLOP: I think you're right.

3 You'd be concerned if it underpredicts. In fact,

4 you'd be concerned if any of the codes

5 underpredicts, for that matter.

6 DR. POWERS: Well, as you get up into

7 the CFD realm, you more expect a line through the

8 data, there's going to be scatter around it.

9 MR. HYSLOP: Of course, yes.

10 CHAIRMAN ROSEN: One thing about this

11 puzzles me, though, J.S.

12 MR. HYSLOP: Yes.

13 CHAIRMAN ROSEN: And that is isn't there

14 any existing V&V for these codes? Why do we have to

15 start over?

16 MR. IQBAL: Not for the nuclear power

17 plant.

18 CHAIRMAN ROSEN: But I mean a fire in a

19 chemical plant with the same source as a nuclear

20 plant, the fire doesn't know it's in a nuclear

21 plant.

22 MR. IQBAL: Most of those models like

23 the CFAST and FDS, they are tested for residential

24 facility and --

25 CHAIRMAN ROSEN: Oh, residential

1 facilities rather than industrial facilities.

2 MR. IQBAL: Right.

3 CHAIRMAN ROSEN: And the loadings are

4 different?

5 MR. IQBAL: Different. We have cables

6 and oil.

7 CHAIRMAN ROSEN: So the V&V is for

8 residential facilities for these codes you're

9 saying?

10 MR. IQBAL: Office buildings.

11 CHAIRMAN ROSEN: Office buildings and

12 residences.

13 MR. HYSLOP: Thank you.

14 CHAIRMAN ROSEN: The industry always

15 gives you problems. And the NRC always gives the

16 industry problems, and one of those problems is that

17 they've taken 20 minutes out of your allocated hour.

18 MR. BRANDES: Well, for that we thank

19 you.

20 MR. EMERSON: This is Fred Emerson with

21 NEI.

22 I'd like to also thank the ACRS for the

23 opportunity to present this as one of several topics

24 we'll be discussing with you today.

25 CHAIRMAN ROSEN: We're glad to have you

1 here.

2 MR. EMERSON: Thank you.

3 I'd just like to just give a minute or

4 so of introductory comments, and Doug Brandes will

5 conduct the presentation on the risk-informed fire

6 protection.

7 We've been active, as you've heard from

8 some of the industry folks, with both the

9 development of 805 on the NFPA committee along with

10 NRC and with preparation of the implementing

11 guidance and extensive interactions with the staff

12 on the rule language as it has become available for

13 public comment. We have investigated a lot of

14 effort in making the implementing guidance attuned

15 with the rule, which was a concern expressed

16 earlier. There's always some difficulty in trying

17 to get two elements of a parallel activity to

18 coordinate with each other properly, but we've been

19 working very hard with the staff to do that.

20 We've also expended effort, as Doug will

21 discuss, in testing the implementing guidance. And

22 Doug's utility was gracious enough to volunteer to

23 do this. This is no small effort. And NEI would like

24 to express our appreciation to Duke Power and to the

25 Farley plant for their efforts in supporting the

1 development of this through actual testing and
2 increased exposure to regulatory scrutiny that
3 always involves.
4 So with that, I'd like to turn it over
5 to Doug.
6 MR. BRANDES: Okay. Thank you, Fred.
7 I'm Doug Brandes from Duke Power
8 Company. I'm a fire protection engineer and I chair
9 the NEI fire protection rulemaking task force. And
10 as such, I will be speaking about our perspective on
11 the risk-informed fire protection rule.
12 DR. WALLIS: Are you involved with the
13 implementation guide, too?
14 MR. BRANDES: Yes, sir. Our task force
15 actually coordinate development and actually we are
16 responsible for the implementing guide.
17 Fred? Okay.
18 The topics I want to talk about then, I
19 think NRC has covered my first one pretty well, the
20 current status of the risk-informed rulemaking.
21 Then I want to talk about the McGuire pilot project,
22 and I'll also talk very briefly about the Farley
23 project, although I don't have a slide concerning
24 Farley. And then I wanted to talk about my
25 perspective on the draft rulemaking as it's

1 currently available to us.

2 Okay. The current status is that the

3 draft rule language is indeed available for comment.

4 It's on the NRC website.

5 The implementing guide, as has been

6 mentioned, has been submitted for NRC review and

7 comment, and we eagerly anticipate receiving those

8 comments. And NEI 00-01 has been resubmitted to NRC

9 addressing the comments we've previously received.

10 Since the ACRS has not seen the

11 implementing guide, I wanted to talk briefly just

12 about the structure of the implementing guidance.

13 And I'll be glad to answer any questions I can,

14 although I didn't prepare an in depth discussion of

15 the implementing guide.

16 This slide shows the organization of the

17 implementing guidance. Chapter 1, of course, is

18 background, introduction an we characterize it as

19 boiler plate history of fire protection in nuclear

20 power plants and how we got to this point.

21 Chapter 2 goes to the qualification of

22 the professionals and the responsibilities of those

23 who are involved. I heard questions earlier

24 concerning the qualification and proper use of the

25 tools. And that very much concerns us, and it's our

1 opinion that that goes directly to the
2 qualifications of the individuals using the tools
3 and responsible for the overall program. So what
4 we've tried to do is define in a fairly narrow
5 fashion the qualifications that we expect from a
6 fire protection engineer responsible for the overall
7 program for the safe shutdown engineers, both the
8 mechanical nuclear and the electrical circuit
9 analysis engineers and the PRA risk analyst who
10 would be involved in this project.
11 CHAIRMAN ROSEN: Doug, are fire
12 protection engineers covered by the engineering
13 support personnel training requirements in the INPO
14 and National Academy training programs?
15 MR. BRANDES: Let me answer it this way:
16 All plant engineering personnel are required to be
17 certified or qualified or trained to the INPO
18 standards. But it's not a fire protection
19 qualification in and of itself.
20 CHAIRMAN ROSEN: Because I know
21 mechanical engineers, electrical engineers are all
22 covered by that program, design engineers.
23 MR. BRANDES: Right.
24 CHAIRMAN ROSEN: And plant support
25 engineers. And I was just wondering whether there

1 fire protection engineers are also in that program?
2 MR. BRANDES: They're in that program,
3 but they're not certified as a fire protection
4 specialist.
5 CHAIRMAN ROSEN: I understand that. But
6 they are covered by that program.
7 MR. BRANDES: Yes.
8 CHAIRMAN ROSEN: Which means they have
9 to have training materials developed for them and
10 attend the course work? So there's some structure
11 of their training?
12 MR. BRANDES: That's correct, yes.
13 Okay. Chapter 3 of the implementing
14 guidance talks about applicability when it's
15 appropriate to use the guidance document and
16 occasions where it's not appropriate to use the
17 guidance.
18 We get into the meat of it in Chapter 4
19 which talks about the regulatory framework and how
20 one would go about transitioning from a current
21 state licensing basis to a new risk-informed
22 licensing basis. As we've mentioned, the concept of
23 adopting the risk-informed regulations licensing
24 basis is you're either in or out. It will not be a
25 partial adoption. So we've in Chapter 4 described

1 the process for making the adoption, and I'll talk
2 about this a little bit more when I talk about the
3 McGuire pilot project.
4 And we've also talked about if you adopt
5 the entire licensing basis and then want to focus in
6 and discriminate between different fire areas, how
7 to use the deterministic versus the risk-informed
8 process.
9 Chapter 5 talks in large measure about
10 how to use the tools, proper use of the risk-
11 informed tools either in existing licensing basis or
12 in use for transitioning to the new risk-informed
13 licensing basis.
14 Chapter 6, again, talks about the
15 transition process. And the concept is that you
16 should be able to transition your current licensing
17 basis into the 805 risk-informed licensing basis and
18 then start the application to use the risk-informed
19 tools, if that's your preference. So in our
20 experience in developing Chapter 6 it was our
21 opinion that Chapter 3 of NFPA 805, which is the
22 classical fire protection issues and fire protection
23 program, is really not clear in its intent about
24 meeting Chapter 3 in toto. So we tried to elaborate
25 in Chapter 6 about transitoning existing licensing

1 basis into Chapter 3 of 805 where you didn't have a
2 direct compliance. And if you're not in compliance
3 and not fully covered, then what steps are available
4 to you to resolve issues that are not addressed NFPA
5 805 Chapter 3.
6 MR. SIEBER: Is there any time limit for
7 undergoing this transition or could you make it last
8 ten years or 20 years or 30 years?
9 MR. BRANDES: Yes. We anticipate a time
10 limit. I'd like to talk about that a slide or two
11 further down when we talk about the pilot project
12 and perhaps even further when we talk about the
13 overall resource allocation.
14 Chapter 7, again in some measure,
15 reiterates the use of the tools within existing
16 licensing basis. Our opinion is that for those who
17 don't decide to transition early on and for those
18 who decide that it's not appropriate ever to
19 transition to risk-informed licensing basis, they
20 still need to make use of the state-of-art tools
21 that are available through the NFPA 805 and NEI 00-
22 01. And so our intent is try to give guidance on how
23 to properly use the tools for either developing
24 exemption requests, deviation requests or using it
25 for making nonregulated plant programmatic

1 decisions.

2 Chapter 8 is the chapter that talks

3 about maintaining the design basis, the licensing

4 basis, configuration control. It talks about

5 monitoring system availability, system performance.

6 For those systems where we take credit for

7 performing within the context of our PRA we have

8 assigned some degree of availability and performance

9 in our PRA format. So we have to monitor these

10 systems to be sure they're meeting our performance

11 expectations.

12 Also in Chapter 8 is where we included

13 the change evaluation process which is, indeed, the

14 PRA formulas. And, again, we adopted essentially the

15 reg guide 1.174 process for evaluating the

16 acceptability of changes.

17 I want to talk now about the McGuire

18 pilot process. The documents we used as the basis

19 of performing the pilot were the NFPA 805 2001

20 version, the language of the draft rule, the draft D

21 of the implementing guidance as was submitted to the

22 staff for review and comment and the NEI 00-01 as it

23 was submitted to staff for final review.

24 As we were structuring and developing

25 the McGuire pilot, it looked like there were six

1 discrete elements of overall transition. And first
2 of all is the licensing transition, how to properly
3 transition from current state to a future state
4 licensing basis. And I'll talk more about that.
5 Then there is the classical fire
6 protection program as delineated in Chapter 3 of 805
7 and the challenge was to demonstrate that your
8 current licensing basis is comprehensive and
9 complies with those elements of Chapter 3.
10 The next task was to look at the safe
11 shutdown analysis and to be sure that it met the
12 requirements of 805 and that you've captured the
13 licensing basis.
14 The next issue was a new issue to the
15 fire protection licensing basis, which is outage. I
16 characterize it as outage management or a nonpower
17 mode operation.
18 The next discrete element was
19 radiological protection, and that's a function
20 primarily of fire fighting.
21 And then there's the overall
22 configuration management to manage monitoring of
23 system performance and availability, and setting up
24 the changed management evaluation process.
25 The first team, and to conduct this

1 pilot, we had a contract team that was essentially
2 the contract team that has assisted us in developing
3 the implementing guidance. And on that team there is
4 an attorney who assisted us in the licensing
5 transition in cooperation with a Duke Power
6 compliance engineer. As part of this pilot we
7 realized that our initial concept of the transition
8 process needed to be improved. And what we conceived
9 then was a three stage process rather than a one
10 stage process as is currently described in the
11 implementing guidance.
12 The first stage of this process was to
13 advise the NRC of intent to transition the program.
14 And this is the letter, the initial submittal that
15 would include the information such as the intent,
16 the schedule and the milestones along the way. As
17 we have been discussing with the NRC staff about
18 some of the incentives for transitioning, one of the
19 incentives we've discussed and was mentioned earlier
20 is the enforcement discretion during this transition
21 period while the engineering analyses are ongoing.
22 And we concede that this draft letter of intent
23 would then invoke the incentive for enforcement
24 discretion while we go forward with the evaluation.
25 Just to go back and I guess answer the

1 question that we had earlier about what is the time
2 frame. It's my opinion, and we're trying to
3 structure our guidance as such, that the time frame
4 depends on the degree of difficulty and some of the
5 impediments that a licensee envisions going forward
6 with the new licensing basis. So the draft letter
7 intent would stipulate projected time frame and the
8 milestone schedule.
9 The next letter would be a request for
10 license amendment. And we envision that to be
11 submitted sometime downstream, probably as the
12 engineering analyses are wrapping up, at which point
13 the licensee would have a good understanding of what
14 if any modifications needed to be made, what would
15 be involved in the transitioning the plant programs
16 to the new licensing basis. And only then if major
17 issues arose during this engineering study would the
18 milestone schedule and the ultimate schedule change
19 in any way.
20 So the license amendment then would be
21 specifically a request for a change in the license
22 condition with a schedule. And it would also
23 identify any regulatory documents that needed to be
24 changed, any licensing conditions such as technical
25 specifications, selected licensee commitments or any

1 previous commitments such as safety evaluation
2 reports. So our intent was that that license
3 amendment would be submitted with a request of
4 response date from the staff.
5 And then we would follow up, the third
6 document that the licensing team developed and it
7 was really a good idea that we had not conceived
8 prior to the pilot, is actually a transition
9 document. We initially conceived this because the
10 staff had agreed to review the first few
11 applications that were submitted and do a
12 comprehensive review so that going forward licensees
13 could have confidence that they were doing the right
14 thing in being comprehensive. So this transition
15 plan is going to be a document that essentially
16 compares the elements of Chapter 1, 2, 3 and 4 of
17 NFPA 805 to how the plant was evaluated for
18 transition and compliance to each of those items.
19 It's a fairly high level document, but
20 it's cross connected to the existing plant program
21 so that if somebody takes this transition document
22 and reads how the plant complies with a certain
23 section of NFPA 805, they can then go to the plant
24 specific design basis document or other programmatic
25 document to look at the details of the compliance.

1 CHAIRMAN ROSEN: And that section would
2 also say, I presume, what changes to the plant's
3 programs or hardware, presumably if needed, would be
4 made in order to make the transition?
5 MR. BRANDES: Yes.
6 CHAIRMAN ROSEN: So you could pick up
7 pieces of it and go do an inspection?
8 MR. BRANDES: Well, not only can you
9 pick up pieces, but ultimately it would be
10 summarized in the license amendment of here are the
11 additional things that we need to change.
12 CHAIRMAN ROSEN: Okay.
13 MR. BRANDES: Okay. The next section or
14 next team is the classical fire protection program.
15 And what we found in going through the license
16 renewal several years ago is that we didn't have our
17 fire protection current licensing basis captured
18 well enough that any outsider could come in and
19 completely review it. And it was a good lesson to
20 us, so we at that point literally, first of all, we
21 started going back through all licensing documenting
22 correspondence pertaining to fire protection.
23 McGuire is in a situation where the
24 construction permit request was issued in 1970. So
25 McGuire had been on the books a good while. And so

1 we initially responded to Appendix A to the branch
2 technical position 9.5-1. Because of the delay in
3 actually construction and reaching the in toto
4 status we were reviewed to this Appendix A it seems
5 to meet subsequent staff expectations.
6 Now, the Duke plants, including McGuire,
7 had conceived and proposed to have a standby
8 shutdown system in 1978 which was prior to the
9 conception of Appendix R. So when McGuire was being
10 reviewed by the staff, the staff didn't have
11 anything to compare McGuire to other than the
12 Appendix R requirements that were either in draft
13 stage or on the books. So they would go through the
14 evaluation of the standby/shutdown system and say
15 this appears to meet this section of Appendix R or
16 this meets Appendix R.
17 And so what we did is we developed a
18 spreadsheet that started with here is the Appendix
19 A, here's our response to Appendix A, here's some
20 NRC correspondence, here's the SER, here's any
21 engineering analysis that we have developed to
22 address this specific issue. And we rolled that all
23 into here is our current licensing basis. So we had
24 a good point of departure. And my opinion is
25 anybody that doesn't have that as a point of

1 departure would need to develop that or should need
2 to develop it as part of their transition.
3 But having that spreadsheet available
4 then, we were able to extract very easily our
5 current licensing basis and map it or compare it to
6 each element of Section 3.
7 DR. POWERS: It seems to me that this
8 dispersed nature of the current licensing basis at
9 plants is something that was revealed in previous
10 versions of the triennial inspections that were
11 done. I mean, we see it. It's pretty common across
12 the plants. Is that going to get corrected?
13 MR. BRANDES: Well, you know, let me
14 first of all speak for Duke. Clearly it was
15 corrected. You know, the situation was that I needed
16 a license basis and I could go to a document and
17 hand it to an inspector and the site fire protection
18 engineer could do the same, but that wasn't properly
19 structured for an ongoing, you know --
20 DR. POWERS: Nobody else can do it. I
21 mean, if you get hit with a truck, we're in big
22 trouble.
23 MR. BRANDES: Right. And so we realized
24 that and we have corrected that for the Duke plants.
25 For those going forward with Chapter 3,

1 then the answer is clearly yes. You know, the way
2 that we have structured meeting, showing you meet
3 each section of Chapter 3 will compel a licensee to
4 be sure they've got all that captured.
5 DR. POWERS: We've been doing triennial
6 inspection for some time now. And I mean it seems
7 like that ought to be one of the first things that
8 gets inspected. There ought to be a place that I
9 can go sit down and say here is the licensing basis
10 for the fire protection for this plant. You got to
11 have that. That thing's just got to be set down.
12 MR. BRANDES: Well, you know, having
13 been through the process, I can preach now. And I
14 can only preach about Duke. But I know we clearly
15 needed that before we had it, and it was a good
16 exercise.
17 DR. POWERS: Because I think all plants
18 are kind of in the same situation. If you go to the
19 fire protection specialist, he's got it all in his
20 file cabinet, the back of his head and things like
21 that. But nobody else does. And the difficulty
22 we're running into is that when we look at fire as a
23 risk contributor, it's bigger than what we thought
24 it would be. And it impacts what you do in the rest
25 of the plant.

1 MR. BRANDES: The next team -- by the
2 way, in closing I'll mention that for this classical
3 fire protection team we had contractor who was on
4 the contract team helping us develop the
5 implementing guide and then the site fire protection
6 engineer worked on updating the classical fire
7 protection licensing basis. And that effort is
8 essentially done. If we decide to transition,
9 there's no additional work to do.
10 The safe shutdown team was comprised of
11 our site Appendix R engineer whose a mechanical
12 engineer and his support engineer, the electrical
13 circuit analysis engineer and our PRA analyst whose
14 also a shutdown expert, that's Dennis Henneke and a
15 contract person who had, again, worked on drafting
16 the implementing guidance for the safe shutdown
17 program.
18 The safe shutdown program is for the new
19 regulation is structured such that you can drop in
20 your current licensing basis without doing the full
21 risk-informed analyses prior to transition. So as
22 part of that structure again to properly document
23 the existing licensing basis we went through a fire
24 area by fire area description of how we meet the
25 safe shutdown requirements. And we had done that in

1 a current design basis document. We had done it at
2 a very high level. And in this new mapping of the
3 licensing basis we took it to a very low level,
4 including emergency lighting, operating procedure,
5 manual actions and anything that was specifically
6 germane to our ability to show that we could achieve
7 and maintain safe shutdown.
8 Since we had not done that, that was
9 done in sample form and there is still more work to
10 do if we decide to go forward and complete that
11 effort. But the Duke plants, specifically at
12 McGuire, we're more interested in looking at
13 transitioning our safe shutdown approach, our
14 program to the risk-informed program that's
15 available in 805. And there's several compelling
16 reasons.
17 Part of it is that our original
18 licensing basis, which was conceived prior to
19 Appendix R, just had some deterministic elements
20 that didn't have any technical basis and we see
21 continuing challenges every time we see a regional
22 inspector. And, you know, it makes sense to look
23 back and look at these nontechnical decisions and
24 see if there's any safety significance in the way
25 that we have implemented them. So that was one of

1 the compelling reasons to look at the risk-informed
2 analysis. And also the Duke plants and specifically
3 McGuire have a couple of safety features that we
4 think make them perhaps more safe than the norm.
5 One is that we use the armored
6 interlocked cable, which is relatively unsusceptible
7 to the spurious activation events, and we'll talk
8 more about that. And also McGuire has the dedicated
9 third train shutdown systems such that there are
10 only a couple of areas where this third train
11 actually interacts or is located in the same area
12 with both other normal plant trains.
13 So we feel like we need only need to
14 look backwards and to understand the potential
15 safety significance of our current licensing basis,
16 but we also need to look forward and see, you know,
17 if we can take advantage of some of the inherent
18 safety features at McGuire.
19 So to do that, several years ago we
20 reconfigured or we started to update our safe
21 shutdown analysis. And I continue to make this
22 point when I talk to industry peers that Appendix R
23 analysis, the traditional, looked at one train of
24 equipment versus another and was essentially an
25 electrical interaction analysis once you defined

1 separation between the big redundant components. And
2 so it's heavily burdened with the electrical
3 interaction analysis.
4 The way we have structured the new safe
5 shutdown design basis document is that we have
6 looked at the multiple success paths for nuclear
7 safety function, such as decay heat removal. And
8 that's an example of a slide that I put together to
9 typically use at these NEI forums to try to convey
10 to our peers that there is, as an example, a lot of
11 ways to get water into the steam generators. And
12 that Appendix R analysis for simplification
13 typically took one path versus another and looked at
14 the separation of electrical interaction. And that
15 the way that we have structured it now with multiple
16 success paths is we have looked at the fire areas
17 and assured ourselves that the pumps and the motive
18 forces are separated so that one fire won't damage
19 them all.
20 And then to start with looking at okay,
21 how many combinations of spurious activations would
22 it then take to cause loss of that safety function
23 altogether. And what we're looking at is if the
24 number of combinations of spurious activations based
25 on the risk numbers that are emerging now through

1 the EPRI and NEI research, if the combinations are
2 that required are below the safety significance
3 threshold, then we would at this point set that
4 aside and think about okay, at this point we have
5 screened this nuclear safety function such as decay
6 heat removal.
7 CHAIRMAN ROSEN: Is that safety
8 significance threshold something related to reg
9 guide 1.174?
10 MR. BRANDES: Yes. Yes.
11 MR. HENNEKE: This is Dennis Henneke.
12 It's a little bit more complex because
13 we have circuits and circuit failures that go area
14 to area, so they might go in multiple areas. But
15 generally it's the 10 to the minus 6 number for core
16 damage and 10 to the minus 7 for LERF.
17 MR. BRANDES: Okay. And I think that's
18 a segue to what I wanted to discuss next, is the use
19 of the NEI 00-01 risk-informed circuit analysis
20 method.
21 At McGuire we conducted a pilot
22 examination or pilot use of the NEI 00-01.
23 Ironically it was just 2 years ago right now. And
24 what we did is we compared our logic diagrams that
25 we developed for the new design basis document flow

1 paths, we compared it to our fire PRA. And it was
2 pretty graphic that the pinchpoints and potential
3 problem areas popped up pretty quickly by comparing
4 these two documents. And it was encouraging that
5 they both showed essentially the same pinchpoints.
6 So we went through analysis looking at
7 ten specific fire scenarios and combinations of
8 potential failures that could be effected by those
9 scenarios. And then rolled that into the NEI 00-01
10 pilot report.
11 Now, during this 805 pilot, the bigger
12 picture, we decided we would build on that 805 or
13 the NEI 00-01 pilot and that to feel comfortable
14 that we had identified enough combinations or the
15 right combinations so that the low probability
16 combinations don't compound at any particular
17 location and potentially reach a level of safety
18 significance, we feel like that we need to go look
19 at probably another ten or so combinations in the
20 plant. Again, just to be sure that we're way below
21 the level of safety significance combinations we've
22 not specifically looked at.
23 DR. POWERS: Doug, as you look at this
24 and certain analysis document, below this formula,
25 the 16 --

1 MR. BRANDES: I'm sorry?

2 DR. POWERS: A bunch of probabilities

3 that get most comprised together.

4 MR. BRANDES: You mean probabilities

5 such as the fire ignition, fire growth? Yes, sir.

6 DR. POWERS: And all those things are

7 still treated as independent factors?

8 MR. BRANDES: Help me. Dennis?

9 MR. HENNEKE: Yes.

10 MR. BRANDES: Thank you. Thank you,

11 Fred.

12 DR. POWERS: You're going to tell me

13 somebody explain to me how they can be independent?

14 MR. EMERSON: When we have several hours

15 to present that in that kind of detail, yes, we

16 will.

17 MR. HENNEKE: Yes. This is Dennis

18 Henneke.

19 They are treated independent except

20 where we know they're not. For example, fire size

21 and manual suppression, it's all the data. It

22 depends on how you do the data. And so the EPRI NRC

23 re-quantification that's going on right now will be

24 developing some new data which will be much more

25 useful and they'll address the dependence and

1 independence much better than the EPRI data we had
2 previously.
3 DR. POWERS: So what you're telling me
4 is that the thing was in the works here, it's not a
5 final done deal?
6 MR. HENNEKE: Yes. And we know some
7 dependence is there now and we treat that correctly.
8 But I'm not sure we know everything, so hopefully
9 the EPRI NRC with re-quantification will address
10 that.
11 DR. POWERS: Well, I mean the truth of
12 the matter is that you'll never know everything.
13 You create independence by an argument that that's
14 the best you can do. Because I guarantee you,
15 everything's dependent on everything else at some
16 level. But there's a point where you can view them
17 independently careful. It's just the original
18 incarnation of that wasn't obvious, though it was
19 independent.
20 MR. HYSLOP: This J.S. Hyslop of Office
21 of Research.
22 And, yes, the studies that Dennis
23 referred to are looking at the fire frequencies in a
24 manner such that that dependence isn't going to be a
25 problem. So the double kind which is often a

1 concern of many people between frequency and
2 suppression, we're looking at that very carefully.
3 DR. POWERS: Yes. As it was, the putting
4 out a trash can fire and putting out a lube oil fire
5 were kind of the same thing in the way the format
6 was set up.
7 CHAIRMAN ROSEN: I will point out to the
8 presenters that we're now entering the forbidden
9 period. So do what you can to speed it up.
10 MR. BRANDES: Yes, sir.
11 Okay. The next task was to look at the
12 new issue of low power and shutdown operations. And
13 about 10 years from McGuire we did an analysis based
14 on NUREG-1449. And we actually did an Appendix R
15 type analysis for these systems that we would need
16 for low power and shutdown operation.
17 In the meantime, we've become much more
18 sophisticated in our outage management and our task
19 going forward would be to synthesize our old study
20 with our current outage management program.
21 The next segment was for the issue of
22 radiological protection for fire fighters to protect
23 them against Part 20 releases while doing fire
24 fighting activities.
25 We looked at the McGuire program and

1 McGuire actually has an RP technician on shift
2 assigned to accompany the fire brigade, not as a
3 fire brigade member but as an advisor to the fire
4 brigade leader. And this individual acts, has
5 authority to stop fire fighting and evacuate the
6 area if he identifies a radiological hazard.
7 DR. POWERS: Does he have criteria for
8 doing that?
9 MR. BRANDES: He has criteria which is
10 part of his RP training.
11 DR. POWERS: It's a judgment call or
12 does he just have an actual --
13 MR. BRANDES: No, it's a judgment call.
14 DR. POWERS: You're going to get X
15 number of rem and if there are, stop?
16 MR. BRANDES: Yes.
17 CHAIRMAN ROSEN: Judgment call or
18 actually my understanding or recollection is that
19 during emergencies there are specific standards for
20 saving life and saving equipment, which are
21 obviously different, for persons to actually, those
22 requirements. That one can go up higher than normal
23 operational things.
24 MR. BRANDES: Yes. In effect.
25 CHAIRMAN ROSEN: So those criteria are

1 in effect for in the emergency plan.

2 MR. BRANDES: Yes. And indeed, I think

3 Part 20 has very specific limits. But the RP

4 technician that accompanies the fire brigade has

5 authority to stop fire fighting activities and

6 evacuate the area at their discretion.

7 CHAIRMAN ROSEN: Oh, yes. He can

8 override the team leader, the fire brigade leader?

9 MR. BRANDES: Yes, sir.

10 And then the next element was the

11 configuration control and monitoring and so on. And

12 we found that having a new licensing basis would fit

13 well within our existing plant programs and it would

14 be a matter of transitioning to the things we would

15 take credit for as a future state licensing basis.

16 The resource requirement, that was

17 something that we were interested in and felt like

18 it was very important to be able to properly

19 describe to industry what the resource investment

20 would be to make this transition. And as no

21 surprise, the amount of work is directly dependent

22 on the quality of the initial document.

23 At McGuire we had done a lot of leg work

24 already. And McGuire would be on the very low end of

25 the resource investment to complete the transition.

1 We think it's about a 1000/1200 hours for McGuire.
2 My personal estimate was on the order of
3 2000 to 6000 work hours. And as part of this pilot
4 program we're developing a report that should be
5 available within a month or so. And we'll refine
6 that estimate a good bit and we'll also define the
7 work hour estimate for each discrete element of this
8 transition so a licensee should have confidence in
9 the investment requirement before they decide to
10 proceed.
11 Another important issue is what skill
12 sets do you need to go forward with the transition.
13 DR. POWERS: Doug, excuse me. When you
14 developed the -- these are our estimates, one of the
15 things we developed very, very dramatically in the
16 license renewal process is that once somebody had
17 gone through it for your kind of plant, your time
18 was dramatically -- maybe the total time wasn't
19 reduced, but the magnitude of the effort was
20 heroically reduced. Okay. We're kind of the first
21 guy, and now the next guy ought to be less or that
22 kind of an estimate, or you just getting -- or what
23 kind estimate are you giving?
24 MR. BRANDES: Yes. What we're
25 estimating on giving is based on each discrete

1 activity and the time that we think would be
2 allocated to actually conduct that activity.
3 I guess the direct answer to your
4 question if you had the same contract team that was
5 doing the same task at each station, could they
6 speed it up? The answer is surely they could, but I
7 don't have a feel for that.
8 DR. POWERS: Okay. So you're really
9 giving here's kind it would take if you were to do
10 McGuire again?
11 MR. BRANDES: Right.
12 DR. POWERS: If now you have kind of a
13 process of doing it. The first time you didn't have
14 that.
15 MR. EMERSON: This kind of an estimate
16 is going to be very important for utility managers
17 in making a decision as to whether to go forward.
18 DR. POWERS: Now, but it strikes me that
19 what I'm willing to bet that he gives a high
20 estimate for the nth plant of a given type. Okay.
21 MR. BRANDES: Yes, that would stand to
22 reason, but I don't have a feel for what it would
23 be.
24 DR. POWERS: Yes, I understand.
25 MR. BRANDES: The skills sets are you

1 certainly need a compliance person. The pilot
2 project was able to provide draft documents for the
3 letter of intent, the license amendment request and
4 the transitioning plan such that any licensee should
5 be able to pick it up and insert name and his plant
6 specific information and move forward fairly
7 rapidly.
8 You need a classical fire protection
9 engineer, and that would typically be the site fire
10 protection engineer who would be responsible.
11 You would need the safe shutdown
12 analyst, both the mechanical nuclear, electrical and
13 the PRA risk analyst.
14 The fire brigade person is, of course,
15 important to be sure you've properly protected the
16 fire fighters from the radioactive release. And then
17 you need the design engineering, configuration
18 management type of folks to be sure that that's
19 properly implemented.
20 My conclusion in looking at all this is
21 that it might actually work. You know, we had six
22 discrete teams and six discrete tasks, but at the
23 end of the week it seemed to all flow together and
24 out the end of this report to become something that
25 it would appear to be a very comprehensive program

1 that would make sense and people at the plant could
2 implement.
3 And in closing very briefly I'll just
4 say that I have one comment on the rulemaking as it
5 stands, or as I understand it. And perhaps the good
6 news is I don't properly understand the wording or
7 the intent of the rulemaking language that's
8 currently out. But it talks about the use of
9 alternate analysis, methods and techniques and it
10 suggests that a license amendment is required. And I
11 guess I'd envisioned that as use of new computer
12 models or new analytical techniques such as NEI 00-
13 01 and enhanced. And it doesn't seem to me that a
14 license amendment is the right way to go about
15 approving or having the NRC accepting use of new
16 tools. And, hopefully, I just don't understand that
17 properly.
18 DR. WALLIS: Especially since the whole
19 basis is performance based.
20 MR. BRANDES: And that concludes my
21 presentation.
22 CHAIRMAN ROSEN: Thank you very much.
23 Are there any other questions or comments from the
24 committee members? The public? Staff?
25 MR. BIRMINGHAM: Perhaps a brief comment

1 that the version of the language that was available
2 on the website, we're negotiating a piece of that
3 with OGC and it had to do with this alternative
4 method. And we're making progress in that area.
5 MR. BRANDES: Okay. Thank you.
6 CHAIRMAN ROSEN: All right. Well, with
7 that we'll steal five minutes --
8 DR. POWERS: Mr. Chairman, can I just
9 ask a question for you to think about? We have the
10 staff from 805 coming in and saying that thou can go
11 to hot shutdown rather than cold shutdown in
12 response to a fire event. If I was going to go to a
13 plant with a complete all bells-and-whistles PRA
14 such as, oh I don't know, South Texas perhaps and
15 ask what is the risk significance of going to hot
16 shutdown rather than cold shutdown, would I get an
17 answer or a blank stare? I don't expect an answer
18 now, but I sure would like one after the break.
19 CHAIRMAN ROSEN: I'll give you a blank
20 stare right now.
21 With that, we will recess until 5
22 minutes after the hour of 11:00.
23 (Whereupon, at 11:51 a.m. a recess until
24 11:08 a.m.)
25 MR. ROSEN: Okay. We're back in

1 session, and we'll turn the discussion over to
2 Sunil.
3 ** MR. WEERAKKODY: The next presentation
4 is on circuits. I'm going to have a quick overview
5 of the subject, and Mark Salley -- you know, he's
6 fire protection -- will go into the details of this
7 issue.
8 Let's go to the next one.
9 Just to give a quick background, this is
10 one area, I think, where we have made, you know,
11 significant accomplishments since we met you last
12 year. The background goes to when about three years
13 ago we issued a memo holding inspections on circuits
14 and also simultaneously making a change to our
15 enforcement manual on the circuits, and
16 subsequently, you know, there was some experiments
17 performed, you know, by NEI to determine the hot
18 short failure probability.
19 And then there was a series of
20 activities including a meeting on February 19th with
21 all stakeholders to come to a consensus or decision
22 on what the significant and non-significant hot
23 shorts are, and we are getting ready to retract the
24 memo halting (phonetic) inspections, and when we do
25 this, again, I'm not going to go to a lot of

1 technical details. Mark will do that.

2 When we do that, the new inspection is

3 going to focus on very significant issues rather

4 than any hot short in any circuit, and we believe

5 although that this is the approach that we want to

6 take because this will enable us to, you know, get

7 the most effective use of inspection resources and

8 also would prevent undue licensing resources.

9 I do want to elaborate a little bit on

10 this last bullet here in terms of right now, you

11 know, some of the activities that we are working on

12 or considering.

13 We have overall objectives in this.

14 When we restart inspections, you know, I can

15 summarize our overall objectives in three bullets.

16 We want to make sure that we do this in

17 a manner so that the licensees and we are motivated

18 to find and fix significant circuit issues.

19 We want to make sure that whatever

20 obstacles we have to overcome we will do that to

21 minimize the agency or the licensee's spending

22 resources on issues that don't add value to the

23 public safety.

24 And a subsidiary of that is we want to

25 find a way; we are thinking very hard, and we are

1 looking at all kinds of options to find a way within
2 our processes and including changes to our processes
3 to eliminate unnecessary engagement with licensees
4 that go on forever, again, without any added value
5 to us or the licensees.
6 Under that umbrella, you k now, if I
7 become more specific as to what we are doing, within
8 the Fire Protection and the Plant Systems Branch,
9 Mark will demonstrate or Mark will give you a
10 briefing on the number of things we have
11 accomplished, and frankly, I feel that we have gone
12 as far as we can go as a branch.
13 So what we have done is we have engaged
14 the other officers, the other divisions, the other
15 branches that come in and who have a role to play in
16 terms of, you know, making this happen within our
17 overall objectives, and we have a lot of meetings to
18 discuss details on that. We are working those
19 details.
20 And also, sometimes in these discussions
21 we find, in fact, we have found maybe in some
22 situations, again, given that we are required to
23 stay within our processes, we may have to go to the
24 Commission. We have the same vehicle I described to
25 you under 805 to get certain processes changed.

1 Then finally, let me go over these items
2 real quickly, and Mark will go into details. One
3 item that is not here just last week we held a
4 workshop with about 30 inspectors from the regions,
5 and in trying to inform them of what's coming and
6 then sharing them information on a number of fire
7 protection matters, including the models that we
8 use.
9 Then the first bullet here, we are
10 planning, you know, and again I emphasize the word
11 "plan"; we planning to have a public workshop at NRC
12 headquarters in the November time frame to share
13 with our stakeholders as to what our new findings
14 are and the approach and the directions we plan to
15 take.
16 We have issued a regulatory issued
17 summary that shares our findings in terms of very
18 significant hot shorts and how they would be used in
19 a new inspection guidance.
20 We are planning to publish the draft for
21 comment that summarizes a knowledge base of the post
22 trial safety analysis, and then we are working very
23 closely with our Inspection Branch to revise the
24 inspection procedure. In fact, informally we have
25 made long strides in that area.

1 And finally we are working with our
2 partners in DSSA to have a workable SDP ready to
3 enable this process.
4 That is all I have.
5 MR. ROSEN: Thank you.
6 * MR. SALLEY: I'm Mark Salley, fire
7 protection engineer in SPLB, and I'll go through my
8 slides here.
9 I'd like to give you a quick background.
10 We'll run through a quick background and show you
11 where we're at and what we've accomplished.
12 By way of background, 10 CFR, Part 50,
13 Appendix R, NUREG-0800 standard review plan, they've
14 got the guidance in there, the requirement to
15 "provide a reasonable assurance that fire induced
16 circuit failures that could adversely affect the
17 ability to achieve and maintain post fire safe
18 shutdown will not occur.
19 That's where we're at with the
20 associated circuits and what we're looking at.
21 Beginning back in about '99 time frame,
22 we issued an Information Notice 99-17. Ninety-nine,
23 seventeen identified a number of problems that
24 different licensees were having with associated
25 circuits. The issue was thought to be somewhat

1 generic because it was coming from a number of
2 different licensees.
3 In November of 2000, the NRC suspends
4 the associated circuit inspection.
5 Next slide.
6 NEI had taken on an initiative to look
7 into this and see what they could find, as a part of
8 that initiative, they did a series of I believe it
9 was 16 fire tests out at Omega Point in San Antonio.
10 From that data we gave --
11 MR. ROSEN: Mark, could you hold on just
12 a minute? I'm sorry. On your prior slide, you talk
13 about recent problems with associated circuits at a
14 number of licensees. Could you just give us a
15 flavor of what kinds of things were being seen at
16 that time?
17 MR. SALLEY: Yeah. Information Notice
18 99-17 goes into detail, and it's basically a lot of
19 LERs where the licensees had found things and
20 submitted LERs. It covers the gauntlet pretty much.
21 Okay? I mean cable routing errors, separation
22 errors, fire induced hot shorts, spurious
23 operations.
24 MR. ROSEN: These were problems where
25 the licensees were postulating hot shorts?

1 MR. SALLEY: Yes.

2 MR. ROSEN: And then saying because of

3 this configuration we've got an issue here?

4 MR. SALLEY: For the most part it was

5 self-identified, and it came through LERs, and what

6 they were doing was going back and looking at their

7 Appendix R analysis and finding these types of

8 design problems and reporting them.

9 And they were pretty widespread. The

10 information notice talks about it being a generic

11 concern. It would be handled generically, and I

12 believe that's why NEI stepped up and did the

13 initiative.

14 DR. WALLIS: So the LER, it's an event

15 report. This event was finding something which they

16 could analyze. It wasn't something actually

17 happening physically.

18 MR. SALLEY: No, no. It was through

19 their review, their design or, you know, a lot of

20 times in a plant you'll do a mod, and sometimes they

21 won't catch that that mod impacted their Appendix R

22 analysis till later on and they've picked it up,

23 self-assessments, that type of thing.

24 MR. ROSEN: There's enough interest that

25 we'll have a copy of the 99-17 given to each member.

1 MR. SALLEY: Sure. Yeah, it's a good
2 background.
3 Now, we're talking about the NEI fire
4 testing, and the NEI fire testing was very good.
5 There's been a lot of cable fire testing over time.
6 The NEI test program was real good. In fact, it
7 specifically was looking for the spurious
8 actuations, and they designed their tests around
9 that, pulling the relays to actually get the
10 spurious from the cable fires.
11 So it had a definite goal, is what it
12 was looking for.
13 The results of that testing when all of
14 the data came back, NEI worked with EPRI, and in
15 May 2002, they published "Spurious Actuations of
16 Electrical Cables to Cable Fires: Results of Expert
17 Elicitation," and that document kind of brings it
18 all together, and it wants to put the risk aspect on
19 it as to the probabilities and such. So that's a
20 pretty good reference also, and like I said, it was
21 based directly out of the NEI testing.
22 Last year we met with you in June of
23 2002. The key to that meeting was to look at your
24 recommendations for NEI '01, if you remember, and
25 you gave us a number of ideas in that meeting.

1 Following up this year, in February 19th
2 of 2003, we held a facilitated public workshop. Mr.
3 Chip Cameron led it for us, and it was a very good
4 workshop. We brought together all of the
5 stakeholders. NEI was there, a number of licensees;
6 the NRC staff was there, and we had, and we had a
7 good, open discussion on, you know, can we get a
8 consensus on the most risk significant scenarios.
9 We want to try to take things that we
10 learn from the testing and how do we really focus in
11 on what matters.
12 Just as a side note here, when we're
13 looking at a circuit analysis for a power plant,
14 thinking back to my time at TVA and Watts Bar comes
15 to mind as the last one; when you look back at that
16 effort for circuit analysis, I tried putting a
17 number on it, and it's about five man-years for an
18 electrical engineer to actually run the cables,
19 figure out.
20 So what I'm saying is it's a pretty
21 involved process to go through the completely
22 circuit analysis for Appendix R.
23 DR. POWERS: A couple of years ago we
24 were discussing the time involved in doing this
25 circuit analysis, and the running of the cables, you

1 had looked at -- I can never produce the language
2 exactly -- you've got to look at all the possible
3 faults one at a time, and that's something that's
4 really easily done by a computer and really terrible
5 for a human being to actually do it.
6 MR. SALLEY: Right.
7 DR. POWERS: And I was just wondering if
8 they had made any progress on just getting a
9 computer to -- once I know where all of the cables
10 are and things like that, I can go through and just
11 have the computer tell me about what the effect are
12 that unfolds.
13 MR. SALLEY: Like I said, I've been away
14 from that. I can't give you an answer on that.
15 MR. GALLUCCI: I can. I'm Gallucci.
16 I'm a new hire, but I just came from Ginna. So I
17 was there as late as August.
18 And up at Ginna, we have aa complete
19 cable track database where every cable that's in the
20 Appendix R program is computerized. It gives the
21 fire zone, the cable circuit tracing, et cetera, and
22 when we did our fire PSA, when we had to look at
23 what cables were in a certain fire zone, we just
24 went into the access database, and it would pull up
25 all of the cables that were in that zone, and you

1 know, where they go and things like that. I mean,
2 there's practically nothing you can do except just
3 sit down and do that.
4 MR. SALLEY: Right.
5 DR. POWERS: But once you have all of
6 that information, the discussion centered on the
7 idea that one can computerize the subsequent
8 analysis.
9 MR. SALLEY: Oh, yeah.
10 DR. POWERS: has any progress been made
11 in that direction?
12 MR. SALLEY: I've been out of the
13 utilities for a few years, but I know back at TVA we
14 were doing that back then where we had data bases,
15 and the database was important for a number of
16 reasons: Appendix R, knowing where the cables were.
17 The civil engineers also used it a lot
18 for their seismic loading and their trays. So the
19 computerized database had a lot of advantages. And
20 like I said, when you did a plant mod, it was
21 important to know that when you were doing a
22 modification.
23 DR. POWERS: Well, I was thinking it was
24 actually just going through and doing the volts and
25 the subsequent analysis. One could -- because you

1 could then link to the PSA to see what components
2 are supplied by each of those cables.
3 So I imagine some of the other plants
4 that have full fire PSAs are very advanced. They
5 wouldn't be able to do it without a computerized
6 database as well.
7 DR. POWERS: Yeah, the database is one
8 thing, but doing the analysis is what I'm after.
9 MR. GALLUCCI: The analysis of the fire?
10 DR. POWERS: The Appendix R requirement
11 is that you look at faults one at a time among all
12 of these cables.
13 MR. GALLUCCI: Oh, you're looking at
14 like cable-to-cable, cable-cable interactions?
15 DR. POWERS: Sure.
16 MR. GALLUCCI: I mean, if you want to
17 postulate, you have the cables that are in a
18 specific location. So if you wanted to do that, the
19 computerized database would allow you to do that.
20 DR. POWERS: Yeah, but you end of doing
21 it by hand.
22 MR. GALLUCCI: I can't answer. I think
23 it could be done by computer.
24 DR. POWERS: Yeah. I think it -- I
25 mean, the suspicion was that you could actually do

1 it by computer once you knew where the cables were
2 and what they were connected to, but it seems like
3 that's one of those things that research ought to
4 have a tool and say, "Okay. For this plan here's
5 what we know and here's how to do it."
6 MR. ROSEN: I think you're bordering on
7 what's in the NEI guidance, what should be in the
8 NEI guidance on how to do associated circuit
9 analysis and maybe would include these tools you're
10 talking about.
11 DR. POWERS: Well, yeah, I mean, I
12 presume that the NEI guidance would be part of the
13 expert database that you would give the computer
14 program that does the analysis.
15 MR. WEERAKKODY: And, Dr. Powers, I just
16 want to make one point. In terms of it is true that
17 there are a number out there that have the cable
18 information or computerized, but I think you already
19 know this.
20 DR. POWERS: Yeah, but, I mean, what
21 you're doing is you have to review these things, and
22 you're tying up expensive manpower doing a grunch
23 job. Why aren't you beating on research. Tell
24 them, "Give me a tool. Save my guys. I want to use
25 them for the things that only people can do."

1 DR. WALLIS: Also we can't look at all
2 of the possibilities, whereas a computer can --
3 DR. POWERS: Yeah, zip through them all.
4 DR. WALLIS: Right.
5 DR. POWERS: Instantly, and it does it
6 fairly reproducibly and fairly reliably. How come
7 you're not beating on research? I mean, what in the
8 hell good are they for you if they don't help you
9 save your manpower?
10 MR. WEERAKKODY: This is true, J.S.
11 (Laughter.)
12 MR. WEERAKKODY: I hope you're taking
13 notes there. But while I was at ADNIS (phonetic),
14 one of the things we found out when we had this
15 workshop with the inspectors is that it is also true
16 that there are a number of utilities out there who
17 met appendix, our old rule (phonetic), simply by
18 knowing where their cables associated with the safe
19 shutdown parts are, but not knowing what the layout
20 of most of the other cables are.
21 DR. POWERS: The guy comes in with a
22 plant change and says, "I'm going to reroute this
23 cable." I mean, think of what this would be. You
24 could just run your computer code and say, "Oh, no.
25 You're not going to reroute that cable because it

1 goes through this fire zone and you get a circuit
2 problem here."
3 I think you need to get research to do
4 some decent work for you instead of just sucking up
5 the money, you know.
6 (Laughter.)
7 MR. HYSLOP: I'll respond to that later
8 in the presentation.
9 MR. ROSEN: We'll give research its due.
10 DR. POWERS: We'll give you equal time.
11 MR. ROSEN: But I do have another
12 question on the slide that's currently on the
13 screen, and that's the third bullet, the consensus
14 on the most risk significant scenarios --
15 MR. SALLEY: Yes.
16 MR. ROSEN: -- that was arrived at at
17 this facilitated public workshop. It seems to me
18 that that would be a hard thing to do because isn't
19 it true that these most risk significant scenarios
20 depend very -- are very plant specific?
21 How does one do that, in general?
22 MR. SALLEY: You will get different
23 opinions on that from different people depending
24 upon who you talk to, and this was a lesson, a
25 valuable lesson, Sunil and I learned last week when

1 we brought all of the regions in and talked to them.
2 The inspectors have a pretty good notion
3 of seeing a number of plants, and they can see
4 equipment that's going to give them problems or
5 things they want to look at, and they start to get
6 an idea f developing that.
7 Yes, the cables are typically routed
8 uniquely to the plant, but when they go back to the
9 P&IDs and look a component that would give them a
10 problem, you know, diverting flow or something along
11 those lines, they get a pretty good idea what
12 they're actually looking for, and they can even get
13 through a Westinghouse versus a BMW unit a to what
14 components they've seen in the past.
15 So they get smarter the more they
16 inspect, which is real good.
17 MR. ROSEN: Unless they get to a plant
18 that has, for example, three safety trains.
19 MR. SALLEY: Right.
20 MR. ROSEN: And they've never seen
21 anything like that before.
22 MR. SALLEY: The facilitated workshop
23 though, I think, was a pretty good experience, and
24 we had a lot of good discussion and a lot of good
25 ideas on how to do this, and it forms the basis for

1 the risk, and that's what we'll discuss here in a
2 second.
3 The next bullet. The RIS is currently
4 available. It's on the public server. We announced
5 it in the Federal Register, and it's available for
6 comment. I have gotten a few comments back, mostly
7 from in-house NRC. The inspectors gave me a lot of
8 good comments last week and a few of the other staff
9 members. So I'm still waiting for a lot of public
10 comment on it.
11 MR. ROSEN: Now, what are you going to
12 do with these most risk significant cable
13 configurations and attribute?
14 MR. SALLEY: I'm glad you asked that.
15 If you'll turn the slide there, when we look at the
16 risk from associated circuit failure, there's a
17 number of factors that we need to consider to gear
18 the risk analysis toward the cables. These are some
19 of the things we've learned.
20 When we set the basic equation up, and
21 Steve Nolan helped us with this from Sandia, is that
22 we could define the risk as simply a three terms:
23 the fire frequency, that's a number we know the
24 plants have different frequencies of fire based on
25 the historical database, and that's well established

1 and the SDP and the IPEEEs.

2 The second bullet or the second item is

3 kind of unique to the cables, and it's the

4 likelihood of the cable, the fire effects and cable

5 attributes that contribute to the failure.

6 This one is very important because we're

7 not just looking --

8 DR. POWERS: I'm struggling to

9 understand what a "creditable fire threat" is.

10 "Credible ones" I know about, but "creditable" is

11 saying that this is a good fire to have? It keeps

12 you warm at night?

13 MR. SALLEY: That's a typo. That's a

14 typo. Sorry about that. You caught that good.

15 Yeah, we were going to check and make sure you

16 caught that.

17 But the likelihood of the fire effects

18 and the cable attributes that contribute to the

19 failure, that's an important bullet. I'm going to

20 talk a lot about that bullet because what we're

21 doing here is we're not just saying a cable is a

22 cable is a cable. Looking back at some other

23 research, looking at what NEI did in the fire

24 testing is that we learned that cable attributes are

25 very import to the failure, and we learned a lot

about that, and that's going to form a big part of this.

DR. WALLIS: Your equation, it seems to me isn't complete. It should have another term in it, which is a magnitude of the consequences. It cannot just be probabilities. It has got to have some magnitude of consequence or something.

MR. SALLEY: Right. The third term is that likelihood of the undesired consequence, and --

DR. WALLIS: If it's only one consequence like core damage, maybe that's okay, but it has got to be some measure of the size of the consequences in risk.

DR. POWERS: See, Graham, I mean it's not just that. It's the likelihood that the fire -- hopefully its affects and not effect -- cable attributes and the likelihood and desire consequences can't possibly be independent of each other.

DR. WALLIS: You've got it in the last bullet behind your shoulders there. It says severity of consequence, but that has got to be somewhere in the risk.

MR. SALLEY: That is the consequence. When you look at the consequence of an associated

1 circuit, when you have the cable failure, the hot
2 short, if you will, that causes something to happen,
3 that something can be different.
4 PARTICIPANTS: Yes.
5 MR. SALLEY: Okay? It can be a small
6 test line flow diversion or it can be a much larger
7 one. So that's the consequence that we use here,
8 and we'll talk about that at the end here because we
9 do address that.
10 Okay. So that was kind of the basis of
11 how we started the February workshop, and like I
12 said, the first time fire frequency, that's well
13 defined. We didn't spend any time on that.
14 The second and third ones are the ones
15 we really focused on, primarily the second.
16 DR. POWERS: It does not describe the
17 fire frequency is something that you can ignore
18 totally. Maybe you could do it for this study, but
19 in general it seems to me that one of the features
20 of fire risk analysis is that we plot frequency
21 versus fire size, and we find quickly you don't have
22 much data for larger fire, large damaging fire. So
23 you tend to extrapolate that linearally, maybe
24 linear in one space and whatnot, because you just
25 don't have much data there.

1 And the question always is: should you
2 make that linear extrapolation or, in fact, do you
3 have some sort of a curve so that you end up by
4 linear extrapolating over predicting the frequency
5 of large fires?
6 MR. SALLEY: For our purposes, we knew
7 fire frequency was being worked on elsewhere and we
8 focused on the circuits. That's what I meant to
9 say.
10 DR. POWERS: You're just going to do the
11 rest of it.
12 MR. SALLEY: J.S. can address fire
13 frequency per your question, but like I said, we
14 knew research and other people working on that. We
15 weren't going to work on that inside associated
16 circuits. We wanted to focus on --
17 DR. POWERS: I understand. I mean that
18 makes sense because I think that fire frequency is
19 one of the great assumptions that's made in the fire
20 risk analysis.
21 MR. WEERAKKODY: J.S., that's one of the
22 task forces that you are in, right? The fire
23 frequency EST?
24 MR. HYSLOP: The requantification
25 studies are looking at frequency and are looking at

1 fire severity. As I put on my slide, you know, one
2 of the things we're looking at is heat release
3 rates, and there we're looking at a range and we're
4 trying to characterize it more accurately such that
5 those higher consequence fires will be included in
6 an analysis. And so in that sense we're trying to
7 capture, I believe, what you're talking about.
8 DR. POWERS: It's a real problem. I
9 mean, I don't know how you do it, but I'm encouraged
10 that you're looking at new ways of looking at it
11 because it has always has been just very glaring,
12 and it's that extrapolation that tends to dominate
13 all of the consequence analyses because you've got a
14 probability of a big fire and nothing works. That's
15 what gives you big consequences.
16 MR. HYSLOP: And that's why we're
17 particularly interested in it, because of the
18 consequences that can come from those larger fires,
19 and the reason why we feel like we need to consider
20 it in that research project. And naturally the
21 insights from the research project carry over into
22 the other activities as well, the requantification
23 studies.
24 DR. POWERS: See, I was wrong. He is
25 spending your money well.

1 (Laughter.)

2 MR. SALLEY: I'm sorry. Do you have a

3 comment?

4 MR. ROSEN: Well, that's the first time

5 you have been wrong.

6 (Laughter.)

7 MR. BRANDES: Very briefly if I may, the

8 industry understands this issue, and we are

9 implementing a fire reporting program that is

10 voluntary, but our intent was to set the fire

11 reporting threshold very low, much lower than the

12 existing regulatory threshold, and so that we could,

13 indeed, capture fires and promptly understand the

14 frequency of significant fires.

15 And this information is being captured

16 and then being provided to EPRI to dissect and, I

17 guess, properly evaluate the significance and the

18 frequencies.

19 DR. POWERS: But then, Doug, the problem

20 still is that, quite frankly, you don't have many

21 larger fires at nuclear power plants.

22 MR. ROSEN: That's a very good thing,

23 Dana, actually.

24 DR. POWERS: And consequently these guys

25 end up when they do their risk analysis, end up

1 doing an extrapolation, which up until now has been
2 done linearally. I mean, there's nothing else you
3 can do right now unless somebody looks at it in a
4 very imaginative way.
5 MR. ROSEN: Let's go on.
6 MR. SALLEY: Next slide.
7 Let's talk about fire testing because
8 this is the crux of this argument. The cable fire
9 testing, there's been a lot in the past. Sandia and
10 Factory Mutual were two laboratories that have done
11 20 years or so of this, and they've done it for a
12 number of reasons.
13 After Browns Ferry, of course, they
14 looked at things like flame spread and
15 combustibility cables. They did do a little looking
16 at the spurious operation and how the cables are
17 going to interact. Sandia has done a number of
18 that.
19 I've got to acknowledge NEI did a very
20 good job of setting their experiment up because they
21 specifically went in for the things of spurious
22 operation and designed their testing around that,
23 which was an excellent effort by the industry.
24 From that effort and the previous work,
25 we could see some things come together about the

1 cables, and this is important because in the risk
2 aspect this is going to set the stage for how the
3 cables respond.
4 Let's take a break from the slide for a
5 second, and I'm going to pass a sample around, and
6 this is an actual cable out of NEI testing that I
7 recovered from the dumpster. That's the Pittsburgh.
8 MR. SIEBER: That's where we eat.
9 (Laughter.)
10 MR. SALLEY: I'd like you to take a look
11 at this cable.
12 DR. WALLIS: Well, when you recovered it
13 from the dumpster, how did you really know what its
14 origin was?
15 MR. SALLEY: Well, I watched it go out
16 there, and then I --
17 DR. WALLIS: Well, I see, I see.
18 DR. POWERS: Is that the same place the
19 fuses were found?
20 MR. SALLEY: Actually, we took it off
21 the sample when it was disassembled from the test.
22 Fred took a lot of samples, and I took some back
23 from this type demonstration here, and there are
24 very important things I'd like to point out to you
25 and have you take a look at, the failure mechanisms

1 and modes of cables that we understand.

2 You'll notice there were three seven-

3 conductor cables here and a number of single

4 conductors around it, and like I said, NEI designed

5 this experiment to look for these failures. We can

6 have a number of different failures.

7 We can have, for example, what we call

8 intra-cable failures. Intra-cable failures are when

9 you have like seven conductors inside a single

10 cable, and the conductors within the cable fall

11 together. Okay?

12 Then we define what's called an

13 intercable failure where we have two separate cables

14 coming together and shorting that way. Okay? So

15 the test was designed very well to find that.

16 Also, when we look at cables, we can

17 break it into two garden variety types of cables.

18 We can have thermoset materials or we can have

19 thermoplastic, and the failure mechanisms of the

20 cables are very specific.

21 If you'll notice here, this single cable

22 that kind of looks like it was a hot dog on a grill

23 a little bit too long, this is a thermoset cable,

24 and when the thermoset cable fails, it tends to

25 expand. It cracks, and it basically blisters up.

1 So in the jacket or the insulation, this is the
2 classical failure mode we're seeing with thermoset
3 materials.
4 Thermoplastic materials, on the other
5 hand, tend to melt and drip. It's interesting to
6 note here that these two cables, I believe, came out
7 in TVA, and these were what TVA called PJJ, which is
8 a PEPVC cable, and it's actually what was in Browns
9 Ferry. This is some leftover stuff on the reel.
10 But you'll notice that it forms the
11 dripping, and also that the failure mechanisms, the
12 thermoset cable doesn't want to interact with the
13 other cables, be they thermoset or thermoplastic,
14 where the thermoplastic because it's going through a
15 melting phase, it wants to interact cable to cable,
16 an intercable failure.
17 You can also look in here and you'll
18 notice where some of the conductors actually
19 shorted. So let me pass that around and go through
20 the slides.
21 Mr. Sieber?
22 MR. SIEBER: Thanks.
23 MR. SALLEY: Watch it. It's a little
24 bit --
25 MR. SIEBER: I should have worn a dark

1 suit.

2 DR. WALLIS: Well, when it melts then,

3 whether or not a short must depend a lot on the

4 mechanical state because whether or not these pieces

5 of metal which make up the conductors want to push

6 sideways so that they hit another one is going to

7 depend upon some stresses, is it not?

8 MR. SALLEY: Yes, it is in the cables.

9 DR. WALLIS: So if there's a bend in the

10 cable or something that makes a big difference.

11 MR. SALLEY: Sure. Bend radius becomes

12 important that you're on the bend radius.

13 There's one other factor that I kind of

14 glossed over here that's important when we look at

15 cables, and that is at what temperature these things

16 occur. Now, that sample you're looking at there,

17 obviously they were all exposed to the same fire.

18 Okay? So they all got the same thermal insult from

19 the fire.

20 What we've seen from some of the early

21 research is that the thermoplastic cables tend to

22 fail approximately 425 Fahrenheit. That's when

23 things want to start going south, if you will, with

24 the thermoplastic cables.

25 MR. ROSEN: Soft and then melt at? At

1 what temperature do they melt?

2 MR. SALLEY: They start melting and

3 igniting at around 425 Fahrenheit.

4 MR. ROSEN: Okay.

5 DR. WALLIS: Now, you said they go

6 south.

7 MR. SALLEY: Go south.

8 DR. WALLIS: Not soft.

9 MR. ROSEN: Oh, south.

10 DR. WALLIS: You know what south is.

11 MR. ROSEN: Yes, I'm from the South.

12 DR. POWERS: It's where Tom lives, a

13 terrible place.

14 MR. SALLEY: The thermoset material has

15 a much higher threshold, and that tends to be around

16 -- the garden variety thermoset material is around

17 700 degrees Fahrenheit. So you can see that when

18 you start factoring these into the risk, you know,

19 it matters on your fire intensity.

20 For example, if I had a hot gas layer

21 that was in the 600 degrees Fahrenheit range, if I

22 had thermoplastic cables there, I could start

23 saying, you know, I'm going to have failures. I'm

24 going to have ignition to cable, where if I had

25 thermoset I wouldn't be as excited because I haven't

1 reached the activation temperature of the thermoset
2 material.
3 And it's good that we're looking at it
4 in that way. In the past you've always heard IEEE
5 383 qualified or nonqualified. You can again take a
6 broad slice and say that most of your thermoset
7 materials are the 383 qualified materials. Most of
8 your nonqualified 383 materials are your
9 thermoplastics.
10 Again, those are broad slices and we're
11 looking at the cables for what they are, which is a
12 very important part of this.
13 Okay. Next slide.
14 Getting back to your question on the
15 risk significance, from discussions with the
16 inspectors and the fellows who do the NSSS work,
17 what we feel is the most risk significant for a
18 number of reasons are the spurious actuations that
19 occur in the first hour of the event. Those are the
20 ones that the inspectors need to focus in on as far
21 as risk significance.
22 So as you're looking at the
23 consequences, we're looking at those actions that
24 really hurt you in the first hour of the fire event.
25 Next slide.

1 Base on all this data and the work that
2 industry has done, the work that the NRC has done,
3 we had Brookhaven assist us with a letter report.
4 Bringing that all together in February, we came
5 together, and we said, "Okay. Now, how are we going
6 to look at this?"
7 And these are some of the results that
8 came from the February 19th facilitated workshop.
9 The first thing is -- and Dr. Powers talked about
10 this a little earlier -- is how many credible
11 failures do you take. If you look at a cable tray
12 and you can see it's a large mass of cables, it may
13 have thermoset; it may have thermoplastic. It could
14 have Hypalon. It could have EPR. It could have any
15 number of materials in there. How do we start
16 looking at that to do a circuit analysis?
17 What was agreed upon at the workshop or
18 at the facilitated workshop was that it would take
19 two cable failures per scenario. They would be
20 intra-cable failures for thermoset and
21 thermoplastic. That would be acceptable. Any
22 number of conductors and combinations possible
23 within the cable is acceptable, and that intercable
24 failures were possible for the thermoplastic cables
25 because of their failure mechanism. So --

1 MR. ROSEN: And impossible for
2 thermosetting?
3 MR. SALLEY: No, they would not be
4 impossible. What we did in the February workshop
5 was we took the items and we sat three bins up.
6 Okay? Bin one were the items that everyone said,
7 "Yeah, that's probably going to happen for a fire
8 involving the cables. These are the bin one type
9 items."
10 Bin two was, gee, that could happen, but
11 then, again, we didn't see it in the limited number
12 of testing. That needs further research.
13 So that currently has been sent over to
14 J.S. with the user needs saying, "We've identified
15 these items. Could you please look at this? Should
16 they be in bin one?" or bin three was where we had
17 conditions that we didn't think were possible.
18 For example, the one we came out with in
19 bin three was you heard Doug talk about his armored
20 cable. Okay? Armored cable, the cable failure, an
21 intercable failure, that's probably never going to
22 happen because we have to have the conductors short
23 through the steel jacket, which is grounded, and it
24 should have tripped out by there. So those were the
25 bin three type items.

1 MR. ROSEN: Yeah, your next slide
2 answers my question.
3 MR. SALLEY: Okay. Last evening I made
4 a little hand sketch here. I'll pass this around to
5 you to give you an idea how this comes together.
6 Pass these around, please.
7 DR. POWERS: Sure.
8 MR. SALLEY: And, again, this is out of
9 the February facilitated workshop. This is what's
10 documented in the risk. This is kind of the one
11 where I think the picture is better than 1,000 words
12 kind of deal.
13 When we look at a cable, I drew a seven
14 conductor cable up here. You can see that we get 21
15 possible combinations that we can have come out of
16 that pairing if we needed a pair to give us the
17 spurious operation.
18 Now, we can spend a lot of inspection
19 time going through the analysis and trying to look
20 at what the color code was for the cable as to how
21 the device was actually wired. And we could spend a
22 lot of time doing that or we can look at the test
23 samples and say, "Hey, just consider that in that
24 cable whichever ones brought you into the spurious,
25 you'll accept that that was the pair that came

1 together."

2 For example, if it was three and four,

3 they were the two next to each other, and they came

4 together and gives you the spurious.

5 DR. WALLIS: So this is seven factorial

6 over two factorial times five factorial?

7 MR. SALLEY: You start getting into that

8 fine math, yes.

9 So that's how we decided we would handle

10 it, is whatever combinations could come in the

11 cable, take it as the conservative approach, as

12 those were the ones that came together and caused

13 the spurious actuation.

14 Now, how many cables are you going to

15 look at was the next question. Are we going to look

16 at one cable, two cable, five cables, ten cables?

17 Where is the realistic -- where do you get your --

18 you know, where is the -- to get the most out of

19 your inspection, how far do you need to take this?

20 The consensus appeared to be if you had

21 two cables and they both had the smart failures that

22 gave you the spurious actuations you wanted, that

23 you would catch probably the large majority of the

24 high risk applications, and everyone felt pretty

25 comfortable with that, and that's where we're going

1 to start, with two cable failures.

2 Again, in the bin two items we said,

3 "Okay. Could it be three, four, or more?" Again,

4 we pushed that off to research, and we said, "Hey,

5 research, you know, give us a little help here," and

6 J.S. has that.

7 DR. WALLIS: I have a problem here.

8 MR. SALLEY: Yes.

9 DR. WALLIS: I can see how you put all

10 of the combinations two at a time. Number four

11 short to number seven.

12 MR. SALLEY: Right. You would have to

13 short through number one.

14 DR. WALLIS: Right.

15 MR. SALLEY: That would be true, but

16 with the thermoplastics, for example, depending upon

17 how that cable was constructed, how it was wound,

18 they can come together, and the conductors can move

19 around. So that's why we didn't want to make it

20 into a research project of figuring that combination

21 out. We said let's take that as a given and we'll

22 move on.

23 The other thing is how do you know what

24 combinations the electricians actually hooked up

25 without opening and seeing what his color code was?

1 DR. WALLIS: That's your state of
2 knowledge.
3 MR. SALLEY: Right, and we could spend a
4 lot of time tracing things to the nth detail, but we
5 don't get a lot of inspection done. So we had to
6 make some adjustments here.
7 To give you a quick example of how this
8 would come into play, I've drawn a little sketch
9 here. It's very simplistic, and it really wants to
10 just emphasize how we'll look at a cable failure
11 attribute. I've got a tank, and that tank has water
12 that is used for fire safe shutdown function.
13 Coming off the other side of the tank
14 I'm worried about a spurious operation. Cables pass
15 through the same fire area. That could drain my
16 tank time. So I want to make sure that I don't have
17 a spurious that deletes my water supply.
18 Now, if I had one seven conductor cable
19 and that seven conductor cable was daisy chained
20 between the MOV and A, the pump start and B, and the
21 MOV and C, and that one cable could fail and cause
22 both valves to open and the pump to start and it
23 would drain my tank, that would be in scope. Okay?
24 The second one, if I had two cables, one
25 seven conductor going to the valves A and C and one

1 going to the pump start B, again, applying these
2 roles for inspection, I would assume that the
3 failures came in the right order. Our valves would
4 open and my pump would start, and I would drain the
5 tank time.
6 Now, where we start getting out on the
7 probability curve, where we drew the line was for
8 Item C. If I had three separate cables, one to A,
9 one to B, one to C, and all three cables had to fail
10 and get the correct pair to come together to make
11 the two valves go open and the pump start, we'd say,
12 "Wait. We're starting to get out a little too far
13 into the probability here. That's over in bin two
14 for research."
15 Does that make sense?
16 MR. ROSEN: It makes qualitative sense.
17 MR. SALLEY: Okay.
18 MR. ROSEN: But quantitative sense I
19 can't get from this because I don't know how. I
20 haven't done the math. I don't know how likely or
21 unlikely, let's say, the third case is.
22 MR. SALLEY: Right, and you have to look
23 at the expert elicitation from the EPRI report
24 because a couple of things come up that the
25 probability -- and I'm speaking off the top of my

1 head -- but for thermoplastic cable to fail and give
2 you a spurious was like .6. So 60 percent of the
3 time it was going to give you a spurious.
4 MR. ROSEN: So I have to multiply .6
5 three times.
6 MR. SALLEY: Right. Now, would it give
7 you the correct pairing you heed? Again, it turns
8 into a PRA exercise, which is better handled by
9 people like Dennis. I'm still trying to help with
10 the inspection attributes.
11 MR. HANNON: Yeah, for these a typical
12 MOV, it's going to be .3, and for the pump, if it
13 doesn't have some sort of current limiting device
14 like a CPT, it would probably be .6. But typical
15 MOVs is what we're concentrating on.
16 For MOVs, you know, you get .3 times .3
17 times .3, and at some point given fire frequencies
18 that we typically see of a large, damaging fire with
19 multiple cables down to ten to the minus four to the
20 ten to the minus five range, at .3 cubed you're
21 already below your level of concern.
22 MR. ROSEN: Point, six cubed?
23 MR. HANNON: Yeah, but most circuits
24 we're concerned with are MOVs, and they'll have a .3
25 to start with.

1 Armored cable .075 to .0075, depending
2 on the circuit.
3 MR. SALLEY: Right. It is important to
4 keep in mind that we're trying to restart the
5 inspections in a risk informed manner, and we've got
6 questions over to research that we don't have
7 answers yet. So this is subject to change based on
8 what research brings back to us.
9 MR. ROSEN: So now you're going to use
10 this protocol qualitatively at least, correct, to
11 restart inspection?
12 MR. SALLEY: Yes.
13 MR. ROSEN: Show me. Tell me how that
14 works.
15 MR. SALLEY: Tell you how that works.
16 Okay. Let me see if I've got that in a slide here.
17 MR. WEERAKKODY: Are you asking for how
18 this information is factored into the procedure?
19 MR. ROSEN: Yes. How does one now use
20 this general idea in an inspection, or is that too
21 detailed for this? And I can accept that.
22 MR. SALLEY: I can give you a quick
23 overview, is when the inspector -- backing up --
24 let's back up to this one that said risk. It was
25 fire frequency.

1 MR. WEERAKKODY: Mark, Pete, did you?
2 We work with Pete from the Inspection Branch in
3 terms of taking this input and working the
4 inspection procedure. I don't know. Mark, if
5 you're comfortable answering, go ahead.
6 MR. SALLEY: Yeah, I can, and Pete will
7 correct me if I'm wrong.
8 The one that had risk equals fire
9 frequency.
10 The challenge, and this is what we
11 worked on a lot last week and this is why we had the
12 regional folks here with us, to help us so that we
13 get this right, is that when we do this in a risk
14 informed manner, fire frequency, once again, that's
15 established. Classically they're looking at the
16 IPEEEs and seeing where does the fire frequencies
17 and where was the risk sensitive parts of that
18 unique plant.
19 So that's typically coming out of the
20 IPEEEs.
21 This likelihood of fire effects and
22 cable attributes, that's what we just talked about.
23 Okay? If they have thermoplastic cables, hey, that
24 can go cable to cable. I know that.
25 If I have thermoset, I'm looking at the

1 inter or -- excuse me -- the intra-failures. So
2 those are the kind of insights that we're putting
3 into the inspection guidance, and the third thing is
4 that undesired consequence, once again, from the
5 P&IDs. They're looking at what happens in the first
6 hour that is really risk significant that's going to
7 cause a flow diversion, cause a drain down. What's
8 going to really give me my problems?
9 DR. WALLIS: So when you do this inter
10 thing, you have, say, a tray with ten cables in it.
11 MR. SALLEY: Right.
12 DR. WALLIS: So any cable can short to
13 any other cable in that tray; is that right?
14 MR. SALLEY: No.
15 DR. WALLIS: no?
16 MR. SALLEY: If they're thermoplastic.
17 DR. WALLIS: If they're thermoplastic?
18 MR. SALLEY: Yes.
19 DR. WALLIS: Any cable can short to any
20 other cable even if they're on the extreme ends?
21 MR. SALLEY: That's where the level of
22 detail starts to get a bit much. If they're in the
23 same raceway, yes.
24 DR. WALLIS: You don't know where they
25 are. You simply say they could.

1 MR. SALLEY: Those would be things we
2 would start looking at in Phase 3's SDP.
3 MR. ROSEN: You just have to go look at
4 the cable tray installation in any plant to realize
5 that you could go to one spot on the tray and it
6 could be here and here and then ten yards down the
7 tray you'll find the right --
8 DR. WALLIS: So you don't know where
9 they are. So they could easily short to any other
10 one.
11 MR. SALLEY: Right. Random fill.
12 DR. POWERS: Let me ask you about the
13 one hour. Clearly, if I think about the Browns
14 Ferry fire, one hour is not a good time frame to
15 think of.
16 MR. SALLEY: Right.
17 DR. POWERS: But Browns Ferry was a long
18 time ago. Things are different.
19 If I think of, say, a more recent fire,
20 like the San Onofre fire, again one hour is not the
21 right time to think about it. So why one hour?
22 MR. SALLEY: I will defer to Phil
23 Qualls. Phil.
24 (Laughter.)
25 MR. SALLEY: From the NSSS side of

1 things.

2 MR. QUALLS: Hi. I'm Phil Qualls. I'm

3 in the Fire Protection Engineering Section.

4 One hour is kind of an arbitrary time,

5 but there's two or three things that happen at one

6 hour. The initial major events that we've found in

7 analyses during the inspection process over the

8 years, things like Westinghouse pump, RCP seal

9 failures, events like that are typically very time

10 constrained with the capability of the systems to

11 make up. That's usually within one hour.

12 At time equal one hour also at most

13 facilities, we also keep in mind that the plant gets

14 augmented; the plant staff gets augmented

15 significantly through the emergency plan. A severe

16 fire that causes damage to safety related

17 equipments, typically an alert or higher events, you

18 man the TSC, the OSC, the EOF. The plant gets a lot

19 of additional support, a lot of additional

20 engineering support, a lot of other operators.

21 Plant management is involved directly. NRC may be

22 involved.

23 At time one hour, there's a lot of

24 additional resources available to the operators

25 also, but --

1 MR. ROSEN: The one thing I would think
2 some of those things might be counterproductive, the
3 ones you mentioned. But the ones that are
4 productive are the off-site fire response. It seems
5 to me within an hour is reasonable.
6 MR. QUALLS: It is at most utilities.
7 There's a few outliers I'm aware of that it takes
8 over an hour for off-site response. That's true,
9 too, Off-site response is typically 15 minutes or
10 less away.
11 DR. WALLIS: This is assuming you know
12 you have a fire.
13 MR. QUALLS: Well, yeah. I was on the
14 AIT for water. I know what you're talking about.
15 DR. WALLIS: Well, I'm just thinking if
16 TMI took two hours before the new shift came on,
17 certain things were realized. This wouldn't happen
18 with a fire?
19 MR. ROSEN: Fires tend to be hard to
20 ignore.
21 DR. WALLIS: Well, I think what happened
22 to TMI might have been hard to ignore, but somehow
23 it got ignored
24 MR. ROSEN: Well, I think in the main
25 you're going to find a fire or it will find you

1 DR. POWERS: I mean all of this is true,
2 but what you don't assume is that the mere existence
3 of these people puts the fire out. And so the
4 question is: why do we stop the analysis at one
5 hour?
6 And it seems to me I could make all of
7 that argument and say surely then two hours.
8 MR. SALLEY: Let me clarify. We don't
9 stop at one hour. What we're saying is if you have
10 all of the possible associated circuit interactions
11 that are going to occur, okay, in the first hour of
12 trying to safely shut the reactor down, which ones
13 am I most concerned about?
14 That's what we're saying here from a
15 risk standpoint.
16 DR. POWERS: That's a little different
17 MR. SALLEY: It's a little different.
18 I'm sorry. Let me clarify.
19 But in that first hour of we scram the
20 reactor and we're going into shutdown; we have a
21 significant fire; in that first hour what are the
22 possible associated circuit interactions that would
23 give me the most trouble?
24 That's what we're asking the inspectors
25 to look at. We just had an inspector transfer to

1 headquarters, George. I don't know if you could
2 from all of your inspections provide any insights on
3 that. You've looked at a number of these.
4 PARTICIPANT: I'll pass.
5 MR. SALLEY: Thank you.
6 DR. WALLIS: So you seem to be assuming
7 a fire is a rapid thing.
8 MR. SALLEY: Of course.
9 DR. WALLIS: The kinetics are such that
10 a fire is rapid, but a fire is an oxidation
11 reaction. It can glow. It can go very slowly.
12 Davis-Besse was an oxidation reaction.
13 They call it a fire. It took a few years before --
14 MR. SALLEY: You can't pin that on Fire
15 Protection.
16 DR. WALLIS: No, but you see what I'm
17 saying?
18 (Laughter.)
19 DR. WALLIS: You see what I mean.
20 You've got the idea that fire should be a rapid
21 thing, but you can have slow fires.
22 MR. SALLEY: Yes, yes.
23 DR. WALLIS: Which may not be detected
24 for a while.
25 MR. SALLEY: Yes.

1 DR. WALLIS: And yet there may be
2 shorts.
3 MR. SALLEY: Yes, and there's also the
4 location factor. When you look at a compartment and
5 you have the cables run around as to where is the
6 location that the fire takes place, but let me just
7 clarify that the thing that the inspectors were
8 looking at is in that first hour. We scrammed the
9 reactor. We know we have a fire. We're going to
10 fire safe shutdown. What are the key associated
11 circuits that give me the biggest problems?
12 That's where we've directed them.
13 DR. POWERS: Then it's important to take
14 your one hour because you're saying surely in one
15 hour I'll have all of this additional support to
16 handle the plant. What's given the operators before
17 is all of this additional support. I understand
18 now.
19 MR. SALLEY: Right. The ones that pose
20 the most risk.
21 MR. ROSEN: One second, one hour, let's
22 get off that and tell me what the inspectors do with
23 this conceptual chart. How do they decide using
24 this rationale, this logic what things to inspect or
25 what things to be concerned about?

1 I don't get it.

2 MR. SALLEY: That's what we worked on

3 last week, and that was the very argument or very

4 discussion that we had with the inspectors, is how

5 can we best guide you through this to inspect this

6 in a risk informed manner.

7 Sunil used the term that we want to put

8 the risk on the front end of the process rather than

9 just grabbing a random associated circuit in the

10 plant and saying, "Okay. This is an associated

11 circuit. Was it protected? If it failed, what

12 could it do?"

13 We wanted to try to be up front and put

14 the risk informed part up front and look at, okay --

15 MR. ROSEN: Screen out a whole bunch of

16 stuff.

17 MR. SALLEY: Right, and we get to that

18 screening process. Now, I had a very good lesson

19 with the inspectors last week that screening is not

20 a good word. Well, when I started going through a

21 number of screens, they wanted to stay in process

22 with steps, okay, as to how they're used to

23 inspecting.

24 And the key here and the challenge that

25 we have with the inspection procedure with Peter is

1 how do we focus them on, you know, what is the most
2 risk significant ones, and that's the process that
3 we're doing right now with the inspection procedure.
4 MR. ROSEN: Oh, so you're not going to
5 answer the question. You're going to tell me that's
6 a good question and we're working on it?
7 MR. SALLEY: Okay. I can answer it a
8 little better than that. We had a number of steps
9 in there. Let's call them experience, and it was
10 things to look at. If you have this, then you
11 should go here. If you have thermoplastic cables
12 and it's two cables that give you the action, that's
13 definitely one you want to consider.
14 Another one that we haven't talked about
15 yet is the credible fire threat. You know, do we
16 have a credible fire threat that's going to make all
17 of this, make the cables do what they do?
18 So a number of guidance steps, if you
19 will, to help focus the inspectors is what we're
20 trying to come up with. That's what the procedure
21 is going to say.
22 MR. ROSEN: Now, are they going to
23 conduct a de novo review of the whole plant based on
24 this logic that you've provided us, plus these steps
25 that you want?

1 Are they going to start at square one
2 and go right through to square 540 or however many?
3 MR. SALLEY: No, they have the freedom
4 to inspect how they want to inspect. You know, they
5 have enough latitude to do what they think is best.
6 MR. ROSEN: So they're going to do some
7 sampling.
8 MR. SALLEY: Yes, it's always sampling,
9 but as to where they sample, they can have a number
10 of options as to how they want to sample. For
11 example, what was classically done in the first
12 round of triennials was to look at the IPEEEs and
13 say where is the most risk significant areas of this
14 plant, and that was one area they liked to pick up
15 on.
16 They have that same option with this or
17 they can look at the components, and when they back
18 off of P&ID and say, "These are the components I'm
19 concerned in. Which fire areas do they pass
20 through?"
21 MR. ROSEN: So let's take a hypothetical
22 inspector at a hypothetical PWR. He knows the
23 auxiliary feedwater system is one of the most risk
24 significant systems. He knows which compartments
25 hold key auxiliary feedwater system components,

1 pumps, valves, and so he says, "Okay. Here's this
2 compartment. I select this compartment. I'm going
3 to do this analysis."
4 He finds out what cables are in that
5 compartment and in what trays, and he then applies
6 this kind of logic to that kind of cable. Also he
7 finds out what is thermoset or thermoplastic, and he
8 picks out, "Ah, here's one that doesn't pass my set
9 of tests."
10 Isn't it certain that if he's going to
11 do that, that he's going to find areas where the
12 test, the multiple kind of thinking that this
13 implies will not pass because that was not a
14 criteria for the design of the facility in the first
15 place?
16 MR. SALLEY: That's a long question.
17 Let me break it into pieces that I can answer.
18 Was it a criteria for the plant in the
19 first place? That's the kind of licensing basis,
20 design basis, and, yes, with some plants he could
21 find that. The licensing basis on some of the
22 plants are different.
23 MR. ROSEN: And the multiple spurious
24 associated circuit failures is beyond the design
25 basis or is it within the design basis?

1 MR. SALLEY: It's within it, but how it
2 was interpreted has been done differently at
3 different plants, depending upon when they were
4 licensed. That's part of the problem of how this
5 all got started.
6 MR. ROSEN: How 8-99-17.
7 MR. SALLEY: Yes.
8 MR. EMERSON: And if I can interject
9 here, the difference in interpretation of the
10 regulatory guidance was how this issue got started
11 five years ago. Most licensees would say multiple
12 spurious actuations was not within their design
13 licensing basis, and their argument over whether it
14 was or it wasn't led to the desire for a risk
15 informed solution
16 MR. ROSEN: So in some places at least
17 this hypothetical inspector will, in fact, find
18 problems.
19 MR. SALLEY: Yes.
20 MR. ROSEN: Then what?
21 MR. SALLEY: Then he has to enter the
22 process. If it's in the licensing basis, how he
23 deals with it, we have the SDP as to the risk
24 significance.
25 Sunil, if there's anymore on process.

1 MR. WEERAKKODY: If we had started the
2 inspection process today, then they are finding -- I
3 don't think there's a whole lot more to add to what
4 you say -- they will enter the reactor process and
5 look at if they are significant and then whatever,
6 you know, color that the finding gets colored that
7 way, and if it's green, you know, depending on the
8 color there will be -- I think your interaction
9 matrix --
10 MR. ROSEN: Let me roll you back again.
11 MR. WEERAKKODY: yeah.
12 MR. ROSEN: I understand the action
13 matrix and the ROP. Coming back to the beginning
14 now for plants that have gone through this analysis,
15 we're talking about cable attributes, that portion
16 of your thing there.
17 But the plants have barriers to fire
18 progression.
19 MR. SALLEY: That's right.
20 MR. ROSEN:
21 MR. ROSEN: Does that get counted, taken
22 into account?
23 MR. SALLEY: Sure. I mean, this all
24 gets down to Appendix R. I mean, the 3G2, if the
25 licensee had that cable and that cable gave them the

1 interaction and they protected it with an electrical
2 raceway fire barrier system, then obviously it's in
3 compliance and the inspector moves on.
4 It is, I guess, the compliance issue to
5 the licensing basis is where it all begins.
6 MR. ROSEN: Okay. AT some point you're
7 going to write an inspection for this?
8 MR. SALLEY: It's drafted.
9 MR. WEERAKKODY: It's drafted already.
10 MR. ROSEN: Well, Peter can give us some
11 insights.
12 MR. WEERAKKODY: Come on over.
13 MR. KOLTAY: My name is Peter Koltay.
14 I'm with the Inspection Program Branch.
15 First of all, the inspection procedure
16 that exists out there is a viable procedure. The
17 only thing we stopped three years ago, we asked them
18 not to identify or pursue issues that deal with
19 associated circuits.
20 So we stop inspecting in that one area.
21 So the inspection procedure that's going to be
22 updated is the same inspection procedure we had
23 before. The information on procedures coming out of
24 the technical group, okay?
25 And we're still trying to figure out

1 where we break down the inspection guidance to the
2 inspector and then the screening process that the
3 inspector is going to use to determine if they have
4 a finding.
5 Like Dr. Rosen just said before, an
6 inspector is going to go into a room and start
7 looking at associated circuits and evaluating them.
8 I'm not sure that's going to really happen.
9 First, the inspector needs to have a
10 reason to suspect or identify performance
11 deficiency. Going back one more step, the inspector
12 has to understand the design basis, and based on the
13 design and licensing basis, he's doing his
14 inspection. He identifies a performance deficiency.
15 It may or may not be in the associated circuit or
16 any circuit area at all. It could be separately
17 criteria. It could be any other defense in depth
18 element in that specific fire area that starts them
19 off on the process of determining how significant
20 the performance deficiency is.
21 And that may lead him to looking at the
22 associate circuit analyses. That's how I foresee at
23 this time getting into that, unless you have some
24 other thoughts.
25 MR. ROSEN: What you were saying, I

1 think, is that there is not going to be a broad
2 scale, de novo review. There's only going to be a
3 case-by-case review if something else that the
4 inspector sees or if that point event occurs prompts
5 him.
6 MR. KOLTAY: Exactly. In other words, I
7 don't foresee inspectors going out and saying, "The
8 purpose of my inspection today is to evaluate the
9 way associated circuits were handled in this
10 particular room, although they may -- well, let me
11 take that back.
12 They may go back and ask, "Give us your
13 associated circuit analyses for this room," and they
14 review that. And if they feel that there's
15 something wrong with that, they'll go down the path
16 of additional evaluation and determine what may be
17 wrong with it and determine where the performance
18 deficiency is.
19 Okay. That's one way of getting into
20 looking at associated circuits.
21 MS. BROWN: Hi. I'm Eva Brown. I'm the
22 lead PM for Fire Protection and also was a team
23 leader on several inspections, one at some of the
24 Duke plants.
25 We've had some of these issues, and we

1 would look at associated circuits once we get
2 permission to do so. It would be a risk informed
3 choice of certain circuits, block valves, poured
4 valves, other types of valves like that that we know
5 are associated circuits and maybe important to the
6 maintaining the ability to safely shut down.
7 And also in the course of an inspection
8 if we did find something else in another area that
9 may be associated circuit related, then we would get
10 into what Pete was discussing, but we will be
11 looking at associated circuits for a certain group
12 that are risk --
13 MR. ROSEN: Well, my question went to
14 the question of what is the catalyst for this
15 inspection, and Peter answered it by saying
16 something else is going on, not just a purely I'm
17 going out today into a pristine environment, to a
18 safety significant space, and starting an associated
19 circuit evaluation. That wouldn't be the way it
20 would start.
21 MS. BROWN: It's going to be both.
22 MR. ROSEN: It would be both you think?
23 MS. BROWN: It's the way I plan my
24 inspection, yes, sir.
25 MR. ROSEN: Oh, okay. All right.

1 MS. BROWN: It would be both.

2 MR. KOLTAY: It's part of the alternate

3 shutdown inspection.

4 MS. BROWN: Yeah, that's part of what

5 the electrical inspector does, is they take a look

6 at --

7 MR. ROSEN: Okay. So that clarifies it.

8 MR. SALLEY: It's an element of the

9 overall procedure, I think is the summary.

10 Back to my slides, I talked about what

11 we called bin two in February, the moderate risk

12 items. This is -- J.S. maybe able to answer this a

13 little bit better than me -- but these are the items

14 that are currently with our research folks over in

15 Research.

16 This is the questions that we're not

17 sure of. We don't have a good feel from the tests

18 that were done, and that's the intercable shorting

19 between the thermoset cables.

20 Speaking from memory, I believe there

21 was like one case maybe where that occurred in all

22 of the testing that was done in Texas.

23 How many cables do we have to have to

24 get the bad action scenario? Is it three, four,

25 five, six, seven? Where do you draw the line in a

1 realistic space?

2 That question is currently over with

3 Research. We've got two, and that's where we're

4 going to start this from.

5 Dennis had mentioned CPTs. Control

6 power transformers were put in halfway through the

7 NEI testing, and they made a difference because now

8 you can make the spurious activation happen.

9 Depending upon your current leakage through the

10 insulation, it can significantly reduce them.

11 Just as to what effect and, you know,

12 what balance it is, we don't have an answer.

13 Research is looking at that.

14 The other question then, too, is how

15 long does this hot short last for. Speaking from

16 memory, I believe that 20 minutes was the longest

17 one that we had seen in about that area, and after

18 20 minutes if you take the hot short away and the

19 valve returns to its normal position, how do you

20 factor that into the overall analysis?

21 So these are the questions that are

22 sitting today.

23 MR. ROSEN: Well, the valve did not

24 return to its position, too. I mean, the circuit

25 may be designed in such a way that it seals in.

1 MR. SALLEY: That's true.

2 MR. ROSEN: In the valued position.

3 MR. SALLEY: Right. So it depends on

4 the circuit design.

5 MR. ROSEN: We understand that, yes.

6 MR. SALLEY: But that duration time is

7 something we need to look at, and these are the

8 items that are currently with research today.

9 J.S., do you have anything you would

10 like to add?

11 MR. HYSLOP: I'll talk about it in my

12 presentation. Basically like Mark said -- this is

13 J.S. Hyslop -- research has a user's need to

14 identify if any other circuit issues should be added

15 to the inspection, and for that user's need, we're

16 going to be looking at the current available

17 information to make this decision.

18 And so whatever decisions we can make

19 with the current information we'll make, and then

20 we'll go from there.

21 DR. POWERS: Are you going to comment on

22 the current information?

23 Much has been made about the EPRI fire

24 tests which have been presented to this

25 subcommittee, and I think in fact even to the full

1 committee, and in the course of those presentations,
2 the speakers would put, as all experimentalists tend
3 to do, put lots of caveats that said, "Ignore these
4 experiments," and lots of criticisms have arisen.
5 I mean, the fact of the matter is it's
6 one set of tests and one particular configuration.
7 It's a subset of all of the conditions that you're
8 really interested in.
9 Are you going to identify what a really
10 useful database would look like, how big it is, what
11 kinds of conditions it would look at?
12 MR. HYSLOP: Well, whatever conclusions
13 we draw will be predicated upon the data that we've
14 decided to base those conclusions on. So in that
15 sense, you know, we'll be supporting our
16 conclusions.
17 DR. POWERS: But, I mean, here's what I
18 know, is that fire has become an issue of
19 international significance, and everybody out there
20 is facing the same problem. To create a database is
21 an expensive thing, and it's difficult for one
22 person to do it.
23 If a guy could come in and say, "Look.
24 I've looked at this data that we have. I've looked
25 at our needs, and here's the data we ought to have,

1 and the highest priority data to facility things,
2 the second and the third."
3 He might be able to put together an
4 international consortium type experimental program
5 that would actually get it, whereas right now
6 everybody looks at the cost and says, "Huh-un, I
7 just don't know whether I can do it," and the guys
8 that are doing it, you know, in those cases like in
9 France where they have experimental programs,
10 they're not coming in armed with some comprehensive
11 examination of what the needs are, the fighting,
12 whatever flaming duck is the current big brouhaha.
13 And so something like that might get you
14 into a position where, you know, some critical
15 examination of what the database needs are as
16 opposed to the data that you have might get you into
17 a position where you could get some of these data.
18 MR. HYSLOP: I think the results of this
19 public meeting and the next one may help steer us in
20 that direction because, you know, this last public
21 meeting where important circuit analysis and ones we
22 weren't quite sure of were developed, and to my
23 knowledge, that was the first coming together of a
24 group.
25 So, you know, I see these public

1 meetings as potentially spawning activities, and
2 you're right. There are international programs.
3 The Germans are doing some testing it is my
4 understanding, too, and you know, research. We
5 collaborate with these groups.
6 And so I would expect us to start
7 thinking along the lines related to this information
8 that has come out of these meetings.
9 DR. POWERS: Well, I'm just suggesting
10 make it an ancillary. I mean, as you go through
11 these things --
12 MR. HYSLOP: Be organized about it.
13 DR. POWERS: -- find holes in the
14 database and find challenges. If you just keep a
15 set of notes and say, "This would be very useful and
16 this would be useful," and put out a document that
17 says, "Here's the data that would be really useful
18 for this," then you've got a position to go to these
19 people and say, "Hey, if I've got these needs,
20 everybody else does," because these plants are not
21 all that different in Western Europe and Japan.
22 You might be able to put something
23 together here that no individual country can really
24 afford to do. Become a hero.
25 MR. HYSLOP: Yeah.

1 MR. ROSEN: Okay.

2 MR. HYSLOP: That's a good suggestion.

3 I'll take that back.

4 MR. ROSEN: Mark, you've got three more

5 slides, and I'll give you three more minutes.

6 MR. SALLEY: Okay.

7 DR. POWERS: He's giving a good

8 presentation. Lighten up.

9 MR. SALLEY: I'm on Slide 9. Okay.

10 These are the bin three items, and this is what the

11 consensus of the group said were the lowest of the

12 risks in the associated circuit arena, and let me

13 just walk through the list that easiest.

14 Open circuits. We defined open circuits

15 as were the copper conductor typically vaporized,

16 and you physically lost the continuity. You know,

17 we didn't see that in any of the tests. You didn't

18 see that in Browns Ferry. So that seemed to be a

19 low risk where the conductor physically leaves.

20 DR. POWERS: I have seen fire tests of

21 bore rate packed cables in which the copper didn't

22 vaporize. It dissolved in the borate, and the

23 borate was put in as a fire suppressant and melted

24 and lost the copper not by vaporization, but by

25 dissolution.

1 MR. ROSEN: Well, you could take that
2 for study.
3 DR. POWERS: But it's another thing to
4 look at because I don't know whether MGO packed
5 cables will do this, but the borate ones -- I mean,
6 the work was done in the Netherlands, and the idea
7 was the borate would act like a really good fire
8 suppressant, and it was a really good way to wipe
9 conductors out and create a liquid now that itself
10 was highly electrically conducting, and it just
11 shorted out everything.
12 MR. SALLEY: That's interesting.
13 DR. POWERS: If you need a reference for
14 it, it was the Material Research Society meeting in
15 San Francisco about four years ago.
16 MR. SALLEY: And they do that for fire
17 protection, was why they put the borate there in the
18 first place.
19 DR. POWERS: What did you say?
20 MR. SALLEY: He had the borate there for
21 fire protection?
22 DR. POWERS: Yeah, that's right. That's
23 right.
24 MR. SALLEY: Okay. The second item
25 we're going to look at is the intercable shorting

1 between conduits and armor cable. Again, we want to
2 be complete. That's why we want to look at it, but
3 I think we can all fathom that if you have an air
4 drop that passes along a conduit, that air drop is
5 not going to pass through the conduit and get the
6 conductors inside.
7 But we want to be complete and look at
8 it.
9 Multiple high impedance faults of a
10 common power supply, that's one that seems to be
11 somewhat weak. The probabilities of that happening
12 based upon what we're seeing didn't seem to be that
13 good. We want to look a little more at that and
14 make sure that that doesn't occur.
15 DR. POWERS: It has occurred to me.
16 MR. SALLEY: The three phase failures
17 occurring with proper polarity, what we're looking
18 at here is the power cable, and typically you'll
19 find your three phase cables are set up in a piece
20 of triplex. They have a piece of triplex on a power
21 side along with another piece of triplex such get to
22 it from Phase A to A, B to B, and C to C.
23 Again, in reality space this tends to be
24 out there quite a bit.
25 And reversible DC motors, the power

1 cables, from what the electricals have explained to
2 me that you need five failures to come in in the
3 correct polarity in order to make that DC motor
4 work.
5 Again, getting the five failures,
6 getting it in the correct polarity for that
7 reversing motor to work seems to be getting more far
8 out on the probability curve.
9 Again, this is the second tier of things
10 that the folks in research will be looking at it for
11 us.
12 Next slide.
13 These will be quick. Our remaining
14 activities. Just to finalize what Sunil said in the
15 opening is we plan to --
16 MR. ROSEN: This is number ten, right?
17 MR. SALLEY: N, this is number ten.
18 MR. WEERAKKODY: We skipped one.
19 DR. WALLIS: We have it. So you can
20 talk about it.
21 MR. SALLEY: Okay.
22 MR. ROSEN: You're talking about ten.
23 He's got 11 up there.
24 MR. SALLEY: I'm on ten.
25 We're going to issue the risk as final

1 after we've gotten comments, and I have gotten a
2 number of comments, and it will do some changes.
3 We are going to be issuing a draft
4 NUREG. I've got a number for it. It's 1778, and
5 it's going to be out for public comment, and this
6 will form the knowledge base of all the circuit
7 analysis we've had since 1980, and try to put
8 everything into one coherent package.
9 A public workshop. Before we actually
10 start the inspections, we'll have a public workshop
11 with our stakeholders. We're looking at about the
12 November time frame, November of this year.
13 And Peter, as he said, he's revised the
14 insepction procedures. That will be continual. If
15 the bin two items come back with something that's
16 risk significant, Peter will make an adjustment in
17 the inspection procedure accordingly. So that will
18 be ongoing with the Office of Research.
19 In conclusion, our goal here was to try
20 to make the associated circuits, the inspections be
21 in a more risk informed manner and look at the risk
22 significant cases. That's what we're going for, and
23 we're trying to do that, of course, so that we can
24 make the most effective use of the inspection
25 resources.

1 That's all we have.

2 MR. ROSEN: All right. Are there any

3 questions from members of the -- pardon?

4 I'm sorry. J.S., how much have you got?

5 ** MR. HYSLOP: J.S. Hyslop, one slide.

6 MR. ROSEN: We're 20 minutes into our

7 slide.

8 MR. HYSLOP: Yeah, I have one slide --

9 MR. ROSEN: All right. Go ahead.

10 MR. HYSLOP: -- just to sum up research

11 support for the circuit analysis resolution.

12 First of all, Research participated in

13 the industry Omega Point circuit analysis test. We

14 did that by adding cables and a test rig to provide

15 more extensive information on cable failure modes.

16 This complemented the industry test.

17 We supported the expert elicitation

18 panel, which was the panel to interpret spurious

19 actuation data on the test.

20 We've authored a chapter on risk in the

21 draft N.R. NUREG 1778, which was described earlier,

22 and there we've identified risk insights as far as

23 circuit analysis goes.

24 We participated in the February public

25 meeting to identify important circuit issues for

1 plant inspections, their research law with NRR and
2 industry.
3 We've been asked by NRR to participate
4 in the upcoming public meeting on associated
5 circuits later in the fall.
6 And then the last thing that we've done
7 is agreed to address the user's need, which I
8 described in response to Dr. Power's earlier
9 question on research support for circuit analysis.
10 I guess lastly I'll give a little
11 promotion. Research is in the process of publishing
12 a NUREG which is a multi-year effort on circuit
13 analysis. Sandia is the author of that NUREG.
14 And it's that NUREG which is really
15 enabling us to or the work done in that enabling us
16 to help NRR so effectively. We initiated this
17 program prior to those Omega Point tests. So I just
18 wanted to let ACRS know about that.
19 MR. ROSEN: Well, that's all very
20 helpful. We have to write an input to the ACRS
21 report on research agency wide. So this is the kind
22 of stuff we need.
23 MR. HYSLOP: Yeah. Any questions?
24 (No response.)
25 MR. HYSLOP: If not --

1 DR. WALLIS: So you are doing all of the
2 things that Mark said you were doing?
3 MR. HYSLOP: I can't remember what Mark
4 said, but I'll just summarize. Yes, we've got a
5 user's need.
6 DR. WALLIS: It's Sandia that's doing
7 that work --
8 MR. HYSLOP: Sandia is looking to
9 identify whether any of the circuit analysis issues
10 were excluded, whether they should b included in bin
11 one or using the available information to make that
12 determination. So we're doing that.
13 MR. ROSEN: All right. Well, with that,
14 we'll thank you all for this morning's
15 presentations. We'll stay in recess until 1:15, and
16 I'll try and squeeze a little more time out of the
17 presenters this afternoon and get that on schedule.
18 Thank you. We are in recess.
19 (Whereupon, at 12:25 p.m., the meeting
20 was recessed for lunch, to reconvene at 1:18 p.m.,
21 the same day.)
22 CHAIRMAN ROSEN: We're back. Mr. Fred
23 Emerson of NEI. Nice to see you, Fred.
24 MR. EMERSON: Thank you. You'll see
25 more of me later, too.

1 CHAIRMAN ROSEN: We're reflecting,
2 meditating.
3 MR. EMERSON: Most people are sitting in
4 the back.
5 MEMBER WALLIS: Are you going to resolve
6 something for us?
7 MR. EMERSON: Well, I've been working at
8 it for the last seven years. I hope to.
9 MEMBER SIEBER: When are you eligible
10 for retirement?
11 MR. EMERSON: About another seven years.
12 CHAIRMAN ROSEN: They haven't told you
13 that this needs to --
14 CHAIRMAN ROSEN: All right. I think we
15 are ready, Fred.
16 F. NEI DISCUSSION
17 MR. EMERSON: Thank you for the
18 opportunity to present some of the industry
19 perspectives on fire-induced circuit failures. You
20 heard this morning from the staff about their plans
21 for proceeding with the inspection of associated
22 circuits again. I am going to provide a little bit
23 different viewpoint.
24 Mark Salley made a number of references
25 to the NEI testing. Topics I am going to cover, I

1 am going to spend one slide telling you what we told
2 you last June from the standpoint that I am not
3 going to cover the same ground again. Then I am
4 going to talk about the current status of resolving
5 fire-induced circuit failure issues.
6 These were the topics we addressed at
7 the last meeting. We talked about the EPRI-NEI
8 circuit failure testing. I want to be sure I give
9 due credit to EPRI because they were an important
10 part of this testing activity. At the time we
11 talked last, we only had observations. We didn't
12 have hard data and conclusions. We do now.
13 We talked about the expert panel
14 development of probabilities of cable damage and due
15 to fire and the probability of spurious actuations.
16 So I will not be going into that at all.
17 MEMBER WALLIS: As I remember, you had
18 lots of observations, but it wasn't much in the way
19 of theory or correlations or something that you
20 could use to predict what would happen.
21 MR. EMERSON: Well, I'll be touching on
22 the point of how predictable these are, how well you
23 can characterize them a little bit later in this
24 talk. We talked about the pilot evaluations. And
25 Doug touched on it again this morning.

1 And we talked about some of the issues
2 that remain to be resolved with NEI 00-01, which is
3 the industry document intended to resolve some of
4 the open issues related to circuit failures. But
5 that was in draft, and it has now been issued as
6 Rev. 0.
7 So the topics I will address today, I
8 will be presenting a sampling and only a sampling of
9 the conclusions, the results and conclusions of the
10 EPRI NEI testing. And I would refer you to this
11 EPRI report that is on the screen for a detailed
12 summary.
13 That report is about 400 pages of text
14 and many, many, many tables and figures showing
15 detailed results for each of the 18 tests that we
16 did. A complete review of that would depend on the
17 review of this document.
18 MEMBER WALLIS: Again, are these just
19 curves or something or is there some attempt to
20 understand what happened and model it?
21 MR. EMERSON: We have not made any
22 attempt to model it. We are reporting on
23 observations and conclusions that we had drawn from
24 those observations in making an attempt to use that
25 information to move forward with the resolution of

1 this longstanding regulatory issue. I would leave
2 any modeling to a research effort, which we're not
3 really funded to do.
4 The second topic I will cover briefly is
5 a summary of where we are with the NEI 00-01
6 document, the Revision 0 that has been submitted to
7 the staff for review, its intended use. And I'll
8 address specifically the deterministic methods, the
9 probablistic or the risk methods that are in there,
10 and our conclusions on multiple high impedance
11 faults, which was touched on this morning in Mark's
12 presentation.
13 The last, very last, of the 35 slides
14 that I have will be recommendations for issue
15 closure, more regulatory than a technical position.
16 Because there are 35 slides and I have an hour, I am
17 going to be going through them fairly quickly.
18 This is what the EPRI test report
19 includes. There is a detailed description of all
20 the tests. Each test is reviewed and analyzed on a
21 test-by-test basis. And the information about those
22 tests that you see listed is provided in the test
23 report.
24 MEMBER WALLIS: How is it analyzed if
25 you didn't do any modeling?

1 MR. EMERSON: In other words, by
2 "analysis," I meant we went through the results of
3 the tests and tried to draw some conclusions on it
4 based on the information that we got, the
5 temperature curves, the electrical profiles that we
6 generated, the actual spurious actuation results
7 that we got. We tried to correlate all of that
8 information to try to get a picture of just to see
9 what conclusions we could draw.
10 MEMBER WALLIS: So this will be the sort
11 of word analysis that a lawyer might view as rather
12 than a scientific type of analysis?
13 MR. EMERSON: I would like to think
14 there was some science involved in it. We didn't
15 have a lawyer review it.
16 MEMBER WALLIS: But it is a word
17 analysis?
18 MR. EMERSON: It is an analysis of the
19 data, rather than an attempt to model.
20 MEMBER WALLIS: It's descriptive and --
21 MR. EMERSON: It's descriptive of the
22 actual results, rather than an attempt to be
23 predictive. Dennis?
24 MR. HENNEKE: Yes. Dennis Henneke, Duke
25 Power.

1 When you refer to modeling, there was a
2 considerable amount of modeling done for predictive
3 purposes, the features that can affect the circuit
4 analysis and spurious actuation failures; for
5 example, time, which Fred will talk about in a
6 little while.
7 They did some time curves on there to
8 see how long the spurious actuation can occur and
9 found the median time for spurious actuation was
10 about two minutes. And then all circuits cleared
11 within 13. So then you can set that to a
12 probability. And you have a model of time versus
13 spurious actuation.
14 They also looked at temperature and the
15 probability of cable damage versus temperature. We
16 looked at the effect of CPTs and what factor that
17 would have on the risk.
18 There are factors in order to generate
19 if you have a configuration at your plant. You look
20 at the various factors, and you can determine the
21 spurious actuation probability, but it's not
22 extended to a circuit that they haven't run tests on
23 to create a model to predict what its probability
24 is.
25 MEMBER WALLIS: No. What I just mean is

1 that you must have strongly resisted the temptation
2 to do technical analysis when you see a temperature
3 which is going on so exponentially for some sort of
4 equilibrium.
5 It must be very tempting to say, "I
6 understand why it is doing that because I know
7 something about heat transfer, heat capacity, and so
8 on." You resisted the temptation to use what you
9 learned in school. That's all.
10 MR. HENNEKE: Well, it was just after
11 failure we were looking at the various probabilities
12 of when it failed, what it would fail to look like,
13 rather than why, I guess.
14 MR. EMERSON: Okay. This was the
15 configuration. This is a typical configuration.
16 And I'll show you a sampling of the curves that were
17 generated for the test pertaining to this
18 configuration.
19 Typically we had two layers of cable in
20 a ladder-backed tray. It was in an L-shaped
21 configuration, as I've indicated in previous
22 presentations here. We had four instrumented cable
23 bundles of the type that Mark showed this morning,
24 where we had a single multi-conductor cable
25 surrounded by three single conductor cables. Those

1 are the orange circles in the tray.

2 MEMBER WALLIS: Can I ask you, when they

3 actually lay cables, they don't fit as neatly as

4 this, do they?

5 MR. EMERSON: Well, in an actual plant,

6 some plants have them, some tied off. And they're

7 kept pretty much in order. Some plants it's very

8 random.

9 We tried to create some reproducibility

10 in the test so that we could make changes.

11 MEMBER WALLIS: So you laid them in very

12 carefully and straight and parallel?

13 MR. EMERSON: Well, they were touching

14 each other. It doesn't show that here, but we tried

15 to create a configuration that was as close to an

16 approximation of how they are actually done in a

17 plant as we could.

18 The instrumented bundles are shown by

19 the DA numbers, DA 1, 2, 3, and 4. We tried to vary

20 the locations to measure the -- we tried to measure

21 the effects of locating the cable on the bottom or

22 the top of the rows. Sometimes we varied the number

23 of rows of cable to see what the effects were of

24 varying tray fill. And I will get to that a little

25 later.

1 The test results, we created temperature
2 and electrical profiles for each one. And I'll show
3 you a sampling of those profiles for this actual
4 case in a slide or two.
5 We created a graphical depiction of
6 cable performance. And these were helpful in
7 identifying patterns and trends. We made
8 observations and tried to draw conclusions from
9 collections of the data.
10 And we spent a lot of time reviewing.
11 There was a huge amount of data that we gathered
12 from these tests. And we did the best we could at
13 trying to draw conclusions that were useful in a
14 regulatory environment.
15 As was indicated this morning, there are
16 probably some areas where questions still remain
17 that are subject to further research. The example
18 profiles you'll see on the next couple of slides
19 involve a seven-conductor and single-conductor
20 thermoset cable bundle.
21 As I mentioned, the heat release rate
22 for this particular bundle was 350 kilowatts, which
23 was toward the upper range of the heat release rates
24 we tested. It was located in the bottom of the tray
25 and used a laboratory power supply.

1 This presents a temperature profile.
2 This is typical of the types of temperature curves
3 that we have in the -- this represents -- I'll see
4 if I can speak into the microphone while turning it
5 around 00 average and maximum temperatures in the
6 vicinity of the cable bundle.
7 You'll see a reference to the onset of
8 failure and full failure. In the subsequent figure,
9 I'll explain just exactly what those terms mean.
10 The onset was at 35 minutes, and the full failure
11 was at 42.
12 MEMBER WALLIS: Onset is the beginning
13 of a short --
14 MR. EMERSON: Yes. And I'll --
15 MEMBER WALLIS: -- the beginning of
16 melting or --
17 MR. EMERSON: It will be very clear on
18 the next slide what that means.
19 MEMBER WALLIS: So the maximum
20 temperature is on the outside of something?
21 MR. EMERSON: The maximum temperature is
22 in the dark blue line.
23 MEMBER WALLIS: That's the outside of
24 the cable?
25 MR. EMERSON: Yes. The temperatures

1 were measured not in the cable. We didn't insert
2 thermocouples into the cable itself, but we measured
3 them on adjacent cables.
4 MEMBER WALLIS: So the maximum, so skin
5 temperatures, as they were? And the average skin
6 temperature is on the outside of the cable?
7 MR. EMERSON: On the outside of the
8 cable.
9 MEMBER WALLIS: Probably where the
10 breakdown would probably start would be on the
11 outside?
12 MR. EMERSON: You would think so, yes,
13 following classic heat transfer.
14 MEMBER WALLIS: And the failure was the
15 one that was at the maximum temperature? Which one
16 failed?
17 MR. EMERSON: I'll get to that.
18 MEMBER WALLIS: I was wondering what I
19 should interpret from the fact that you got a
20 maximum and an average here.
21 MR. EMERSON: We were, again, trying to
22 correlate the failures that we got, whether they
23 were hot shorts or spurious actuations or shorts to
24 ground with the temperatures at which they occurred
25 to try to get some feel for how long it takes and

1 what are the temperature conditions required to
2 produce the cable failures of interest.
3 MEMBER WALLIS: You are going to show us
4 more? This is the only temperature profile we are
5 going to see?
6 MR. EMERSON: Yes. This is the
7 temperature profile. If you keep that in mind while
8 we are looking at the next slide, it shows on the
9 left is the voltage performance of this particular
10 cable bundle and on the right is the current. I am
11 going to try to illustrate this. I guess I can't
12 pull that out.
13 The onset of failure is at the far left
14 here, where the voltage between the two cables
15 starts to increase.
16 MEMBER WALLIS: What's the one which has
17 already started? That yellow one has already done
18 something before 4:30.
19 MR. EMERSON: Each of the colors
20 represents a different conductor in the bundle.
21 MEMBER WALLIS: They should be either
22 zero or 120.
23 MR. EMERSON: Right. That's correct.
24 MEMBER WALLIS: Some of them have
25 already departed before you got to 35 minutes

1 presumably. Am I looking at the wrong thing? They
2 should be all either zero or 120. At least two of
3 them are at some intermediate place at 35 minutes,
4 right?
5 MR. EMERSON: Well, the start of the
6 picture is at 35 minutes, rather than at zero.
7 MEMBER WALLIS: Something has failed
8 before that.
9 MR. EMERSON: Since this is 35 minutes
10 -- back at zero, they will either be zero or 120.
11 MEMBER WALLIS: That one which is brown
12 or red or some different color there, red, that has
13 already failed a long time before presumably.
14 MR. EMERSON: Well, it hasn't achieved
15 full failure yet. We started to get some current
16 leakage between --
17 MEMBER WALLIS: Any current leakage is
18 symptomatic of failure because insulation should
19 prevent essentially any current leakage.
20 MR. EMERSON: Symptomatic of failure,
21 but it has not yet resulted in a hot short or a
22 spurious actuation.
23 MEMBER WALLIS: But it might have
24 started at 20 minutes.
25 MR. EMERSON: The insulation resistance

1 breakdown? Yes, it might have, but it hasn't yet
2 resulted in a --
3 MEMBER WALLIS: That might be enough to
4 cause a spurious signal to something.
5 MR. EMERSON: Well, the spurious signal
6 is that particular curve where it spikes up to 120
7 volts, starts from zero and spikes up to 120. The
8 information you saw in the previous slide for the
9 onset of failure was here beginning at 35 minutes,
10 where you started to get a slow increase in the
11 voltage to that conductor.
12 When the failure actually occurred at 42
13 minutes, it spiked up. And you got the spurious
14 actuation here.
15 MEMBER WALLIS: Okay. What are the
16 other two curves, then?
17 MR. EMERSON: The other two curves
18 represent other conductors, where the voltage did
19 not get up to --
20 MEMBER WALLIS: It never got up to 120?
21 MR. EMERSON: It never got up to 120.
22 It did not. There was no spurious actuation.
23 MEMBER WALLIS: Obviously something has
24 happened to the insulation.
25 MR. EMERSON: Yes. Oh, yes, it

1 certainly has, but --

2 MEMBER POWERS: If we had done this

3 experiment ten times, would we have seen the same

4 conductor spike up to 120 and the other 3 conductors

5 give just this small lump or would one or the other

6 one of them have spiked up to 120?

7 MR. EMERSON: That's difficult to say.

8 I wouldn't care to predict that we would get exactly

9 reproducible results in ten separate experiments.

10 CHAIRMAN ROSEN: Could it have been

11 worse?

12 MR. EMERSON: It could have been worse.

13 It could have been better. It's very difficult to

14 reproduce the exact temperature profiles, the exact

15 layout in the tray, the exact --

16 CHAIRMAN ROSEN: So you're not going to

17 hang your hat on the fact that you've got 42 minutes

18 until we get a spurious actuation?

19 MR. EMERSON: Not for a single

20 actuation, not for a single result. But if you look

21 at the aggregate of the results, which we will do in

22 a little bit, we believe that you can. That

23 information is useful.

24 In fact, that is one of the conclusions

25 that we drew, is that in the aggregate, the data can

1 be useful for generating conclusions that can be
2 applied in the regulatory arena, but you cannot
3 predict for any single conductor or any single cable
4 exactly what will happen. You just can't do it.
5 MEMBER POWERS: Would you remind me,
6 Fred? Did you conduct any of the tests such that
7 they were as identical as humanly possible, one was
8 identically as possible to another one?
9 MR. EMERSON: No. With the limited
10 number of tests, we were trying to cover as many
11 parameters as we could. If I remember a meeting
12 that we had in front of the subcommittee maybe three
13 years ago, while we were setting this up, you all
14 recommended that we have an analysis done to make
15 sure that the data we were capturing -- it was
16 reasonable to make the parameter variations we were.
17 We were to get as much information as we
18 could. And we had the University of Maryland
19 analyze our test setup to make sure that we were
20 doing that.
21 MEMBER POWERS: I can't imagine somebody
22 on this subcommittee didn't whine that you have to
23 do a replicate test and --
24 CHAIRMAN ROSEN: There was someone. It
25 was you, actually, Dana. You were arguing for more

1 repeatability, and Nei was arguing for a broader set
2 of tests given the finite resources.
3 MR. EMERSON: There was no way we were
4 going to do enough tests. We just didn't have the
5 resources or the time to do that. We were trying to
6 get the maximum amount of information from a minimum
7 number of tests.
8 And that's what we asked the University
9 of Maryland to help us decide, whether we were going
10 about that the right way. And their answer was yes.
11 MEMBER WALLIS: Something that is
12 peculiar, it says "spurious actuation of DA number
13 3-2." This is cable number DA number 3? The "-2"
14 color doesn't correspond to that color of the one
15 that reached 120 volts. Number 2 has a different
16 color, both number 2's. It looks like number 3 at
17 the bottom or something. Which is it?
18 MR. EMERSON: Well, there were seven
19 conductors in bundle DA 3.
20 MEMBER WALLIS: And then they start
21 again at CUR number 1, 2, 3 as well. It's the
22 seven.
23 CHAIRMAN ROSEN: One conductor.
24 MEMBER WALLIS: There is one conductor,
25 and then there are seven. But the color doesn't

1 correspond to the number.

2 MR. EMERSON: I'm sorry. I'm not quite

3 following you.

4 MEMBER WALLIS: The color. That one

5 that spiked to 120, the light greenie-blue color

6 there, doesn't correspond to number 2 on your table.

7 That's all.

8 CHAIRMAN ROSEN: It's number 4 on your

9 table. It looks like 4.

10 MR. EMERSON: That one was for wire

11 number 4 in the bundle.

12 MEMBER WALLIS: Anyway.

13 CHAIRMAN ROSEN: I see your point. The

14 label on the chart says "spurious actuation of DA

15 3-2." Do you see that, Fred?

16 MR. EMERSON: Yes.

17 CHAIRMAN ROSEN: The color that looks

18 like it's spuriously actuated starts down at 35

19 minutes, flips around a little between 36 and 37,

20 showing some indication of distress, then comes over

21 and at 43 minutes or so is the one that creates a

22 spurious actuation, conductor number 4, not

23 conductor number 2.

24 MEMBER WALLIS: One would think so.

25 CHAIRMAN ROSEN: Right, by the colors.

1 Now, that is easy to screw up when you are doing a
2 chart like this.
3 MEMBER WALLIS: But number 2, isn't
4 number 2 the one which was wandering around and
5 partially wrong before? What's the one which was --
6 CHAIRMAN ROSEN: Number 3.
7 MEMBER WALLIS: -- you couldn't quite
8 see the color scheme there?
9 CHAIRMAN ROSEN: Number 3 is all
10 drifting upward. Number 4 wiggles around a little
11 bit.
12 MEMBER WALLIS: What's the one which is
13 -- what's this one here?
14 CHAIRMAN ROSEN: Yes. That's probably
15 number 7. But it cuts across here, goes right
16 across there. So it never reaches the full 120
17 volts. The point is that one conductor in this
18 cable becomes distressed and eventually provides 120
19 volts --
20 MR. EMERSON: Right.
21 CHAIRMAN ROSEN: -- current of voltage
22 across the actuator.
23 MR. EMERSON: Right. The other thing
24 from this slide that you can look at is a short to
25 ground, which is the performance typified by that

1 curve when you start off at 120 volts. And at some
2 point, it shorts to ground and drops almost
3 instantaneously to zero voltage.
4 So those were the two types of phenomena
5 that we saw, the spurious actuations and the shorts
6 to ground, in this. We saw no open circuits as
7 initial failure modes.
8 CHAIRMAN ROSEN: Now, if you are riding
9 a pump and it's running and that is a good thing,
10 your losing power and shorting to ground means the
11 pump stops.
12 MR. EMERSON: Right.
13 CHAIRMAN ROSEN: That's a bad thing.
14 But if it's a valve and it's already open by 53
15 minutes into the accident or whatever, it's probably
16 fine that it has long since taken its accident
17 position. And at 53 minutes, it shorts and stops.
18 And motor operating valves typically fail as is. In
19 this case, it wouldn't matter.
20 So you have to take into account the
21 design --
22 MR. EMERSON: Of course.
23 CHAIRMAN ROSEN: -- in terms of whether
24 these are significant failures. In every case, you
25 have to look at when did it happen, what was the

1 position? If it's a valve, is that the safe
2 position or the non-safe position? If it's a pump,
3 has the pump already discharged enough fluid to not
4 matter if it fails at 53 minutes and so on?
5 MR. EMERSON: And those are things that
6 are considered in the safe shutdown analysis as what
7 the failure mode is for each of the components
8 you're questioning.
9 CHAIRMAN ROSEN: And timing.
10 MR. EMERSON: Right.
11 CHAIRMAN ROSEN: Just by way of
12 information, the right-hand curve shows that doing
13 the same spurious actuation, the current was about
14 .25 amps. And we observed that in general, if the
15 current -- in some cases, you can see from the
16 current chart, the current ranges up to, say, .1 amp
17 or higher. In those cases, we did not get a
18 spurious actuation. It was the .25 amps were pretty
19 characteristic across many tests of the current
20 level when you did get one.
21 MEMBER WALLIS: The maximum amperage
22 there is bigger for the green one, which got to 120.
23 There's one above it which didn't get to 120 but had
24 more amps. So I don't quite know what to conclude.
25 MR. EMERSON: Well, the conclusion that

1 we drew from this chart is that if you are looking
2 at the data and you are trying to determine just by
3 looking at the data whether a spurious actuation has
4 occurred or not, that if it hasn't gotten 2.25 amps,
5 you didn't have a spurious actuation.
6 CHAIRMAN ROSEN: For this test
7 configuration?
8 MR. EMERSON: For this particular test
9 configuration, for this particular equipment setup.
10 MEMBER WALLIS: It looks to me as if
11 2.25 amps could be caused by a voltage less than
12 120.
13 MR. EMERSON: Well, the two were
14 together. It wasn't caused by the voltage being
15 less than 120. We found that the voltage levels
16 when you didn't have a spurious actuation were on
17 the order of 90, 80 volts or less. So it's a
18 combination of the two of them occurring
19 simultaneously or not occurring.
20 MEMBER WALLIS: So the real criterion
21 was the amps, rather than the volts?
22 MR. EMERSON: Again, we were using this
23 as a way to determine just by looking at the data
24 and trying to correlate what the temperature, what
25 the current, and what the voltage profiles were at

1 the time that we saw an actual actuation. The
2 actuations, as Mark had indicated, we set up actual
3 devices. And it was pretty obvious from looking at
4 the devices and the noise that was involved when an
5 actuation had occurred.
6 MEMBER WALLIS: So a motor wouldn't
7 start. It would probably go "brrrrrrrrrrrrrrrrrr."
8 And then it wouldn't start until it went up to a
9 high enough voltage?
10 MR. EMERSON: In some cases, we saw
11 that, where it just didn't quite get there. We saw
12 some relay chatter, but it didn't actually lock in.
13 MEMBER WALLIS: So the point is all of
14 this is very dependent on what is downstream. So
15 the --
16 MR. EMERSON: Certainly.
17 MEMBER WALLIS: -- behavior of the
18 device that is connected at the end of the wire.
19 MR. EMERSON: Yes, the type of device
20 you have connected, the type of current limiting
21 devices you have, all of that. Again, this was
22 provided only to indicate as a typical example the
23 type of electrical data that was generated.
24 And, again, we tried to do that. We
25 didn't want to measure just electrical conditions or

1 just spurious actuation, existence or nonexistence.
2 We tried to correlate the two to get some feel for
3 what was actually going on electrically when you did
4 have a visible spurious actuation.
5 MEMBER WALLIS: Now, to get back to my
6 colleague's question about repeatability, it seems
7 to me the actual trays, the wires are more
8 higgledy-piggledy, they're not put exactly parallel,
9 exactly straight, and that you would get a great
10 variability in the amount of shorts you would get
11 and which ones would short depending on all sorts of
12 uncontrolled variables here.
13 MR. EMERSON: That would be true if
14 there were a lot of cable-to-cable interactions, but
15 if you are looking at actuations within a single
16 multi-conductor cable, the location of the cable in
17 the tray is less important. You don't really care
18 whether it's higgledy-piggledy or whether they're
19 laid out in straight rows.
20 MEMBER WALLIS: The thermal transient
21 might depend on these things.
22 MR. EMERSON: Yes. Whether you got the
23 cable damaged would certainly be impacted by the
24 location.
25 Okay. Moving along, I am going to

1 provide, try to provide, a fairly quick summary of
2 the overall results. Again, this is a very broad
3 characterization with very little analysis involved.
4 Just this is a reporting of what we actually saw.
5 MEMBER WALLIS: This is why we're asking
6 so many questions. We are trying to figure out what
7 it is you actually took as a measurement and how
8 repeatable it was and what it might be due to and
9 what uncertainties there were so we can understand
10 sort of the meaning of these numbers you are going
11 to show us.
12 MR. EMERSON: Right, right. What we
13 measured were temperature, voltage, and current.
14 What we observed were spurious actuations or
15 failures of circuits via shorts to ground. And we
16 tried to correlate the observations with the
17 electrical and temperature measurements.
18 MEMBER WALLIS: So this failure is which
19 of these things. Is it a voltage or a current or
20 spurious actuation?
21 MR. EMERSON: The phenomenon that you
22 see electrically is a hot short. And the spurious
23 actuation is a result of the hot short. Not all hot
24 shorts result in spurious actuations.
25 MEMBER WALLIS: These numbers here where

1 it says "failure"?

2 MR. EMERSON: The failure was intended

3 to the three classic types of electrical failures

4 that are discussed in appendix R: open circuits,

5 ground faults, and hot shorts. So those are the

6 three types of failures we were attempting to --

7 MEMBER WALLIS: So a hot short is when

8 you get any volts or when you get 120 volts or when

9 you get any current or .25 amps or when is a hot

10 short a hot short and when isn't it a hot short?

11 MR. EMERSON: A hot short is when you

12 get two conductors transferring voltage from one to

13 the other. It may not be --

14 MEMBER WALLIS: Any deviation from zero

15 is a hot short?

16 MR. EMERSON: A hot short is when you

17 get two conductors touching and transferring

18 voltage.

19 MEMBER WALLIS: So any voltage recording

20 on your instrument other than zero or 120 presumably

21 is a hot short?

22 MR. EMERSON: It was probably a

23 threshold involved. I can't say that any voltage,

24 any minuscule voltage, would be considered a hot

25 short.

1 By way of general observations, we noted
2 that the percentage of ground faults versus hot
3 shorts for thermoplastic and thermoset cable was
4 approximately equal. Then the percentage was higher
5 for armored cable. I don't have a similar table for
6 spurious actuations, but what we observed is that
7 there was a higher percentage of ground faults for
8 thermoset cable than for spurious actuations. Again
9 --
10 MEMBER WALLIS: I am puzzled here. I
11 mean, when you showed us the data, you looked as if
12 you had 2 cables at 120 volts and 5 or 6 or
13 something, 5 at zero. So how do you get a ground
14 fault on the voltage that is already zero?
15 MR. EMERSON: Well, the ground fault is
16 when a voltage of 120 goes to zero.
17 MEMBER WALLIS: But if only 2 of the
18 cables are that, then are you taking 64 percent of
19 the ones which are hot? You must be doing that.
20 The ones which already have zero voltage but still
21 are grounded don't count?
22 MR. EMERSON: The ones which were
23 already at zero voltage obviously --
24 MEMBER WALLIS: They may have failed to
25 ground but you didn't know it.

1 MR. EMERSON: That's correct. You would
2 not know that.
3 MEMBER WALLIS: So I am trying to see if
4 this is percent of the ones which were at 120 that
5 --
6 MR. EMERSON: That's correct, the
7 percentage of ones that were at 120.
8 In general, we had gone into the test
9 with a theory, which did not hold up, that there was
10 some residual impedance between two burned
11 conductors. There would be some sort of a char
12 layer on the outside which would provide some
13 impedance. That did not, in fact, turn out to be
14 true.
15 So that was one valuable result.
16 Generally when a cable fails, it goes very quickly
17 from 120 volts to zero, rather than there being a
18 gradual drop-off.
19 MEMBER WALLIS: How about the ones that
20 got 40 volts?
21 MR. EMERSON: In what respect?
22 MEMBER WALLIS: Well, when you said
23 there is no residual impedance, but if there are
24 either zero or 120 because there is no impedance,
25 how come some are 40?

1 MR. EMERSON: Yes. For those, yes. I'm
2 speaking in terms of the cables that actually were
3 subject to spurious actuations.
4 Along the lines of our earlier
5 discussion, looking at the results of a whole,
6 looking at 4 cables times a number of circuits times
7 18 tests, we came to the conclusion that you could
8 generally predict trends and you could draw
9 conclusions based on some of the more important
10 factors, which I'll cover in a minute.
11 You gave us an understanding of the
12 primary influence factors. But in terms of
13 probabilities, the probabilities, though the expert
14 panel came to some conclusions, the uncertainties
15 are still fairly high. And that's one of the
16 outputs of the expert panel.
17 MEMBER POWERS: How do you envision
18 developing the probabilities and the associated
19 uncertainty on them? Do you, say, well, look at the
20 several hundred cables that were tested overall in
21 all of these experts and use that as my devisor as
22 the number of full tests solved or do you do
23 something more detailed than that?
24 MR. EMERSON: I'm not sure I understand
25 your question.

1 MEMBER POWERS: I want to know the
2 probability that a thermal set insulated
3 multi-conductor cable developed, say, a hot short,
4 for example.
5 MR. EMERSON: Okay.
6 MEMBER POWERS: How do I develop that
7 probability out of your data set here?
8 MR. EMERSON: That's what the expert
9 panel did for us.
10 MEMBER POWERS: Right.
11 MR. EMERSON: Those results are reported
12 in that. Are you asking how --
13 MEMBER POWERS: Yes.
14 MR. EMERSON: -- we developed the
15 probability?
16 MEMBER POWERS: Do you take the number
17 of thermoset semiconductor cables that you tested
18 and do you count the number of volts that are
19 observed by that count, by the number of cables
20 tested, and you say that is probability?
21 MR. EMERSON: I would say that would be
22 a crude way to do it. You would want to try to
23 group them by the parameters you were trying to
24 measure. I didn't say that very well. You would
25 want to make sure you understood the inputs into

1 that and try to differentiate the varying
2 parameters, rather than just taking a very broad
3 approach.
4 MEMBER POWERS: You could do it in a
5 more microscopic way and say, "Well, is the
6 conductor varied?" or you could use a function of
7 the heat flux that is imposed on it, things like
8 that.
9 MR. EMERSON: You could vary it. You
10 could look at it by heat flux, by the amount of fill
11 that was in the tray, by the type of insulation it
12 had. That was probably the biggest --
13 MEMBER POWERS: Suppose I get the -- I
14 want to get the actual number in mind here. Suppose
15 I say, "Okay. Having done this analysis, I get a
16 ten percent probability that I will get a hot short
17 in this class of conductors."
18 MR. EMERSON: Okay.
19 MEMBER POWERS: Now, how do I go about
20 saying it is 10 percent plus or minus 20 percent or
21 whatever it is? How do I get that plus or minus
22 probability?
23 MR. EMERSON: How did you get the
24 uncertainty band that was associated with that?
25 Frankly, I don't know the answer to that question

1 because there were a number of different experts,
2 each of whom may have had a somewhat different
3 approach to doing that.
4 Dennis was one of the reviewers of it.
5 Dennis, would you care to comment on that?
6 MR. HENNEKE: Yes. There were a number
7 of people on the expert panel. Mark Salley was also
8 on that from the staff. Basically, Bob Budnitz ran
9 the expert panel.
10 Everybody went out independently and
11 gave probabilities for what they felt comfortable
12 with giving with regard to influence factors,
13 temperature, time, the use of CPTs, current power
14 transformers, that type of thing. And that was
15 brought back in. They were asked to give it. And
16 if they couldn't give their best guess, you had
17 uncertainty.
18 They were all given the same data. So
19 they had to analyze the data in different ways. And
20 then Bob Budnitz put it together. And based on the
21 variability of the expert panel and their
22 variability of uncertainty gave uncertainty bounds
23 to the best of his ability.
24 MEMBER POWERS: Without knowing the
25 variability of a given experiment, how did they come

1 up with that number?

2 MR. EMERSON: How did each of the --

3 MEMBER POWERS: How did they come up

4 with that number without knowing -- how do you

5 measure trends when you don't know the variability

6 from experiments to experiment?

7 MR. EMERSON: Well, they had access to

8 the test setups that were used for each experiment.

9 So they could see which items were varied from

10 experiment to experiment. They had access to all of

11 the results and all of the --

12 MEMBER POWERS: What I am asking is, I

13 can see in experiment configuration A, I've got a

14 ten percent failure. In experiment configuration B,

15 I get a 20 percent probability of failure. And I

16 can attribute the difference between those numbers

17 entirely to the fact that it's varied when, in fact,

18 it may simply be had you repeated experiment A 50

19 times, you would have seen 20 percent on average.

20 It just happened that that particular test, you had

21 ten percent.

22 And there may be no trend there at all

23 without knowing the experimental variability, just

24 the variability in the experiment itself.

25 MR. EMERSON: That is true.

1 MR. HENNEKE: I think the uncertainty,
2 though, is from a general standpoint of looking at a
3 cable. You really don't know where it is on a cable
4 tray, how across are the cables, that type of thing,
5 that you could see. From the experiments, you could
6 see cables getting above their damage temperature.
7 And you might get one spurious actuation. And then
8 you repeat a test in a different way.
9 But cables get above their damage
10 temperature, and you have three. So you will get a
11 .5 for the worst and a .15 for the best. That gives
12 you an upper bound and a lower bound.
13 If you look at the variation for similar
14 types of experiments, you can see a general trend of
15 upper bound and lower bound based on the worst and
16 best that you have seen.
17 The tray fell. And how the cable laid
18 out was all fairly similar. So all you were varying
19 was some of the electrical characteristics and then
20 how quickly they got the temperature.
21 MEMBER WALLIS: But there are also other
22 things that matter. The whether or not a conductor
23 is going to lean over and touch another conductor,
24 given that there is some kind of softening of the
25 interaction, is going to depend upon maybe residual

1 stresses in the wire itself. It's been bent before,
2 and it wants to bend back to what it was before when
3 it was in the loop. So it's got some residual
4 stress. And when you soften it up a bit, it leans
5 over. It's the other one.
6 If they're resting on top of each other,
7 this weight and so on, there are individual
8 mechanical forces on these wires, which you know
9 nothing about, which depend upon history and how the
10 cable will be laid in the tray. All of these are
11 going to influence the result.
12 MR. HENNEKE: More influence on the
13 inter-cable than the intra-cable. For example, we
14 didn't expect spurious actuation of armored cable.
15 And we saw one. It turned out that they had an
16 L-shaped bracket that the cable is run and the
17 inter-cable, the very first cable, was bent beyond
18 its radius. And so we saw a spurious actuation,
19 which was quite a surprise.
20 We reran the test with the correct cable
21 tray. And we didn't see any, as what we expected.
22 The expert panel took that under advisement and
23 actually showed a lower voltage for spurious
24 actuation for armored cable --
25 MEMBER WALLIS: In the plant, it may

1 well be that these cables at some time have been
2 bent beyond their radius.
3 MR. HENNEKE: Based on the insulation
4 specification, they wouldn't be. If you did that,
5 you would have to remove it and replace it. And we
6 do inspections. So you shouldn't have anything bent
7 beyond its allowable bend radius.
8 MR. EMERSON: The types of questions
9 that you're asking certainly support what we have on
10 this slide, that it would be very difficult to
11 predict with any certainty what is going to happen
12 to any given cable in any given tray.
13 But, again, the results across the whole
14 spectrum of tests for comparable heat release rates,
15 for comparable tray loads, for comparable positions
16 within the tray do indicate enough consistency that
17 it's useful information.
18 MEMBER POWERS: I think what you are
19 saying is that you have a plausible story. It may
20 not be statistically rigorous, but it's a plausible
21 story.
22 MR. EMERSON: You could certainly
23 improve on the statistical rigor, though. There's
24 no question about that. Basically what we were
25 trying to do is improve on the state of knowledge,

1 which was essentially zero for a phenomena like
2 this.
3 So is this a finishing point? No. Is
4 it a good starting point? Yes, we think so.
5 MEMBER POWERS: What you're saying
6 conclusively is that it's an excellent motivator for
7 the material that has been discussed throughout the
8 day.
9 MR. EMERSON: Yes, I would say so.
10 Okay. There were two tests with no
11 failures at all. Those were the HGLs, hot gas
12 layer. Those were the types of fire phenomena that
13 we saw for those tests. They both involved
14 thermoset cable.
15 Now, the cable fragility curve was
16 developed by the expert panel. And that's this
17 particular set of curves.
18 MEMBER WALLIS: They must have had a
19 tremendous bias about the number .5. It kinked
20 everything .5.
21 MR. EMERSON: Yes. I should indicate
22 here that there were three separate probabilities
23 estimated by the expert panel.
24 MEMBER WALLIS: This is before they saw
25 any data or after?

1 MR. EMERSON: No. This was after they
2 saw the data. Now, the 5 percent, 95 percent, and
3 50 percent probability is a failure. At what
4 temperature --
5 MEMBER WALLIS: That is what they were
6 asked?
7 MR. EMERSON: That's all they were
8 asked.
9 MEMBER WALLIS: Okay.
10 MR. EMERSON: That's all they were
11 asked. And we just drew lines through the points.
12 CHAIRMAN ROSEN: All those dots imply
13 some sort of extraordinary laboratory precision.
14 MR. EMERSON: No. There was certainly
15 not that extraordinary laboratory precision.
16 Basically it was me taking the three data points and
17 trying to create curves out of three data points for
18 each of those types of cables.
19 CHAIRMAN ROSEN: I would have used each
20 of the three points in a straight line. It's
21 elegant fiction.
22 MEMBER POWERS: Then you have to make
23 something that is visible as a viewgraph.
24 CHAIRMAN ROSEN: All right. We
25 understand that. Okay. So now it becomes

1 artistically --

2 MR. EMERSON: Moving right along, what

3 we observed is the important influence factors were

4 the cable --

5 MEMBER WALLIS: The problem is, though,

6 when you present something like this, someone is

7 going to believe it. And they are going to take,

8 say, .75 on that curve, which is probably completely

9 wrong, the thermoset. It is unlikely that there is

10 going to be that ramp between .5 and 1.

11 MEMBER POWERS: If there's one thing you

12 can be confident about, it's knowing it can't be

13 wrong by more than 50 percent or so.

14 MEMBER WALLIS: You guessed 50 percent.

15 MEMBER POWERS: Right.

16 MR. EMERSON: Again, not statistically

17 rigorous, but it's better information than we had

18 before.

19 The judgments we arrived at on influence

20 factors: cable type. You've heard that already,

21 thermoset versus thermoplastic versus armored.

22 MEMBER WALLIS: It says "probability of

23 any cable damage." I'm sorry. Do you really mean

24 probability of a short?

25 MR. EMERSON: The definition of cable

1 damage was a subject of intense debate amongst the
2 members of the expert panel. Is it any cable
3 damage? Is it the type of cable damage that will
4 result in a spurious actuation or a short to ground?
5 MEMBER WALLIS: Well, at least it's a
6 short. It's not just that you melted some of the
7 insulation.
8 MR. EMERSON: Right.
9 MEMBER WALLIS: So the probability of
10 any kind of a short is what --
11 MR. EMERSON: Getting to the point where
12 you could get a short or a cable failure of the type
13 that we were trying to measure during the test.
14 MEMBER WALLIS: So you could take this
15 thing up to 1,200 degrees without a short?
16 MR. EMERSON: The actual temperatures we
17 measured were up. I think the highest temperature
18 was somewhat over 1,000.
19 MEMBER WALLIS: What happens to copper?
20 MEMBER POWERS: I think their
21 temperatures are put into Fahrenheit, I believe,
22 aren't they?
23 MR. EMERSON: That's correct.
24 MEMBER POWERS: And copper is about
25 1,000 degrees Centigrade.

1 MEMBER WALLIS: All right.

2 CHAIRMAN ROSEN: For melting.

3 MR. EMERSON: Yes. We weren't melting

4 any copper.

5 MR. HENNEKE: Yes. I had a thing. This

6 is Dennis Henneke again.

7 There is actually a misnomer on this

8 curve. There were actual cables; for example, the

9 eight major and armored cable. There was one cable

10 that went way beyond the temperature curve here that

11 never failed. And there were thermoset cables that

12 also never failed. Some were in the 700-800 degree

13 temperature range. Those were thrown out of the

14 data.

15 So this was actually when the failure

16 occurred, what did it fail at? What temperature did

17 it --

18 MEMBER WALLIS: You threw out the data?

19 You only had a few data points, didn't you?

20 MR. HENNEKE: Well, with the armored

21 cable, we had eight cables. And with the thermoset,

22 we had some 50-something?

23 MR. EMERSON: Something like that.

24 MEMBER WALLIS: But you arbitrarily

25 threw out some of the data?

1 MR. HENNEKE: Well, I was a reviewer on
2 the expert panel. I commented on that, but they
3 were looking at the actual failure temperature.
4 When it failed, this was the temperature it failed
5 at. That's what the curves are based on.
6 So if you were actually looking at how
7 do you treat when it only got to 700 and your curve
8 is going out to 1,100, it would have failed 720 or
9 730. They did not know how to. So they threw it
10 out.
11 Of the ones that failed, that's what's
12 plotted there.
13 MEMBER WALLIS: But if it didn't fail,
14 it is also useful information. Anyway, we'll move
15 on.
16 MR. EMERSON: Okay. Now, Mr. Chairman,
17 I have a fair amount more to cover. So I am going
18 to try to get beyond the test results if I can
19 because that seems to be generating the --
20 CHAIRMAN ROSEN: More questions.
21 MR. EMERSON: There's a couple of other
22 points that I would like to make. So I'll go
23 through the remainder of the test-related slides
24 very quickly. And then I'd like to spend a little
25 bit of time on where NEI 00-01 is because that has

1 something to do with the NRC's plans for restarting
2 inspections and for the licensees, how they're going
3 to be approaching circuit failures in the future.
4 CHAIRMAN ROSEN: Please go ahead.
5 MR. EMERSON: Okay. Thermoset cable,
6 more resistant to failure than thermoplastic cable.
7 Tray fill showed the more tray fill you have, the
8 more resistance there is to failure because of the
9 thermal --
10 MEMBER SIEBER: Insulation.
11 MR. EMERSON: Right. There's more mass
12 there to take up the heat that the fire is
13 generating. If you have volt current-limiting
14 devices, you are less likely to have a spurious
15 actuation if you have a hot short.
16 It doesn't affect the incidence of hot
17 shorts. It does affect the incidence of spurious
18 actuations if you -- these limiting devices are
19 typically installed and control circuits of the type
20 that you see in nuclear plants. So this wasn't just
21 a way to reduce the number of failures.
22 There were some second-order influence
23 factors of the type that you see on the slide.
24 MEMBER SIEBER: Say a few more words
25 about water spray.

1 MR. EMERSON: We attempted to see
2 whether the existence of water would create
3 additional failures for badly damaged cable. So we
4 sprayed at the end of each test in any case where
5 there was a cable that was damaged but had not yet
6 resulted in a failure to see if a failure would
7 result.
8 In one out of the 18 cases, that
9 occurred. So we thought that was a lower-order
10 influence factor. The water by itself did not
11 substantially increase the likelihood of failure,
12 which has some ramifications for fire-fighting
13 operations.
14 MEMBER WALLIS: The orientation was
15 horizontal or vertical?
16 MR. EMERSON: Horizontal or vertical.
17 MEMBER WALLIS: I would think a bend
18 would be more than susceptible.
19 MR. EMERSON: We had a bend in all of
20 the horizontal tests. And we had no bend in the
21 vertical tests.
22 CHAIRMAN ROSEN: And in every case, you
23 used water. That tended to lower the temperature
24 and put the fire out.
25 MR. EMERSON: Well, it was certainly

1 useful for lowering the temperature, but what we
2 were trying to measure is electrical effects to see
3 whether a badly damaged cable would result in
4 additional electrical failures. And in only one
5 case, it did.
6 You do get external hot shorts from
7 cable to cable, but the likelihood is lower than
8 internal. And, as Mark showed from the information
9 that came out of the workshop this morning, you
10 really don't expect it is very likely for thermoset
11 cables.
12 One additional conclusion that came out
13 to be useful was that if you have a failure in a
14 multi-conductor cable, you can't just say, "You're
15 only going to have one interaction. You could have
16 any number of interactions."
17 MEMBER WALLIS: What was the purpose of
18 this work?
19 MR. EMERSON: First, to see how likely
20 spurious actuations were; and, secondly, under what
21 conditions they would occur; thirdly, how likely
22 they were in comparison with shorts to ground.
23 MEMBER WALLIS: The reason I ask, it
24 sort of sounds exploratory. If you were actually
25 going to put it into some kind of a failure model

1 for some -- I don't know -- PRA or something, put it
2 into some model for risk, you have to be asking
3 certain questions that you needed as input to your
4 risk model.
5 I don't think you got to that stage yet
6 at all. You are just looking at the kinds of things
7 that might happen and saying, "Is there a problem
8 here? Is there not? How big is it?"
9 MR. EMERSON: Well, we did try to
10 characterize the risk levels associated with
11 different but related types of failures. That was
12 one of the purposes.
13 MEMBER WALLIS: Some specifications for
14 what you wanted to get out of the tests in terms of
15 a quantitative risk model.
16 MR. EMERSON: We were trying to get a
17 better handle for how likely spurious actuations and
18 ground faults were.
19 MEMBER WALLIS: So you could have
20 predicted how many tests you needed to get
21 statistically significant answers?
22 MR. EMERSON: Given the number of
23 variables we had, the number of tests needed was
24 always going to be greater than the number we could
25 do. But, again, we were trying to --

1 MEMBER POWERS: That's always true.

2 MR. EMERSON: Again, given the number of

3 variables that there are to measure in tests like

4 this --

5 MEMBER POWERS: It was my impression

6 that the going-in hypothesis was that spurious

7 actuations would be quite rare.

8 MEMBER WALLIS: Yes, that's right.

9 MR. EMERSON: There was a school of

10 thought that felt that way.

11 MEMBER POWERS: And that as a result, to

12 disprove that, you needed X number of tests, which

13 is certainly smaller even than the number you did.

14 MR. EMERSON: I want to be sure we

15 understand. We weren't trying to prove or disprove

16 any particular theory. We were trying to see what

17 happened in typical fires and typical circuits.

18 MEMBER POWERS: I am just trying to cast

19 it in the terms that the question was posed. So as

20 soon as you saw one spurious actuation, you knew

21 they were not quite rare.

22 MEMBER WALLIS: I think this is what I

23 remember from the previous presentation was the main

24 message, was that there was this theory that nothing

25 much is going to happen and, gee, whiz, when you did

1 a few tests, a lot of things happened.

2 There were lots of hot shorts

3 significantly. So you had to obviously change your

4 mind or somebody had to change his mind.

5 MR. EMERSON: Well, having been involved

6 in this from the very beginning, I can categorically

7 tell you that while it might have been nice to see

8 no hot shorts, we didn't approach it with the idea

9 that we were trying to prove that theory. Again, we

10 wanted to see what happens. And we were going to

11 live with the results.

12 MEMBER SIEBER: It seems to me that

13 during the Browns Ferry fire, which was a real fire,

14 there were a spurious actuation.

15 MEMBER POWERS: Quite a few.

16 MEMBER SIEBER: And so that established

17 --

18 CHAIRMAN ROSEN: As there were at San

19 Onofre.

20 MEMBER SIEBER: -- that it is possible.

21 MEMBER POWERS: I didn't know that.

22 MEMBER SIEBER: And then beyond that,

23 then in a deterministic sense, you can say you need

24 separation criteria like appendix R has. And if you

25 want to say that's too stringent, then you ought to

1 go to some kind of a risk argument, which the data
2 supports both deterministic and risk arguments
3 provided you can have confidence in it. So it seems
4 to me that is why you are doing this and the
5 conclusions one can draw from it.
6 MR. EMERSON: This slide indicates that
7 if you have, again, a failure in a multi-conductor
8 cable, you can't just categorically say you are only
9 going to get one interaction. You may get any
10 number of them.
11 MEMBER SIEBER: Right.
12 MR. EMERSON: If you have different
13 multi-conductor cables in the same fire exposed to
14 the same conditions, you can get more than one hot
15 short, but the likelihood that it will be between
16 those two particular cables is much lower. The
17 likelihood that that will be the result of
18 cable-to-cable interactions is lower.
19 In terms of the times to actuation, this
20 slide indicates generally the trends that we saw in
21 times two spurious actuations. As you can see, most
22 of them are over 30 minutes. Some are well over 30
23 minutes.
24 MEMBER WALLIS: This x-axis is not a
25 scale of number of actuations. These are all

1 individual actuations, I take it?

2 MR. EMERSON: These are all the

3 actuations we saw plotted against the time to

4 actuation.

5 CHAIRMAN ROSEN: One took only two

6 minutes is what I see.

7 MR. EMERSON: Right. There were a few.

8 Those were the thermoplastic cables that took place

9 much sooner.

10 MEMBER WALLIS: Was it all the same

11 fire?

12 MR. EMERSON: Oh, no. This is over a

13 range of fire conditions from 70 kilowatts to more

14 than 400 kilowatts.

15 MEMBER WALLIS: So the short one is a

16 very hot fire or a very bad cable?

17 MR. EMERSON: It's thermoplastic cable,

18 which tend to fail at a much lower temperature, as

19 Mark indicated this morning.

20 MEMBER WALLIS: Presumably it's a very

21 hot fire very quickly, too, isn't it?

22 MR. EMERSON: Well, as you could see

23 from the temperature profiles I put up earlier, the

24 temperature had a ramp increase, a fairly slow ramp,

25 rather than a sudden spike, to --

1 MEMBER WALLIS: I am surprised you
2 didn't throw out that data point as being a glitch.
3 MEMBER POWERS: What you're missing is
4 the important point on this slide, Graham, which is
5 that at about ten minutes, you're going to have a
6 respite from the operators because there won't be
7 any actuations.
8 MR. EMERSON: Well, for us the important
9 point of this slide was that there's --
10 MEMBER WALLIS: Nothing happens between
11 10 and 20 minutes.
12 MR. EMERSON: -- time to interdict --
13 CHAIRMAN ROSEN: That's not true.
14 There's one point they came down in 20 minutes.
15 MR. EMERSON: For thermoset cables,
16 there's typically time to interdict the fire and
17 take some action to prevent a --
18 MEMBER WALLIS: This is a spotty plot.
19 I mean, I would think you would plot it against
20 something else, like fire temperature or kind of
21 cable or something, because we don't know what to
22 make out of it. We just see it as a variation.
23 MR. EMERSON: That's all it's intended
24 for.
25 MEMBER WALLIS: Well, we don't know

1 whether it's a random variation or it's something
2 because --
3 MR. EMERSON: Oh, no. Again, it's over
4 a wide range of fire conditions, cable loading
5 conditions. It's just a report of the time it took
6 for each spurious actuation to occur. You would
7 have to analyze it much more closely to figure out
8 what the determinants for that time were.
9 MR. HENNEKE: That data is available in
10 the EPRI report by cable.
11 MEMBER WALLIS: Use the cable again
12 here.
13 MR. EMERSON: I would refer you to the
14 400-page EPRI report for the type of detail.
15 MEMBER POWERS: Is there a reason to
16 select thermoset over thermoplastic in application?
17 MR. EMERSON: We were trying to look at
18 the types of cables that are typically used.
19 MEMBER POWERS: Yes. And I understand
20 that, and I understand that you have a variety of
21 them. When a guy calls out the cable and the
22 insulation on it, is there some reason you want
23 thermoplastic, instead of thermoset?
24 MR. EMERSON: Thermoplastic tends to be
25 the cable used in older plants.

1 MEMBER POWERS: Okay.

2 MEMBER SIEBER: It's cheaper.

3 MR. EMERSON: Yes.

4 MEMBER POWERS: Cheaper, easier to

5 spring, twist, bend.

6 MR. EMERSON: But judging from our

7 difficulty in obtaining samples, it's very much in

8 the minority in plant use now.

9 MEMBER POWERS: Good.

10 MR. EMERSON: This shows the duration,

11 which was touched on earlier. The maximum duration

12 was 13 minutes for any of the cables that failed.

13 Average for thermoset was about less than two

14 minutes; for thermoplastic, less than three minutes

15 before the faults cleared. Typically the mode of

16 clearing was that it would turn into a short to

17 ground.

18 This is important in four AOVs and

19 PORVs, indicating that those types of valves will

20 return to their safe state after just a short

21 duration of the fault in general.

22 MEMBER WALLIS: This is because the fire

23 keeps going? Is that what happened? Is that why

24 this happened?

25 MR. EMERSON: Was your question because

1 the fire --

2 MEMBER WALLIS: It seems to me you would

3 have a short. And then you could quench the fire,

4 and the short would be there forever. Why should

5 the short stop? Because the fire keeps going, and

6 it makes a worse short to ground, which just swamps

7 everything?

8 MR. EMERSON: Yes, that's correct.

9 MEMBER WALLIS: Because the fire keeps

10 going. If the fire stopped at five minutes, maybe

11 this longest duration would have been forever or

12 until you went and disassembled the cable.

13 MEMBER POWERS: Just let the fire burn.

14 MEMBER WALLIS: Let the fire burn. It

15 will bring you short to ground, which will --

16 MR. EMERSON: I don't think we will try

17 to do that.

18 MEMBER SIEBER: That was the real hot

19 spot where the conductor short occurs because there

20 is some resistance there. More often than not,

21 sooner or later, the conductor will fail.

22 MR. EMERSON: These are the conclusions

23 that we drew. The likelihood is higher than we

24 thought it used to be. Again, if we were an

25 industry that was bent on improving that spurious

1 actuations are unlikely, we wouldn't be reporting
2 data like this.
3 MEMBER SIEBER: I'm curious about
4 something you said, that when you remove the hot
5 short, the device goes back to its normal position.
6 I keep thinking of torque valves because that's what
7 the majority of valves are. The control circuits
8 for those, if you have a hot short that says open to
9 the valve, if you open. If you take that hot short
10 away, it won't close.
11 MR. EMERSON: That's true. And I was
12 careful not to include those types of valves in my
13 statement.
14 MEMBER SIEBER: That's the majority of
15 the valves, though.
16 MR. EMERSON: True. And that's why I
17 said AOVs and PORVs.
18 MEMBER SIEBER: Well, AOVs, you know,
19 have seal and surface. An AOV that is designed when
20 you remove the power and it trips, you're basically
21 opening a solenoid valve that is normally energized
22 when it's closed. And then there is a seal in
23 contact for that. And it won't change state when
24 you take the short away on it.
25 So I'm not exactly sure that I buy into

1 anything for valves would say it goes back to its
2 normal state. A hot short on a power cable for the
3 pump, on the other hand, if it's not on the control
4 circuit but on the actual power feed probably if you
5 clear that hot short, the pump motor will stop
6 running.
7 CHAIRMAN ROSEN: The pump motor will do
8 what?
9 MEMBER SIEBER: Stop running.
10 CHAIRMAN ROSEN: Stop?
11 MEMBER SIEBER: Yes. If the spurious
12 actuation was to start, it will stop if you clear
13 that short. But typically the power cables aren't
14 the ones that will fail first. It's the control
15 cables that will because they're smaller. So I
16 guess I have to take that with a grain of salt.
17 CHAIRMAN ROSEN: That's the point I made
18 earlier. You have to look at the circuit specifics
19 because even pumps that are running, if you lose
20 power to them, they'll stop, obviously. But if you
21 return power to them, they may not start because
22 they will be permissive certainly, not be made up.
23 MEMBER SIEBER: That's right.
24 MEMBER WALLIS: I want to ask you about
25 the times.

1 MEMBER SIEBER: Cold shutdown in 20
2 minutes.
3 MEMBER WALLIS: How long do these tests
4 run for? It seems to me you put these cables in a
5 fire, which must have been about 1,500 Fahrenheit or
6 something, and left them there until something
7 happened.
8 MR. EMERSON: Well, most of the tests
9 lasted at least an hour, some far longer than that.
10 We just basically tested them --
11 MEMBER WALLIS: They lasted an hour?
12 And the average time to failure was 30 minutes.
13 Well, that's sort of not surprising because if you
14 only waited an hour --
15 MR. EMERSON: Well, we tested them until
16 there appeared to be diminishing returns either from
17 most of the failures that already occurred and there
18 was very little point --
19 MEMBER WALLIS: Do you see my problem
20 here with saying the average time to failure is 30
21 minutes? If the test was run for -- if it never
22 failed, that's an infinite time. That makes the
23 average time very long. But if you stop the test at
24 half an hour, it's not surprising that you couldn't
25 get an average time to failure much more than 30

1 minutes.

2 MR. EMERSON: Well, again, we ran the

3 test to the point where we were trying to produce

4 failures, basically. From the tests that we stopped

5 before failures occurred, we were monitoring the

6 voltage conditions in the individual conductors.

7 And it was quite obvious from the trends that we

8 were going to have to burn it for four or five hours

9 to get any failures at the rate it was going.

10 MEMBER WALLIS: Do you monitor the

11 temperature in the conductor? You might say if they

12 reach 800 without failing, we'll say they survived,

13 something like that. It seems much better criteria.

14 The time itself isn't really a measure of the

15 thermal stress on the cable. It's --

16 MR. EMERSON: Oh, no. It's the trays.

17 MEMBER WALLIS: How hot it gets seems to

18 be the main thing.

19 MR. EMERSON: How hot, yes.

20 MEMBER WALLIS: What's the temperature?

21 MR. EMERSON: That's correct.

22 MEMBER WALLIS: If it reaches that

23 temperature in two minutes, then the rest of the

24 time is unimportant. If it takes 2 hours to reach

25 700 degrees, then it's likely to survive. Time

1 isn't a very important parameter in all of this, is
2 it?
3 MR. EMERSON: Well, time actually is an
4 important parameter because you are trying to see
5 whether you have time to do something about the
6 fire.
7 MEMBER WALLIS: It depends on how hot
8 the fire is.
9 MR. EMERSON: Right. And that's why we
10 were trying to use heat release rates that might be
11 considered typical of the fires you would expect in
12 plants. You could certainly postulate much hotter
13 fires, but we were trying to --
14 MEMBER WALLIS: You see what I am
15 getting at. You say the time to failure was 30
16 minutes; therefore, it was okay. This could mean
17 that you ran the test for an hour and half of the
18 time you had a hot enough fire to melt the cable at
19 all. It's just a question of the temperature
20 reached during the test.
21 And you only ran it for an hour. Half
22 of them failed. So the average time to failure was
23 30 minutes. Right? Is this the right parameter to
24 use to characterize failure?
25 MR. HENNEKE: Yes. Fred, there were

1 only a couple of cables that didn't fail once they
2 got above their temperature. There were two tests
3 we did where the cable didn't get above their
4 temperature. And so we had no failures whatsoever.
5 And that data was not used.
6 But when it got above its fail
7 temperature, there was one armored and only a couple
8 of thermoset cables. So if you looked at those, you
9 probably could take those out a couple of hours and
10 get those to finally fail at some point.
11 MEMBER WALLIS: So you progressed to the
12 point where you got a failure?
13 MR. HENNEKE: In almost every cable,
14 yes.
15 MEMBER WALLIS: Then how is that you had
16 only 14 percent of shorts? You had some sort of a
17 failure. Okay. I see what you mean. Which mode
18 failed? Okay.
19 MR. HENNEKE: Yes, a short to ground.
20 MEMBER WALLIS: So you did progress to
21 failure each time. Okay. Sorry.
22 CHAIRMAN ROSEN: With only three
23 exceptions.
24 MEMBER WALLIS: Go ahead. Thank you.
25 MR. EMERSON: Okay. Obviously, you can

1 get spurious actuations. That was shown.
2 Cable-to-cable spurious actuations are less likely,
3 especially for thermoset cable. We believe --
4 CHAIRMAN ROSEN: Would you go back to
5 that just one moment? I wanted to draw a conclusion
6 here. Multiple spurious actuation actuations cannot
7 be ruled out.
8 MR. EMERSON: True.
9 CHAIRMAN ROSEN: Now, Mark Salley was
10 here earlier and showed us --
11 MR. EMERSON: He still is.
12 CHAIRMAN ROSEN: -- a chart where I
13 guess he admitted the possibility of multiple
14 spurious actuations but said that it was very low,
15 that it was low likelihood. There is an X on one of
16 them. It says, you know, "can't happen."
17 I am just trying to see whether you
18 think this is consistent with Fred's first bullet.
19 And if not, can you explain the difference?
20 MR. SALLEY: No. I believe they're
21 actually in alignment.
22 MR. EMERSON: I think so, too.
23 MR. SALLEY: What we're saying here in
24 this tank exercise is that if we look above that
25 typical seven-conductor cable, what I'm saying in

1 that example, number one, one seven conductor trips
2 A, B, and C.
3 If you look at this and you say that 2
4 and 3, for example, conductors 2 and 3 are control
5 circuit for MOV A, 4 and 5 are the pull-in for the
6 pump B, and 6 and 7 are the two controls for MOV C,
7 that one cable fails, those three pairs make up, you
8 get this scenario.
9 And that would agree with what you are
10 saying up there, right, Fred?
11 MR. EMERSON: Yes.
12 MR. SALLEY: What we are further saying
13 is that for this start-up of associated circuit
14 inspections, we would postulate two cables. But
15 when we start postulating three cables and
16 everything is starting to fail in together, that's
17 where we put that in bin 2 and we have asked JS and
18 research for help as to how many cables we can do.
19 CHAIRMAN ROSEN: Okay. I'm focusing on
20 the X on this chart.
21 MR. SALLEY: Right. That one we would
22 say in the probablistic world, to get three cables,
23 to have them line up, we're starting to get a little
24 further away from where we wanted to be.
25 CHAIRMAN ROSEN: Right. That's further

1 away from where you want to be. But his first
2 bullet says it cannot be ruled out.
3 MR. SALLEY: That's right. It cannot be
4 ruled out, which is why it went to bin 2 for further
5 research.
6 CHAIRMAN ROSEN: Okay.
7 MR. EMERSON: But you have to start
8 someplace with an inspection focus. So starting
9 with 2 is a likelier phenomena to produce
10 risk-significant results than 3 or 4 or 5 or
11 whatever.
12 MR. SALLEY: Let me jump in, Fred. You
13 are talking about a single cable up there, too,
14 which is exactly what I had in this example one. So
15 I think they're in alignment.
16 MR. EMERSON: Yes.
17 MR. SALLEY: What we are saying in our
18 example here is the number of cables that you
19 consider to fail. And we are saying that we would
20 stop at two cables giving you the --
21 CHAIRMAN ROSEN: So where do we find
22 ourselves now, as opposed to where we started this
23 discussion way back when? At least some radical
24 fringe elements thought they can't have spurious
25 actuations. What we found here is not only can you

1 have them. You can have multiple spurious
2 actuations.
3 MR. EMERSON: They are possible, yes.
4 CHAIRMAN ROSEN: They are possible at
5 some frequency.
6 MR. EMERSON: Again, we think there are
7 thresholds below which cable failures don't occur.
8 That was one of the results of the expert panel. We
9 have covered the conclusions regarding time to
10 failure, the effect of current limiting devices.
11 MEMBER WALLIS: What are those
12 thresholds?
13 MR. EMERSON: I'm sorry?
14 MEMBER WALLIS: You say they exist. Do
15 you know what they are?
16 MR. EMERSON: If you look at the
17 fragility curve that I put up earlier, basically a
18 little below that is the threshold below which the
19 expert panel postulated that you would not get
20 failures.
21 MEMBER WALLIS: They deduced from the
22 data?
23 MR. EMERSON: Yes. That was the expert
24 panel's conclusion from the data.
25 CHAIRMAN ROSEN: Fred, if you could just

1 get off this slide, you're clear sailing. The water
2 smoothes out. We don't have this document that you
3 are going to --
4 MR. EMERSON: The EPRI report?
5 CHAIRMAN ROSEN: No. The NEI 00-01, the
6 current revision.
7 MR. EMERSON: Okay. You haven't been
8 given that yet?
9 CHAIRMAN ROSEN: That's the one we're
10 missing? Oh, the implementation guide we don't
11 have.
12 MR. EMERSON: Okay. You don't have the
13 implementation guide. Okay.
14 CHAIRMAN ROSEN: This one we have, yes.
15 MR. EMERSON: Okay. I am going to take
16 just a couple of minutes literally just to go
17 through my points on NEI --
18 MEMBER WALLIS: Most of these
19 conclusions are not overwhelming. They're what you
20 might have expected except perhaps the magic number
21 of 30 minutes. Most conclusions are what one might
22 have gone into to test the programs of the thinking
23 you find. I mean, it's not surprising that there is
24 a threshold below which they are and so on.
25 So I think that in order to reach some

1 conclusion, we would have to study these reports.

2 MR. EMERSON: I agree.

3 MEMBER WALLIS: With the questions we're

4 asking, these reports really should be put into good

5 shape, not too wishy-washy.

6 CHAIRMAN ROSEN: It remains to be seen

7 exactly how these conclusions are going to be used.

8 MEMBER WALLIS: That's right. That's

9 right.

10 MR. EMERSON: And that is reflected in

11 NEI 00-01. We tried to make an attempt to sort

12 through the results of the expert panel and the two

13 EPRI reports that pertain to the results of the

14 testing to try to draw some conclusions for how long

15 --

16 MEMBER WALLIS: They're to be used

17 within some regulation framework?

18 CHAIRMAN ROSEN: Well, that's what we're

19 here to find out, whether the staff will adopt them

20 by adopting 00-01 in some purpose in the regulatory

21 guide.

22 MR. EMERSON: So if you will let me --

23 MEMBER WALLIS: I've not yet seen a

24 logical framework into which all of this fits that

25 makes any sense to me.

1 MR. EMERSON: Well, the whole reason for
2 undertaking the testing was to try to add to our
3 store of information that would help us determine
4 whether fire-induced circuit failures were
5 risk-significant and if so, under what conditions
6 are they risk-significant and then try to -- since
7 NEI 00-01 was, at least in part, intended to help
8 you determine the risk significance of particular
9 circuit configurations, it will help you demonstrate
10 with more knowledge than you had before whether any
11 particular configuration is risk-significant or not.
12 Remember, the likelihood of spurious
13 actuations is only one point in the risk equation.
14 There are a number of other factors, as Mark pointed
15 out this morning, that go into that determination of
16 overall risk as well. But this was the point at
17 which we had the least data, and we were trying to
18 come up with --
19 MEMBER WALLIS: So someone in a far PRA
20 has some place where he has to assign a probability
21 and he goes to this NEI 00-01 and finds that
22 probability?
23 MR. EMERSON: Yes, or the EPRI expert
24 panel report.
25 Okay. I am going to move very quickly

1 through the presentation on NEI 00-01. Its two
2 major functions are to provide guidelines for the
3 use of the deterministic methods. And these methods
4 generally reflect the licensed commonly used
5 practices that are normally employed in safe
6 shutdown analyses in plants today. It's not
7 intended for a licensee to go in and do a wholesale
8 re-baselining of a safe shutdown program unless he
9 wants to.
10 It has also risk significance methods
11 that can be used to determine the significance of
12 any particular identified failure or combination of
13 failures. And I particularly call your attention to
14 the last sub-bullet there.
15 These are intended as a double screening
16 process, which I will get to in a minute. We try to
17 balance the risk screening with a safety
18 margins/defense-in-depth analysis, which we
19 discussed in some detail this morning, before you
20 can screen out. In other words, you look at it from
21 a deterministic standpoint, as well as a
22 probablistic standpoint, before you just screen
23 failures out based on risk alone.
24 MEMBER WALLIS: I think we asked the
25 question this morning about that, and it turned out

1 that that was rather difficult parts of the work and
2 that we had to get this NEI document to tell whether
3 it worked or not.
4 MR. EMERSON: From the standpoint of NEI
5 00-01, we based the safety margins/defense-in-depth
6 analysis guidance on what is in Reg Guide 1.174,
7 which was probably the best guidance we had at the
8 time we wrote it.
9 MEMBER WALLIS: So it's a PRA?
10 MR. EMERSON: No, it's not really a PRA.
11 MEMBER WALLIS: No, it's not. So the
12 DID is also in there.
13 MR. EMERSON: I am going to outline
14 without discussing in detail because it would take
15 more time than we probably have, just indicate what
16 changes we have made since the last time we
17 presented NEI 00-01 to you.
18 In the preliminary screening, instead of
19 looking at core damage frequency as the consequence
20 of interest, we changed that based on a staff
21 comment to look at the inability to achieve and
22 maintain safe shutdown. Again, this is a
23 preliminary qualitative screening with quantitative
24 support, which we have looked at in the pilot that
25 we did at McGuire and another plant. The method is

1 in the tables that I have indicated on the slide in
2 the NEI document.
3 There is a quantitative risk screening.
4 The determination of core damage frequency is
5 essentially unchanged from the previous document.
6 We have added consideration of LERF using the risk
7 terms that you see on the slide. This is met if one
8 of the three conditions at the bottom of the screen
9 is met.
10 We have also added some consideration of
11 uncertainty and sensitivity analysis, again based on
12 a staff comment. And we have provided a great deal
13 of additional support for the argument that multiple
14 high impedance faults don't impose a credible risk
15 if you meet certain requirements. And the
16 requirements are listed in the bullets and
17 sub-bullets on this slide. There is about a 30-page
18 appendix in NEI 00-01 which goes into the MHIF
19 phenomenon in a lot more detail than I could
20 possibly do.
21 This is the last slide. Licensees are
22 at the point where a number of licensees are
23 reconsidering whether to re-baseline their safe
24 shutdown programs.
25 Because industry and the NRC have been

1 discussing, if not outright arguing, over what types
2 of circuit failures need to be considered in the
3 plant licensing basis for the last six to seven
4 years, we are looking forward to a stable set of
5 regulatory expectations on both deterministic
6 analysis and how you measure the risk significance
7 of these terms so that both the licensees and the
8 inspectors can move forward on the same page,
9 especially since we are resuming inspections of
10 associated circuits in the relatively near future.
11 We sent a letter to the staff fairly
12 recently which made the recommendations that you see
13 there. Those recommendations are that the NRC focus
14 the circuit failure inspections on compliance with
15 the plant licensing basis while recognizing that
16 there may be configurations that are within the
17 licensing basis but still present a safety concern,
18 which is something that the ROP allows for
19 determining and providing as a finding to the
20 licensee that they accept the deterministic methods
21 if the licensing basis is not clear. And we had a
22 long discussion this morning about whether it is or
23 not; and, lastly, that the probablistic methods be
24 accepted along with other risk techniques, like the
25 SDP or a plant-specific PRA analysis, for

1 determining the risk significance.

2 That concludes my presentation.

3 CHAIRMAN ROSEN: Okay, Fred. Thank you

4 very much. I appreciate your patience.

5 MR. EMERSON: And yours with me.

6 CHAIRMAN ROSEN: And we'll now turn to

7 Mark Salley and Naeem Iqbal for a discussion of fire

8 dynamics spreadsheets.

9 MR. HANNON: Excuse me. While we are

10 making the transition here -- this is John Hannon.

11 Just I wanted to point out that the last comments

12 that Fred made about the recommendations, they did

13 send us a letter, a couple of letters, on that

14 subject that we have recently responded to. Sunil,

15 did you want to say any more?

16 MR. WEERAKKODY: Yes. We received the

17 report in May. And I don't know whether you have

18 received the letter, but I will go back and check.

19 John and I did send you a response giving some

20 observation at a high level on NEI 00-01 and how we

21 do and do not plan to use it integrally for the

22 framework.

23 MR. EMERSON: Thank you. I'll look

24 forward to looking at it.

25 MR. WEERAKKODY: All right.

1 VI. FIRE DYNAMICS SPREADSHEETS

2 MEMBER POWERS: You wanted equations.
3 By God, they deliver it for you.
4 MEMBER WALLIS: Are we supposed to talk
5 about this equation? I want to know how you got
6 6.85.
7 CHAIRMAN ROSEN: Are you sure it's 6.85,
8 not 6.8?
9 MEMBER POWERS: Absolutely. If it were
10 6.8 --
11 MEMBER WALLIS: Are we supposed to
12 discuss this equation?
13 MR. SALLEY: Yes.
14 MEMBER WALLIS: It's very peculiar
15 dimensions.
16 MR. SALLEY: It's a fundamental equation
17 that we use a lot.
18 MEMBER WALLIS: Well, Q/Ah has the
19 dimensions of ΔT except that HB looks like a
20 surrogate for a different H. So the power of
21 one-third seems to be all wrong when you have got
22 temperature to the two-thirds.
23 MR. IQBAL: This is experimental
24 correlations from a fire test.
25 MEMBER POWERS: But experimental

1 correlations had better be unit-wise correct.

2 MEMBER WALLIS: One would hope so. In

3 other words, that 6.85 is a very peculiar unit.

4 MR. IQBAL: It is a correlation

5 coefficient.

6 MEMBER WALLIS: Temperature to the

7 one-third or something like that? I mean, it's a

8 strange --

9 MR. SALLEY: That's exactly correct.

10 MR. IQBAL: This is fire science.

11 MR. SALLEY: That's exactly correct.

12 And I wanted to start out with this before we start.

13 You all should have received --

14 CHAIRMAN ROSEN: Yes, with a paper, with

15 a disk and all.

16 MR. SALLEY: Yes. See, the idea is if

17 you are having trouble sleeping at night, you just

18 put this in the CD player. It's like Brahms'

19 lullaby. And you get about three pages of this, and

20 you're out.

21 MEMBER WALLIS: Brahms' lullaby is for

22 kids.

23 MR. SALLEY: The reading will put you

24 under.

25 MEMBER POWERS: Hence, appropriate for

1 the ACRS.

2 MR. SALLEY: This is a fun topic that

3 Naeem and I have worked on. This is much lighter, I

4 guess, right now than the associated circuits. It's

5 something we have worked on for three or four years

6 now.

7 The reason I throw that equation up to

8 start this out is that a few years ago, we saw

9 things were changing. When you transition, begin

10 transitioning, into this risk-informed

11 performance-based environment, the inspector's job

12 changes.

13 And we went out. And we did some

14 training of our inspectors in the regions and

15 basically talked to them and said, "Well, what do

16 you know about fire?"

17 The first thing you see is that most of

18 your inspectors are not fire protection engineers

19 who are doing this. They are typically electricals,

20 mechanicals, civils. But there is some discipline

21 in engineering other than fire protection.

22 So the challenge became that as we make

23 the transition to the risk-informed performance

24 base, we have got to understand some fire dynamics.

25 How do we begin to work with our inspectors in

1 teaching them fire dynamics?

2 Well, the first challenge you come up

3 against is something like this equation. Now, for a

4 junior-level student over at the University of

5 Maryland, this is what he is studying over there

6 right now. This is an MQH, we call this. It's am

7 empirical one that came out of the National Bureau

8 of Standards. They ran, what, 105 fire tests, I

9 believe, Naeem?

10 MR. IQBAL: A hundred and fifty fire

11 tests.

12 MR. SALLEY: A hundred and fifty fire

13 tests. And they backed out this correlation. What

14 this correlation simply tells you is the temperature

15 change of a hot gas layer in a room, the average

16 temperature of that hot gas layer.

17 Now, if you look at the equation -- and,

18 like I said, this is kind of junior-level fire

19 dynamics -- teaching this to someone, we saw three

20 distinct challenges. I'm trying to lay our problem

21 out for you here before we start. We saw three

22 challenges.

23 The first thing is it's messy math.

24 What I say is when is the last time that an

25 inspector took his calculator out and took something

1 to the one-third power. That's not something they
2 do every day.
3 MEMBER WALLIS: Gee, whiz, the kids do
4 this in junior high school.
5 MR. SALLEY: Yes, they do, but
6 inspectors don't do it every day. So what I'm
7 saying is the math. there is a little bit of math
8 manipulation. And that leads to potential problems.
9 We can simplify that.
10 MEMBER WALLIS: You've got to fire all
11 of those guys and get people who understand it.
12 MR. SALLEY: Okay.
13 MEMBER WALLIS: This is so trivial,
14 especially with a calculator.
15 MR. SALLEY: Please go along with me.
16 MEMBER WALLIS: You don't need to
17 understand math. You can punch these things into a
18 calculator.
19 MR. SALLEY: And there's still always
20 the potential for error.
21 MEMBER WALLIS: Okay.
22 MR. SALLEY: Correct? If I do it, --
23 different calculators will round differently -- I
24 can still get some error.
25 The second thing is there are material

1 properties in here. K(rho)c is something we talked
2 a lot about in fire protection engineering. If you
3 ask an inspector, "What's the thermal conductivity
4 of concrete?" I don't think that is something that
5 he is geared to do every day.
6 He doesn't carry a reference with him.
7 He says, "Oh, yeah, thermal conductivity of
8 concrete. What units would you like that in?"
9 So what I am saying is that that is
10 going to take in some time to have to go and find
11 that. Okay. We don't like concrete. It's gypsum.
12 Well, I've got to go find another book. So that was
13 our second challenge.
14 The third challenge is the real
15 challenge that you're getting to. And that is,
16 let's teach some fire dynamics. Let's focus on
17 that.
18 MEMBER WALLIS: I think a problem, too,
19 is that T is in seconds.
20 MR. SALLEY: My T is in seconds.
21 MEMBER WALLIS: It doesn't say that, but
22 I think it must be.
23 MR. SALLEY: Right.
24 MEMBER WALLIS: That's a big number.
25 MR. SALLEY: Okay. So what I just

1 wanted to illustrate was that when we approached
2 this problem four years ago, we saw there were three
3 challenges that we were trying to work up.
4 MEMBER WALLIS: Your message is whether
5 or not this equation is right, it's a big, scary
6 thing for the average inspector?
7 MR. SALLEY: You got it.
8 CHAIRMAN ROSEN: So give them a curve.
9 MR. SALLEY: No, we can't give them a
10 curve. Let's give them a tool that works real nice,
11 though. That's our goal. Curves, we're not going
12 to make it income taxes, where you look and see what
13 you made, see what you --
14 MEMBER WALLIS: So it's a thing where
15 they can put numbers in and the computer does the
16 math?
17 MR. SALLEY: Exactly. And the computer
18 has those physical constants for you.
19 CHAIRMAN ROSEN: So he doesn't have to
20 go to the wrong book --
21 MR. SALLEY: Exactly.
22 CHAIRMAN ROSEN: -- and get the wrong
23 number to plug in?
24 MR. SALLEY: Or he gets, you know, 9.82
25 for gravity and I get 9.81 and then we fight about

1 .01 for a day.

2 MEMBER WALLIS: This can't be totally

3 correct because if there is no area for ventilation,

4 you still take some time to heat up the room. There

5 is no infinite heat and no time. So something is

6 really strange about the equation, but I don't think

7 we have time to go into that.

8 MR. SALLEY: We'll come back to this for

9 you.

10 MEMBER WALLIS: Okay.

11 MR. SALLEY: So having set the stage,

12 that was --

13 CHAIRMAN ROSEN: You realize you are

14 just throwing meat to the lions.

15 MR. SALLEY: That's okay.

16 MEMBER WALLIS: This isn't meat, man.

17 This is a little snack.

18 CHAIRMAN ROSEN: Snack? Okay.

19 MR. SALLEY: This is our challenge we

20 were presented with. And I want to tell you how we

21 worked around it a little bit and am going to give

22 you a go at it here.

23 We would like your comments. I mean, we

24 sent you copies of this. And we would really like

25 to have some input from you on how we go forward

1 with it.

2 Okay. Kicking off the presentation,

3 once again, the FDT^s -- we had to come up with a

4 good acronym because if you ain't got a good

5 acronym, you don't have a program. I learned that a

6 long time ago. So we're FDT^s.

7 MEMBER POWERS: You need a little logo

8 with that.

9 MR. SALLEY: We'll work on that. The

10 goal of this was using risk insights and the

11 regulation in the reactor oversight process. As we

12 said before, it is a transition period for the

13 inspectors.

14 If you ask them to go on and look at a

15 three-hour firewall, they can do that. They can get

16 the UL directory out. They can say, "Yes, it's 12

17 inches of concrete. Yes, it was the right grade of

18 concrete. Yes, they poured it the right way.

19 Everything is good. The right aggregate was there.

20 The fire dampers are three-hour-rated. The door is

21 three-hour-rated." And they can inspect that. And

22 they have done that since the beginning of time.

23 When we start looking at things in a

24 risk-informed performance base, it's not going to be

25 that simple. They're going to have to be able to

1 address the fire threat. So this was our step of
2 supporting that transition to the risk-informed
3 performance-based type requirements.
4 MEMBER POWERS: You hit the objective
5 right on the head.
6 MR. SALLEY: The second part is with the
7 fire hazard analysis, it's up to this point we used
8 primarily a qualitative approach where we want to
9 give more to a quantitative approach.
10 Doug always seems to be here whenever I
11 do these presentations. So I've picked on you since
12 day one, Doug. I'll continue this now. We find the
13 fine --
14 MEMBER POWERS: That's kind of a
15 tradition in the fire business to pick on Doug,
16 isn't it?
17 MR. BRANDES: It certainly seems like
18 it.
19 MR. SALLEY: But it will illustrate the
20 point I want to get at. If I'm inspecting a Duke
21 plant and I find a potential violation and the
22 question becomes safety significance, they're going
23 to say --
24 MEMBER POWERS: You know, there isn't
25 one, --

1 MR. SALLEY: Oh, yes.

2 MEMBER POWERS: -- a Duke plant.

3 MR. SALLEY: But we have a potential

4 fire in there, and that fire could potentially

5 damage a cable. So the question and the safety

6 significance will be okay, "Mark, can they have a

7 fire in this room? Can it damage the cable?"

8 We have answered this question for

9 years. I said, "Well, yes. There was a pile of

10 transients in the corner. That could start a fire.

11 It could start the cable trays. Of course, it could

12 damage it. So we could have a big fire in that

13 area."

14 Doug would look at it from the

15 licensee's side and say, "Wait a minute. Transients

16 are controlled. It's not that much. It's only

17 going to be a little fire. The cable won't be

18 damaged."

19 So Doug and I will basically sit there

20 and fight out the meaning of big and little. And we

21 have done that for a long time. This is our first

22 attempt to try to put some numbers with it.

23 Will it produce a hot gas layer of 700

24 degrees or 200 degrees? Let's define big and little

25 with some numbers. That is what we are trying.

1 This is a first step at that.

2 Next slide. The current applications

3 for today are, of course, with the SDP. You know,

4 part of the SDP, it tells the inspector to postulate

5 a fire. He can do it qualitatively. He can do it

6 quantitatively. We're giving him some tools to

7 start doing a quantitative approach. This will help

8 with the example that I just said, the significance

9 of noncompliance.

10 And another thing is with the licensee,

11 this tool is available to the public. If they want

12 to do an exemption-type request and they want to see

13 how the NRC is going to answer the big/little

14 question, they will have this tool available for

15 them.

16 MEMBER POWERS: Well, your transient

17 combustible example was just a perfect one. Doing

18 the quantitative analysis is really nifty because

19 were there a bunch of transient combustibles or just

20 a little bit of transient combustibles?

21 MR. SALLEY: Right.

22 MEMBER POWERS: It makes all the

23 difference in the world to whether it is significant

24 or not.

25 MR. SALLEY: Sure. You can do some of

1 the models with "What does the plant's program
2 allow? Do they allow 100 pines uncontrolled or do
3 they allow 10?" And by things like that, we can
4 postulate --
5 CHAIRMAN ROSEN: Or you can use the
6 existing circumstances. Define circumstances in the
7 field. If an inspector went in and found a wooden
8 table that was in a place that's inappropriate, he
9 could say, "That's the source, that wooden table,
10 the very one that I found there. We weighed it. It
11 weighs 11.4 pounds. It's pine wood."
12 MR. SALLEY: We can do that.
13 CHAIRMAN ROSEN: And then you can --
14 MR. SALLEY: If you give us that --
15 MEMBER WALLIS: The fire standard is red
16 oak per square foot, pounds of red oak per square
17 foot.
18 CHAIRMAN ROSEN: I'm just making a point
19 that you can use what you find.
20 MR. SALLEY: Of course, that was treated
21 wood, though, because a plant is only allowed
22 treated wood.
23 CHAIRMAN ROSEN: In my hypothetical, it
24 was not. That's in Plant X.
25 MR. SALLEY: Okay. Moving along here,

1 our key here, like I said, is when we polled the
2 regions four years ago now, that we had to do some
3 work in the fire dynamics area. We had to make some
4 steps forward. This is what we used to start
5 teaching the fundamentals of fire dynamics.
6 A. STATUS OF NUREG-1805
7 MR. SALLEY: Eighteen-o-five. Again,
8 that's the NUREG. The CD contains the spreadsheets
9 that are locked. How to use them and all the backup
10 material as to where we got this is all contained in
11 the NUREG.
12 Next slide. The evolution is what I am
13 trying to convey on this next slide. In the past --
14 go back to the '60s, when they were first laying
15 these plants out in a design basis of fire areas.
16 The way the fire areas were classically
17 laid out was if someone did an estimate on the
18 number of combustibles. The total combustible
19 loading that would be in that room primarily was
20 cable.
21 And he said, "Okay. If I take that and
22 lay that against an ASTM E119 curve, I can back
23 out." You want to talk about some strange units.
24 That will give you some strange units.
25 Nevertheless, I can back out an area

1 under the curve. And that area under the curve will
2 tell me what my firewall bounding needs to be to
3 call this a fire area.
4 And that's how that was done. And that
5 was an up-front design. It was a pretty
6 conservative approach. However, over time, people
7 started taking that up to the fourth place in
8 decimal accuracy. And you started to have people
9 report 37.22-minute fires.
10 How did you ever derive that? This is
11 hand grenades. This is not that precise micrometer
12 stuff. Well, they were just backing an area under
13 the curve because you can manipulate mathematics
14 real nice to solve areas under a curve.
15 Presently, we want to go to this fire
16 dynamics tool that Naeem and I have to act as a
17 start-up. And what we are looking for in the future
18 in the 805 world that Paul Lane described this
19 morning is that firewalls are going to become
20 commonplace.
21 So we are in that intermediate step
22 where we teach the fire dynamics, the hand
23 equations, if you will, and understand the
24 principles of it so that when someone does use a
25 model down the road, they will have an appreciation

1 for the terms like "heat release rate" and
2 "ventilation area size" and "material properties,"
3 the "loading of the firewall."
4 MEMBER POWERS: You can have more than
5 that. You know when you have got to go to a more
6 sophisticated tool. If you go through the hand
7 calculation and it tells you there is clearly a big
8 problem here, I don't need a more sophisticated tool
9 to tell me I've got a big problem.
10 If it comes out it's a "No. Never
11 mind," I don't need a more sophisticated --
12 MR. SALLEY: Exactly.
13 MEMBER POWERS: It's when you get
14 something that is just real close to the boundary
15 and your licensee says, "I still want to do it" and
16 you know your hand calculation isn't so good, then
17 you know you've got to call in the pros at that
18 point.
19 MR. SALLEY: Exactly. We consider this
20 -- for conversation, we call these first-order
21 determinations, first-order approximations.
22 MEMBER POWERS: That is a great thing
23 because then the guy knows when he needs help and
24 when he can do it by himself just from order of
25 magnitude kind of things.

1 MR. SALLEY: Right. In the past, it was
2 big or little and who shouted louder, me or Doug.
3 So we'll put a little bit to that.
4 To give you some origins on this, I
5 would like to take credit for inventing this, but
6 this was not invented here. Some colleagues of
7 Naeem's and mine worked over for the ATF. And they
8 had a similar problem a couple years before us.
9 And their problem was when they would
10 investigate a case, an arson scene -- they're
11 responsible for the arson across the country. And
12 when they would investigate an arson case, someone
13 would give an eyewitness account.
14 They would say, "Dana. Okay. So you
15 bought this million dollars in this barrel. How
16 high were the flames?"
17 "And, oh, man, they were higher than the
18 house."
19 "Really?"
20 "Yes."
21 "And where is all the residual left
22 over?" "Well, it all burned up."
23 Well, they needed to put tools together
24 to do the exact reversal we do. Okay? They needed
25 to say, "How high would a flame height be for

1 ordinary combustibles in a 55-gallon drum?" They
2 should be between this range. And they could do a
3 quick calculation to see if the witness or the
4 person was basically telling the truth that matched
5 the physics of it.
6 So we knew they had this tool. And they
7 were using it. And they were somewhat successful
8 with it was the starting point for Naeem and I to go
9 with our inspectors. Like I said, we worked the
10 problem in reverse. What is the credible threat
11 that they were trying to verify?
12 The other thing was that the
13 combustibles in the environment we're in, in the
14 power plant, you know, cables are everything.
15 Cables tend to be the big fire hazards. We do have
16 some lube oils. The structure, thick concrete is
17 the norm. So we needed the tools and the equations.
18 You'll notice the one I threw up this
19 morning. It had two cases: thermally thin and
20 thermally thick. We needed to address that
21 enclosure parameter. They were in pretty much a
22 thermally thick environment. So we needed to do
23 some research and give the best numbers available to
24 give the most accurate input.
25 Next slide. So what we settled on was

1 that we could take a user-friendly program, like
2 Microsoft Excel, and that we would put the fire
3 dynamics equations in and it would be all
4 preprogrammed. We would lock the program. We would
5 control what variables you changed. And you could
6 do a simple first-order calculation.
7 As far as the equations, it's a good
8 point. The accuracy MQH that I laid up here this
9 morning we take no credit for. Is it very good or
10 is it very bad? Is the accuracy of it?
11 What we're taking is what we'll call
12 state-of-the-art fire protection engineering, things
13 straight out of the fire protection engineering
14 handbook, with the main line fire protection
15 engineers are using across the world. And that's
16 what we used here. We did not invent any questions.
17 CHAIRMAN ROSEN: And those main line
18 fire protection engineers believe 6.85 is a pretty
19 significant figure.
20 MR. SALLEY: That's what they're using
21 out there. That's state-of-the-art. And, of
22 course, there is a danger with state-of-the-art.
23 State-of-the-art changes. Your state-of-the-art
24 changes. Then we'll change with it accordingly.
25 The unit conversions are there. Fire

1 dynamics tends to work in metric units. We talk a
2 lot, mostly in metric, but the field engineers are
3 comfortable measuring things in feet and inches.
4 So, again and just to play the part of unit
5 conversions, I have seen some serious programs.
6 Wasn't Hubble Spacecraft the telescope?
7 They had a problem with the conversion?
8 CHAIRMAN ROSEN: Yes. It got 60 miles
9 too close to the surface.
10 MR. SALLEY: Exactly. Over a
11 conversion?
12 MEMBER POWERS: Lockheed slammed a
13 satellite into Mars because it made the meter
14 conversion incorrectly.
15 MR. SALLEY: Right. We want to prevent
16 our inspectors from making kilowatt to Btu improper
17 conversions. So we captured that. So these were
18 the things we were forward looking trying to cover
19 that we would prevent that. I want to go through
20 these quickly because I want to give Naeem some time
21 to run through this.
22 Let's go to the next slide. In the
23 training, the textbook part of this is that we have
24 covered a lot of the assumptions, limitations, and
25 bonding analysis.

1 We have tried to give the user some
2 insights. For example, if you're calculating
3 sprinkler heads and you get a nice program called
4 DTAC free of charge from the National Bureau of
5 Standards off the street and you say, "Hey, look, I
6 can load this in. I can run it. I can tell you
7 when the sprinkler heads go off."
8 Well, that's true if the sprinkler heads
9 are all on the ceiling. If they're hung three feet
10 down from the ceiling, that's no longer valid.
11 So we tried to put a lot of the
12 correlations and cautions in there as to how to use
13 these tools properly in the environment that we have
14 them in.
15 B. INSPECTOR TRAINING
16 MR. SALLEY: Again, we used to have a
17 quarterly program where we went to the regions and
18 we worked with the inspectors. So we have been
19 training them roughly for three years. So they do
20 have a feel for this.
21 A lot of their comments were
22 incorporated. When things were too hard -- you
23 mentioned putting in numbers. When they would key
24 in a number, 13.3, somebody put the point in the
25 wrong place and put in 132. Then we sat there for

1 five minutes figuring out what they did wrong.

2 They asked for a lot of pull-down

3 numbers. So we incorporated the things. And then

4 we tried to make it as user-friendly as we possibly

5 could.

6 CHAIRMAN ROSEN: Pull-down numbers?

7 MR. SALLEY: Oh, yes. Well, pull-down

8 parameters. Okay? And Naeem will demonstrate that

9 for you.

10 Next slide. Let me go through the

11 conclusion here. And I really want to focus on the

12 example problem and go that way. What we've taken

13 here is a commercially available material program,

14 like Microsoft Excel. And we have programmed it in

15 to applications for the inspectors to do fire

16 dynamics out on their inspections.

17 It will reduce the mathematical

18 complexities, errors, and promotes greater

19 applications of fire science and engineering in

20 field use. Our user, our customer here, is the

21 inspector out in the field. We're hoping that this

22 makes a positive impact in moving us forward in the

23 SDP, in the risk-informed performance-based arena.

24 Like I said, I've covered that fairly

25 quick. I'd like to turn it over to Naeem here. I

1 think the best way of doing this is to see an
2 example as to how this works. It will give you the
3 best feel.
4 So, Naeem, if you want to take it?
5 C. DEMONSTRATION OF TOOL
6 MR. IQBAL: We are just postulating a
7 fire from an oil leakage from a compressor and the
8 compressor has 12^2 oil retention dike. The dike is
9 located one foot from the wall. The unprotected
10 safety-related cable trays are located eight feet
11 above the floor and four feet horizontally from the
12 edge of the dike. A safety-related electrical
13 cabinet is located five feet horizontally from the
14 edge of the dike.
15 These are the inputs that we need to
16 perform fire hazard analysis. And the dimension of
17 the corridor is 30 feet by 15 feet and 10 feet high
18 and has 2 fire-rated doors, 3 times 7 feet in
19 dimension.
20 The corridor has no forced ventilation.
21 The wall setting and floor are constructed of
22 one-foot-thick concrete. The corridor has a smoke
23 detection system and a wet pipe sprinkler system.
24 The nearest sprinkler is rated at 165
25 degrees F and an RTI of 235 meter/second$^{1/2}$ and

1 located 6.5 feet from the center of the dike. The
2 nearest smoke detector is 20.5 feet from the center
3 of the dike.
4 So we will show if there is any credible
5 fire in that area.
6 MEMBER WALLIS: Now, there's nothing
7 here about ventilation?
8 MR. IQBAL: We have two fire doors.
9 MEMBER WALLIS: But they are closed.
10 MR. IQBAL: We can presume closed/open.
11 We will show that.
12 MEMBER WALLIS: But if that is closed,
13 there is no ventilation?
14 MR. IQBAL: But you have some leakages,
15 right?
16 MEMBER WALLIS: Well, when the area of
17 ventilation goes to zero, my ΔT goes to infinity.
18 MR. SALLEY: Yes.
19 MR. IQBAL: You have some leakages from
20 that, from the door.
21 MR. SALLEY: When we look at it in fire
22 protection engineering, we tend to look at it in two
23 microscopic cases. The first case -- and this is
24 the one we're solving here -- is a natural
25 ventilation case.

1 For this example, we will probably work
2 with one door open or if you wanted to, no
3 compartment is hermetically sealed. We would take
4 the gaps. There are always going to be gaps between
5 the doors, dampers. You're going to have some
6 in-leakage.
7 The second style of problem -- and, once
8 again, I'm talking in the macroscopic arena -- is
9 when the HVAC runs. And the HVAC continues to run
10 through the fire. We use a different set of
11 equations for that.
12 MEMBER WALLIS: This is the plant view,
13 right?
14 MR. IQBAL: Yes, this is the plant view.
15 MR. SALLEY: Right.
16 MR. IQBAL: This oil here, we have 12
17 feet for a dike. We have a cabinet. We have a
18 cable tray. And we have one sprinkler system, the
19 6.5, 6.4.
20 CHAIRMAN ROSEN: That's the detector
21 right there?
22 MR. IQBAL: Yes.
23 CHAIRMAN ROSEN: That's the sprinkler.
24 Where's the detector?
25 MR. IQBAL: The detector is 20 feet.

1 CHAIRMAN ROSEN: And that's what the RTI
2 is.
3 MR. IQBAL: RTI for the sprinkler.
4 CHAIRMAN ROSEN: What does that RTI
5 stand for?
6 MR. IQBAL: It is response time index.
7 It is a property of the sprinkler.
8 MEMBER WALLIS: So we assume that the
9 dike is full of oil?
10 MR. IQBAL: Yes and ignition from a
11 failed compressor. And you have a full fire.
12 CHAIRMAN ROSEN: What do you assume from
13 the compressor? Additional?
14 MR. IQBAL: Ignition occurring from a
15 failed compressor.
16 CHAIRMAN ROSEN: A failed compressor?
17 MR. IQBAL: Yes.
18 CHAIRMAN ROSEN: Oh, the oil in the
19 compressor?
20 MR. IQBAL: Yes.
21 CHAIRMAN ROSEN: The compressor fails as
22 a result of the fire?
23 MR. IQBAL: Right.
24 CHAIRMAN ROSEN: And the oil comes out
25 of it?

1 MR. IQBAL: Yes.

2 CHAIRMAN ROSEN: Okay.

3 MR. IQBAL: And you can see that these

4 are the cable trays. And this is the cabinet, and

5 this is the sprinkler.

6 MEMBER WALLIS: So there's no wind

7 blowing along the --

8 MR. IQBAL: You assume there is no wind,

9 no. But if you zoom in --

10 CHAIRMAN ROSEN: It's an interior

11 compartment, right?

12 MR. IQBAL: Yes.

13 CHAIRMAN ROSEN: There's no compression

14 --

15 MR. IQBAL: But sometimes if you have a

16 sprinkler system on, you can have a tilted flame

17 now. Your flame is built like that.

18 MR. SALLEY: Do you get the basic idea

19 of what the scenario looks like? Now, we are going

20 to take those numbers, that scenario that Naeem just

21 described, and we'll take our spreadsheets. And

22 instead of saying "big" and "little," "hot" and

23 "cold," we are going to try to put some numbers with

24 it following the simple algorithms

25 CHAIRMAN ROSEN: Now, is the inspector

1 going to be able to give you all of this data?

2 MR. IQBAL: Yes. These are the input

3 data.

4 CHAIRMAN ROSEN: Most of this is stuff

5 he can do with a ruler.

6 MR. SALLEY: Yes. I think that

7 everything --

8 MR. IQBAL: This data is required for

9 the calculation.

10 So we'll use two types of spreadsheets.

11 We'll show the localized damage. And we'll show the

12 hot gas temperature in the compartment. So first I

13 will just use the spreadsheet to show the localized

14 damage.

15 MR. SALLEY: This is what you will find

16 on your CD, these spreadsheets.

17 MR. IQBAL: Every time when we saw this

18 menu, me have to click on macros to activate the

19 programs. This problem, they're just using the lube

20 oil. This is a drop-down menu. You can select the

21 lube oil.

22 CHAIRMAN ROSEN: So tell us what you are

23 doing as you do it. First you're selecting your

24 fuel type.

25 MR. IQBAL: Yes, fuel type. See, the

1 properties are shown in these yellow input cells.
2 Then we will enter the dike area, 12 feet^2, and the
3 distance between fire and target. First, we are
4 analyzing the cable cabinet. The cabinet is five
5 feet from the edge of the whole fire.
6 MEMBER WALLIS: What's the first there
7 about the burning way the fuel was --
8 MR. IQBAL: Yes. It's a property of the
9 lube oil you take from the table.
10 MR. SALLEY: I think you missed that.
11 Go back to your select fuel type. And if you click
12 on that, drag down a menu.
13 MR. IQBAL: Yes.
14 MR. SALLEY: For illustration, I think
15 --
16 MR. IQBAL: Crude oil.
17 MEMBER WALLIS: So it automatically puts
18 that number in?
19 MR. IQBAL: Yes.
20 MR. SALLEY: Watch the upper block
21 there.
22 CHAIRMAN ROSEN: It's just a little hard
23 to read from way back here.
24 MR. EMERSON: That's the burn rate at
25 which the surface burns.

1 CHAIRMAN ROSEN: What does that line
2 say, something burning rate of fixed --
3 MR. EMERSON: That's the burning rate of
4 the fuel.
5 MEMBER WALLIS: That's meters per second
6 or something. It really burns down the --
7 MR. IQBAL: Meters per second, kilogram
8 per meter^2 second.
9 MEMBER WALLIS: Yes. So it burns down.
10 The 20 gallons, does that come in somewhere here,
11 too, the amount of fuel or no?
12 MR. IQBAL: Yes. That 20 gallon affects
13 the fire duration, not here.
14 MEMBER WALLIS: Right. It doesn't
15 affect this.
16 MR. IQBAL: It doesn't affect your HRR,
17 heat release rate.
18 CHAIRMAN ROSEN: We're here calculating
19 heat release rate.
20 MR. IQBAL: No. We are calculating the
21 heat flux to the cabinet, what is the hazard to the
22 cabinet from this fire?
23 MEMBER WALLIS: Are they going to put in
24 all of the geometry of these --
25 MR. IQBAL: So we'll again select the

1 lube oil. You have to enter this dike area. This
2 is between the fire and the target. This area
3 between the fire and the target is this area, five
4 feet.
5 MR. SALLEY: So those are all the
6 critical parameters that the inspector could easily
7 determine.
8 CHAIRMAN ROSEN: Wait a minute.
9 MR. SALLEY: Those are the dike area.
10 All you're worried about is the surface,
11 two-dimensional fire with a combustible liquid; the
12 material properties of the fuel. And the third
13 thing is the distance.
14 CHAIRMAN ROSEN: What's the stuff in the
15 gray there? That's a conversion to meters?
16 MR. IQBAL: This is meters to -- because
17 all of the equations there are -- we need meters.
18 CHAIRMAN ROSEN: But the inspector puts
19 it in feet?
20 MR. IQBAL: In English numbers, yes. If
21 you see this, this is like very complicated math.
22 These are all steps.
23 MEMBER WALLIS: It must do something
24 about the geometry of the dike. It says 12 square
25 meters. It could be 100 meters by 12 millimeters.

1 MR. IQBAL: Yes. Yes, it could be.
2 Yes.
3 MEMBER WALLIS: Something absurd.
4 MR. IQBAL: We are just showing an
5 example, you know, how to do the calculations.
6 MEMBER WALLIS: It makes a difference,
7 the shape of the dike, doesn't it, not just the
8 area?
9 MEMBER SIEBER: Well, when the sprinkler
10 goes off, the dike will flood. And then the whole
11 floor --
12 MEMBER WALLIS: Makes it worse.
13 CHAIRMAN ROSEN: Go on, Naeem.
14 MR. IQBAL: Yes. You can see this
15 equation that we are solving here. We are showing
16 every step.
17 CHAIRMAN ROSEN: I can't see a thing
18 you've got. It's not in our package. So we're
19 trying to see it on the screen. And it's faint.
20 MR. SALLEY: Right.
21 MR. IQBAL: If you see the guide I just
22 passed, those equations are there.
23 MR. SALLEY: Exactly. The radiation
24 will get us on the B factor algebra to a point.
25 Now, that's something that takes a little time to

1 solve out. We can run through quite quick here
2 knowing that --
3 MEMBER WALLIS: That's okay. Just so
4 you get an answer.
5 MEMBER SIEBER: You can actually use
6 this to figure out when the sprinkler will go off.
7 MR. IQBAL: We'll show you that
8 sprinkler activation, too, especially.
9 MEMBER SIEBER: That's an important
10 factor here. The question is, does it go off before
11 you run out of fuel or not?
12 MR. SALLEY: Or damage is incurred, yes.
13 MEMBER SIEBER: Right.
14 CHAIRMAN ROSEN: Have you animated this
15 yet?
16 MR. SALLEY: No. This is as animated as
17 we are going to get.
18 CHAIRMAN ROSEN: Well, you are always
19 animated, but I am talking about whether --
20 MEMBER SIEBER: You can actually print
21 that, right?
22 CHAIRMAN ROSEN: -- you could have a
23 little cartoon.
24 MR. IQBAL: Yes, you can print it. You
25 can print it.

1 MEMBER SIEBER: That would be a good
2 idea if you would and give us a copy so we could
3 study it.
4 MEMBER WALLIS: Two megawatts. That's a
5 pretty big fire.
6 MR. IQBAL: Yes, a big fire because the
7 area of the dike is only 12 feet^2.
8 MEMBER SIEBER: And there are 20 gallons
9 in it. So it's pretty thick.
10 MEMBER WALLIS: A pretty tall fire, too.
11 Is the room tall enough to do that?
12 MR. IQBAL: Yes.
13 MEMBER WALLIS: The height of the fire
14 is 3.69 meters in a 3-meter room?
15 MR. IQBAL: Yes.
16 MEMBER WALLIS: It spreads along the
17 ceiling, then?
18 MR. IQBAL: Yes. That means your flame
19 height is touching the ceiling.
20 MR. SALLEY: What you're doing is the
21 exact key of these spreadsheets. We're not putting
22 in a number, cranking it through a black box. And,
23 all of a sudden, you get two meters out the other
24 side. We're getting --
25 MR. IQBAL: I was just wondering.

1 MR. SALLEY: You see the equation work,
2 and then you have to think.
3 MEMBER WALLIS: What does it do when it
4 says the height is taller than the height of the
5 room? What does it do then? Does it recalculate
6 the spread along the ceiling or something? I don't
7 quite understand.
8 MEMBER SIEBER: You get a plume.
9 MR. IQBAL: This calculation is showing
10 you the localized damage to the cabinet. The height
11 --
12 MEMBER WALLIS: It looks as if the
13 height of the flame is taller than the height of the
14 room.
15 MR. IQBAL: Yes.
16 MEMBER WALLIS: So what does the
17 calculation do then? Does it ignore it and assume
18 that it goes through the roof?
19 MR. IQBAL: No, no. Calculation assumes
20 this flame height in making this heat plus
21 calculation equation.
22 MEMBER WALLIS: Does it go back and
23 recalculate the flame?
24 MR. IQBAL: Yes. These are all
25 interconnected in those equations, the flame height,

1 the heat --

2 CHAIRMAN ROSEN: But the point is that

3 if the room is 10 meters high, assume it is 10 feet

4 high, and the flame is 10.5 feet high, half a foot

5 of flame is going to be, in other words, a quarter

6 of a foot closer to the target assuming it's

7 distributed equally. It's actually going to get

8 closer to the target. The flame is going to deflect

9 off the ceiling head of the target, at least I part.

10 MR. IQBAL: This is a 30-foot long

11 corridor.

12 CHAIRMAN ROSEN: And the question is,

13 does the calculation take into account the fact that

14 half a foot of flame is going to head toward the

15 target? That was Dr. Wallis' question.

16 MR. SALLEY: Remember, we're in

17 first-order approximations.

18 MEMBER WALLIS: But you've got a flame

19 height bigger than the height of the ceiling.

20 MR. SALLEY: Which means you have

21 floor-to-ceiling flame height.

22 MEMBER WALLIS: And then it just stops

23 it? So there's a column going to the ceiling? It

24 doesn't spread along the ceiling?

25 MR. SALLEY: Right. And it sees that as

1 the incident flocks on the target. First-order
2 approximation, that's our level of accuracy.
3 MEMBER WALLIS: That's okay. It's
4 pretty hot at the cabinet, pretty hot anyway.
5 MR. IQBAL: Then we have a 8.85 kilowatt
6 per meter^2 heat flux to that cabinet.
7 MEMBER WALLIS: Which is about --
8 MR. IQBAL: This is about like 400
9 degrees C, 300 degrees --
10 MEMBER WALLIS: This is about 8 times
11 the sun at 40,000 feet or something. It doesn't
12 sound all that scary on that basis.
13 MR. SALLEY: Take it into the next one,
14 Naeem.
15 MR. IQBAL: Okay.
16 MEMBER SIEBER: Yes. Well, that gives
17 you a curve, those temperature versus time.
18 MR. IQBAL: Okay. The next one --
19 MEMBER WALLIS: It's useful. It gives
20 an idea of how important it might be.
21 MR. IQBAL: -- is a cable tray. We have
22 a cable tray now. Cable tray is eight feet high
23 from the floor and four feet from the edge of the
24 pull. So, again, first we select the lube oil.
25 MEMBER WALLIS: But they're almost done.

1 MR. IQBAL: Burning rate and heat of
2 combustion. And dike area, 12 feet^2; and length, 4
3 feet away from the pull; and 8 feet high. That's
4 it.
5 MEMBER WALLIS: It's still a radiation
6 calculation.
7 MR. IQBAL: Yes, to that cable tray,
8 that eight feet high from the floor.
9 MR. SALLEY: So you see how quickly we
10 can just change the parameters to get another answer
11 without having to go through all the iteration
12 process.
13 Another valuable thing with this tool
14 for the field applications, let's say we didn't have
15 a dike there. Then we get into a fun game of how
16 big is the spill.
17 Well, if it starts out before ignition,
18 it's three-foot in diameter. It goes to four-foot,
19 five-foot, six-foot. Is there any point where that
20 surface area gives you enough heat release to give
21 you damage to the target?
22 You can quickly iterate and change into
23 a fuel spill big enough without a confined area.
24 CHAIRMAN ROSEN: And also the inspector
25 can e-mail this thing to you --

1 MR. SALLEY: They do. They do that.

2 CHAIRMAN ROSEN: -- and let you have a

3 look at it and see whether you believe that you made

4 a mistake.

5 MEMBER SIEBER: But it won't calculate

6 how fast it is spreading, right?

7 MR. SALLEY: No. We assume once the

8 surface starts on the pull fire, it's pretty much

9 instantaneous.

10 CHAIRMAN ROSEN: And that's pretty much

11 true.

12 MEMBER SIEBER: Well, it depends on the

13 viscosity of the fluid. If you take a heavy number

14 6 oil, for example, it doesn't spread real fast

15 compared to number 2.

16 MEMBER POWERS: Compared to the point

17 where he is interested.

18 MEMBER SIEBER: Yes, I guess.

19 MR. SALLEY: For first-order, it's

20 pretty quick. You can make them hard areas as easy

21 as you want. I know some of the work that EPRI has

22 dome with some of the training -- as a matter of

23 fact, they were just down at Duke.

24 As you think about it, that compressor

25 is there. Depending upon where that leak is, are

1 you really going to get a two-dimensional pull?
2 Well, no. Let's make this a three-dimensional,
3 where it spills down the side of the compressor and
4 then to the pull. And then that changes our service
5 area. And it gets real complex real quick.
6 The question is, at the end of the day,
7 when you look at the number, how much did it change
8 your accuracy? Very little. So for the first-order
9 is where we want to keep this.
10 Keep going?
11 MR. IQBAL: This one is for hot gas
12 temperature in the compartment. So we need some
13 input. The width of the compartment is 15 feet.
14 The length is 30 feet. And the height is ten feet.
15 And we have a --
16 MEMBER WALLIS: Now, he has to put
17 "feet" in there. Otherwise, he's in real trouble.
18 CHAIRMAN ROSEN: If he tries to do the
19 conversion first --
20 MEMBER WALLIS: No, no. He must put it
21 into feet. Is that right?
22 MR. IQBAL: Yes, it's feet.
23 MEMBER WALLIS: He must put it in feet.
24 MR. SALLEY: We are going to make a
25 metric version of this, too. And they will just do

1 the conversions in reverse.

2 MEMBER WALLIS: You could put it in in

3 the right maybe or something. I don't know how

4 you're going to do it. Put in one or the other.

5 MR. IQBAL: So we have too doors. We

6 will presume one door is open at three feet wide by

7 seven feet tall. And the top of the vent from the

8 floor is seven feet, the height of the door. And

9 the thickness of the corridor and the boundaries is

10 12 inches, one feet.

11 MEMBER WALLIS: So the top of the vent

12 from the floor --

13 MR. IQBAL: Is the height of that.

14 MEMBER WALLIS: The height of the top of

15 wherever the hole is?

16 MR. IQBAL: Right. We will select the

17 corridors into your boundaries. The corridors into

18 your boundaries will have concrete. We will go and

19 select them.

20 MEMBER WALLIS: But how does he know

21 it's a thermally thick?

22 MR. IQBAL: Because it's 12 feet thick,

23 just like 12 feet --

24 MEMBER WALLIS: But he determines if

25 it's --

1 MR. IQBAL: There is another, especially
2 for thermally thin. If you have one-inch tape, you
3 can use others especially.
4 CHAIRMAN ROSEN: He doesn't have to do
5 that. He puts in the thickness. And the computer
6 knows what to use.
7 MR. SALLEY: No. He has to read
8 NUREG-1805 because it tells him, "If you have a
9 single sheet of gypsum, that's a thermally thin
10 case. Use the thermally thin spreadsheet. If you
11 got a foot of concrete, that's thermally thick. Use
12 the thermally thick spreadsheet."
13 MEMBER WALLIS: It would be good, I
14 think, if this thing figured it out, whether it was
15 thick or thin, which is quite easy to have a
16 criterion put into the program here, where he
17 doesn't have to look it up.
18 MR. SALLEY: Right.
19 MR. IQBAL: Then we have to input the
20 fire size. You know, that fire was 2-megawatt,
21 2,000 kilowatts. That's it.
22 CHAIRMAN ROSEN: Now, wait a second.
23 What did you just do? I couldn't read the units.
24 It looks like 2,000 megawatts.
25 MR. IQBAL: No, no. It's kilowatt.

1 CHAIRMAN ROSEN: Is that a kw?

2 MR. IQBAL: Kw, right.

3 CHAIRMAN ROSEN: Okay. It's a k.

4 MEMBER SIEBER: You're worse off than I

5 am.

6 MR. IQBAL: It's kw. Hot gas

7 temperature --

8 CHAIRMAN ROSEN: It's the wrong hair

9 color. What does it say the temperature is?

10 MR. IQBAL: It gives you like in 2

11 minutes, 493. I'm sorry. In one minute, 493-degree

12 F. In two minutes, it's 544-degree F.

13 MEMBER WALLIS: That's the temperature

14 of the ceiling or something?

15 MR. IQBAL: It's the temperature in the

16 room.

17 MR. SALLEY: That's the average

18 temperature of the hot gas layer.

19 MEMBER WALLIS: Which is where,

20 everywhere in the room?

21 MR. IQBAL: Yes.

22 MR. SALLEY: No. In the ceiling.

23 MEMBER WALLIS: The ceiling.

24 MEMBER POWERS: Everything above seven

25 feet.

1 MR. IQBAL: Exactly.

2 MEMBER WALLIS: Anything above seven

3 feet. So that looks worse, more threat to the

4 cables to me than the radiation.

5 CHAIRMAN ROSEN: Especially if it's

6 thermoplastic.

7 MR. SALLEY: Let's just say for

8 illustrative purpose, you can see what it does here.

9 What was your fire, two megawatts?

10 MR. IQBAL: Yes.

11 MR. SALLEY: Let's make it four

12 megawatts. I want to show you the speed, how fast

13 we can do this.

14 MEMBER WALLIS: That's 40,000. That's

15 really going. Put a reactor in there. You can

16 really get --

17 MR. SALLEY: And you can when he pages

18 Doug here, how quick doubling that fire --

19 MEMBER SIEBER: It makes it hot here.

20 MR. SALLEY: Right. And you can see

21 that we can quickly step through things to get

22 first-order approximations. So, yes, you can do

23 this all with a Radio Shack and, I agree, with pen

24 and paper, but it would take you a lot of time,

25 where here we can go in and say, "Let's try this,

1 try that. And you get different scenarios," --

2 MEMBER SIEBER: You get some idea.

3 MR. SALLEY: -- quickly ginned out.

4 MEMBER WALLIS: Do these guys like this?

5 MR. SALLEY: They don't like fire

6 dynamics. So no. It's a part of --

7 MEMBER WALLIS: It's a tool for users.

8 MEMBER POWERS: I would. I mean, some

9 fraction of them are surely going to be motivated to

10 go over to the fire protection handbook --

11 MR. SALLEY: Oh, yes.

12 MEMBER POWERS: -- based on this. And

13 they are going to see -- I mean, that's a pretty

14 nicely written book. You know, once you have played

15 with this a little bit, you can say, "How the hell

16 did they get this?" It kind of explains how they

17 got things and whatnot. And you learn a lot.

18 MR. IQBAL: They were using this for

19 LGP, too.

20 MEMBER POWERS: But even after you have

21 read it, just having this little tool to do the

22 calculations for you saves you a lot of time.

23 MR. SALLEY: Yes. Let me characterize.

24 The inspectors realize a change. And it is a pretty

25 significant change to how they have to think in that

1 most of them have welcomed it.

2 And after they have worked on it, as a

3 matter of fact, a lot of complaints that come from

4 them, "Hey, I don't like typing in all of these

5 properties for concrete. Can't you make me a

6 pull-down menu?" or "Can't you give me a little

7 graph?" or "Can't you?" So this is largely based on

8 the inspectors' feedback.

9 Currently this is out in the public

10 domain. And we're getting feedback from the general

11 public. What's interesting is where we have gotten

12 feedback from. A lot of folks who do arson-type

13 work have sent us in some fire marshal association.

14 We have gotten requests from Korea. Some folks in

15 Korea wanted it. Research has it out with Sandia

16 for some of the projects they are working on.

17 CHAIRMAN ROSEN: Any fire protection

18 engineers that the plants escort?

19 MR. SALLEY: Doug helped us along --

20 MR. BRANDES: Yes. I think, as a matter

21 of fact, I wouldn't say a majority. A lot of them

22 have access to it and are what is characterized as

23 practicing with it.

24 MEMBER SIEBER: Is it on your Web site?

25 MR. SALLEY: It's all downloadable.

1 MEMBER SIEBER: What do you look for?
2 What do you look for? Is it a NUREG or --
3 MR. SALLEY: We announced it in the FRN,
4 and we put it on --
5 MEMBER SIEBER: I keep those. They're
6 combustible.
7 MR. SALLEY: Combustible loading.
8 CHAIRMAN ROSEN: Mark, let's wind it up.
9 MR. SALLEY: Okay. It's on our Web
10 site. You can download both documents. What was
11 interesting, though, is when they put the
12 spreadsheet on the Web site, everything has to be in
13 .pdf.
14 Well, Microsoft spreadsheets don't work
15 too well in .pdf. So what we have done is people
16 have downloaded and said, "Hey, this spreadsheet
17 comes out of .pdf." We e-mail them the spreadsheet.
18 So it's all publicly available.
19 CHAIRMAN ROSEN: I think this is like
20 the next best thing.
21 MR. SALLEY: To sliced bread?
22 CHAIRMAN ROSEN: Right after the sliced
23 bread, right.
24 MEMBER POWERS: And you know what the
25 fundamental question is.

1 CHAIRMAN ROSEN: What's what?

2 MEMBER POWERS: What was the best thing

3 before they had sliced bread?

4 MR. SALLEY: Canned beer.

5 MEMBER WALLIS: I think the bread

6 before, fossilized bread, was probably better.

7 MEMBER SIEBER: You're obviously a

8 Pittsburgher.

9 CHAIRMAN ROSEN: We are now ready to

10 take our 3:00 o'clock break. And we will do so

11 until 20 minutes until 4:00.

12 MR. SALLEY: Yes. We would like your

13 comments on this, too.

14 (Whereupon, the foregoing matter went

15 off the record at 3:26 p.m. and went

16 back on the record at 3:41 p.m.)

17 VII. MANUAL ACTIONS

18 MR. DIEC: Good afternoon. My name is

19 David Diec. And I am a project manager for the

20 post-fire operator manual action rulemaking effort.

21 With me today are Phil Qualls of the Office of NRR;

22 Erasmia Lois from the Office of Research; and

23 additional people, who are staff, who are sitting in

24 the back, who are also available to answer

25 additional questions you may have as we go through

1 the presentation today.

2 Next slide. The agenda for the grouping

3 today, we are going to talk to you a little bit

4 about the current status of the proposed rulemaking

5 plan that we forwarded to the commission in July.

6 And we talked about a background of the

7 manual action issue a little bit and the objective

8 of our rulemaking plan and the options that we

9 foresee of what the outcomes, possible outcomes that

10 we see for the rulemaking effort and the approach to

11 get there. Certainly we are going to talk about the

12 next steps that we have got to do.

13 Next, please. We forwarded the

14 commission plan in July 2nd of this year. The

15 commission made it publicly available for

16 information. We also received a number of comments

17 from NEI. And I understand that Fred is going to

18 make a presentation after us. So Fred will expound

19 on that a little bit more.

20 A FOIA request came in asking for

21 information relating to the developing information

22 that leads to the proposed rulemaking plan. And the

23 staff has partially responded to the requests on

24 this issue as well.

25 As I was sitting in the background 15

1 minutes ago, I learned that the commission has voted
2 positively on our rulemaking plan. Let me caution a
3 little bit more here. We don't know the detail of
4 those comments yet until we receive the SRM, but
5 overall we received the positive comment to move
6 ahead with this effort.
7 On March 6 of this year, we issued the
8 inspection procedure that helps inspectors
9 consistently document the inspection findings
10 related to potential feasibility of operator manual
11 actions.
12 The inspection findings at this time
13 would indicate the feasibility of the manual action
14 that can be given a green finding and then put in
15 the licensing corrective action program. If
16 findings otherwise will be given non-green, then the
17 SDP process would have taken place. And we have a
18 process to sort out issues.
19 CHAIRMAN ROSEN: Non-green would be a
20 manual action found not to be feasible. Is that
21 what you said? I'm trying to follow.
22 MR. QUALLS: What the inspectors are
23 really finding is where the manual action that
24 they're reviewing doesn't meet the screening
25 criteria that's in the inspection procedure, it is

1 potentially non-green. It automatically is green,
2 green as being feasible, if it meets the inspection
3 criteria, they will screen it green. Okay?
4 If it doesn't meet this inspection
5 criteria, it goes into the SDP for further
6 evaluation. Further evaluation may well determine
7 if the manual action is green, but it may not.
8 CHAIRMAN ROSEN: And the kinds of
9 criteria that are in the inspection procedure are
10 that it's accessible, that it's good enough
11 lighting, that there is high-radiation fields, those
12 kinds of things?
13 MR. QUALLS: Right. I can read them off
14 real quick, but you are there.
15 MR. DIEC: They are very closely related
16 to the plan that we put forward to the commission.
17 A. BACKGROUND
18 MR. DIEC: In way of background, when
19 appendix R was promulgated, it was recognized that
20 strict compliance with paragraph III.G.2 of appendix
21 R, associated with certain blank conditions and
22 configuration, may not provide any enhanced safety
23 level than we provided by the licensees' system
24 configuration.
25 And certain manual action, relatively

1 simple set of manual action, work is either
2 acceptable to the licensee, normal licensing action
3 deviation or exemption request. And we have given
4 that exemption request or deviation request.
5 The recent inspection raised a number of
6 concerns because of the widespread use of manual
7 action as a way to meet one of the requirements in
8 paragraph III.G.2. And the manual action, as we
9 understand it, used was the genesis as part of
10 trying to resolve the resolution of the thermal lag
11 in mid 1990, instead of upgrading or replacing the
12 appropriate protectant barrier, licensee utilizing
13 manual action as a compensatory action to meet those
14 requirements.
15 However, the requirement, as we
16 understand in III.G.2 does not recognize explicitly
17 manual action. And that's where the issue came
18 about that leads to a better approach to resolve the
19 issue by recognizing manual actions in the context
20 of regulation so long as it can prove and
21 demonstrate certain visibility aspect of it and
22 consistently approach as part of the results.
23 MEMBER WALLIS: The impression I got
24 from reading the documents you send us was that
25 these manual actions are widespread and relatively

1 few of them are approved. It's not a question of
2 not all, but relatively few of them are actually
3 approved by the NRC.
4 MR. QUALLS: That would be probably a
5 very good conclusion. What I found historically in
6 my research was that up until 1992, I searched our
7 database. We had approved on the order of 50
8 exemptions for manual actions for III.G.2.
9 At one licensee alone in a recent
10 inspection, they identified 100, on the order of
11 100, manual actions that weren't approved by the
12 NRC. In other words --
13 MEMBER WALLIS: Just from one licensee?
14 MR. QUALLS: At one licensee. And that
15 was pretty much in the recent post-thermal lag era
16 that these came into be, --
17 MEMBER WALLIS: Right.
18 MR. QUALLS: -- of which a certain small
19 number are usually we have been finding not properly
20 analyzed.
21 C. RULEMAKING
22 MR. DIEC: So the objectives of our
23 approach for the rulemaking effort is to recognize
24 operator manual action and allow the user use so
25 that we can incorporate into the requirement that

1 everybody can follow and do it consistently.

2 We will develop a set of generic

3 acceptance criteria for the visible operator manual

4 action so people can understand what it is the

5 expectation from the regulation.

6 And what we foresee is that so long as

7 the acceptance criteria was followed by the

8 industry, we don't feel that there is a need for

9 them to come in for any license amendment or require

10 approval required by the NRC because this is purely

11 a voluntary approach rule.

12 As far as the possible outcome for the

13 rule, our current thinking is this. We go back to

14 the intention of paragraph III.G.2. Again, we

15 understand that manual actions are not allowed

16 without prior approval by the NRC.

17 We can see two different possible

18 outcomes. One is using manual action in lieu of

19 barrier with the combination of existing fire

20 detection and suppression capability already in

21 place or there may be a more limited set of defined

22 manual action with the existing fire barrier and

23 protection and suppression system in place.

24 MEMBER WALLIS: Shouldn't this be

25 performance-based in that as long as they meet some

1 required performance, it can be done with a
2 combination of things?
3 MR. DIEC: At this point, I think that
4 we are trying to stay from the deterministic side of
5 it and using the risk insight to supplement --
6 MEMBER WALLIS: It can certainly be
7 performance-based without having anything to do with
8 risk as long as you meet some performance criteria.
9 MR. QUALLS: In one regard, yes. We
10 have performance criteria, which is what we are
11 doing with the manual actions. The other issues,
12 like fire detection and fixed suppression, that may
13 come about as a result of the fact that if we have a
14 one-hour barrier, also it's a defense-in-depth
15 issue.
16 We also require detection and
17 suppression. If we have 20 feet, no intervening
18 combustibles, we have detection and suppression.
19 Then on III.G.3 of appendix R, where we allow manual
20 actions already as part of our rule, wherever we
21 have alternative shutdown, we also require detection
22 and suppression.
23 So that may become an issue further in
24 the rulemaking. He's presenting possible outcomes.
25 MEMBER WALLIS: Well, these are

1 alternatives in order to achieve some performance
2 objective, aren't they?
3 MR. DIEC: Yes. By this, either one of
4 these alternatives can become --
5 MEMBER WALLIS: So if you were clear
6 about the performance objective, you could perhaps
7 determine which combinations were satisfactory?
8 MR. DIEC: That's our intention.
9 MEMBER SIEBER: I presume that when you
10 consider allowing manual actions, you look at staff
11 size, minimum staff size?
12 MR. DIEC: The next slide will explore
13 the key parameter that will influence the acceptance
14 criteria that we have to develop.
15 MEMBER SIEBER: Because you use
16 operators as fire-fighters. So there is sometimes
17 nobody left to do the --
18 MR. QUALLS: The answer is yes. One of
19 the current inspection criteria is staffing, to
20 review licensee shift staffing to determine whether
21 adequate qualified personnel are available to
22 perform the required manual actions to safely
23 operate the reactor. That is currently in our
24 inspection guidance.
25 MR. DIEC: And to go back to a earlier

1 comment from Mr. Rosen, lighting is also a
2 consideration that we have to look at from the
3 overall approach for the visibility argument.
4 I am not going into detail, sub-bullets.
5 Clearly they are very self-explanatory but areas
6 that we need to consider to develop the acceptance
7 criteria.
8 The most important things that I want to
9 have stressed in this point is that the parameter
10 that talks about "time to damage," we need to
11 clearly understand how they came about and what time
12 is available for operator and whether or not an
13 operator can actually carry through given the time
14 constraints that they are having to work within.
15 The environment is so very important
16 because if the human cannot function in a certain
17 environment, if they don't understand the effects of
18 the fire given the smoke environment or toxic
19 environment, clearly they may get there, but they
20 may not be able to perform the job as they are
21 required to do. So there are things that we have to
22 be really vigilant about.
23 MR. WEERAKKODY: I would just like to
24 make a comment here. Let me look for feasibility of
25 manual actions, even at the percent we have good

1 general criteria at a high level, what is feasible
2 manual action or not.
3 It's not broken down to a number of
4 elements like this here, but our current ROP process
5 has some general guidance that the licensees'
6 programs are about.
7 What we plan to do is maybe go to some
8 level of detail with some stakeholder discussions to
9 make a rule that achieves the safety objectives
10 without making it so prescriptive that people
11 couldn't adopt it.
12 So these are things under consideration
13 when we reach that point.
14 MR. DIEC: Next slide, please. Clearly,
15 as part of the visibility argument, we want to be in
16 a position to understand the visible approach
17 because those manual actions identify need to be.
18 They're verify-invalidated that, indeed, they can be
19 performed and carry out --
20 MEMBER POWERS: How do you do that? How
21 do you validate an operator action?
22 MR. DIEC: At this point your question I
23 am going to take back and do study on it because
24 that is one of the things that we have to think --
25 MEMBER POWERS: Is there any hope? It's

1 not like you can set up a simulator and test an
2 operator action.
3 MR. QUALLS: Well, in many cases --
4 MEMBER POWERS: Send him into a burning
5 building.
6 MR. QUALLS: In many cases, a JPM would
7 be an acceptable validation, for example.
8 MEMBER POWERS: A JPM?
9 MR. QUALLS: A job performance measure.
10 The licensees have in their various --
11 MEMBER SIEBER: One approach to
12 training.
13 MR. QUALLS: Well, let's use an example:
14 the manually operated valve. Okay? What are the
15 big issues that we come across as a spurious
16 operation of valves? How do you validate that
17 someone can spuriously operate a valve?
18 First, you are concerned about the
19 timing issue. That's partially analyses and
20 partially walk down with one of the operators in the
21 plant.
22 CHAIRMAN ROSEN: I don't understand what
23 you are saying. How can you validate if someone can
24 spuriously operate a valve? Is that what you said?
25 MR. QUALLS: Well, one of the issues is

1 if a valve spuriously operates, how do you
2 reposition --
3 CHAIRMAN ROSEN: Oh, reposition. Okay.
4 MR. QUALLS: I apologize. I talk faster
5 than I think sometimes.
6 MS. BROWN: Phil, I just wanted to add
7 that we do during the inspections validate.
8 Sometimes the licensees will actually set up the
9 simulator. And we will use operator-licensing
10 individuals and actually have them go through the
11 job performance measures and do timing and take a
12 look at smoke, light, and those conditions. So we
13 do validate during the inspections.
14 MEMBER POWERS: How do you do that? How
15 do you simulate smoke, light, fire, ringing bells,
16 fire engines, crazy people running around?
17 MS. BROWN: In some cases, we turn the
18 lights off. In other cases, we take a look at
19 whether or not there would actually be smoke in the
20 area. If there is, we talk to the licensees about
21 whether or not they have used SCBAs.
22 We have actually asked them to get a
23 crew out and do some of these. And we have had
24 inspection findings from that they were --
25 MEMBER POWERS: But you don't simulate

1 the smoke.

2 MS. BROWN: We don't simulate smoke, no.

3 MEMBER POWERS: You don't simulate --

4 MEMBER SIEBER: Some licensees do.

5 MS. BROWN: Well, they will practice in

6 SCBAs.

7 MEMBER POWERS: We don't even find them

8 practicing in the simulators with breathing

9 protection.

10 MEMBER SIEBER: That's pretty rare.

11 MS. BROWN: But then they don't get

12 credit for the manual action either. I mean, that's

13 part of the criteria. If operators have to do it

14 and that means that part of the current SDP

15 criteria, that they have trained under the

16 conditions that they have to perform in. So if they

17 need an SCBA, they haven't used it, then they don't

18 get credit by the inspection staff.

19 MR. QUALLS: SCBA is pretty easy to

20 verify on site during inspection that someone --

21 MEMBER POWERS: I agree.

22 MR. QUALLS: -- is qualified in its use.

23 MEMBER POWERS: I agree with that. The

24 question that I was giving to David was, what

25 constitutes a validation? Now, if it is adequate to

1 say yes, the guy can go turn the valve with a SCBA
2 apparatus on, that's one thing. Okay?
3 We might interrogate him fairly closely
4 on why he thinks that is valid or not.
5 MR. DIEC: That's one of the key
6 parameters if you go back to the previous slide,
7 where we talked about training needs to include some
8 sort of simulation that is part of the --
9 MEMBER POWERS: Well, the question,
10 then, is, when you say some sort of simulation, how
11 close to reality must be the simulation? And how do
12 you know what the reality is?
13 MR. DIEC: Certainly your question is
14 valid. And I don't have the answer for that. One
15 of the things is we developed the rule we need to
16 consider that.
17 Do we have any other comments from the
18 staff on this question at all?
19 (No response.)
20 B. INSPECTION
21 MR. DIEC: Okay. The Office of Research
22 is also working as part of the team here and helping
23 to review a number of sources to attract insights
24 from updated PRAs, from IPEEE reports, fire
25 requantification project, insight from that, and

1 certainly inspection-related sample plants that we
2 used to review and to extract information, whether
3 or not types of manual action were credited by the
4 licensee and how they were credited, the fact that
5 they were considered in assessing the likelihood of
6 success of those manual actions, and certain
7 important factors and conditions that can influence
8 the visibility of the manual action. Those kinds of
9 things we are trying to extract from reviewing, from
10 a number of sources.
11 CHAIRMAN ROSEN: Would you go back one
12 slide, please? To reinforce this question and talk
13 for a moment more about validation and operator
14 manual actions, on the next to last line on this
15 slide, is the complexity of operator manual actions.
16 So the question there would be, how complex is too
17 complex?
18 It would seem to me that one might get a
19 handle on that by looking at some error-forcing
20 functions and have some sort of threshold, some
21 numeric threshold, that says if it gets below 20
22 percent likelihood or 30 percent or 50 percent
23 likelihood that the guy will succeed when you go
24 through the human factors analysis, that you simply
25 are going to allow that complex of a manual action.

1 In other words, you can go into some
2 existing techniques and establish some sort of
3 quantitative threshold for complexity based on the
4 error-forcing functions. In other words, rather
5 than just use, "Well, it seems too complex for me"
6 --
7 MR. QUALLS: We agree. We have been in
8 discussions with the folks in our human performance
9 group and with research concerning these types of
10 issues. This is stuff that is going to be addressed
11 in the rulemaking process and in the public meetings
12 and stuff.
13 You know, some of the manual actions I
14 have run across in the past inspections include
15 local manual start of a diesel without control
16 power. Another utility had someone opening 16
17 breakers with no lighting and actually opening the
18 back of electrical panels and reaching in with no
19 lighting and doing this kind of stuff to manual
20 actions.
21 CHAIRMAN ROSEN: In SCBA gear.
22 MR. QUALLS: In SCBA gear. Actually,
23 yes, in SCBA gear with 30-minute bottles, which is
24 good for 20 minutes.
25 CHAIRMAN ROSEN: Have you been in SCBA

1 gear? If you have, you know that it's a little
2 harder than --
3 MR. QUALLS: I realize that. I realize
4 you really have 15 or 20 minutes maximum and you're
5 in a bad situation and we didn't credit the manual
6 action.
7 CHAIRMAN ROSEN: My point is only that
8 there are adjacent technologies that one can use to
9 assess this. And I would point towards doing as
10 much as you can using those technologies to quantify
11 this some so that licensees as well as the staff and
12 the inspectors can all have a common frame of
13 reference that says this is too complex or you take
14 a given circumstance, perhaps like the one you just
15 laid out, and recognize right up front that it is
16 too complex until the licensee would choose to do
17 something about that.
18 MR. QUALLS: I agree. I agree
19 completely.
20 CHAIRMAN ROSEN: Okay.
21 MR. QUALLS: We're going to be looking
22 into that as the rulemaking progresses. We're
23 getting help from the various groups and from the
24 agency.
25 CHAIRMAN ROSEN: I will look for that

1 because I am also chairman of the Human Factors
2 Subcommittee.
3 MR. QUALLS: Oh, good.
4 MR. DIEC: Certainly your
5 recommendation, perhaps we are going to use it in
6 the context of a screening tools approach.
7 CHAIRMAN ROSEN: I would be less
8 impressed with opinion on either side, either from
9 the staff or the licensee, than an analysis that
10 actually looks at the error-forcing context.
11 MR. WEERAKKODY: One of the things that
12 -- I think I understand what you're saying, but are
13 you saying that we should consider numerical
14 thresholds as the definition for feasibility --
15 CHAIRMAN ROSEN: For actions.
16 MR. WEERAKKODY: -- for every --
17 CHAIRMAN ROSEN: Wherever you can, you
18 should consider --
19 MR. WEERAKKODY: Well, yes, that --
20 CHAIRMAN ROSEN: Quantitative --
21 MR. WEERAKKODY: To the possible because
22 --
23 CHAIRMAN ROSEN: To the largest extent
24 possible.
25 MR. WEERAKKODY: Because I could enter

1 some constants where there is -- I wouldn't say
2 impossible, but that is very --
3 CHAIRMAN ROSEN: On the borders, you can
4 always do that. But I think if you are talking
5 about a human being taking a specific action, you
6 can identify the error-forcing context and do some
7 quantitative reasoning and place that against the
8 thresholds which you establish, reasonable
9 thresholds.
10 One that comes to mind right off the bat
11 is 50 percent probability. Anything below that
12 certainly wouldn't be allowed. Sometimes he does
13 it, and sometimes he doesn't. And if you are going
14 to take credit for something, it has got to be
15 better than that.
16 MR. WEERAKKODY: Chairman Rosen, I
17 shouldn't just right of way react to that, but one
18 of the for instances that I have used, if you get
19 into more of a holding to a strict numerical
20 criteria, given the variability that you -- I mean,
21 if you are chairman of the Human Factors Committee,
22 you know if you look at an operator error
23 probability, there is a lot of variability in that.
24 E. RES SUPPORT
25 MR. WEERAKKODY: The one thing that we

1 want to do is get the benefit of all of that
2 research but not have the rules be held hostage to
3 the variability, which is why I think it is a good
4 idea, but it should be more to the extent practical.
5 CHAIRMAN ROSEN: I will leave you with
6 the details, but the idea is that one should do
7 better than just arm-waving. One should use
8 quantitative approaches as best you can.
9 MR. WEERAKKODY: This I fully agree
10 with, yes.
11 CHAIRMAN ROSEN: Fred?
12 MR. EMERSON: A quick question. The
13 last two sub-bullets on your slide there are not
14 currently part of the feasibility inspection
15 procedure. Are these things that are going to be
16 added to the inspection procedure? Because right
17 now the inspectors aren't asked to assess the
18 complexity.
19 MR. QUALLS: No, because the inspection
20 procedure, the current -- what we have currently is
21 III.G.2, which doesn't allow manual actions. If the
22 inspector goes out and he finds manual actions in
23 lieu of a barrier that had not had prior approval by
24 the NRC, he calls it a finding.
25 The inspection criteria is criteria that

1 is free net finding, green, or non-green, or
2 potentially non-green for further SDP evaluation.
3 Okay?
4 Now, these are things that are going to
5 have to be evaluated and discussed publicly at
6 public meetings during the rulemaking process
7 because they may become issues because it becomes a
8 rule for saying, "These manual actions are okay.
9 It's not a finding. It's not a problem. These are
10 good. These are as good as a three-hour barrier.
11 These are as good as a one-hour barrier with
12 detection and suppression."
13 Is there a total number that is too
14 many? I don't know. Is there a certain probability
15 of failure of each manual action such that the sum
16 is too high? We don't know. There are issues that
17 are going to be discussed at further meetings and
18 such.
19 MR. EMERSON: Okay.
20 MR. DIEC: I think we've pretty much
21 discussed this slide. If you don't have any
22 questions, we are going to move to the next slide.
23 D. SCHEDULE
24 MR. DIEC: Our next steps, clearly once
25 we receive the SRM, which we are anticipating

1 receiving soon on this one, we are going to engage
2 in more discussion with industry to help understand
3 and determine a little better what feasibility means
4 and the kind of limitation that we have to confront
5 with when we develop acceptance criteria for manual
6 action.
7 Our expectation is that we will develop
8 the acceptance criteria and associated guidance as
9 part of the package for the publishing of the final
10 rule.
11 The proposed rulemaking plan that we
12 have in front of the commission does have the
13 request for exercise of discretionary action
14 regarding the inspection findings.
15 Since we received the approval, perhaps
16 our first primary goal is to go forward with this
17 approach in the context of a SECY paper requesting
18 approval from the commission before refraining
19 ourselves from taking any regulatory action against
20 findings associated with manual actions.
21 We will also issue the regulatory issue
22 summary and conveying our position and our direction
23 where we are going to go from here and what we will
24 expect from the rulemaking effort itself.
25 Our next step is to share the draft rule

1 language with the public and stakeholders consistent
2 with the commission approach regarding about making
3 the regulatory action transparent to the public.
4 This can be done in a number of ways. We can
5 publish in the rule forum discussion, where
6 everybody is having equal access. And they can also
7 make comments on that. So that is our immediate
8 milestones ahead of us once we receive the SRM.
9 In your slides, there are two additional
10 slides that I have, one of which is the definition
11 of the operator manual action. Go to the next one.
12 This is just for the background information. It has
13 nothing to do with the part of the presentation.
14 It's the way that we define operator manual action
15 versus the current manual actions that are being
16 received by NEI as a point of reference.
17 The next slide is simply telling you
18 what is the current regulation in paragraph III.G.2
19 that has the three options if the licensee can meet
20 one of those provided that they follow the
21 requirements.
22 That concludes my presentation. Are
23 there any questions that we can --
24 MEMBER POWERS: I guess here's my
25 misgiving. We have for a long time, since I've been

1 on this Committee, had people come in here and say,
2 "We want to put into this reg guide this criteria
3 for how you decide when there is sufficient time for
4 manual action, as opposed to automated action, under
5 accident conditions."
6 And it's mostly associated with a
7 switch-over to recirculation, but there are a
8 variety of other things, too. And they say, "We've
9 got this huge database that comes from simulators
10 that we can use for this."
11 And this committee has rejected that
12 thing. I think three times now we have bounced that
13 out of here because we cannot relate the criteria
14 that people have come up with to the database, nor
15 can we see the database, which was an EPRI database.
16 We can see it, but the public can't see
17 it. So it pretty much kills it right there. In
18 other words, they would have a tremendously
19 difficult time. What you are proposing to do seems
20 far more difficult than what they are proposing to
21 do.
22 I mean, what I don't see in your plan is
23 anything that addressed the top parts of it. I
24 mean, what you have got is somebody coming along
25 saying, "I am going to do X, and I am going to do Y

1 and Z," but the trouble is X is just fraught with
2 enormous numbers of difficulties, I mean, things
3 like what is an adequate validation of a proposed
4 manual action.
5 How much simulation do you have to do to
6 persuade me that the action which under simulated
7 conditions involves modest amounts of stress, in
8 reality involves huge amounts of stress, and things
9 like that?
10 The hard part is not planned out here.
11 That's the trouble.
12 MR. WEERAKKODY: In this comment, you
13 started out with the recirculation to sump and how
14 that operator action is validated or --
15 MEMBER POWERS: I forget what I --
16 MR. WEERAKKODY: I am trying to
17 understand.
18 MEMBER POWERS: It's a reg guide that
19 has been in draft since the dawn of time, as far as
20 I am concerned.
21 MR. WEERAKKODY: I am not sure that I
22 will be directly answering your real questions, but
23 if I look back at the experiences I have had in
24 terms of determining whether a particular operator
25 action is feasible or not, we go to licensees and

1 sometimes for certain actions, they have timing.
2 They record the times. And they compare that to the
3 time available based on that scenario. And that is
4 the basis to accept or reject feasibility, at least
5 in that example.
6 Now, I know in our ROP, we say that the
7 feasibility should be established for the accidents
8 under that same condition you postulated. I'm not
9 using the exact right words, but we do factor the
10 accident for which you are relying on this
11 particular manual action and demonstrative
12 feasibility for that accident.
13 Now, in terms of how much depth you go
14 into, whether you simulate more, I think that is a
15 matter of practicality. I don't think for every
16 manual action, we go that far.
17 MEMBER POWERS: Here's one of the
18 challenges that I see in all of this. We are
19 looking at power uprates for a lot of boiling water
20 reactor plants. One of the questions that comes up
21 with you do power uprates is you shorten the time
22 that you have to scram the plant in the event of
23 ATWS. And so we ask people, "Gee, what did you
24 conclude on this risk?"
25 And he says, "Well, we have read

1 simulators, and all of our operational crews do so
2 regularly, unscramming the reactor in the event of
3 an ATWS signal. And every crew does this exactly
4 correctly every single time," and they do it in 32
5 seconds, certainly less than 52 seconds.
6 But when they go into the PRA, we still
7 give them a .015 probability of failure. Okay?
8 What that says is, here is something that is just
9 routine, practiced all the time, simulator. And we
10 still don't trust them enough to give them any
11 better than a little less than 99 percent
12 probability of success.
13 Now you're talking about a much more
14 complicated operation. How many simulations, how
15 many trainings do they regularly have to set up for
16 the PRA folks to give them more than a 50/50 shot on
17 this?
18 And the whole thing boils down to
19 simulators are simulators and events are events.
20 And events are just different than simulators.
21 MS. LOIS: I guess from a human
22 reliability/PRA perspective, the concept of
23 combining hardware bias with potential human actions
24 should be entertained. The idea of using just human
25 actions for every scenario, considerable scenario,

1 probably is not a realistic one.

2 As Mr. Rosen suggested, we can use some

3 techniques to kind of create some bounding cases or

4 values as to how many human actions, what

5 combinations of human actions, what are the

6 potential scenarios, and yes, to verify or to

7 validate the ones that are potentially under-defined

8 as logic to be included in the rule. It would be

9 very difficult.

10 On the other hand, the case is right

11 now, we are operating plants -- this is the state of

12 conditions. We are using those human actions. And

13 what the rule will do is at least create some

14 criteria that will help the implementation of these

15 human actions and considerably make them more

16 reliable. So it's how do you balance the ideal

17 situation with the reality we are dealing with?

18 And this is the rulemaking we are

19 proposing. And I hope that this what we have been

20 through looking at error-forcing conditions, et

21 cetera, will help us how to develop some criteria

22 will get us close, if not in the ideal place.

23 MR. GALLUCCI: This is Ray Gallucci from

24 the Fire Protection Branch.

25 I think two of the techniques that have

1 already been described might be helpful towards this
2 validation idea. As the inspection has mentioned
3 earlier, the plants currently do run some sort of
4 simulation, whether SCBA gear, et cetera, et cetera.
5 It may be possible to enhance these somewhat.
6 Maybe if they had a training center or
7 something, you could actually simulate smoke
8 conditions, et cetera. So you could make the
9 simulation somewhat more realistic short of setting
10 off a fire. You could actually have enunciators
11 going off, et cetera, do it during shutdown.
12 That would give you a little better
13 simulation. And you would enhance that with some of
14 the analytical techniques currently being developed
15 in the human reliability analysis area, whether it
16 be the stress factors, et cetera, because I know
17 some of the tools NRC and EPRI are putting together
18 in the HRA guidelines hopefully will be able to take
19 the best of the existing techniques and refine them
20 to a level where a combination of these actual
21 simulator scenarios, on-the-job-training-type
22 scenarios, combined with some analysis may get you
23 as close as you possibly can to the validation
24 without actually setting off a fire in the plant.
25 CHAIRMAN ROSEN: What we are talking

1 about here is trying to set up the regulatory
2 framework where a given proposed manual action is
3 either accepted or not.
4 And the question is, what are the
5 criteria for acceptance? And how does one do the
6 analysis? And that is all I am suggesting is that
7 that be explored, that that is not something that is
8 beyond the current technology.
9 And then once you have this thing, if
10 you apply it conservatively, maybe a few more of the
11 manual actions that you would have accepted fall out
12 as being unacceptable because of uncertainty, for
13 example. But there will be a class of them that
14 everybody agrees can be done because the conditions
15 are benign.
16 It's a simple procedure. The operators
17 are trained. It's easily accessible. It's not
18 radioactive. There will be a class of them that way
19 that reasonable people will be able to agree that
20 manual action is likely to be successful.
21 And then there is going to be a class
22 where everybody will agree it's not acceptable, it's
23 just too hard, conditions are too harsh. So you
24 won't see anybody asking for acceptance of those or
25 getting it.

1 And then there's going to be in the
2 middle be a gray zone. And that will be the area
3 where you will have to apply some considerables.
4 MR. WEERAKKODY: I think we agree that
5 --
6 CHAIRMAN ROSEN: Well, when you came
7 here earlier today, Sunil, you asked us for review
8 and feedback. You have gotten quite a bit of that.
9 MR. WEERAKKODY: Yes. In fact, let me
10 -- I'm sorry.
11 CHAIRMAN ROSEN: And I don't know if
12 you're done with this particular piece of it. So
13 I'm just pointing out that we have given you quite a
14 bit of review and feedback. Have you completed this
15 discussion?
16 MR. DIEC: Yes, we have.
17 CHAIRMAN ROSEN: Okay. I guess we have
18 one more shot by Fred Emerson to try to convince us
19 otherwise?
20 MR. EMERSON: Was that a shot at Fred or
21 a shot for Fred.
22 CHAIRMAN ROSEN: We'll give you one --
23 MEMBER POWERS: If there's shooting
24 going on, Fred, you know it is headed in your
25 direction.

1 MR. WEERAKKODY: Chairman Rosen, before
2 the committee adjourns, I do have one. You asked me
3 questions, but I have a question to ask you because
4 this idea of defense-in-depth you discussed in two
5 sessions. I want to --
6 CHAIRMAN ROSEN: Well, why don't you sit
7 here? Fred, how long do you need? Do you have 15
8 minutes' worth? Oh, you have 15 or 20 minutes. Why
9 don't you stay up here and let Fred do his thing.
10 Then we have a kind of a little bit of a colloquium
11 here to wrap up the session.
12 MEMBER POWERS: Fred's usually
13 controversial enough it will probably be an hour and
14 a half.
15 CHAIRMAN ROSEN: Only if you are picking
16 on him, Dana.
17 MEMBER SIEBER: He's an official victim.
18 MR. EMERSON: I'm looking for the
19 presentation.
20 F. NEI DISCUSSION
21 MR. EMERSON: Okay. The last
22 presentation today, at least that I am aware of, is
23 the resolution of manual actions issues or perhaps,
24 to use an earlier phrase, the re-solution of manual
25 actions issues.

1 What I would like to do is to provide a
2 little bit of background, industry perspective on
3 the issue, what we see as the need for resolution of
4 the issue, which, according to David, is getting
5 much closer with the perspective SRM almost out;
6 provide a slide about the industry views on the
7 feasibility criteria; and just some final
8 recommendations.
9 Now, these are recommendations that we
10 provided to the commission after SECY-03-100 was
11 issued and we were contacted by one of the
12 commissioner's offices since we had expressed an
13 interest in it and we offered comments on it. So I
14 guess we will see to what extent our comments were
15 considered.
16 The basic issue, as David just
17 explained, is how the regulator should treat manual
18 actions for redundant shutdown, III.G.2 for the
19 appendix R plants. It had its origin in NRC
20 inspection findings.
21 There was an NEI survey -- and all of
22 these I am going to pursue in a little bit more
23 detail -- of the industry views and practices, which
24 I will elaborate on a little bit.
25 There was an industry-NRC meeting on

1 June 20th last year, where we I think reached a
2 watershed with regard to how this issue should be
3 treated, which was later embodied in the rulemaking
4 and the inspection guidance, and what actions have
5 taken place since this meeting.
6 Our understanding of this was that this
7 whole thing started when the inspection findings
8 were noting as a finding the licensee use of manual
9 actions without NRC approval being a violation of
10 appendix R, section III.G.2.
11 I think the first such inspections were
12 not quite two years ago. And that is when this
13 issue began to surface.
14 MEMBER WALLIS: How long had it been
15 going on before it was surfaced?
16 MR. EMERSON: I'll get to that, but the
17 short answer is many years.
18 MEMBER WALLIS: Yes. It has been going
19 on for a long, long time and surfaced a couple of
20 years ago.
21 MR. EMERSON: Yes.
22 MEMBER SIEBER: Since 1980.
23 MR. EMERSON: Yes. And I will touch on
24 that a little bit more. When the issue surfaced, it
25 became apparent to us that this was potentially a

1 generic issue. We sent the staff a letter
2 indicating our preliminary view was that manual
3 actions should be considered acceptable for
4 redundant shutdown as long as they were feasible.
5 We sent that letter more than a year and a half ago.
6 After that point, there were discussions
7 back and forth with the staff. So I personally
8 conducted a survey of practically every licensee to
9 see to what extent manual actions were used for
10 redundant shutdown.
11 The result of that survey, in very
12 brief, was that most use them to some extent, a
13 number use them to a large extent, and the licensees
14 have consistently over the last 20 years interpreted
15 this practice as being acceptable and that numerous
16 inspections during the 1980s and beyond had not
17 identified any need for prior approval until the
18 issue surfaced a couple of years ago.
19 MEMBER WALLIS: This is strange to me
20 that it seems to be categorical in the NRC view that
21 this practice is a violation of appendix R. And,
22 yet, how much the licensees believed it was
23 allowable because it's a long time?
24 MR. EMERSON: Well, the --
25 MEMBER POWERS: Especially since it's

1 the explicit words of appendix R. I mean, it
2 definitely says "without prior approval."
3 MEMBER WALLIS: "Thou shalt not" is
4 appendix R, and it has been going on for a long
5 time.
6 MR. EMERSON: Well, the words in the
7 regulation don't say, "Thou shalt not." They don't
8 say, "You can." And that has been interpreted as
9 "If it doesn't say you can, then you can't." In our
10 meeting on June 20th, we cited some other regulatory
11 guidance, which led us to believe that it was
12 considered and --
13 MEMBER WALLIS: So it's not explicitly
14 forbidden, then?
15 MR. EMERSON: Not explicitly forbidden.
16 I don't want to spend too much time dwelling on that
17 because I think we have gotten past that issue. So
18 I would like to focus on where we are going in the
19 future.
20 In the meeting, we presented our views
21 informally. As a result of that meeting, the staff
22 agreed that they should focus on whether the actions
23 were feasible, rather than whether the prior
24 approval had been achieved. And that began the
25 chain of events, which led to the rulemaking and to

1 the changes in the inspection procedure.

2 MEMBER POWERS: Let me ask you a

3 question. When they made this decision, did they

4 make it from a risk perspective; that is, an

5 automated action I can make have a reliability of

6 10^{-3} probably? It's pretty easy to do for an

7 automated action; whereas, it is very difficult for

8 me to make a human action reliable better than 10^{-2}.

9 MR. EMERSON: I'm not really in a

10 position to speculate on why the staff made their

11 decision.

12 CHAIRMAN ROSEN: Well, Dana, let me just

13 ask you, is that 10^{-2} for every action or is there

14 --

15 MEMBER POWERS: No. I'm taking a round

16 number, but you can imagine if I have to go do

17 something in a plant under stressful conditions, you

18 go through THERP. And you can do it, but it's

19 difficult.

20 CHAIRMAN ROSEN: My argument is only

21 about how stressful. In other words, if you tell me

22 that a fire alarm comes in and I have to go down to

23 a room remote from the fire and turn around, which

24 is a new procedure to open something that is needed

25 and that is in a procedure, not very far from the

1 control room, and it's a clearly accessible space,
2 that's not very stressful for an operator. As a
3 matter of fact, the adrenaline he gets pumped from
4 that makes him more likely to succeed.
5 So there are some actions that are well
6 within the capability of trained operating --
7 MEMBER POWERS: The proof is --
8 CHAIRMAN ROSEN: A one percent success
9 rate for some actions is not correct. I mean, it
10 depends on --
11 MEMBER POWERS: No, no.
12 CHAIRMAN ROSEN: It depends on the
13 action.
14 MEMBER POWERS: Yes. But you go
15 through. Pick anybody's human reliability model.
16 CHAIRMAN ROSEN: Sure.
17 MEMBER POWERS: It's just very difficult
18 to get human -- I mean, you have to go to some
19 length to get --
20 CHAIRMAN ROSEN: Very stressful. It's a
21 stressful circumstance. I agree 100 percent. But
22 there are some circumstances that are not stressful.
23 They're simply responses to indications that
24 operators can and should do with --
25 MEMBER POWERS: In just the transfer of

1 numbers from one page to the other, a totally
2 non-stressful operation, the general rule of thumb
3 software developers use is one mistake in 100.
4 CHAIRMAN ROSEN: One mistake in 100; in
5 other words, 99 successes.
6 MEMBER POWERS: Ninety-nine successes.
7 CHAIRMAN ROSEN: I agree.
8 MEMBER POWERS: And one percent. It's
9 just very difficult to get reliability down to .01.
10 MR. QUALLS: Well, I can tell you in
11 answer to your first question about what the staff
12 considerations were about risk, the staff had
13 evaluated, not specifically in the risk context,
14 because appendix R, when you go back and read the
15 original documentation preceding appendix R and the
16 statements of consideration and there was a petition
17 by I think Union of Concerned Scientists about that
18 time and the commission ordered commission order
19 CLI-80-21, I think the number is, where the
20 commission chose specifically at that time not to
21 incorporate the state-of-the-art risk into the
22 appendix R program. They said the fire was not
23 predictable at that time. They didn't have the fire
24 modeling techniques. They didn't have the computer
25 techniques. We have developed a lot of technology

1 since then.

2 But appendix R is not a risk-informed

3 rule.

4 CHAIRMAN ROSEN: I understand that.

5 MEMBER POWERS: It doesn't matter.

6 MR. QUALLS: Statistically it does

7 matter.

8 MEMBER POWERS: You've still got a

9 policy to take into account risk to the extent that

10 it is practicable today.

11 MR. QUALLS: And during the process of

12 the '80s, if you look at the exemptions -- I did

13 research on the exemptions -- you will find on the

14 order of 50 or so exemptions that were reviewed and

15 approved. And that does not count the manual

16 actions that were reviewed as part of the newer

17 licensees where the fire protection program actually

18 submitted the manual actions as part of their

19 original submittal and the manual action might be

20 approved in an SER. I am only counting the appendix

21 R exemptions for the 379 plants. We had on the

22 order of 50.

23 When I looked at the bases for many of

24 the exemptions, at least in 2 plants, the exemptions

25 were based on no manual actions for the first 30

1 minutes of a fire assuming that the licenses that
2 operators had were time-critical and most of them
3 were things on the order of manual transfer of fuel
4 to the diesel day tanks, something that is not
5 time-critical, it's done 2 to 4 hours into an event.
6 It's fairly simple.
7 The operators do it occasionally anyway
8 so that they'll know how to do it. And if they fail
9 the first time, it's no big deal because they will
10 get another shot. Those were the types of things
11 that were typically reviewed and approved by the
12 exemption process in the 1980s.
13 CHAIRMAN ROSEN: I think that's called
14 use your engineering insights and your knowledge of
15 the plants to analyze this manual action
16 realistically and then apply conservatism. Don't
17 use a criterion that basically says manual actions
18 aren't allowed for 30 minutes. That was okay then,
19 but this is now.
20 Because some actions may very well be
21 capable of being taken within 30 minutes with a very
22 high reliability, but it remains for the licensee to
23 show that. And if they do and they should meet the
24 criteria you set and they do the work correctly and
25 well, I see no reason not to credit operators.

1 The operators in our plants are our very
2 significant line of defense. And anyone who doesn't
3 think so needs only to look at the history.
4 MR. QUALLS: I'll tell you what the
5 inspectors were finding. They were not taking issue
6 with the simple manual action that was not
7 questioned, the local transfer of the fuel oil from
8 the day tank. They were taking issue with local
9 manual start of a diesel generator, which was
10 time-critical without control power. All right?
11 And that is something that involved several --
12 CHAIRMAN ROSEN: If you go --
13 MR. QUALLS: You went through this
14 already. Those were the types of things they were
15 finding on some examples. Now, how do you separate
16 the examples?
17 CHAIRMAN ROSEN: Because you do human
18 reliability analysis using the error-forcing
19 context. In the example you just gave, you get a
20 very low reliability. You get one percent or 10
21 percent likelihood of success; whereas, in the cases
22 where you would credit manual action, you would get
23 90 percent likelihood of success or 99 percent
24 likelihood of success.
25 I want you to use your brain and to look

1 at the conditions and to either say this manual
2 action is acceptable or it's not using some
3 conservative threshold. That's all I would ask you
4 to do.
5 I think the industry would -- well, I
6 can't speak for the industry, but I think the
7 industry ought to accept that as a reasonable
8 approach because that would protect their asset. If
9 they're going to rely on a manual action in the
10 event of a fire, industry is going to want it to be
11 highly reliable.
12 MR. HENNEKE: Yes. I guess I have a
13 comment on that. There is one other consideration
14 that hasn't been discussed. Fred can kind of
15 confirm this from the survey results.
16 Most manual actions, especially the ones
17 that have been added, are either as a result or to
18 prevent failures, like spurious operation, either
19 single or multiple spurious operations.
20 So what you have is a less likely or an
21 unlikely event, especially, say, for armored cable
22 that we know can happen in a fire area. And now we
23 have an operator action to prevent that spurious
24 operation.
25 Well, that is a different issue than

1 having to change the recirc from the sump valves
2 because that is an in-line function versus something
3 that may or may not occur, something that is low
4 likelihood.
5 We also have manual actions because we
6 couldn't qualify our fire wrap. And so most fires,
7 the fire wrap is going to work fine. And for maybe
8 a very, very low probability of fire, fire wrap
9 won't. And then you have manual actions for that.
10 So these types of manual actions,
11 really, you have to take that into consideration
12 what it is really needed for. And you might have
13 different criteria for different manual actions.
14 If you had a manual action where it's an
15 in-line function that is absolutely required to
16 perform the safe shutdown function, that's one
17 thing. If it's prevent or to react to a
18 low-probability event, such as spurious operation,
19 that's another thing. And all of that has to be
20 considered in with the probability.
21 CHAIRMAN ROSEN: I think it should. It
22 should be considered, just as you suggest.
23 MEMBER WALLIS: These very high
24 probabilities of success assume that nothing else
25 happens. And there are times when people make

1 mistakes. Even though they are very, very reliable,
2 there has been something unexpected intrude. And
3 they get distracted.
4 And you can never be sure of what that
5 might be. I mean, it could be a wasp flying around
6 or something. There are all kinds of things that
7 can happen, even for the most reliable people.
8 CHAIRMAN ROSEN: That's why you never
9 get 100 percent.
10 MEMBER WALLIS: Never get 100 percent,
11 right.
12 CHAIRMAN ROSEN: That's right.
13 MEMBER WALLIS: You shouldn't.
14 MR. EMERSON: Okay. After the meeting
15 --
16 MEMBER POWERS: Except pushing a scram
17 button at an boiler in an ATWS.
18 CHAIRMAN ROSEN: Well, you don't get
19 100. You get very high.
20 MEMBER POWERS: It's 100 percent.
21 MR. EMERSON: David earlier outlined the
22 steps that the staff has taken in the last year or
23 so. I'm not going to elaborate on that.
24 The criteria that David listed were not
25 exactly the same list as the criteria that are

1 listed in the inspection procedure currently, which
2 are these. And I'm again not going to go over them
3 in detail.
4 Again, since the meeting, the view that
5 was espoused in the rulemaking plan, SECY-03-100, I
6 thought it was best summarized in the statement
7 which is a quote from that SECY. And I would say
8 we're in agreement with that that feasible operator
9 manual actions constitute a safe and acceptable
10 means of protecting --
11 CHAIRMAN ROSEN: I am not sure, but I
12 don't think anybody disagrees with that.
13 MR. EMERSON: That's right.
14 CHAIRMAN ROSEN: But the question is
15 what is feasible.
16 MR. EMERSON: Okay.
17 CHAIRMAN ROSEN: At issue is feasibility
18 and how you assess that.
19 MR. EMERSON: I understand.
20 MEMBER POWERS: It seems to me that it
21 is -- I mean, I will take issue with the statement
22 that the fact that something is feasible through
23 heroic efforts by brave men --
24 CHAIRMAN ROSEN: Well, you are just
25 playing with words.

1 MEMBER POWERS: I mean, what you want is
2 something that is risk-effective; that is, it is a
3 wash.
4 MR. EMERSON: We are in vigorous
5 agreement, violent agreement. We're issuing --
6 MEMBER POWERS: I think the word
7 "feasible" is the wrong word up there.
8 MR. EMERSON: I'm interpreting it
9 broadly as being something that can be done. And
10 how you can assess what can be done with a high
11 reliability is the issue in front of us.
12 MEMBER WALLIS: What you really need is
13 reliable operator manual actions.
14 CHAIRMAN ROSEN: Yes, highly reliable.
15 MR. EMERSON: Seeing that we're in
16 agreement with the staff position on the feasible
17 manual actions are a safe means of accomplishing
18 this, then what are the current issues? The biggest
19 issue --
20 MEMBER WALLIS: It's rather superfluous,
21 I mean, the word "feasible" utterly to say the use
22 of "infeasible." I mean, it doesn't add.
23 Obviously, if you're relying on operator action, it
24 must be feasible. Feasible adds nothing.
25 CHAIRMAN ROSEN: You're right. It

1 should say "reliable" or "highly reliable."

2 MR. EMERSON: The current issue, as we

3 see it, is not so much where the staff is going,

4 which we agree with, but what happens between the

5 time now and the time we get there.

6 There is a gap, as has been pointed out,

7 between what the NRC's intent is and what the

8 current rule language allows. Now, looking at it

9 from an inspectee's perspective, the inspectors

10 rightfully are inspecting against what the current

11 rule says, not what has been espoused in a SECY

12 document.

13 This creates difficulties in terms of

14 expectations for both the licensees and to some

15 extent the inspectors. And, as has been said, the

16 green findings are issued, even when the manual

17 actions are deemed feasible. And, at least in my

18 opinion, there is something wrong with that because

19 it says that if something is safe and something is

20 feasible, why should there be a finding at all?

21 Now, I understand why it is being done

22 is because the rule hasn't been changed yet, but

23 this gap is an inherent difficulty that needs to be

24 closed.

25 So what do we need to do? Well, we need

1 to close the gap. I just discussed what the gap is.
2 I don't need to elaborate on that.
3 Going to the feasibility criteria for a
4 moment, generally our view is that the feasibility
5 criteria are generally appropriate, as laid out in
6 the inspection guidance.
7 We have a task force that has gone over
8 those criteria and the supporting language in the
9 inspection procedure. And we will in the near
10 future be recommending some changes to the language
11 from the licensee perspective, which is probably
12 more of a tweak than substantive revisions. But we
13 think the licensee perspective ought to be reflected
14 in the guidance that the inspectors use to assess
15 feasibility.
16 I mentioned that we sent a letter to the
17 commissioners in August. The principal
18 recommendations from that letter were in order to
19 address this gap issue that I mentioned, to speed up
20 the rulemaking process, if possible, through
21 implementation of a direct final rule.
22 I realize that there are limitations on
23 the NRC's ability to do that, but if we can, the
24 length of time where you create a situation where
25 there is a difference between NRC expectations and

1 NRC rules is always a difficult one that you need to
2 get through as rapidly as possible.
3 CHAIRMAN ROSEN: Help me with this,
4 Fred. I don't know the protocol for direct final
5 rule. What does it do to speed up the rulemaking?
6 What happens if someone were to agree with you?
7 What's the difference?
8 MR. EMERSON: Well, I can give you my
9 limited understanding of it, but it would probably
10 be better if somebody from the staff who understands
11 the process better answered your question.
12 My understanding of it is that when the
13 rule is published, if there is no substantial
14 disagreement with it -- Eileen is going to.
15 MS. McKENNA: Yes. This is Eileen
16 McKenna. I'm from NRR, the Policy and Rulemaking
17 Program.
18 The idea with the direct final rule is
19 you publish it. Essentially, you publish a proposed
20 rule and a final rule at the same time, the idea
21 being if the proposed rule -- you put out the final
22 rule. And if there are no significant adverse
23 comments, then it becomes effective.
24 If there are comments, then you have got
25 to revert back to the proposed rule process so that

1 if you think there is a high likelihood that the
2 rule not be controversial, then the direct final was
3 faster because this is more of a one-step process.
4 CHAIRMAN ROSEN: And I understand that
5 NEI has petitioned for that and in a letter
6 recommended that the NRC issue a direct final rule
7 and that that is under advisement. Is that correct?
8 MR. DIEC: This is David Diec from the
9 staff.
10 Clearly, yes, the answer is that we have
11 to wait for the SRM to come down, whether or not it
12 addresses that issue or --
13 CHAIRMAN ROSEN: You have to do what?
14 MR. DIEC: We have to wait for the SRM
15 to see whether or not the SRM talks about that
16 issue. So we have to go back and do the
17 justification to make a decision whether or not the
18 direct final rule is appropriate and recommend it to
19 the commission.
20 CHAIRMAN ROSEN: So what you are waiting
21 for, what you expect is an SRM that will respond to
22 the NEI request.
23 MR. DIEC: We would hope that it
24 addressed one of those elements in the context of
25 the overall approach from the rulemaking.

1 CHAIRMAN ROSEN: I understand that.
2 Thank you.
3 MR. EMERSON: The other piece of our
4 recommendation was the staff had recommended in a
5 SECY document enforcement discretion and we
6 recommended that it go a step further and have a
7 moratorium on inspecting that issue until the rule
8 is in place, again eliminating the difficulty with
9 citing green findings for perfectly valid, perfectly
10 feasible manual actions, however you define that
11 term.
12 We realize that it might be a big step
13 to take to completely suspend inspections. So we
14 had also proposed in our letter that to fill that
15 gap, the staff could conduct audits, as opposed to
16 inspections, to gather information on this practice
17 and that if there were an observation of a
18 difficulty, then inspections could continue at that
19 point and enforcement discretion could be applied.
20 And, again, these recommendations were to help bring
21 the rule in line with the intent as soon as
22 possible.
23 Now, let me just say one more word about
24 this. there has been some discussion as to what the
25 difficulty is with being cited with a green

1 inspection finding. To a licensee, that's not a
2 small deal.
3 Any inspection finding is reviewed
4 seriously by management and because it indicates a
5 weakness with a licensee's program. It's either a
6 safety problem or it's a compliance issue or maybe
7 both. But licensee management cannot understand why
8 you need a citation if something is perfectly okay
9 just as a placeholder.
10 In summary, manual actions safely
11 support plant shutdown if their feasibility is
12 demonstrated. It sounds like we're pretty much in
13 agreement on that. The key issue is demonstrating
14 feasibility.
15 MEMBER WALLIS: I'll make a plea again
16 for not using the word "feasibility." To me,
17 feasibility means it's possible. I mean, it's
18 feasible that this student might pass the course.
19 It probably means that I am expecting a C- or a D.
20 You have to say something different.
21 And the manual action by definition is almost
22 feasible, the fact that you consider it at all. You
23 need a word like "effectiveness" or "reliable" or
24 something that --
25 MR. EMERSON: I understand.

1 MEMBER WALLIS: -- means that it works,
2 not that it just can't be done.
3 CHAIRMAN ROSEN: Works in most cases,
4 something like that.
5 MR. EMERSON: I understand your concern.
6 MR. DIEC: This is David Diec with
7 staff.
8 Dr. Wallis, I think that your thinking
9 is pretty much what we are trying to define, what
10 feasible means. And in the --
11 MEMBER WALLIS: Don't use the word.
12 MR. DIEC: That's right. But we
13 probably were thinking along the line that it is
14 attainable, achievable, and reliable, that kind of
15 thing.
16 CHAIRMAN ROSEN: There really isn't
17 anything wrong with the English language. It's
18 really how we use it that gets us in trouble. So
19 I'm sure you can find the right set of words to
20 better characterize than what we have been talking
21 about.
22 MR. EMERSON: That concludes my
23 presentation.
24 CHAIRMAN ROSEN: Well, very good. We
25 should be beginning a general here. At 5:15, I will

1 from us just saying, "Gee, it seems great." I mean,
2 you can read the --
3 MR. WEERAKKODY: I understand.
4 CHAIRMAN ROSEN: You can read the
5 transcript, but --
6 MEMBER WALLIS: You want a letter at
7 this stage? It would seem to me an awful lot of
8 this was preliminary education of the subcommittee
9 about some of the things going on. But nothing much
10 had come to a conclusion yet. And so I don't see
11 how we can endorse something --
12 MEMBER POWERS: The committee is not
13 going to give you a letter without a document that
14 they can endorse that is not going to change very
15 much.
16 CHAIRMAN ROSEN: So you see where I
17 think the difficulty is. While we could present the
18 summary of this to the full committee -- and I think
19 I have a little time on Friday to do that, maybe 30
20 minutes.
21 MR. WEERAKKODY: What the subcommittee
22 decides will be what you decide. But when I said
23 "endorsement," I know you have a lot of feedback on
24 the details. But one question, one high-level
25 question, that I had I was hoping to get feedback

1 point out we are 25 minutes early. So, Dr. Powers,
2 would you like to wax poetic or any other members
3 would like to have this open pulpit to talk about
4 any subject?

5 VIII. GENERAL DISCUSSION

6 MEMBER POWERS: Should I wax poetic over
7 the entire day?
8 CHAIRMAN ROSEN: Well, I would say that
9 I would go back to Sunil's earlier request. He
10 asked us for the three bullets. He wanted out
11 review of what they're doing. He wanted any
12 feedback we had, which we certainly haven't been
13 shy. And he wanted endorsement of future direction.
14 Now, I don't know how that would be
15 done. I would suspect that we would go to the full
16 committee. To get an endorsement, you need an ACRS
17 letter. To get an ACRS letter, you have to go to
18 the full committee.
19 And the subcommittee has to recommend
20 something, provide some sort of draft document
21 usually to the full committee or draft letter. I
22 presume that is what you are asking for, an ACRS
23 letter.
24 MR. WEERAKKODY: Yes.
25 CHAIRMAN ROSEN: You get no endorsement

1 and endorsement with, in your opinion, is the start
2 going in the right direction?
3 In other words, I said in my outline
4 that if you look for the common thread in the four
5 different issues presented today, the common thread
6 is trying to risk-inform all our efforts to the
7 extent possible. You see that, whether it's manual
8 actions or risk-informed inspections or adopting a
9 rulemaking 805.
10 So I was only seeking an endorsement at
11 that level.
12 CHAIRMAN ROSEN: Well, I would say that
13 my failure to provide endorsement would be against
14 commission policy. That is the commission policy to
15 move in a risk-informed performance-based way.
16 So, first off, I agree with the policy.
17 Secondly, even if I didn't, I would have to salute
18 it. So yes, of course, you should be risk-informing
19 this as well as all of the other activities of the
20 agency in accordance with commission policy, as I
21 said.
22 And then I would make the obligatory
23 speech. I think you're doing the right thing. I
24 thank.
25 MR. WEERAKKODY: I think the question

1 needs to be rephrased as, in your opinion, are all
2 of these efforts with all of those directions that
3 the commission has set --
4 MEMBER WALLIS: In order to risk-inform
5 it, you have to be a bit more systematic about what
6 information you need in order to evaluate risk. Go
7 back to the discussion we had about these cables.
8 It seems that some sort of studies of
9 what happens to cables and so on needed to be
10 specifically asking some risk-informed questions and
11 saying, "How much do we need to know in order to
12 make risk-informed decisions?"
13 It might have helped design the
14 experiments in a different way or something. I
15 didn't see that. It's a logical tie-in. If you
16 want to risk-inform something, you need certain
17 specific information? How are you going to get it?
18 How good does it have to be? What are the
19 uncertainties and so on?
20 You have to face up front what that
21 information is. I think you are just beginning to
22 find out what you might need to know in order to do
23 some of this risk-informing.
24 MR. WEERAKKODY: I thought if we could
25 compare where we are today to three years ago, if

1 the inspectors did inspections three years ago, they
2 were just evaluate or inspect any circuit without
3 any consideration for their failure probability.
4 I think what did happen these last three
5 years is that we know and we have communicated to
6 the inspectors what are most likely to be the risks.
7 So I think we may not be 100 percent
8 there, but I thought the experiments and capturing
9 those experiments into the inspection proceeding is
10 taking a big step in that direction. That's just my
11 personal --
12 MEMBER WALLIS: Well, I didn't see the
13 risk. I mean, I could see that yes, you have done
14 some experiments and certain things are more likely
15 to happen than others. Certain failures are now
16 credible, and they weren't before. That's useful
17 information. But this doesn't really have anything
18 to do yet with evaluating risk.
19 MR. WEERAKKODY: If you mean "risk" by
20 in terms of doing the actual PRA quantification, I
21 guess I do --
22 MEMBER WALLIS: Does it matter from the
23 point of view of risk whether this fails at 600
24 degrees or 800 degrees or melts or chars and so on?
25 I don't know because I haven't seen the risk

1 analysis.

2 CHAIRMAN ROSEN: Well, I propose that we

3 get anything off our chests that we and kind of go

4 around the table and give Sunil and his staff and

5 Fred whatever kind of feedback we have got.

6 But recognize that it is not likely that

7 we would be able to give you an ACRS letter. There

8 is nothing in front of us to agree with or disagree

9 with, really, in hard terms.

10 Jack?

11 MEMBER SIEBER: I was thinking as we

12 went through the day. I have been on the Fire

13 Protection Subcommittee starting my fifth year. And

14 my overall comment is that we're moving at glacial

15 speed on a lot of things.

16 I am glad to see that NFPA 805 is still

17 alive and moving forward. I was also glad that Mr.

18 Emerson told us that about 15 plants may adopt a

19 risk-informed fire protection approach. And to me,

20 that is good news.

21 So I would encourage further pursuit as

22 rapidly as a rulemaking can be, which is the reason

23 for the glacial speed, bringing that to a close.

24 The circuit analysis, we have heard

25 about this before when we were given the preliminary

1 results. I think the results are not surprising.
2 And I have been concerned that inspection of
3 associated circuits had not been done for some time.
4 Now that we are close to resolution of
5 exactly what happens in the associated circuits
6 area, I think that there is a feasible risk-based
7 approach toward evaluating what is reasonable and
8 what is not.
9 The fire dynamic spreadsheets, I got a
10 copy of the disk. And I am going to calculate
11 tonight why every time my wife broils something, she
12 sets off all the smoke detectors, which I think I
13 may be able to find out why.
14 MEMBER WALLIS: What is she broiling?
15 CHAIRMAN ROSEN: Do you know the heat
16 release rate for lamb chops?
17 MEMBER SIEBER: I don't know what it is.
18 When I do it, they don't go off.
19 MEMBER POWERS: It's about the same as
20 lube oil. In fact, maybe you just --
21 MEMBER SIEBER: Well, it's one of the
22 three basic.
23 MEMBER POWERS: The lamb chops you could
24 get cheaper by just frying that blue off.
25 MEMBER WALLIS: Deep fry in red oil.

1 MEMBER SIEBER: Well, at any event, I
2 think that is an advance for the inspectors. I
3 think it's a good tool. And I am going to try it
4 out and look through it. And if there are comments
5 that I can make that are useful, I will make this.
6 And so I was glad to see that. And I think it's a
7 better process than what has been used in the past.
8 As far as manual actions are concerned,
9 I concur with the direction that the staff has taken
10 at the present time. So overall my presentation
11 other than the speed at which things are happening,
12 my impression overall is positive from the
13 presentations today.
14 And that would be it for me.
15 CHAIRMAN ROSEN: Okay. Thank you, Jack.
16 Dana?
17 MEMBER POWERS: Well, let me say that
18 the overall objective of having more risk
19 information in connection with the fire protection
20 regulations is inherently hampered because we just
21 don't have the risk information that we do for
22 normal operations. We have not done the kinds of
23 studies of representative plants that were done for
24 operations. And that inherently drags on the
25 system.

1 On the specific topics we heard about
2 today, I believe the staff has underestimated the
3 resources and an effort will be required to
4 adequately review the methods and fire protection
5 documents retained at the site by the licensees
6 making the transition to NFPA 805.
7 Their current plans that they have seem
8 destined to impose a burden on each of the regions
9 that the regions are already yelping about because
10 they don't have adequate resources and limited
11 expertise.
12 The staff has developed guidance and
13 plans training. It's not apparent that they have
14 established that these will be adequate, nor has the
15 staff assured itself that they have an understanding
16 of the rates of change among licensees to NFPA 805.
17 I think they have some indication.
18 The staff has made the argument that
19 they are not going to pre-approve methods because
20 there really isn't a standardized method now. So
21 they have to look at them fairly well on a
22 case-by-case basis anyway.
23 I think this makes it even more
24 important and staff should inspect these methods and
25 the documents that the licensee has produced using

1 these methods on a fairly timely basis.

2 I would point out that the circuit

3 analysis area has been around with us for a long

4 time. It's a source of contention. It seems to me

5 there are some opportunities for the research

6 program to assist the staff in their review of a

7 licensee's circuit analysis by computerizing a lot

8 of this.

9 And I wonder why we don't have a

10 research program to do that. We have talked about

11 it for a long time. It looks like it's feasible.

12 There are parts of it that just have to be done by

13 hand. That's figuring out where the cables are and

14 where they go to, but once you have that, the

15 circuit analysis itself ought to be something that

16 is computerized.

17 Furthermore, on the research, it seems

18 to me as the staff goes through and examines the

19 data on fire effects on cables, they should also be

20 developing a list of the database they would really

21 like to have in the hopes that the research program

22 can establish some sort of an international

23 collaboration to start getting some of that

24 additional data.

25 We have seen how tremendously helpful

1 the NEI tests were. And I will point that the staff
2 participated extensively in those NEI tests. They
3 have been helpful to us in a very qualitative and
4 perhaps even quantitative step.
5 But I think what they did was just
6 enlighten us to the amount of information that we
7 don't have. We have pretty good databases and
8 growing databases on fire frequency. We just don't
9 have very good databases on fire effects. It's
10 clearly an area that the research may want to move
11 more aggressively on to perhaps international
12 collaboration.
13 And with respect to the NEI tests and
14 with respect for the NEI tests because I understand
15 how those tests came about and what their objectives
16 were, on any test program, I think we absolutely
17 must have some understanding of what the
18 experimental error is. And that calls for replicate
19 tests.
20 So when we think about designing future
21 test programs, I think a measure of the experimental
22 error is essential. I know that lots of people come
23 in and make the argument that, "Well, we haven't got
24 much resources." We want to get as much information
25 as possible so we're not going to do a replicate

1 test.

2 In fact, I think there is a strong

3 consensus within the community designing, developing

4 experiment designs that when your resources are

5 constrained and when you can't do very many tests,

6 that it's even more important that you do a test to

7 measure the experimental error. Otherwise, you're

8 looking at noise when you're trying to find trends

9 in a sparse database.

10 We didn't talk much about it, but I will

11 point out that in that multi-factor formula for LERF

12 that appeared in some of the later slides from the

13 NEI presentation and, in fact, in several of the

14 presentations where there were factors multiplied by

15 each other to develop probabilities, that kind of

16 multiplication is acceptable only when you've

17 established that the two things that you are

18 multiplying together are independent. And we have

19 not seen that establishment of independence up until

20 now.

21 MEMBER WALLIS: Well, Jack has been here

22 for five years on this subcommittee. And I am

23 relatively new.

24 On the risk-informed fire protection

25 rule, it makes sense to tie it in with the NFPA 805

1 standard. The thing I found interesting was what is
2 RES doing in support on this use of CFD and fire
3 analysis and dynamics and so on. I think it might
4 be useful to have a presentation of that at some
5 time for our researcher purposes. We can say, "Is
6 this appropriate research? And how well is it
7 going?"
8 So that was really the only thing that
9 struck me about that. Otherwise the rest of it is a
10 good thing to do. But what is the support that RES
11 is providing?
12 In the circuit analysis, very
13 interesting description of phenomena and a few
14 quantitative results. What I didn't see was how it
15 all fit together logically and quantitatively in
16 their risk analysis. And perhaps we can see that
17 sometime.
18 What is one trying to get from the
19 evidence, which actually we can agree is real? And
20 how does it fit into whatever it is used as measure
21 of risk?
22 The spreadsheets for inspectors, again,
23 this sounds good stuff, but it's all for some
24 customer, presumably the inspectors themselves. And
25 without knowing to it and whether they find it

1 useful or not, I'm not sure how to evaluate it.

2 It sounds like a useful tool, but it's a

3 tool for a certain user. If the user isn't going to

4 use it or doesn't like it or misunderstands it or

5 something, then it's not a very good tool. So we

6 need that side.

7 It makes sense to give credit for these

8 manual actions which have been going on for a long

9 time anyway as long as they're effective. It really

10 wasn't clear to me, in spite of all the talk and

11 listing of criteria and so on, what the clear basis

12 for a decision was about when these things were

13 feasible, when they weren't feasible, how feasible

14 they are.

15 It still seems we're talking about what

16 we mean by feasible, rather than getting definite

17 about it. And that's where the staff will

18 presumably become more definite and certain and

19 perhaps use better words.

20 CHAIRMAN ROSEN: Thank you very much,

21 gentlemen. Most of what I have been thinking about

22 you all touched on. Let me just go down whatever

23 else I can add.

24 I was also struck by Doug Brandes'

25 comment that 15 licensees, his estimate, will adopt

1 NFPA 805. I was worried from the beginning that it
2 would be too hard, that the staff would, for
3 whatever reasons, make the barriers to entry too
4 large.
5 MR. BRANDES: Excuse me. Let me be sure
6 that I properly characterized that. Fifteen is the
7 number of my personal count based on licensees and
8 sites that I know that are going through reanalysis
9 right now that I believe would benefit from having
10 this risk-informed rule available.
11 And if it were available today, my
12 opinion is it would be the best option for those --
13 I can only speak for the Duke plants, that if,
14 indeed, the final rule were available essentially in
15 the form that we see it and the implementing
16 guidance was essentially acceptable and the NEI
17 00-01 was acceptable, as I have last seen it
18 submitted, it would make sense for the Duke plants
19 to go forward or it would appear to to me right now.
20 These other dozen or so sites in my
21 opinion would benefit from having it available to
22 them.
23 CHAIRMAN ROSEN: That's your opinion.
24 It's not what the representatives of those sites
25 have said.

1 MR. BRANDES: That's correct.

2 CHAIRMAN ROSEN: Well, I appreciate that

3 clarification. That's an important difference.

4 Let me just talk for a minute about the

5 circuit analysis resolution. We on the committee

6 haven't seen the implementing guidance. And,

7 Marvin, you are going to get that to us and probably

8 the latest version of NEI 00-01. I don't know what

9 revision that is. Is that D or C?

10 MR. EMERSON: It's Rev. 0.

11 CHAIRMAN ROSEN: It's Rev. 0. The last

12 one I saw was C, I think, Rev. C.

13 MR. EMERSON: Right.

14 CHAIRMAN ROSEN: So maybe I have skipped

15 a revision here, which is a good thing. They are

16 two separate documents. Am I correct about that?

17 MR. EMERSON: What were two separate

18 documents?

19 CHAIRMAN ROSEN: NEI 00-01.

20 MR. EMERSON: Yes.

21 CHAIRMAN ROSEN: That's Rev. 0. That's

22 one document.

23 MR. EMERSON: Yes.

24 CHAIRMAN ROSEN: And the implementation

25 guidance --

1 MR. EMERSON: Two separate documents.
2 That's correct.
3 CHAIRMAN ROSEN: Two separate documents.
4 And I haven't seen either one. I saw an earlier
5 version of NEI 00-01, I think Rev. C.
6 MR. EMERSON: Right.
7 CHAIRMAN ROSEN: So I think it will be
8 useful for the committee members and certainly for
9 me to have a chance to look at those as we go
10 forward.
11 I think the fire dynamic spreadsheets
12 are great. It is very important if you're working
13 in an area -- is Mark still here?
14 MEMBER SIEBER: Mark is here, yes.
15 CHAIRMAN ROSEN: There he is.
16 -- if you're working in an area like
17 this and trying to get some sort of physical feel
18 for phenomena that you really don't understand very
19 well intuitively. Not many people really know how
20 hot a fire is because we try to stay away from them
21 as human beings. And so it's important to have a
22 tool that could teach us if we have to be involved
23 in these subjects.
24 These spreadsheets are very good for
25 that. They're a great heuristic tool. And I

1 applaud their development and wish I had some time
2 myself to work on them.
3 Let me comment on the manual actions
4 thing. I've probably said this before, but what
5 we're looking for is effective manual actions, as
6 Dr. Wallis has suggested.
7 Our question is about how does one get
8 on the same page, how to get the industry, the
9 licensees, and the staff on the same page as to what
10 is effective. I think you do that by agreeing on a
11 technique for doing the analysis.
12 There are many different techniques. We
13 just need to settle on one that is reasonably
14 current and has some of the more advanced parameters
15 in it and then say, "This is the technique we are
16 going to use to assess manual actions."
17 It has these 8 or 12 or 19 parameters
18 we're going to look at. And here is how we are
19 going to look at each of those parameters. And here
20 is how we are going to sum them up and add them up,
21 dice them and slice them.
22 And then when we get the answer for that
23 manual action, we are going to compare it to a
24 threshold that we will set. And we'll set it
25 conservatively, not very, very conservatively but

1 plenty conservatively. So if your action is deemed
2 to be more reliable than that threshold, then you
3 can take some credit for it. If not, then you
4 can't.
5 And anyone can argue about that. And
6 maybe you should have some arguments about that, how
7 you do the analysis and how you set the threshold.
8 But after a while, it is going to be a matter of
9 judgment. Then the staff should set it
10 conservatively. And everybody should say, "That is
11 how it is analyzed."
12 That is just like how we used to do
13 appendix R. Everybody knew you couldn't take credit
14 for manual actions theoretically. So you shouldn't.
15 You shouldn't. Okay? That was the rule. Nobody
16 knew. That was the way you did business.
17 Well, I'm suggesting a new way to do
18 business. And it's that agreeing on a technique and
19 setting a threshold and everybody moving forward
20 from there.
21 MEMBER WALLIS: Doesn't it depend on the
22 context, though? You can't just say it's a reliable
23 action. It depends on all the context.
24 CHAIRMAN ROSEN: That's right, of
25 course, the context or the error-forcing context for

1 each in my view, in my mental model, to go out there
2 and know whether or not you have got time, whether
3 it is something you have done before.
4 A lot of times, routinely or not,
5 whether you are following procedure or you are in a
6 knowledge-based space or in skill-based space or
7 rule-based space. It should be different. The
8 error likelihood will be different for each of those
9 in terms of --
10 MEMBER WALLIS: But it should be
11 performance-based. It's replacing some hardware.
12 There is going to be hardware plus manual action
13 that is equivalent to hardware itself. So you have
14 got to have some performance criteria which one or
15 both, each of them, has to satisfy.
16 CHAIRMAN ROSEN: You're trying to
17 achieve a function. You are trying to do something
18 in the plant, --
19 MEMBER WALLIS: Right. That's right.
20 That's right.
21 CHAIRMAN ROSEN: -- like isolate a given
22 fire. How well do you achieve a given function is
23 the question.
24 MEMBER WALLIS: That's right.
25 CHAIRMAN ROSEN: And so there you simply

1 look at the error-forcing context. Where does a
2 person have to go to do it? What does he have to
3 do? How much time does he have? Is it
4 proceduralized, all of those kinds of things? I
5 mean, that's not brain surgery right now.
6 And then you set a threshold. And you
7 do those calculations, set a threshold and compare
8 your answer in the calculations of the threshold. I
9 think that's well within our capability and the
10 right way to go.
11 And, with that, if you really want to
12 hear what we are going to say on Friday, I've only
13 got 15 minutes to say it. I looked on the agenda.
14 MEMBER POWERS: These folks aren't
15 presenting anything on Friday. Is that right?
16 CHAIRMAN ROSEN: No. I am just inviting
17 them to be there. If you look at the current agenda
18 for Friday, it is that there is a report by the
19 subcommittee chairman of fire protection scheduled
20 for 11:15 a.m. on Friday, September 12 in this room.
21 MEMBER SIEBER: And the full committee
22 keeps schedules just as good as the subcommittees?
23 CHAIRMAN ROSEN: Right. Be prepared to
24 listen to it after lunch.
25 MEMBER SIEBER: Or first thing in the

1 morning.

2 CHAIRMAN ROSEN: Or Saturday morning.

3 MS. BLACK: Dr. Rosen, if I could make a

4 comment because I missed part of the meeting today?

5 CHAIRMAN ROSEN: Please?

6 MS. BLACK: This morning there was a

7 question about why we had separated --

8 CHAIRMAN ROSEN: Suzanne.

9 MS. BLACK: Oh, sorry. Suzanne Black,

10 director, DSSA.

11 There was a question this morning about

12 why we separated the regulatory guidance from this

13 rule. And instead of relying on my memory, I went

14 back and got the piece of paper that we brought you

15 the copy of.

16 This was back in 2001 when the decision

17 was being made about whether we would actually

18 forward in trying to adopt this regulation or

19 whether it was just a useless exercise because

20 nobody in the industry was going to use it.

21 So we came to the agreement with NEI

22 that we would go forward and they would support this

23 by preparing the implementation guidance. But at

24 that time they said they couldn't finish the

25 implementation guidance until December 2002. It's

1 not December 2002 yet, is it?

2 Anyway, we also had a schedule here for

3 the rule. But we told the commission in this

4 commission memorandum that we were separating the

5 schedules because we didn't want to hold up the rule

6 for the guidance document at that time.

7 I think we wanted to keep the impetus

8 behind getting the rule out. We also realize that

9 there are some people, like perhaps Duke, that has

10 already done some of this piloting, that could pick

11 it up in advance of our reg guide that was endorsing

12 one way of implementing the rule. So it was a

13 conscious decision, although an unusual decision, to

14 separate them.

15 And the final rule that you heard

16 described today is essentially identical to the

17 draft rule that you reviewed a year ago. So I think

18 our position would be that we would prefer to have

19 the rule go out in advance of the reg guide. That's

20 been our management position anyway and as agreed to

21 by the fact that they didn't disagree.

22 We didn't put this up for a vote, but we

23 informed them that was out path. And we didn't get

24 any disagreement from the commission in that. So

25 that would be --

1 MEMBER WALLIS: This happens in other
2 areas, too, where there is an issue and a decision
3 has to be made to what you do. It seems that the
4 staff should never be in the position for waiting
5 for NEI to do something if there is an issue.
6 MS. BLACK: Right.
7 MEMBER WALLIS: You should go out and
8 issue a rule or whatever it is that has to be done.
9 And this will provoke NEI to actually get on and
10 finish up that part of the job.
11 MS. BLACK: Exactly. And in this case,
12 it's a voluntary alternative, so if it's to their
13 benefit to pick it up. And we are going to review
14 the first couple just as a trial to make sure that
15 the implementation guidance is perfectly understood,
16 as well as can be.
17 MR. WEERAKKODY: Can I have a minute?
18 CHAIRMAN ROSEN: Yes, of course. It's
19 feasible, but make sure it's effective.
20 MR. WEERAKKODY: Actually, that is the
21 item I wanted to mention. I have been taking notes
22 down, but I am going to rely on this constant to
23 look at your feedback; in fact, the communication
24 plan.
25 The one item that I am looking at the

1 feasibility and some of the alternative words
2 suggest that in the area of manual actions, I am
3 looking at the high-level guidance that you shared
4 in talking in terms of using the state-of-the-art to
5 the extent practicable, I think that we fully agree
6 and we want to adopt.
7 But the other I wouldn't say
8 contradictory but other constraints we would come
9 under that I wanted to share with you because if you
10 have a proposal to the point where we create
11 numerical thresholds for the manual actions and try
12 to use them as additional criteria, we may have
13 practically trouble doing that for all manual
14 actions.
15 One of the items I gave Marvin was the
16 award sheets. It's pre-decisional. He's going to
17 make copies for you and pass out. And there you
18 would see some comments that, actually, all three of
19 the commissioners made.
20 So when we made the plan, obviously we
21 want to listen to your advice and follow it, but
22 there are some numerical constraints there when you
23 really do find out what they are because I know
24 maybe a year from now or six months from now, we
25 will be back here. And then you would want to know

1 how we comment on did we use the word "feasibility"
2 or did we use a different word that is more
3 number-oriented?
4 CHAIRMAN ROSEN: I hope it's not a year.
5 I will respond to Jack's comment about the glacial
6 pace of all of this. To the extent that we could
7 help you move it along more quickly, I think the
8 Fire Protection Subcommittee ought to give you more
9 opportunity to come and talk to us. I hope it's not
10 a year. Marvin will do his best to try and schedule
11 you in here before next September comes.
12 MR. WEERAKKODY: Okay.
13 MR. HANNON: Just to follow up on that
14 thought. Earlier -- this is John Hannon -- we had
15 asked that maybe there would be a way the
16 subcommittee could help us expedite and facilitate
17 some of the actions that we are trying to take; in
18 particular, with regard to the 805 rulemaking.
19 We heard a pretty good synopsis of the
20 status of that effort this morning. I am wondering
21 if there is a way you could reconsider the potential
22 for providing us an opportunity to come back and
23 brief the full committee on that rule to try to get
24 an endorsement for what we are doing there.
25 CHAIRMAN ROSEN: Well, I will ask the

1 staff to look into that. I think that it is not
2 likely that it will be possible in October, but
3 November or possibly December, we might be able to
4 do that.
5 But we would need a subcommittee meeting
6 again if we are going to actually go to the full
7 committee with a recommendation of some kind.
8 MR. HANNON: I understand.
9 MEMBER WALLIS: Do you have to have ACRS
10 endorsement for this? Is it stipulated that we have
11 to do it? Why can't you just proceed because it's a
12 good thing to do without having the whole committee
13 involved?
14 MEMBER SIEBER: I think they are just
15 trying to expedite the process.
16 MEMBER WALLIS: This would help you, you
17 think?
18 MS. BLACK: I don't know that it is a
19 requirement. I was asking Eileen McKenna, but,
20 unfortunately, she is no longer here, whether a
21 letter was needed.
22 And I can't recall whether you wrote a
23 letter on the draft rule last year because since it
24 hasn't really changed, if you did write a letter, I
25 don't know that another letter would be needed. I

1 can find out the answer.

2 CHAIRMAN ROSEN: I think we wrote a

3 letter that said we agree with going with the

4 risk-informed --

5 MEMBER SIEBER: Yes. I think I wrote

6 it.

7 MS. BLACK: I think you did, too. And

8 since it hasn't changed, I don't know why another

9 letter would be required. And you could just say,

10 "We don't think we need to write another letter

11 because nothing has changed from the draft."

12 MR. DIEC: This is David Diec from the

13 staff. I could talk to that a little bit from

14 Eileen's perspective.

15 Clearly, the recommendation letter from

16 the committee would help expedite the process as we

17 go through and brief the CRGR because typically they

18 will ask, "Have you gone through the whole process?"

19 and see what people are having any opinions on this

20 issue and whether or not we are consistent with the

21 approach.

22 MS. BLACK: Of course, this is a

23 voluntary alternative. So CRGR is not as crucial is

24 --

25 CHAIRMAN ROSEN: Yes, the CRGR. And you

1 could point to the June or so letter from last year,
2 --
3 MS. BLACK: That's correct.
4 CHAIRMAN ROSEN: -- in which we said,
5 yes, voluntary alternatives to appendix R are a good
6 thing. Let's get 50.48 revised.
7 MS. BLACK: Right.
8 MEMBER SIEBER: Is CRGR involved at all
9 for voluntary?
10 MS. BLACK: We have to give them the
11 opportunity to get involved, but they could decline,
12 too, considering they don't have to.
13 MEMBER SIEBER: Right. Okay. Thank
14 you.
15 CHAIRMAN ROSEN: All right. With that,
16 unless there are comments from members of the public
17 or the staff or my colleges?
18 (No response.)
19 CHAIRMAN ROSEN: If not, we are
20 adjourned for the day six minutes early.
21 (Whereupon, at 5:25 p.m., the foregoing
22 matter was adjourned.)
23
24
25

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 Fire Protection Subcommittee

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.

Rebecca Davis

Rebecca Davis
Official Reporter
Neal R. Gross & Co., Inc.

FIRE DYNAMICS TOOLS (FDTs)
NUREG-1805

Naeem Iqbal and Mark Henry Salley, P.E.

Office of Nuclear Reactor Regulation
Division of Systems Safety and Analysis
Plant Systems Branch
Fire Protection Engineering and Special Projects Section

Presentation at the Advisory Committee on Reactor Safeguards
Meeting of the Subcommittee on Fire Protection
September 9, 2003

United States Nuclear Regulatory Commission
Washington, DC 20555-0001

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Office of Nuclear Reactor Regulation

PURPOSE of FDTs

FDTs are a series of Microsoft Excel® spreadsheets issued with **Draft NUREG-1805, "Quantitative Fire Hazard Analysis Methods for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program."**

- To support the NRC **Goal** of using **Risk Insight** with the Regulation in the Reactor Oversight Process (ROP).
- To advance the **Fire Hazard Analysis** (FHA) process from a primarily **Qualitative Approach** to more of a **Quantitative Approach** by applying fundamental **Fire Protection Engineering Principles.**

REGULATORY APPLICATION of FDTs

- To support **Significance Determination Process (SDP)** to evaluate inspection findings required by the **ROP**.
- To evaluate the **Significance** of non-compliance fire protection issues.
- To support evaluation of fire protection exemption requests.

BACKGROUND and STATUS of FDTs

- NRR developed FDTs as a part of the Quarterly Regional Inspector Fire Protection Training workshop program to train Regional Fire Protection Inspectors in fundamental of **Fire Dynamics.**

- FDTs provide a tool that can be quickly used to assess potential for a credible fire scenario during NPP fire protection inspections on site.

- Draft **NUREG-1805** was developed over a 3 year period, is currently published for public comments.

EVOLUTION OF QUANTIFYING FIRE SCENARIOS IN NPPs

PAST

- Fire load expressed in (BTU/ft^2) does not consider other factors which greatly affect the compartment fire intensity such as, compartment volume, heat transfer characteristics of the enclosure boundaries, and ventilation openings.

PRESENT

- **FDT^s** is a training tool that can be used to teach **Fire Dynamics** and develop **First Order Fire Dynamics** evaluation in actual NPP applications.

FUTURE

- **NFPA 805**, Performance Based Standards for Fire Protection for Light Water Reactor Electric Generating Plants will use detailed **Fire Modeling Calculations.**

ORIGIN OF FDTs

- FDTs are modeled after the **U.S. Bureau of Alcohol, Tobacco, and Firearms (ATF)** Fire and Arson Investigation Program.

- Selected a series of state-of-the-art **Fire Dynamics Correlations** from *SFPE Handbook of Fire Protection Engineering*, *NFPA Fire Protection Handbook*, and other relevant fire dynamics text.

  - Customized for NPP applications
  - Appropriate physical properties

FEATURES OF FDTs

- User-friendly, Microsoft Excel® based on **Fire Dynamics** equation/correlations, **Pre-Programmed.**
  - Quick application of **Fire Dynamics** principles found in the Handbooks
  - Spreadsheets are protected to prevent tampering.
  - Automatic unit conversion.
  - Related material fire properties data for materials found in NPP listed within each spreadsheet.
  - Reduces input errors from inaccurate manual entries pull-down menus allow user to select the input from the material fire property data table.

REGIONAL INSPECTOR TRAINING

- Training covered basic principles of Fire Dynamics, **Assumptions, Limitations**, and **Bounding Analysis.**

- Quarterly training led by NRR staff **Fire Protection Engineers.** New spreadsheets were presented at each quarterly training session.

- Inspectors independently develop fire scenarios and solve realistic problems.

- **NUREG-1805** text addresses the **Technical Bases** for **FDTs** and covers many aspects of **Fire Dynamics.**

CONCLUSION

- By taking a commonly available computer spreadsheet software (like Microsoft Excel®) and creating a series of computational spreadsheets, **Complex Concepts** like Fire Dynamics can be taught to inspectors and put into reliable field application.

- The use of the **FDTs** further reduces mathematical complexities and errors, and promotes greater application of fire science and engineering in **Field Use.**

- **NUREG-1805** and **FDTs** can make a positive impact in the NRC's **Fire Protection Inspection Program,** specifically risk-informed fire protection initiatives such as **SDP** and risk-informed Inspection of **Associated Circuits.**

EVALUATING FIRE SCENARIO USING FDTs

Following example demonstrate how to perform a quantitative FHA using FDTs.

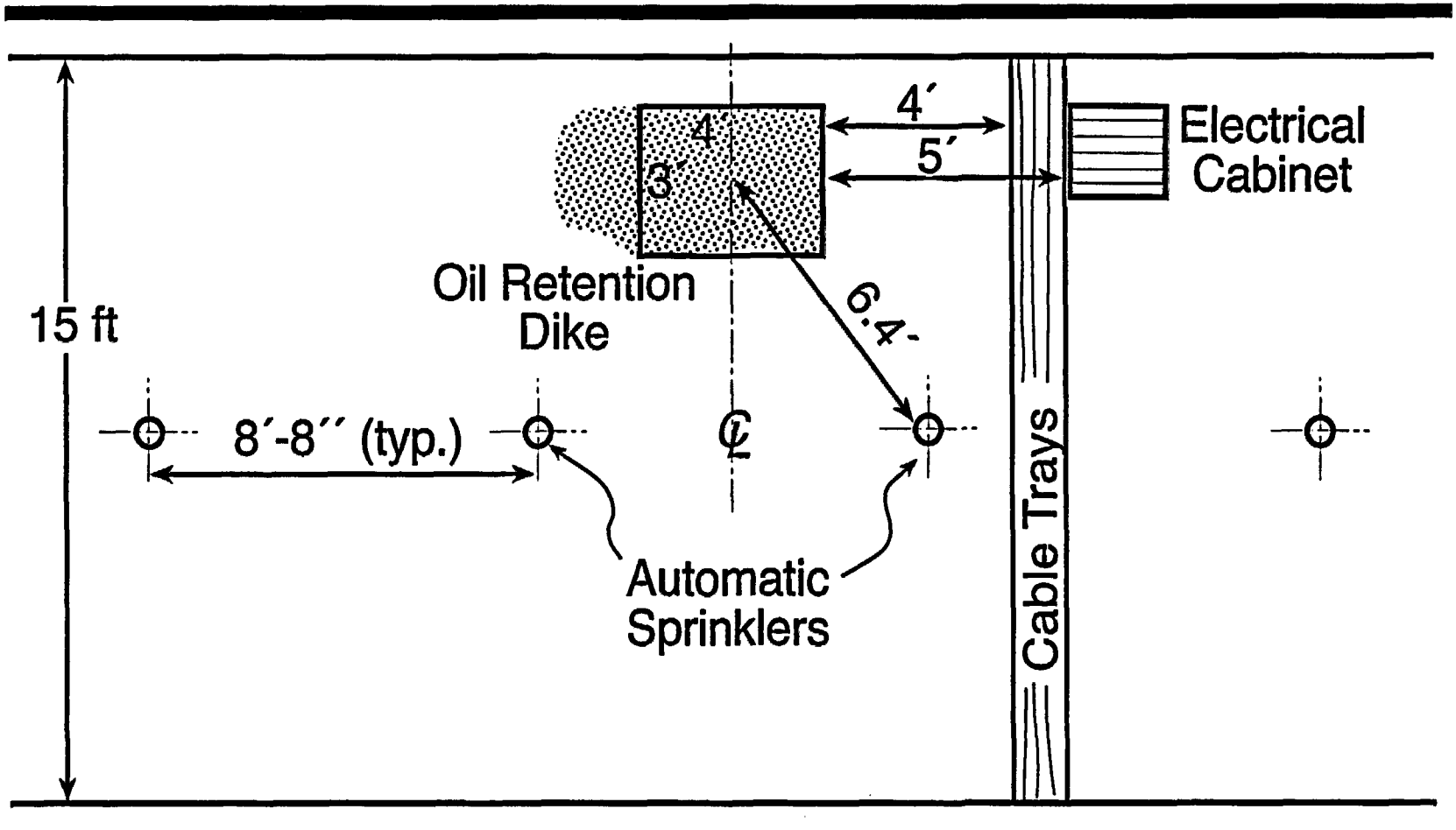
PROBLEM STATEMENT

During a routine fire protection inspection, an NRC inspector discovers an significant oil leak in a station air compressor in an access corridor in the auxiliary building. Compressor has a 12 ft^2 (1.12 m^2) oil retention dike. The dike is located 1 ft (0.3048 m) from the wall. The unprotected safety-related cable trays are located 8 ft (2.45 m) above the floor, 4 ft (1.2 m) horizontally from the edge of the dike. A safety-related electrical cabinet is located 5 ft (1.52 m) horizontally from the edge of the dike.

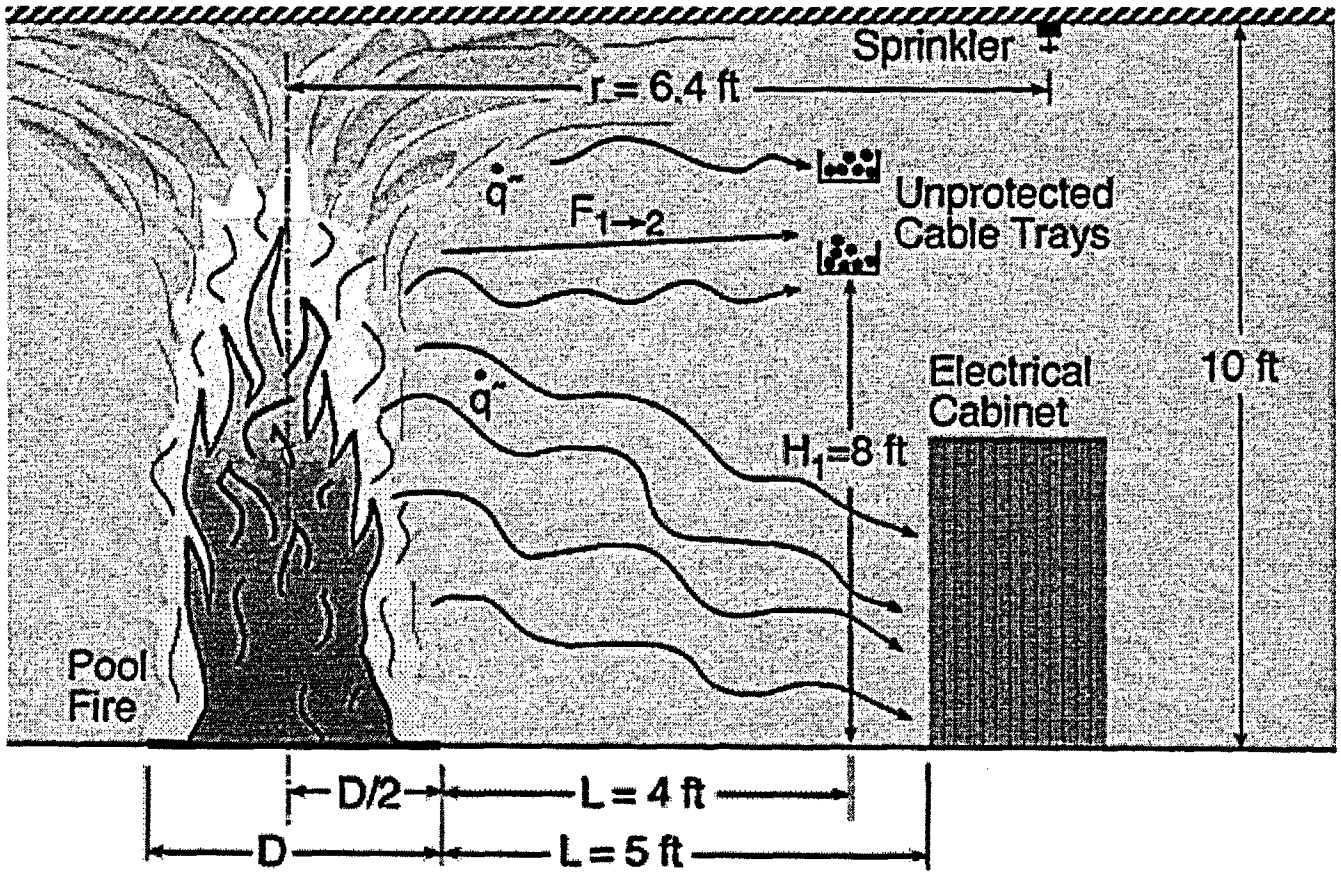
The corridor has a floor area of 30 x 15 ft (36.6 x 4.6 m), a ceiling height of 10 ft (3 m), and has two fire rated doors of 3 x 7 ft (0.914 x 2.15 m). The corridor has no forced ventilation system. The walls, ceiling, and floor are constructed of 1 ft thick concrete. The corridor has a smoke detection system and wet pipe sprinkler system. The nearest sprinkler is rated at 165 °F (74 °C) with a RTI of 235 $(m\text{-}sec)^{(1/2)}$ and is located 6.5 ft (1.98 m) from the center of the dike. The nearest smoke detector is 20.5 ft (6.25 m) from the center of the dike.

Determine if there is a credible fire hazard to the unprotected safety-related cable trays and electrical cabinet. (Assume no ventilation effects on the fire.)

FIRE SCENARIO



FIRE SCENARIO



SOLUTION

ANALYSIS

Fire damage resulting from spills of flammable and combustible liquid fuels depend on the fuel type, the size and shape of the fire, the duration of the fire, its proximity to the target, and the thermal characteristics of the target. Combustible liquids that have relatively high flash points (e.g., lube oil or diesel fuel), require localized heating to ignite. However, once ignited, a pool fire rapidly spreads over the surface of the liquid spill. To perform a FHA, FHA, assume that the 20 gallons of lubricating oil spills into the diked area and is ignited by the failed compressor.

SPREADSHEETS (FDT^s) INFORMATION

Use the following FDT^s to determine:

- Heat flux to the target (electrical cabinet) Heat_Flux_Calculations_Wind_Free.xls (Click on Solid Flame 1)
- Heat flux to the target (cable trays) Heat_Flux_Calculations_Wind_Free.xls (Click on Solid Flame 2) Target above ground level
- Hot gas layer temperature in the corridor Temperature_NV.xls (Click on Temperature_NV Thermally Thick)
- Sprinkler activation time, $t_{activation}$ Detector_Activation_Time.xls (Click on Sprinkler)

RESULTS

The summary results of FHA calculations are:

- Heat flux to the target (electrical cabinet) = 8.90 kW/m^2
- Heat flux to the target (cable trays) = 16.40 kW/m^2
- Hot gas layer temperature in the corridor = 450 °F (232 °C) doors open
- Hot gas layer temperature in the corridor = 545 °F (285 °C) one door open only
- Sprinkler activation time, $t_{activation}$ = 1.2 min

Heat fluxes to the electrical cabinet and cable trays are high enough to damage them. The FHA calculation demonstrates that a pool fire with a 12 ft^2 dike area in a corridor could damage remote unprotected safety-related cable trays and electrical cabinets.

For this analysis the sprinkler system, if operable, should quickly activate and mitigate damage to the safety-related cable tray and electrical cabinet.

OVERVIEW OF FIRE PROTECTION ACTIVITIES

Presentation to the ACRS
Subcommittee on Fire Protection
September 9, 2003

Sunil Weerakkody, Section Chief
Fire Protection and Special Projects
Office of the Nuclear Reactor Regulation

Staff Introduction

Discussion Topics

- 10 CFR 50.48 (c) or NFPA 805 Rule Making
- Risk Informing Associated Circuits
- Development of Fire Dynamic Tools
- Manual Action Rule Making

- Later date by PRA Branch – Significant Determination Process

Challenges and Overall Path for Solution

- Legacy
- Questions on licensing basis
- Achieve safety without undue burden to stakeholders

- Solution: Performance-Based Risk-Informed approaches

ACRS Support

- Review
- Feedback
- Endorsement of future direction

RISK-INFORMING ASSOCIATED CIRCUIT INSPECTION RESOLUTION

Sunil Weerakkody, Chief

Office of Nuclear Reactor Regulation
Division of Systems Safety and Analysis
Plant Systems Branch
Fire Protection Engineering and Special Projects Section

Presentation at the Advisory Committee on Reactor Safeguards
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United States Nuclear Regulatory Commission
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NRC ACTIVITIES

- Preparing to retract the Memo halting Inspections by end of November 2003.
- Inspection will focus on most Risk Significant cases.
- Most effective use of Inspection and Licensee Resources.

NRC ACTIVITIES

- Public Workshop at NRC Headquarters, Rockville, Maryland November 2003.
- Published a Regulatory Issue Summary (RIS) for comments.
- Will Publish a Staff NUREG-1778 on Knowledge Base for Post-Fire Safe Shutdown Analysis for public comments (November 2003).
- Will Revise Inspection Procedure (November 2003).
- DSSA/SPLB working to revise the SDP.

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ESTIMATING HOT GAS LAYER TEMPERATURE METHOD OF McCAFFREY, QUINTIERE, AND HARKLEROAD (MQH)

Natural Ventilation Compartment Fire

$$\Delta T_g = 6.85\left[\frac{\dot{Q}^2}{\left(A_v\sqrt{h_v}\right)\left(A_T h_k\right)}\right]^{\frac{1}{3}}$$

Where:

ΔT_g = upper layer gas temperature rise above ambient (T_g - T_a) (K)

= heat release rate of the fire (kW)

A_v = total area of ventilation opening(s) (m^2)

h_v = height of ventilation opening (m)

h_k = heat transfer coefficient (kW/m^2-K)

A_T = total area of the compartment enclosing surfaces (m^2), excluding area of vent opening(s).

THERMALLY THIN SOLID

$$h_k = \frac{k}{\delta}$$

THERMALLY THICK SOLID

$$h_k = \sqrt{\frac{k\rho c}{t}}$$

Where:

ρ = density of the interior lining (kg/m^3)

c_p = thermal capacity of the interior lining (kJ/kg-K)

k = thermal conductivity of the interior lining (kW/m-K)

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RISK-INFORMING ASSOCIATED CIRCUIT INSPECTION RESOLUTION

Mark Henry Salley, P.E.

Office of Nuclear Reactor Regulation
Division of Systems Safety and Analysis
Plant Systems Branch
Fire Protection Engineering and Special Projects Section

Presentation at the Advisory Committee on Reactor Safeguards
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BACKGROUND

- 10 CFR Part 50, Appendix R/NUREG 0800 SRP.
  - Provide reasonable assurance that **Fire-Induced Circuit Failures** that could adversely affect the ability to achieve and maintain post-fire safe shutdown will not occur
- Information Notice 99-17, Problem Associated with Post-Fire Safe Shutdown Circuit Analyses.
  - Recent problems with associated circuits at a number of licensees
- November 2000, NRC **Suspends** associated circuit inspection.

BACKGROUND (cont'd)

- NEI Fire Testing.
  - May 2002, EPRI published, "Spurious Actuation of Electrical Cables to Cables Fire: Results of Expert Elicitation."
- June 2002 ACRS Fire Protection Subcommittee.
  - Provide recommendation on NEI 00-01
- February 2003, Facilitated Public Workshop.
  - Consensus on most Risk Significant Scenarios
  - Identify most Risk Significant Cable Configurations and Attributes
- August 2003, Draft Regulatory Issue Summary (RIS).
  - Technical input for Risk-Informing Associated Circuit Inspections
  - Public Comment

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ASSOCIATED CIRCUIT RISK

- Risk = (Fire Frequency) x (Likelihood of fire effects & cable attributes that contribute to failure) x (Likelihood of undesired consequences).
  - Fire Frequency established in other programs
  - Creditable Fire Threat
    - Fire Dynamics
  - Cable Attributes
    - Thermal Failure Mechanism
  - Severity of Consequence

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CABLE ATTRIBUTES

- Fire Testing.
  - Past Research Work (Sandia National Laboratory, Factory Mutual, etc.)
  - NEI 00-01 Fire Testing Program
- Results.
  - Thermoplastic vs. Thermoset Jacket/Insulation
  - Intra vs. Inter Cable Failure

SEVERITY OF SPURIOUS OPERATION

- Most Risk Significant.
  - Failures that impede hot shutdown within the first hour of event

NUMBER OF CABLE FAILURE TO CONSIDER

- Two "cable" failures per scenario.
  - Intra – cable failure for Thermoset and Thermoplastic
  - Any number of conductors/combinations possible within the cable
  - Inter – cable failures possible for Thermoplastic cable

ISSUES REQUIREING FURTHER RESEARCH – MODERATE RISK

- Moderate Risk
  - Inter – cable shorting of Thermoset cables
  - Three or more cables for scenario
  - Effects of control power transformers
  - Duration of hot shorts

ISSURES REQUIREING FURTHER RESEARCH – LOW RISK

- Low Risk
  - Open circuits
  - Inter – cable shorting involving conduits and armored cable
  - Multiple high – impedance faults common power supply
  - Three-phase failures occurring with proper polarity
  - Reversible DC–motor power cable

NRR
Office of Nuclear Reactor Regulation

REMAINING ACTIVITY

- Issue final RIS.
- Issue staff NUREG-1778 for public comments.
- Conduct public workshop in November 2003.
- Revise Inspection Procedures as necessary based on Research Results.

CONCLUSION

- Inspections will focus on most **Risk Significant Cases.**
- Most effective use of Inspection and licensee Resources.

RES SUPPORT FOR SELECTED FIRE PROTECTION ACTIVITIES

By

J.S. Hyslop, RES/PRAB

RES SUPPORT – RISK INFORMED FP RULEMAKING

- Develop review guidance to support evaluations of:
  - Fire models
    - V&V: Five Rev 1, FDTs (Empirical), CFAST (Zone), FDS (CFD)
    - Utilize ASTM standard 1355-97 (and supplement)
    - Includes scenarios identified by NRR
  - Inputs to fire models, e.g. heat release rates
  - FRA methods, tools, and data, including
    - Frequency / severity
    - Circuit analysis
    - Detection / suppression

RES SUPPORT – CIRCUIT ANALYSIS RESOLUTION

- Participated in Omega Point tests
- Supported expert elicitation panel
- Authored chapter on risk in draft NUREG-1778, "Knowledge Base for Post-Fire Safe Shutdown Analysis"
- Participated in 2/03 public meeting to identify important circuit issues for planned inspections
- Will participate in upcoming public meeting on associated circuits
- Will address User Need: Identify any other circuit issues which should be added to inspection

NFPA 805 RULEMAKING

ACRS Fire Protection
Sub-Committee Briefing
September 9, 2003

Paul Lain, Plant Systems , NRR
Joe Birmingham, Rulemaking, NRR
J. S. Hyslop, PRA Branch, RES

NFPA 805 - Performance-Based Standard for Fire Protection for LWRs

- Background
- Advantages
- NFPA 805 Structure
- Implementation
- Rule Structure
- Status of Rulemaking
- Related Research

NFPA 805 - Background

- 1975 - Browns Ferry Fire
- 1980 - Appendix R
- 1998 - Reg. Guide 1.174, PRA
- 1998 - SECY 98-058, RI/PB FP Std
- 2000 - SECY 00-009, Rulemaking Plan
- 2001 - NFPA 805 Published
- 2002 - Proposed Rule Published

NFPA 805 - Advantages

- Reduces regulatory burden
- Endorses a National consensus standard
- Stakeholder involvement
- Voluntary
- Sets performance goals and criteria
- Focus on risk significant issues
- Maintains safety margin & defense-in-depth

NFPA 805 Structure

- Maintains a core FP program
- Requires an analysis to establish a fundamental fire protection program
- Allows transition of existing licensing basis including exemptions and GL 86-10 evaluations (Grandfathering)
- Guidance on performing nuclear safety analysis, fire modeling and fire PRAs

NFPA 805 Structure (Continued)

- NFPA 805 Chapter 3 "Fundamental Fire Protection Elements"
  - Fire Protection Plan
  - Fire Prevention (e.g. control of combustibles)
  - Fire Brigade
  - Water Supply
  - Standpipes and Hose Stations
  - Fire Extinguishers
  - Fire Alarm and Detection Systems
  - Water-Based Fire Suppression Systems
  - Gaseous Fire Suppression Systems
  - Passive Fire Suppression (e.g. building separation, fire barriers, penetrations)

NFPA 805 Structure

- Differences from App. R
  - Cold shutdown
  - Emergency lighting
  - Alternate/dedicated shutdown
  - Analyzed shutdown method
  - Recovery Actions
  - Adds radiation release criteria

Implementation

- PB FP Regulatory Guide
  - NEI Implementation Guide
  - NEI Circuit Analysis
- License Amendment SRP
- Enforcement discretion during transition
- ROP monitors future changes

Rule Structure

- Incorporates NFPA 805, 2001 Edition into 10 CFR 50.48 as an alternative to Appendix R
- Identifies 6 exceptions to the standard
- Requires license amendment to adopt NFPA 805 including identifying any license revisions
- Requires licensee to complete a plant wide evaluation before changing fire protection program

Rule Structure

- Licensees document evaluation and retain records on site
- Alternatives to 805 and changes to Chap. 3 elements require a license amendment
- NRC approval of methods is not required
- Decommissioning plants may also comply with NFPA 805
- Allows NRC to review new RI/PB methods in the future

Current Status

- Proposed rule was issued November 2002
- Comment period ended January 2003, comment resolution was developed
- FRN package in concurrence with OGC
- Rev D of implementing guidance was provided by NEI April 2003
- Staff has prepared comments on Rev D

Schedule

- Office concurrences planned for October, 2003
- Final Rule to ACRS, CRGR December, 2003
- Final Rule to the Commission, Spring 2004
- Final Rule Published one month after SRM

Risk Informed Fire Protection

ACRS Fire Protection
Subcommittee Meeting
September 9, 2003
By
Doug Brandes
Duke Power

NFPA 805

- Current Status
- Pilot Project – McGuire
- Comments Concerning Rulemaking

Current Status

- Draft Rule language available for comment
- Draft Implementing Guidance submitted to NRC for comment
- NEI 00-01 NRC comments addressed and resubmitted

Implementing Guidance Outline

- Chapter 1 – Introduction
- Chapter 2 – Responsibilities & Qualifications
- Chapter 3 – Applicability
- Chapter 4 – Regulatory Framework
- Chapter 5 – Process & Options
- Chapter 6 – Transition
- Chapter 7 –Use of "Tools" in existing Licensing Basis
- Chapter 8 – Documentation & Configuration Control
- Appendices

NFPA 805 Pilot - McGuire

Basis

- NFPA 805
- Draft Rule
- Draft Implementing Guidance
- NEI 00-01

NFPA 805 Pilot - McGuire

- Six discrete topics
  - Licensing
  - Classical Fire Protection
  - Safe Shutdown
  - Shutdown Operations
  - Radiological Protection
  - Configuration Management, Performance Monitoring

Licensing

- Produced three documents
  - Draft Letter of Intent
  - License Amendment
  - Transition Plan

Classical Fire Protection

- Map current licensing basis to NFPA 805 Chapter 3

Safe Shutdown

- Draft Sample Fire Area Safe Shutdown Analysis
- Deterministic – "drop in CLB"
- Risk Informed
  - Safe Shutdown Logic Diagrams
  - NEI 00-01 Circuit Analysis

Shutdown Operations

- Analyze Additional Systems
  - Residual Heat Removal
  - Spent Fuel Cooling

  Appendix R type Analysis

  Can be incorporated in Safe Shutdown Analysis & shutdown risk management programs

Radiological Protection

- Protect Fire Fighters to 10CFR Part 20 requirements
  - Existing program satisfies this requirement
  - Update documentation and add to CLB

Configuration Management and Performance Monitoring

- Existing Programs are can be used
- Modify Programs for new licensing basis

Resource Requirements

- Directly dependent on the initial documentation
  - Work hour estimate 2,000 to 6,000 hours
  - Skill sets:
    - Compliance
    - Fire Protection
    - Safe Shutdown
    - PRA
    - Fire Brigade

NFPA 805 Pilot - McGuire

- Conclusion – "It might actually work" HDB

Rulemaking Comments

- Rule language needs clarity with respect to need for license amendments for "alternate methods"
- License amendment should not be required for use of "alternative methods"
  - Non Power Fire PRA
  - New computer Fire models

Resolution of Circuit Failure Issues

Fred Emerson, NEI

Advisory Committee on Reactor Safeguards
Fire Protection Subcommittee
September 9, 2003

1

Topics

- Summary of topics addressed previously to ACRS Fire Protection Subcommittee
- Current status of resolving fire-induced circuit failure issues

2

Summary of Topics Addressed Previously (June 2002)

- Results of EPRI/NEI circuit failure testing
  - Observations only
- Results of expert panel development of
  - Probability of cable damage due to fire
  - Probability of spurious actuations given cable damage
- Results of pilot evaluations of NEI 00-01 at two plants
- Summary of issues remaining to be resolved with NEI 00-01 (early draft)

3

Topics to be Addressed Today

- Conclusions from EPRI/NEI testing
  - EPRI report 1003326, "Characterization of Fire-Induced Circuit Faults, " December 2002
- Summary of NEI 00-01 Revision 0
  - Intended use
    - Deterministic methods
    - Risk methods
  - Multiple high impedance faults
- Recommendations for closing fire-induced circuit failure issues

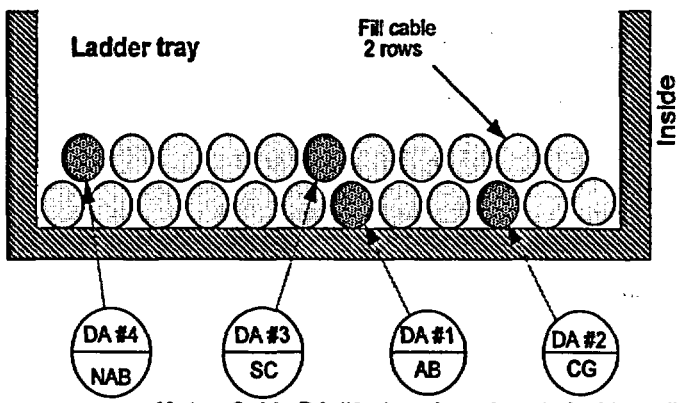
4

EPRI Test Report Includes...

- Detailed description of all tests
- Test-by-test review & analysis
  - Test arrangement & parameters
  - Temperature profiles
  - Electrical profiles
  - Sequence of events

5

Tray Configuration (Typical)



Note: Cable DA #2 placed as close to inside wall as possible without violating cable bend radius.

6

Test Results...

- Temperature & electrical profiles
  - Developed for all cables tested
  - Graphical depiction of cable performance
  - Helpful in identifying patterns and trends
- Key observations & conclusions
  - Fault modes - hot shorts, ground faults, open circuits
  - Characterization of spurious actuations

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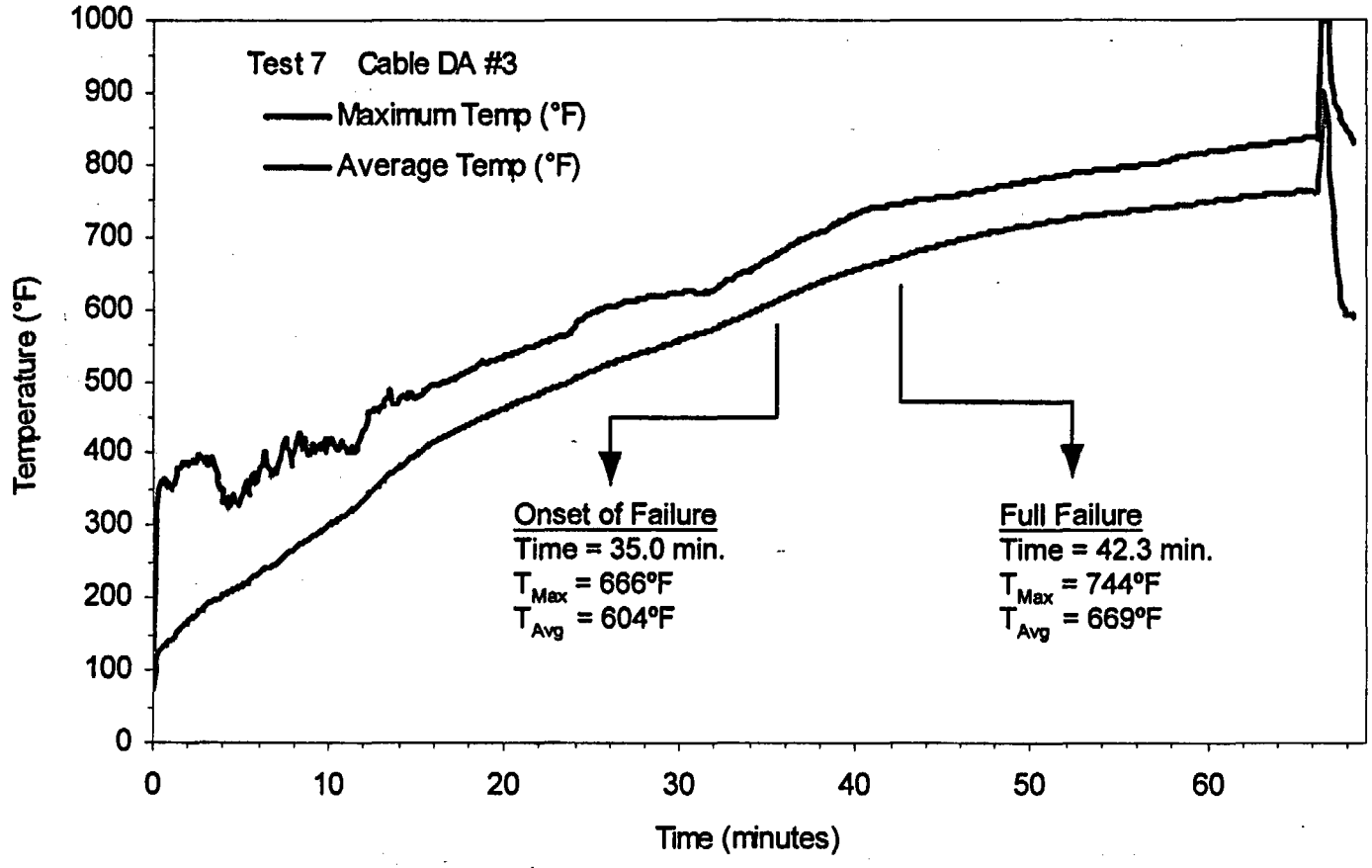
Example Profiles

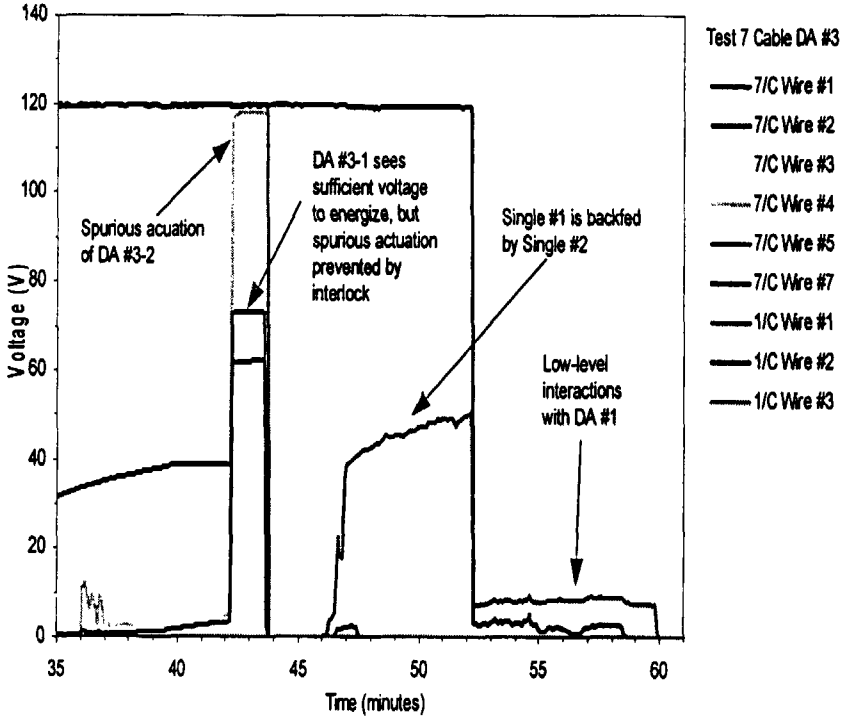
- Test 7 cable bundle DA #3
  - 7/C & 1/C thermoset cable
  - 350 kW HRR with cables in HGL
  - Located in bottom row of tray
  - Laboratory power supply

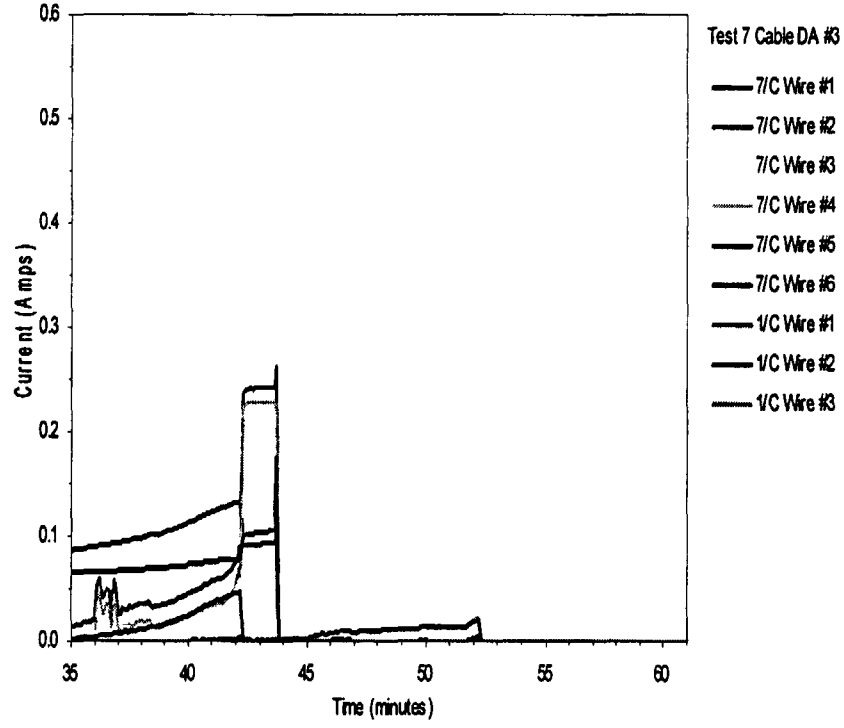
8

Temperature Profile (Typical)



Electrical Profile (Typical)





Overall Results Summary

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Failure Mode Summary by Cable Type

	Armored Cable		Thermoset Cable		Thermoplastic Cable		Total	
Open Circuits	0	0%	0	0%	0	0%	0	0%
Ground Faults	6	85.7%	47	69.1%	25	64.1%	78	68.4%
Hot Shorts	1	14.3%	21	30.9%	14	35.9%	36	31.6%
Total Failures	7	100%	68	100%	39	100%	114	100%

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General Observations

- Pretest concept of 1,000 ohm threshold impedance did not prove viable
  - Many shorts exhibited a near zero fault resistance
- Statistical characterization is achievable
  - General trends predictable
  - Better understanding of primary influence factors
  - Probability values still carry relatively high uncertainty

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General Observations

- Definitive predictions not supported
  - The specific behavior and characteristics of any one fault cannot be predicted with full certainty
  - A full understanding of the fault dynamics and interdependencies is beyond the current state of knowledge

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General Observations

- Two tests with no failures
  - Thermoset cable
  - HGL at 200 KW
  - Plume at 70 KW
- Refer to "Cable Fragility Curve" for temperature correlation

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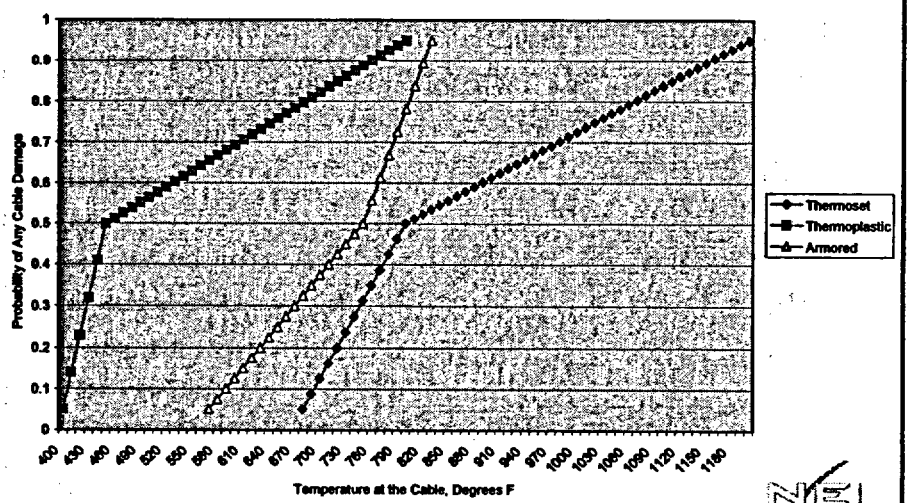
Fragility Curves



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Important Influence Factors

- Cable type
- Tray fill
- Power source characteristics

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Cable Type

- Thermoset cable has much higher damage threshold than does thermoplastic cable
  - Time
  - Temperature
- Occurrence of hot shorts about equal (30-35%) but likelihood of spurious actuation higher for thermoplastic cable (see table), given cable damage

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Tray Fill

- Interior cables shielded against damage
- Interior cables have higher incidence of hot shorts if damaged

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Power Source Characteristics

- Power source characteristics had little influence on failure mode but substantial influence on spurious actuation likelihood
- CPTs (low energy devices) had fewer spurious actuations

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Second Order Influence Factors

- Orientation
- Exposure Type
- Water Spray

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Internal vs. External Hot Shorts

- External hot shorts do occur, but overall likelihood is much lower than internal hot shorts
- External hot shorts occurred in thermoset cable, but **NONE** resulted in spurious actuations
- Thermoplastic cable showed significantly higher propensity for externally generated spurious actuations (47% from external shorts)

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Multiple Simultaneous Hot Shorts

- Given that a hot short occurs in a multi-conductor cable, it is highly probable (over 80%) that multiple target conductors will be affected (i.e., multiple simultaneous dependent hot shorts)
- Multiple independent (different source conductor) hot shorts occurred for a specific cable bundle, with some occurring simultaneously

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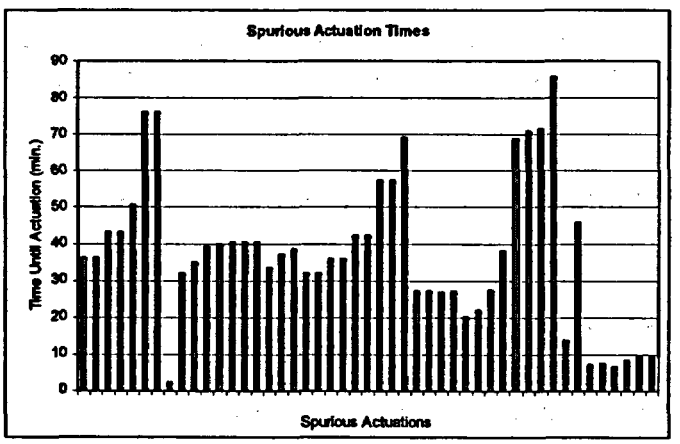
Time to Spurious Actuation



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Spurious Actuation Duration

	Armored (min.)	Thermoset (min.)	Thermoplastic (min.)	Overall (min.)
Longest Duration	0.9	13.0	10.1	13.0
Shortest Duration	0.7	0.1	0.1	0.1
Average Duration	0.8	1.8	2.8	2.1
Standard Deviation	0.1	2.8	3.2	2.9

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Key Conclusions

- Given cable damage, single spurious actuations are credible and multiple spurious actuations cannot be ruled out
- External cable hot shorts are credible, but none resulted in spurious actuations for thermoset cable
- The overall likelihood of spurious actuations (given cable damage) for thermoplastic and thermoset cable is higher than previously thought (NUREG-2258)

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Key Conclusions

- There exist predictable thresholds below which cable failures do not occur
- The overall average time to cable failure was more than 30 minutes – early time critical actions can significantly reduce risk for high consequence failures/spurious actuations
- Current limiting devices (e.g., CPTs, isolation transformers) reduce the likelihood of spurious actuations
- The average duration (< 3 minutes) indicates that AOVs and PORVs will return to a safe condition when the fault clears

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NEI 00-01

- Revision 0 submitted for NRC review in May 2003

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Use of NEI 00-01

- General guidelines for use of deterministic method
  - Typically licensed, commonly used safe shutdown analysis methodology
    - Assumptions/guidelines similar to those currently used
  - Not intended for wholesale re-evaluation of safe shutdown analysis
    - Approved safe shutdown analysis assumed

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Use of NEI 00-01

- Use of risk significance methods
  - Can be used with any deterministic method
  - Can be used to address identified single or multiple spurious actuation issues
  - Must consider all fire areas where combination exists
  - SM/DID analysis must be performed before screening out any combination

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Changes in NEI 00-01

- Preliminary risk screening
  - Analysis considers
    - Risk: Frequency of undesired fire-induced circuit failure
    - Consequences: Inability to achieve and maintain safe shutdown
  - Method:
    - Table 4-1 provides for screening based on frequency and consequences
    - Tables 4-2 provides supporting information for assessing frequency and consequences
    - Table 4-3 provides supporting information for crediting mitigation and hot shutdown

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Changes in NEI 00-01

- Final risk screening
  - CDF determination essentially unchanged
    - Spurious actuation probabilities taken from testing and expert panel results
  - Consideration of LERF:
    - $F_f * P_E * P_{SA} * P_{AS} * P_{DM} * \Delta P_{LERF} < 1E\text{-}7$ (all areas)
    - Met if
      - Quantitative LERF analysis meets above criterion
      - Qualitative LERF analysis shows containment function remains intact and LERF event unlikely
      - CDF < 1 E-7 all areas

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Changes in NEI 00-01

- Final risk screening
  - Uncertainty and sensitivity analysis should consider
    - Sensitivity of the results to uncertainty of the factors in the screening formula, including
      - initiating event frequency
      - suppression probabilities
      - severity factors
      - circuit failure probabilities
      - factors affecting LERF
    - Fire modeling uncertainty
    - Uncertainty of physical location of cables and equipment

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Changes in NEI 00-01

- Multiple high impedance faults (Appendix B-2)
  - MHIF do not pose credible risk if:
    - Power supply conforms to base case requirements:
      - Voltage 110v (AC or DC) or greater
      - Adequate coordination between load and supply side protective devices
      - Minimum size ratio of 2:1 supply:load breakers for 202VAC and 120VDC
      - Fault current sufficient to allow predictable operation of overcurrent protective devices
      - Overcurrent protective devices applied within rating and are listed or approved by recognized test lab
      - Proper maintenance, testing, Etc. for overcurrent devices
    - De-energized power supply will not cause opening of high/low pressure interface valve

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Recommendations for Fire-Induced Circuit Failure Issue Closure

- Well-understood set of regulatory expectations needed to provide a basis for inspections and licensee actions
- NEI recommends
  - NRC focus circuit failure inspections on compliance with plant licensing basis
  - NRC accept plant use of NEI 00-01 deterministic methods if licensing basis not clear
  - NRC accept NEI 00-01 probabilistic methods along with SDP or plant PRA analysis for risk significance determination

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Post-Fire Operator Manual Actions Rulemaking Plan

David Diec
Erasmia Lois
Phil Qualls

September 9, 2003

Post-Fire Operator Manual Actions Rulemaking Plan Briefing Agenda

- Current Status
- Background
- Objectives
- Alternatives
- Approach
- Next Steps

Post-Fire Operator Manual Actions Rulemaking Plan Current Status

- Commission Released Rulemaking Plan (SECY-03-0100) to Public on July 2, 2003
- Fire Protection Inspection Procedure IP-71111.05 Issued on March 6, 2003

Background

- Questions about compliance with Paragraph III.G.2 of Appendix R to Part 50 arose as a result of recent inspections of licensee fire protection programs
- Appendix R, III.G.2 does not recognize manual actions
- Principal concerns are associated with the use of operator manual actions to provide capability to achieve and maintain hot shutdown
- Not all manual actions implemented by licensees have been approved by NRC

Post-Fire Operator Manual Actions Rulemaking Objectives

- Permit the use of operator manual actions as an alternative to existing requirements in paragraph III.G.2 of Appendix R to Part 50
- Develop generic acceptance criteria for feasible operator manual actions
- Use of manual actions that comply with established acceptance criteria would not require NRC approval

Post-Fire Operator Manual Actions Rulemaking – Current Thinking

- Current Rule (Appendix R, III.G.2)
  - No manual actions allowed, without prior approval
- Alternatives:
  - Manual actions, in combination with fire detection and fixed fire suppression systems, or
  - Limited set of defined manual actions, in combination with fire detection and fixed fire suppression systems, and existing fire barriers

Post-Fire Operator Manual Actions Rulemaking Approach

- Key parameters which influence manual action acceptance criteria
  - Time to damage
  - Environment encountered by operators
    - Temperature
    - Fire effects (smoke and toxic gases)
  - Instrumentation available for detection
  - Effectiveness of protective equipment (i.e., SCBA,...)
  - Accessibility of all locations where manual actions are required
  - Specific procedures identifying the required actions
  - Available and accessible special tools required for the action
  - Training program to include the use of simulation
  - Communication capability
  - Complexity of operator manual actions
  - Total number of manual actions

Post-Fire Operator Manual Actions Rulemaking Approach (cont.)

- Operator manual actions must be validated
- RES review of insights from sources such as, Plant Updated PRA, IPEEE report, Fire Re-Quantification project, and inspection findings related to sample plants
  - Factors considered in taking credit for manual actions
  - Potential limits on the feasibility of implementing operator manual actions in lieu of plant design features that might otherwise obviate the need for such actions
  - Ability of operators to perform multiple duties

Next Steps

- Engage public discussion on feasibility and limitations of operator manual actions
- Develop acceptance criteria and associated regulatory guidance
- Implement Commission SRM once released
  - Exercise enforcement discretion
  - Publish Regulatory Issue Summary conveying NRC position and direction
- Develop proposed draft rule language

Operator Manual Action Definition

NRC

- Those actions taken by operators to perform manipulations of components and equipment from outside the main control room to achieve and maintain post-fire safe shutdown. This action is typically performed locally by the operator at the equipment

NEI

- Operation of safe shutdown equipment on the required safe shutdown path using the control room devices (e.g., switches) in the event that automatic control of the equipment is either inhibited based on plant procedures or unable to function as a result of fire-induced damage
  - Remote Manual Operation: Operation of safe shutdown equipment on the required safe shutdown path using remote controls (e.g., control switches) specifically designed for this purpose from a location other than the main control room
  - Local Operation: Operation of safe shutdown equipment on the required safe shutdown path by an operator when automatic, remote manual or manual operation are no longer available (e.g., operating of a MOV using the hand wheel)

III.G.2 Requirements

- Separation of the redundant system by a passive barrier able to withstand a 3-hour fire; or
- Separation of the redundant system by a distance of 20 ft with no intervening combustible material, together with fire detectors and auto-suppression system; or
- Separation of the redundant system by a passive barrier able to withstand a one-hour fire, together with fire detectors and auto-suppression system

Resolution of Manual Actions Issues

Fred Emerson, NEI

Advisory Committee on Reactor Safeguards
Fire Protection Subcommittee
September 9, 2003

1

Topics

- Industry view of issue
- Issue resolution needs
- Industry views on feasibility criteria
- Recommendations

2

Industry View of Issue

- Basic issue: Regulatory treatment of manual actions for redundant shutdown
  - NRC inspection findings
  - NEI survey of industry views and practices
  - Industry – NRC meeting June 20, 2002
  - Actions since this meeting

3

NRC Inspection Findings

- Licensee use of manual actions without NRC approval constituted a violation of Appendix R Section III.G.2

NEI Survey Results

- Most licensees use manual actions to some extent for redundant shutdown
  - Some use them extensively
- Licensees interpreted the regulatory guidance as allowing this practice
- Inspection of many licensee safe shutdown programs since the 1980s had not flagged the need for prior approval until the last 2 years

Meeting June 20, 2002

- NEI presented the industry views and the results of the survey
- NRC staff agreed that the focus should be on whether the manual actions were feasible
- NRC initiated steps to implement this view

Actions Since the Meeting

- Informal staff criteria for determining whether manual actions are feasible
- IP 71111.05 revised to include feasibility criteria (March 6, 2003)
- SECY 03-100 recommended rulemaking plan to Commission

Actions Since the Meeting

- Inspection procedure 71111.05 feasibility criteria
  - Diagnostic instrumentation
  - Environmental considerations
  - Staffing
  - Communications
  - Special tools
  - Training
  - Accessibility
  - Procedures
  - Verification and validation

Actions Since the Meeting

- SECY 03-100 view:

  "The staff has concluded that amending Appendix R and associated guidance to allow the use of feasible operator manual actions is a safe and acceptable method for protecting safe shutdown capability from a fire (in lieu of fire barrier separation)."

- Industry concurs with this position

Current Issues

- Gap between NRC intent (SECY 03-100) and current rule language
- Inspections review against current rule
- Green findings are to be issued even when the manual actions are deemed feasible

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Issue Resolution Needs

- NRC developing rule to bridge gap between current regulation language and intent
  - Current rule: exemption required to implement manual actions for redundant shutdown
  - SECY 03-100 intent: Focus on feasibility/safety rather than existence of exemption
- This gap creates difficulties for inspectors and plants and results in unnecessary inspection findings

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Industry Views on Feasibility Criteria

- Criteria are generally appropriate
- Industry will recommend changes to the IP 71111.05 language

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Industry Recommendations

- Letter to Commissioners August 18, 2003
  - Implement a direct final rule (speed up rulemaking process) if possible
  - Suspend inspections until new rule finalized
  - Implement enforcement discretion if inspections not postponed
- These recommendations will help address gap between current rule and the NRC intent for a revised rule

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Summary

- Manual actions safely support plant shutdown if their feasibility is demonstrated
- Recommended steps should be implemented to eliminate inspector or licensee uncertainty about use of manual actions

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