

# **Official Transcript of Proceedings**

## **NUCLEAR REGULATORY COMMISSION**

Title: Advisory Committee on Reactors Safeguards  
Reliability and PRA Subcommittee

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Thursday, July 26, 2012

Work Order No.: NRC-1783

Pages 1-292

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

6 + + + + +

7 RELIABILITY AND PRA SUBCOMMITTEE

8 + + + + +

9 THURSDAY, JULY 26, 2012

10 + + + + +

11 ROCKVILLE, MARYLAND

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13 The Subcommittee met at the Nuclear  
14 Regulatory Commission, Two White Flint North, Room  
15 T2B1, 11545 Rockville Pike, at 8:30 a.m., John W.  
16 Stetkar, Chairman, presiding.

17 COMMITTEE MEMBERS:

18 JOHN W. STETKAR, Chairman

19 J. SAM ARMIJO, Member

20 DENNIS C. BLEY, Member

21 HAROLD B. RAY, Member

22 JOY REMPE, Member

23 MICHAEL T. RYAN, Member

24 STEPHEN P. SCHULTZ, Member

25 WILLIAM J. SHACK, Member

1 NRC STAFF PRESENT:

2 JOHN LAI, Designated Federal Official

3 HARRY BARRETT, NRR

4 BENJAMIN BEASLEY, NRR

5 STEPHEN DINSMORE, NRR

6 JOSEPH GLITTER, NRR

7 ALEX KLEIN, NRR

8 PAUL LAIN, NRR

9

10 ALSO PRESENT:

11 PAUL AMICO, SAIC

12 FRANCISCO JOGLAR, Hughes Associates\*

13 JEFF JULIUS, Scientech

14 ANIL JULKA, NextEra Energy

15 BOB KALANTARI, EPM\*

16 MICHAEL KAMMER, SCANA

17 TED KULCZYCKY, NextEra Energy

18 GERALD A. LOIGNON, JR., SCANA

19 DAN MacDOUGALL, DC Cook

20 BIJAN NAJAFI, SAIC

21 VINNY RUBANO, NextEra Energy

22 MARK SCHAIRER, EPM

23 LAURA SWENZINSKI, NextEra Energy

24 KIANG ZEE, ERIN Engineering

25 \*Present via telephone

## TABLE OF CONTENTS

1		
2	Opening Remarks - J. Stetkar, ACRS .....	4
3	NFPA 805 LAR Reviews .....	8
4	DC Cook Presentations .....	54
5	Break .....	68
6	DC Cook Presentations (continued) .....	68
7	Lunch .....	148
8	Duane Arnold Presentations .....	149
9	Break .....	233
10	VC Summer Presentations .....	234
11	Meeting Adjourned .....	292

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

8:29 a.m.

CHAIRMAN STETKAR: The meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards, Reliability and PRA Subcommittee. I'm John Stetkar, chairman of the Subcommittee meeting.

ACRS members in attendance are Sam Armijo, Steve Schultz, Harold Ray, Mike Rayn, Bill Shack, Joy Rempe. And we will be joined by Dennis Bley later in the morning. Jon Lai of the ACRS staff is the Designated Federal Official for this meeting.

The purpose of the meeting is for the Subcommittee to hear the technical findings of licensees' fire protection program transition to NFPA 805. We'll hear presentations from three licensees, the nuclear industry and the NRC staff.

There will be a phone bridge line. To preclude interruption in the meeting, the phone will be placed in listen-in mode during presentations and committee discussions. We have received no written comments or request for time to make oral statements from members of the public regarding today's meeting. The entire meeting will be open to public attendance.

The Subcommittee will gather information,

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1 analyze relevant issues and facts to formulate  
2 proposed positions and actions as appropriate for  
3 deliberation by the full committee.

4 The rules for participation in today's  
5 meeting have been announced as part of the notice of  
6 this meeting previously published in the Federal  
7 Register.

8 A transcript of the meeting is being kept  
9 and will be made available as stated in the Federal  
10 Register Notice. Therefore, we request that  
11 participants in this meeting use the microphones  
12 located throughout the meeting room when addressing  
13 the Subcommittee.

14 The participants should first identify  
15 themselves and speak with sufficient clarity and  
16 volume so that they may be readily heard.

17 Before we start, I have a few  
18 administrative things to take care of. First of all,  
19 I'd like to really express our appreciation to the  
20 staff, the industry and the licensees for supporting  
21 this meeting.

22 We know that everybody is really, really  
23 busy with this whole NFPA 805 transition process and  
24 we really appreciate your taking your time out. We  
25 know how much, they have not issued an SER. They will

1 not issue an SER until their review is complete.

2 They have issued RAIs. They're working  
3 through the RAI resolution process. So, please keep  
4 that in mind when you ask questions, because this is  
5 not - we are not reviewing a formal staff product  
6 here. And in that sense, I suspect we will have  
7 several technical questions that will come up during  
8 the meeting.

9 I'd like to emphasize the fact that those  
10 questions are intended for us to improve our  
11 understanding of specific technical issues and how  
12 they're being addressed both in the staff's review and  
13 in terms of the, perhaps, licensees' responses to RAIs  
14 or particular methods that they're using to address  
15 specific issues that come up.

16 It's certainly not our intent for any of  
17 our questions to precipitate further staff RAIs, and  
18 let me just leave it that way. This is for a briefing  
19 of our subcommittee, and I don't know how else to put  
20 it.

21 And if the members would kind of, you  
22 know, keep that in mind a little bit, because it is a  
23 bit - we don't normally get involved at this stage in  
24 the process. So, it's a bit dangerous in that nature  
25 that things that we say may be misinterpreted.

1           One other thing, the meeting is completely  
2 open. There may be questions that tread upon areas of  
3 proprietary information, either data, perhaps  
4 proprietary methods that may be used by some of the  
5 licensees. I don't know if that's the case.

6           And certainly some of the information in  
7 the License Amendment Requests is classified as  
8 sensitive information from the point of details of  
9 plant layouts and things like that.

10           So, if we delve into any of those areas,  
11 I'd ask either the staff, and in particular any of the  
12 licensees, to alert us to the fact that we're going  
13 over the borderline between publically-available  
14 information and something that may be proprietary or  
15 sensitive.

16           We can close the meeting if necessary if  
17 the Subcommittee members feel that it's necessary to  
18 go into details in those areas. It's a little bit  
19 difficult, but we can do it. Let's just keep that in  
20 mind.

21           So, I'd ask for help again from the  
22 licensees. If you think we're getting into  
23 particularly sensitive areas or details that you don't  
24 want on the public record, please alert us to that.

25           And as a final comment, at the moment, we



1 have no intent at least at the current stage of the  
2 process, to have a full committee briefing on this  
3 topic.

4 I suspect at the end of the meeting  
5 depending on how the discussions go, we'll discuss  
6 among ourselves whether we feel that it's necessary to  
7 bring it to the full committee.

8 I personally don't particularly want to do  
9 that. It's again another exercise in bringing  
10 everybody, you know, to the full committee meeting and  
11 an interruption in everybody's normal workday, but  
12 we'll see how the discussions go.

13 And with that, we'll now proceed with the  
14 meeting. And I call upon Joe Glitter to begin.

15 Joe.

16 MR. GLITTER: Okay. Thank you, Dr.  
17 Stetkar.

18 Good morning. My name is Joe Glitter.  
19 I'm the Director of the Division of Risk Assessment at  
20 NRR.

21 Here with me to my right is Alex Klein.  
22 And behind me - and Alex is the Chief of the Fire  
23 Protection Branch. And behind me is Ben Beasley who  
24 is the Acting Chief of the PRA Licensing Branch.

25 Presenting at the head of the table are

1 Steve Dinsmore, Paul Lain and Harry Barrett. Steve,  
2 Paul and Harry are some of the senior technical  
3 reviewers that are working on this project. We have  
4 other technical reviewers and contractors in the  
5 audience today as well.

6 Over the next couple of days you're going  
7 to be hearing from the staff and industry about the  
8 successes and the challenges associated with the NFPA  
9 805 reviews.

10 And while the complexity and sheer volume  
11 of these reviews may seem daunting, I personally am  
12 encouraged by the professionalism, teamwork and  
13 dedication that the NRC NFP 805 team has demonstrated  
14 knowing that their efforts are tied to meaningful and  
15 prudence in fire safety.

16 So, that's all I had to say for an opening  
17 comment. And with that, I'll turn it over to the  
18 presenters.

19 MR. LAIN: Okay, I'll kick us off then.

20 My name is Paul Lain. I've been working  
21 with NFPA 805 for over ten years through the  
22 rulemaking and through the pilots.

23 I would like to - this is what we're going  
24 to go over today. I would like to spend 30 seconds on  
25 a quick look on program status. Mr. Stetkar said he

1 didn't want to have too much programmatic-type  
2 information.

3 Then, we're going to walk through sort of  
4 our process, the acceptance review, some audits and  
5 RAIs on some of our observations. Then, a few -- then  
6 a short summary at the end. So, let's go ahead and  
7 get started.

8 Here's a - we'll do a 30-second snapshot.  
9 We've got ten License Amendment Requests under review.  
10 Four of them right now are into their second rounds of  
11 RAIs. Two of them are in their first rounds.

12 We've done our audits on six, the first  
13 six. The seventh and eighth are - right now they've  
14 given us supplemental information for the acceptance  
15 reviews.

16 And then the last two have come in  
17 recently and they're under their initial acceptance  
18 review.

19 And then we have another one at the end of  
20 this month, ANO1, and then four more at the end of  
21 September.

22 Then we'll start with Steve talking about  
23 PRA.

24 (Laughter.)

25 MR. LAIN: Unless there are any questions.

1 MEMBER SHACK: Somewhere there was a slide  
2 or something with a comment on it about we didn't want  
3 to repeat the ANO experience.

4 Is there something particularly difficult  
5 about that acceptance review or - it seemed a little  
6 late in the game to have fundamental difficulties.

7 MR. LAIN: We're not sure which slide that  
8 is.

9 MEMBER SHACK: Oh, okay. I think it was  
10 from the June 27th public meeting.

11 MR. LAIN: Okay, Alex was going to -

12 MR. KLEIN: Yes, if I could, this is Alex  
13 Klein. I think this mic is on.

14 If I could respond to that, we go through  
15 and I think we'll talk about that maybe a little bit  
16 more. We have a process in place where we go  
17 determine whether or not the licensee submittal is  
18 complete and sufficient for our technical review.

19 And in the case of ANO Unit 2 submittal,  
20 there were some deficiencies that we've identified in  
21 the License Amendment Request. We did have two public  
22 meetings with the licensee to discuss the need for  
23 additional supplementary information in order to make  
24 their License Amendment Request more complete for the  
25 staff to actually start their review.

1                   So, I think that's what you might be  
2 referring to.

3                   MEMBER SHACK: Thank you.

4                   MR. DINSMORE: Well, I see that brings me  
5 right into my slide. My name is Steve Dinsmore. I'm  
6 a Senior Risk and Reliability Analyst in the PRA  
7 licensing branch. I've been there for about 16 or 17  
8 years.

9                   I'm actually not a real fire PRA guy. I'm  
10 more of a general PRA guy. The real fire PRA  
11 engineers are Ray Gallucci and J.S. Hyslop, who are  
12 both here. So, if you get into really detailed,  
13 technical questions, I'm going to wave around and try  
14 to get them up here. And our contractor is Garill.  
15 I see Garill is back there from PNNL.

16                   I'm going to give you an overview of how  
17 this stuff works and some medium level of detail about  
18 what we're coming up with.

19                   So, the first slide here talks about  
20 acceptance reviews. As Alex said when a submittal  
21 comes in, the first thing we do is a real quick review  
22 to see if it contains sufficient information to  
23 complete our review, which really means to start it,  
24 but that's the way the wording is.

25                   So, we do that and we do it fairly

1 quickly. And we come back to the licensee and we  
2 either say we accept the thing for review, or we don't  
3 accept the way it is, but you can supplement, or we  
4 don't accept it, period, and you have to resubmit,  
5 which is unpleasant for everybody.

6 So, in the six or seven - I think we  
7 accepted six so far. And what I've got on this slide  
8 is just a little bit of information of the original or  
9 the initial acceptance review results that we've come  
10 up with in order to try to get these things to be more  
11 complete.

12 The first one is Reg 1.200 compliance  
13 paths. I guess you all know that we require the PRA  
14 to have been reviewed against Reg Guide 1.200. And if  
15 it has not been, then we actually will not accept the  
16 thing for review.

17 If a PRA comes in or if one of these  
18 submittals comes in and says we've got an internal  
19 events peer review in 2010 and we've got another fire  
20 peer review in 2011, that pretty much is very simple  
21 and straightforward.

22 Unfortunately, there's also a path since  
23 these peer reviews have been going on for 10 or 12  
24 years and the guidance or the detail guidance has  
25 changed, we developed a path to keep them consistent

1 without having to redo the peer reviews. And a number  
2 of them have been following those paths and they can  
3 be fairly complicated to understand exactly how the  
4 path that they chose makes them consistent with the  
5 current Reg Guide 1.200.

6 So, we've been going back in a couple  
7 cases and saying, can you explain a little more about  
8 your gap assessments, your self-assessments and how  
9 you got there? So, that's one of the first things  
10 that we've been looking at.

11 The second one, incomplete total risk and  
12 change in risk information as I guess most of you also  
13 - if I say something you don't recall, please let me  
14 know.

15 But most of you probably know if your  
16 increase in CDF is between 10 to the minus six and 10  
17 to the minus five, we need to know your total CDF.

18 The LAR template had a statement in there,  
19 well, our total CDF is less than 10 to the minus five  
20 and LERF is less than 10 to the minus six. Some  
21 licensees interpret that literally, and so they came  
22 in with their submittal and they gave us that  
23 statement.

24 And we said, no, no, we need your estimate  
25 mostly because it convinces us that you have actually

1 done all this work to the extent that you come up with  
2 an estimate.

3 That's actually been a fairly simple one  
4 to deal with. Everybody realizes what's going on.  
5 So, that's kind of passed.

6 This next one is probably the source of  
7 much discussion over the next couple days. We  
8 sometimes go back and ask them, can you complete,  
9 identify relevant sources and model uncertainty?

10 Model uncertainty, I've got two bullets  
11 here. Unreviewed methods, which are methods that the  
12 staff has not yet seen that they've reviewed.

13 Now, the key - I'll keep going. Key  
14 assumptions are alternate reasonable assumptions which  
15 could impact the results being used, and the  
16 consequence of using these different assumptions may  
17 affect the decision.

18 And for both of those types of things that  
19 the licensee have done in their analysis, we request  
20 a sensitivity study. So, they can do unreviewed  
21 methods, they can do key assumptions that maybe we  
22 wouldn't agree with, but they need to provide us with  
23 a sensitivity study before we start our review.

24 That's also caused some consternation  
25 because the sensitivity studies can be difficult to



1 do. And the acceptance review is a pretty short time  
2 fuses, but we're working through that.

3 I guess ANO2 actually we asked them to do  
4 some sensitivity studies that were very time-  
5 consuming. So, that's one of the difficulties that  
6 we've been running across.

7 CHAIRMAN STETKAR: Steve, on those  
8 sensitivity studies, and I see you have a slide coming  
9 up a little bit more on fire modeling, so I wasn't  
10 going to ask, but are those sensitivity studies done  
11 by varying parametric values within the constraints of  
12 the model that they use, or are they sensitivity  
13 studies that compare - if it's a modeling issue, is it  
14 a sensitivity study that compares a set of fixed  
15 parameters from the model they use by comparison to  
16 another model, for example, that might have full V&V?

17 MR. DINSMORE: Thank you for that question.

18 CHAIRMAN STETKAR: You're welcome.

19 MR. DINSMORE: If the model - if we've  
20 already accepted the model, then the sensitivity study  
21 is a parametric study on how you applied it to your  
22 plant.

23 If we haven't accepted the model, we've  
24 been requesting that they - the sensitivity study use  
25 an accepted model.

1 CHAIRMAN STETKAR: Okay.

2 MR. DINSMORE: And we were doing that  
3 because it makes the reviews much more effective and  
4 quick since we really didn't want to review these new  
5 methods in the LAR reviews. And we try to avoid that  
6 as much as possible. Unfortunately, there's a lot of  
7 them coming up in these reviews.

8 So, if we can compare - if we can start  
9 off by knowing what the effect of using their new  
10 model is compared to an old one, we can move along  
11 much quicker. So, those are the two different types.

12 CHAIRMAN STETKAR: Okay, and that helps.

13 In the - and tell me to be quiet if we're  
14 going to address it later. I'm trying to look ahead,  
15 but particularly interested in applications that have  
16 used models, you know, correlations, whatever you want  
17 to call them, that are not part of the V&V suite that  
18 has been accepted in NUREG-1824 anyway.

19 Have you seen - and I know you're early in  
20 the review process. So, you haven't seen a lot of  
21 submittals. And at least from the three that I've  
22 looked at, I've noted that there are, let me just say,  
23 deviations among those three in terms of approaches  
24 that are taken.

25 You mentioned that you don't want to get

1 into a process of essentially reviewing specific  
2 models that have been used.

3 Have you seen any type of tendency for a  
4 large number of applicants to use a specific model or  
5 a suite of models that are outside of the set of five  
6 from NUREG-1824 such that it may be worthwhile to  
7 actually take a focused look at those, or are they  
8 sort of scattered?

9 As I said, it might be not a fair question  
10 because you -

11 MR. DINSMORE: I think I'll give an answer  
12 and somebody else might want to chime in. I think  
13 that there is a tendency to group so that there are -  
14 it's not like there's 30 different methods.

15 There's five different methods that are  
16 being applied in different places. So, it is kind of  
17 grouped.

18 CHAIRMAN STETKAR: It's probably grouped  
19 according to contractors, I suspect. Okay.

20 MR. BARRETT: Yes, one thing I'd like to  
21 point out is - this is Harry Barrett, senior fire  
22 protection engineer.

23 I'd like to point out that in the vast  
24 majority of cases, they're all using five V&V fire  
25 models. What they're changing is the assumptions that

1 go into the front end of that.

2 For instance, electrical cabinet heat  
3 release rates, 6850 has certain 75th percentile, 98th  
4 percentile numbers. They're varying the numbers that  
5 they're using in their model somewhat based on their  
6 assumptions, and that's getting different results than  
7 you would get if you used 6850, but they are using a  
8 verified model when they do it.

9 CHAIRMAN STETKAR: So, they're using the  
10 fundamental correlation. They're just varying the  
11 input parameter accordingly, okay.

12 Thanks, that helps a lot because that's  
13 different than taking the -

14 MR. BARRETT: I think there's a few - I  
15 think detector activation is one that I didn't think  
16 it got V&V'd and they're using that. And they end up  
17 having to come up with some other justifications for  
18 that, but the vast majority of them are all V&V codes  
19 or correlations.

20 CHAIRMAN STETKAR: You're not seeing  
21 somebody come in with here's Joe's Corner Grocery  
22 Store plume --

23 MR. BARRETT: Yes, we haven't --

24 CHAIRMAN STETKAR: -- correlation or  
25 something like that.

1 MR. BARRETT: No.

2 CHAIRMAN STETKAR: Okay.

3 MR. BEASLEY: This is Ben Beasley, acting  
4 branch chief of PRA licensing.

5 So, just the way you asked the question,  
6 I want to make the point that we are willing to review  
7 the methods.

8 CHAIRMAN STETKAR: Sure.

9 MR. BEASLEY: Our preference is to not do  
10 it through the LAR process, but to do it in a separate  
11 -

12 CHAIRMAN STETKAR: No, I understand. I was  
13 just trying to get a sense that if out of the, you  
14 know, eight or so that you're sort of in process so  
15 far, plus the two pilot plants, if you saw a large  
16 number of them all using some, you know, I'll call it  
17 Joe's Corner Grocery Store, you know, correlation or  
18 something like that, it might be more efficient to  
19 actually take a little time and look at that. That's  
20 the sense that I was trying to get.

21 And that's from what Harry said, I don't  
22 get that sense. So, that's good. Thanks.

23 MR. LAIN: As I mentioned, you're reviewing  
24 both the internal events and the fire PRA. So, this is  
25 not just with the fire PRA.

1 MR. DINSMORE: Yes, that was on my RAI  
2 slide.

3 MR. LAIN: Oh, I'm sorry. I'm taking away  
4 your thunder. We'll let Harry talk for a little bit.

5 MR. BARRETT: Okay. In the middle of the  
6 acceptance review, what we basically do is look at the  
7 details in the LAR and make sure that we have enough  
8 information to start the review and essentially the  
9 information we would need to write the safety  
10 evaluation from an amount of information.

11 If we find holes in this application where  
12 we don't have enough information, then we would end up  
13 asking for supplemental information submitted to us on  
14 the docket.

15 So, we get into some fairly detailed  
16 information when we end up doing this. Things like  
17 whether or not they've identified all the variations  
18 from deterministic requirements.

19 We had one licensee that ended up doing a  
20 control room analysis where they didn't actually tell  
21 us all of the VFDRs in the control room, which are  
22 variations from deterministic requirements.

23 It's kind of hard for us to end up judging  
24 whether or not they did the job right if we don't even  
25 know that they have identified all of the components

1 that were damaged in the control room, you know.

2 They gave us the statement that, well, we  
3 don't have a shutdown panel. So, we have one VFDR for  
4 the control room.

5 That's kind of a problem. One of the ANO  
6 issues was the fact that they did their control room  
7 analysis, and what they submitted to us was so  
8 simplistic that we couldn't make sense out of exactly  
9 what they did.

10 In that case, it's kind of hard for us to  
11 accept the license amendment if what they've given us  
12 on the docket doesn't give us enough information to  
13 actually explain how the analysis was done.

14 A second issue that we get into when we  
15 look at these is if they're doing modifications, if  
16 they don't explain what those modifications are or  
17 they say, we may do this or we may do that or we may  
18 do something else that will bring the risk down  
19 equivalently, they haven't actually decided what  
20 they're going to do. So, they're not telling us what  
21 they're asking our approval on.

22 So, we can't end up doing an acceptable  
23 review if we don't know exactly what they're asking  
24 for.

25 So, the acceptance review is basically to

1 look at in total the license amendment and decide  
2 whether or not they've given us sufficient information  
3 for us to actually do the review.

4 So, we can get to a very high level of  
5 detail in the acceptance review, but typically we  
6 don't.

7 CHAIRMAN STETKAR: Harry, in those details,  
8 I mean, I've actually read now through three of these  
9 things, generally there is summary information in the  
10 LAR supported by, I guess, you know, stacks of more  
11 detailed technical reports.

12 MR. BARRETT: Yes, absolutely.

13 CHAIRMAN STETKAR: Are those technical  
14 reports submitted to you, or are they just available  
15 for audit?

16 MR. BARRETT: Well, we've been doing -

17 CHAIRMAN STETKAR: So, for example -

18 MR. BARRETT: We started a policy with the  
19 pilots and we've been following it through with all of  
20 the licensees so far, is they give us a SharePoint  
21 site once we accept their license amendment.

22 CHAIRMAN STETKAR: Okay.

23 MR. BARRETT: On that SharePoint site will  
24 be the PRA calculations, the nuclear safety capability  
25 assessment, the non-power ops review, you know, the



1 monitoring program.

2 All of the detailed procedures and  
3 calculations and stuff that we would need to look at  
4 as backup information to understand exactly how they  
5 did that, is on the SharePoint site.

6 And then when we do the audit, we also go  
7 in and we actually look at hard copies and talk to  
8 them.

9 CHAIRMAN STETKAR: Okay.

10 MR. BARRETT: When I go on to the next  
11 slide, we'll talk about that a little bit.

12 CHAIRMAN STETKAR: But you do have at your  
13 fingertips then their -

14 MR. BARRETT: Not at the acceptance review  
15 stage.

16 CHAIRMAN STETKAR: Not at the - okay.

17 MR. BARRETT: Acceptance review is -

18 CHAIRMAN STETKAR: Not at the acceptance.

19 MR. BARRETT: -- just looking at what -

20 CHAIRMAN STETKAR: Sure, okay.

21 MR. BARRETT: -- they put on the docket.

22 CHAIRMAN STETKAR: I'm sorry, okay.

23 MR. BARRETT: And it's very important  
24 because it has to be the stuff that's on the docket,  
25 because that's what we have to refer to in the safety

1 evaluation.

2 There may be many tiers of information  
3 that are below that, that we wouldn't necessarily  
4 refer to directly in the safety evaluation to  
5 understand how they did it, but we're actually looking  
6 at whether or not it's on the docket and we have  
7 sufficient information to write the SE from.

8 CHAIRMAN STETKAR: So, at the acceptance  
9 review, for example, for the modifications, you'd be  
10 limited to only the information that's in Attachment  
11 S. And if that doesn't -

12 MR. BARRETT Well, yeah, in many cases it's  
13 Attachment S. And it's also Attachment C, which  
14 defines what the actual problem is.

15 CHAIRMAN STETKAR: Yes, yes.

16 MR. BARRETT: Then you look at Attachment  
17 C and you look at Attachment S, and then possibly  
18 Attachment G to see whether or not recovery actions  
19 fit into that.

20 CHAIRMAN STETKAR: I was just thinking in  
21 terms of details of proposed modifications, you know.

22 MR. BARRETT: Right.

23 CHAIRMAN STETKAR: That's one of the items  
24 that you mentioned.

25 MR. LAIN: That's something else we would

1 also do is take a look at some of the things don't  
2 rise to the level of acceptance review, some of the  
3 things we can take care of during the RAI.

4 So, a lot of RAIs kind of get identified  
5 and they're filling the smaller holes versus the  
6 larger ones we can fit in.

7 MR. BARRETT: Yes, and some of the  
8 acceptance reviews actually get into things like  
9 programmatic issues.

10 The first couple of non-pilots said that  
11 they made a promissory thing that they would finish  
12 their monitoring program during implementation and the  
13 details were kind of fuzzy.

14 So, there was a FAQ that was in process.  
15 And once that FAQ got approved, then everybody just  
16 used that FAQ as the structure of what they were  
17 asking for. So, we kind of solved that problem.

18 But the acceptance review gets into a lot  
19 of different things. And for such a short review, it  
20 is very intense, obviously. It's supposed to be a  
21 tenth of the overall License Amendment Review.

22 And when you're talking about hundreds of  
23 hours, even an acceptance review can get to be pretty  
24 intense.

25 Next slide.

1           MEMBER SHACK: Just on that SharePoint  
2           thing, there was some comment about the SharePoint  
3           that you could use that's subject to some sort of  
4           limitations.

5           Those limitations are that you can't use  
6           that information as part of the conclusion that -

7           MR. BARRETT: Well, there's several  
8           different limitations that we place on the SharePoint.

9           One, we can't download or print the  
10          information. In other words, we can view it, but we  
11          don't take it in-house. That's so that we don't end  
12          up having a large volume of material that we would be  
13          FOIA-able with, you know.

14          It's licensee's information. We're  
15          looking at it as if we were at an audit. We don't  
16          bring it back with us. It's their information.  
17          Review it. It's just like being on an audit.

18          The information that's on the SharePoint  
19          is also background information, but it's not to be  
20          referenced in the SE.

21          If there's something that we see there  
22          that we actually need for our conclusion, we would  
23          have to ask an RAI and ask them to submit it on the  
24          docket.

25          Next slide. When we go in for an audit,

1 it's quite a process, actually. We bring a pretty  
2 good size team in anywhere from, I'd say, six to 12  
3 people. And many of them have actually had more than  
4 that because they had observers that were trying to  
5 learn the process.

6 It's a multi-disciplinary team kind of  
7 similar to a peer review that reviews a typical PRA.  
8 We've got fire protection people, fire modeling  
9 people, PRAs, safe shutdown people. And we end up  
10 looking at the whole scope of what the licensee has  
11 done.

12 We typically ask them to give us a  
13 presentation on how they've done various aspects of  
14 it, because all the contractors have a slightly  
15 different process that they use.

16 So, we typically end up having maybe a  
17 day, full day of presentations so that they can show  
18 us exactly how they did it, how their software works,  
19 you know. And we'll talk a little bit about the  
20 details of that because there's some concerns with the  
21 level of; one, contractor us, and; two, the  
22 sophistication of some of the databases and the  
23 information that they're using.

24 But anyway, we end up, you know, having a  
25 very intense one-week visit with the licensee. We do

1 walkdowns and we actually get into detailed one-on-one  
2 discussions with their experts to find out all the  
3 details of what they're doing.

4 And we actually in the walkdown, sometimes  
5 see some things that we wouldn't have expected, you  
6 know.

7 One walkdown we ended up seeing that the  
8 fire modeling had not addressed some of the  
9 combustible insulation on the pipes, you know. That's  
10 the kind of thing when you're on the walkdown you'll  
11 say, well, geez, that's polyurethane.

12 (Laughter.)

13 MR. BARRETT: So, you know, it's quite a  
14 process. And we end up, for instance, many of the  
15 licensees have integrated databases for their safe  
16 shutdown cable and routing programs, the safe shutdown  
17 analysis, and then that links up to the PRA.

18 Typically we want to end up knowing how  
19 are you going to control this now and in the future as  
20 far as configuration management? Because now any time  
21 anybody comes in that does a design change, you got a  
22 potential challenge to your whole analysis because  
23 you're now rerouting cables and changing whether or  
24 not something is in the zone of influence for ignition  
25 source.

1           So, we end up getting into fairly good  
2 detail talking about those kinds of things in the  
3 audit to understand that.

4           That's typically not something you're  
5 going to see in the LAR, but it is important from an  
6 understanding of the process standpoint.

7           We typically end up going into great  
8 detail talking about fire modeling, how they're  
9 dealing with V&V, which models they're using, what  
10 assumptions they are using.

11          In the walkdowns, typically the fire  
12 modelers will end up taking notes and looking at  
13 specific issues that they might want to ask about,  
14 ventilation concerns, that type of thing, how  
15 suppression is addressed.

16          And so, all of this ends up forming the  
17 basis of where the RAIs come from. We do these  
18 walkdowns and discussions with the licensees and then  
19 we have questions. And then from those questions we  
20 end up writing the RAIs, which are then submitted to  
21 the licensee and asked to respond to.

22          It's a very intense week. A lot of  
23 discussions back and forth. And in many cases, the  
24 staff actually does a good job of explaining why we  
25 need information. And the licensee actually

1 understands better after the audit when we come in and  
2 say, well, we need to know this because. And that  
3 ends up being a benefit to both sides. We got a lot  
4 of positive feedback from people saying that the  
5 audits are beneficial.

6 They also talk about program quality.  
7 Things like were people fully qualified to do the  
8 analysis that they were doing and did they follow the  
9 limitations of use, were they within the range of the  
10 V&V models and those kinds of things. A lot of  
11 discussion about all those topics.

12 So, the audit ends up being a very  
13 beneficial thing overall for the whole thing.

14 Next page.

15 MR. LAIN: We'll let Steve jump in on PRA  
16 RAIs.

17 MR. DINSMORE: Okay. As Paul mentioned  
18 earlier, we're doing reviews of internal events and  
19 external events.

20 The fire PRAs, they're done mostly by  
21 imposing the fire failed components onto the internal  
22 events PRA. They don't usually go on start a fire and  
23 try to figure out the whole scenario. They look at a  
24 fire, they see what failed, they go to their PRA and  
25 they failed it.



1                   And so, there is a lot of dependence on  
2                   that internal events PRA which we hadn't really  
3                   expected, but which we're dealing with.

4                   CHAIRMAN STETKAR: Steve, why didn't you  
5                   expect that?

6                   (Laughter.)

7                   MR. DINSMORE: Well, I guess personally we  
8                   did risk-informed ISI and that one you go and you  
9                   actually fail your pipe and you come up with all your  
10                  scenarios.

11                  So, the internal events PRA is used more  
12                  as a source of information whereas in this case you go  
13                  in the - you don't really figure out the whole  
14                  scenario. You figure out what failed and you impose  
15                  it on your internal events PRA.

16                  CHAIRMAN STETKAR: Right.

17                  MR. DINSMORE: Well, okay.

18                  CHAIRMAN STETKAR: I guess I would be  
19                  surprised if - are people actually developing  
20                  different fire PRA models? I mean, have you seen any  
21                  of those?

22                  MR. DINSMORE: You might - they're probably  
23                  better off answering that.

24                  CHAIRMAN STETKAR: Okay.

25                  MR. DINSMORE: I know that they -

1 CHAIRMAN STETKAR: I'll wait.

2 MR. DINSMORE: Okay.

3 (Laughter.)

4 MR. DINSMORE: This makes the quality of  
5 the internal events model equally important to the  
6 fires.

7 And the internal events as I mentioned  
8 earlier, that the peer review started in the late  
9 1990s. And they've gone through this complicated  
10 process.

11 And we've eventually decided that the only  
12 way you can delete a finding or F&O from the  
13 consideration is if you have a new peer review that  
14 doesn't include it. So, they can't delete themselves.

15 So, we always request as I said during  
16 this NUREG review, at this point we're requesting the  
17 whole set of F&Os and findings that you had to date,  
18 and how you resolved them.

19 So, a number of the RAIs are actually -  
20 they submit this stuff and then a lot of times the  
21 resolution will be essentially we fix this. And  
22 they'll immediately get an RAI, please tell us how you  
23 fixed it.

24 So, there's a fair number of RAIs that are  
25 coming out that are dealing with the quality of the

1 PRAs.

2 CHAIRMAN STETKAR: Let me ask you because  
3 I kind of waded through some of that stuff, but only  
4 in the LARs, let me take a hypothetical case that I  
5 built an internal events PRA model sometime late '90s  
6 and I had some sort of peer review done on that in  
7 2002, let's say.

8 And that peer review raised some F&Os and,  
9 you know, maybe I addressed them, maybe I didn't,  
10 because I haven't had any risk-informed licensing  
11 applications in my particular site. So, I had no real  
12 incentive to do that.

13 And now I'm going to use the PRA to risk-  
14 inform my NFPA 805 transition. And I have another  
15 peer review done of that model enhanced to take the  
16 fire PRA input, the fire damage input or however you  
17 want to characterize it. And that's done in, let's  
18 say, 2010.

19 Are you telling me that the second peer  
20 review doesn't subsume the quality of the internal  
21 events PRA as it existed in 2010 so that you have to  
22 look at that 2002 peer review separately from the 2010  
23 peer review?

24 MR. DINSMORE: Well, the question  
25 illustrates -

1 CHAIRMAN STETKAR: Or is it not that  
2 simple?

3 MR. DINSMORE: Well, the question  
4 illustrates the difficulty we're having following this  
5 complicated task. I guess I got a little lost.

6 CHAIRMAN STETKAR: Well -

7 MR. DINSMORE: They could do something  
8 called a focused-scope peer review. If they did a  
9 peer review in 1995 and then they fix some models to  
10 do their fire PRA, they could do a focused-scope peer  
11 review on those elements that they fixed.

12 It's kind of similarly defined in the ASME  
13 standard. And if they do that, then they - and that  
14 focused-scope peer review reviews against that piece  
15 of the standard, then the old F&Os can -

16 CHAIRMAN STETKAR: Can still be open.

17 MR. DINSMORE: No, no, they go away.

18 CHAIRMAN STETKAR: Oh, okay, okay.

19 MR. DINSMORE: But if they just come in and  
20 review and say, did we fix those right, that's not a  
21 focused-scope peer review. That would just be a self-  
22 assessment and the old F&Os would not go away.

23 But then when they came in and told us,  
24 well, we fixed these, then they would have a good  
25 description of why they were fixed.

1 Did I answer - I wasn't quite sure that  
2 was the question.

3 CHAIRMAN STETKAR: I'm not sure it was  
4 either, but we're going to hear about peer reviews  
5 tomorrow. So - I think we're going to hear about peer  
6 reviews tomorrow. At least it's on the agenda. So,  
7 maybe we'll be able to understand it a little bit  
8 better.

9 MR. DINSMORE: Okay. So, there are a fair  
10 amount of RAIs that deal with peer review results, and  
11 some of those are difficult to deal with as well.

12 This detailed documentation on the  
13 SharePoint in the subsequent audits, it actually  
14 allows us to look - take a much closer look at  
15 significant scenarios in great detail that we usually  
16 don't - haven't been doing that. But in this case, we  
17 do because of the effect of the submittals.

18 So, then we end up with a fair number of  
19 RAIs talking about, well, you know, you had recovery  
20 action for fires which failed bus 1A, well, couldn't  
21 fine them for 1B. What's the difference?

22 And so, there are quite a number of RAIs  
23 dealing with the details of the - the scenarios that  
24 they're coming up with.

25 There's another one about, well, there was

1 no transient combustibles postulated in this corner of  
2 the control spreading room, and there are two trains  
3 in that corner. Why aren't they transient  
4 combustibles in that corner?

5 And actually a lot of those real detailed  
6 RAIs have kind of worked their way into some questions  
7 about the methods. So, we've started in the last  
8 couple of submittals, we've started issuing generic  
9 RAIs and this one about the transient combustibles is  
10 a good example.

11 So, now we're starting to ask, well, how  
12 do you place transient combustibles within a fire  
13 area? Because, again, we noticed from the detailed  
14 analyses that there was - I think that NUREG-6850 says  
15 you need to identify pinch points and put the fire in  
16 there.

17 And so, this is one of those examples of  
18 where there's a method that they don't exactly -  
19 they're not following 6850. And so, we'll ask them to  
20 do a sensitivity study to - and of course that's  
21 difficult because they have to go back in the room and  
22 redo. So, the sensitivity studies are not that  
23 simple, but we effectively need them to be able to  
24 continue quickly.

25 So, there's a fair amount of generic RAIs

1 asking directly how did you do something.

2 CHAIRMAN STETKAR: Steve, in those areas -  
3 I know the staff has a continuing dialogue, or I  
4 assume there's a continuing dialogue between the staff  
5 and the industry.

6 In those types of generic areas where -  
7 transient combustibles you just mentioned, for  
8 example, are you getting the message out to the other  
9 applicants that there might be ways that they can  
10 structure the models to make the process more  
11 efficient? I mean, their process and your process  
12 more efficient.

13 In many cases, you know, trying to make  
14 the model perfect might not necessarily be - it might  
15 not be necessary to try to make the model perfect, you  
16 know.

17 If you put the transient combustible in  
18 the worst place in the beginning, it can still show,  
19 you know, have a problem. That makes everybody's life  
20 easier, but my question is more what type of dialogue  
21 do you have if you are finding kind of generic issues  
22 in several submittals like the one you just raised.

23 MR. LAIN: There is a number of dialogues.  
24 I'm kind of looking at Alex to see -

25 MR. KLEIN: I was going to cover that in

1 the last slide.

2 CHAIRMAN STETKAR: Were you? Okay.

3 MR. KLEIN: Well, I think at a high level,  
4 to answer your questions, is that the staff, yes. We  
5 hold very frequent - actually, almost on a - well, we  
6 do on a monthly basis, we do a little communication  
7 with the licensees.

8 I'm stealing some of the thunder from  
9 Paul, but they do keep track of the RAIs. In fact, I  
10 think not at the last monthly FAQ meeting, but I think  
11 the one before that we did go over a matrix of RAIs  
12 that the licensees had been keeping track of.

13 And in addition to that, we periodically  
14 hold public meetings. For example, Dr. Shack  
15 mentioned I think the June meeting. That was a fairly  
16 largely attended meeting between the staff and the  
17 industry to go over some of our observations that  
18 we've noted thus far with both the acceptance reviews,  
19 our audits and so forth.

20 So, yes, I mean, that communication  
21 continues, and it will continue in the future. There  
22 are other meetings that we hold. Our division  
23 director, Joe Glitter, holds monthly NEI-NRC  
24 management - senior management interface meetings that  
25 are public.



1 Joe also contacts on a bimonthly basis,  
2 each of the licensees that have an accepted License  
3 Amendment Request in house for review. So, there's  
4 that constant communication going on there.

5 CHAIRMAN STETKAR: That helps. You know,  
6 the FAQ process has become pretty well formalized, but  
7 that's generally initiated from the industry.

8 So, I'm assuming the industry -

9 MR. BARRETT: Not always. One of the  
10 things I was going to point out was -

11 CHAIRMAN STETKAR: Have you guys actually  
12 initiated some?

13 MR. BARRETT: In this particular instance  
14 talking about the combustibles, transient  
15 combustibles, we initiated a FAQ -

16 CHAIRMAN STETKAR: Okay.

17 MR. BARRETT: - to show a method that we  
18 agree with -

19 CHAIRMAN STETKAR: Oh, okay. Good.

20 MR. BARRETT: - that we're proposing for  
21 the industry to look at. So, sometimes we end up  
22 looking at one of the methods that licensees use and  
23 we try to put that out for everybody to use.

24 And so in that particular instance, we  
25 have a FAQ that's currently in front of the task force

1 that we had initiated.

2 CHAIRMAN STETKAR: Okay, good. Thanks.

3 MR. DINSMORE: Well, I was finished with  
4 the PRA RAIs.

5 MR. BARRETT: Okay, fire modeling RAIs.  
6 For the first review of a given consultant group,  
7 let's say, we typically will end up asking for input  
8 files for the models that they've done and do  
9 confirmatory analysis.

10 We've done that for several of the  
11 licensees. We did it for Cook. We did it for Duane  
12 Arnold just to get an idea of what results we would  
13 see and exactly what assumptions that they made.

14 We get into discussions about uncertainty,  
15 how they deal with uncertainty. There's RAIs that  
16 says, you know, identify what uncertainty you have in  
17 your fire models and exactly how did you address that  
18 in your decision making. That's a typical RAI.

19 We end up having quality issues with V&V.  
20 How do you deal with a V&V? Some of the aspects of  
21 their calculations are maybe either outside the range  
22 that was validated.

23 A good example would be that I think one  
24 of the licensees used CFAST. And the dimensions of  
25 the room that were qualified, they had one that was

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1 just slightly out of that and said, all right, how can  
2 you tell us that this is now V&V when you're outside  
3 the V&V dimensions of what the software is meant to  
4 be.

5 Those are the typical kinds of questions  
6 that the fire modeling guys will end up asking the  
7 licensees from an RAI standpoint.

8 Nuclear safety capability assessment, all  
9 kinds of different questions, you know. We end up  
10 getting into looking at from a deterministic  
11 standpoint, we try to understand exactly how they're  
12 complying with the regulations.

13 And in many cases based on what's in the  
14 LAR, we either can't make sense out of that or it's  
15 inconsistent between either one attachment or another.

16 You end up really having to look at the  
17 Attachment C which is the fire area review, Attachment  
18 G which is the recovery action review, Attachment S  
19 which is your modifications, and then Attachment W  
20 which kind of sums it altogether.

21 And if you look at all of those and  
22 between them it doesn't make sense, then RAIs come out  
23 of that and say, all right, guys, what are you doing?  
24 We don't understand how you got this answer. A lot of  
25 RAIs come out of that.

1           One of the things that when we get into  
2           the baseline program, 0402 has gotten several  
3           different avenues for you to end up showing that you  
4           meet the deterministic - or I should say the  
5           fundamental program attributes.

6           You can either comply directly with 805,  
7           you can comply with clarification which would mean -  
8           or should mean that you're really meeting the  
9           requirement, but let's say it's a different type of  
10          document that it's in, different type of paper.

11          What we're finding is some licensees are  
12          using compliance and clarification to actually ask for  
13          approval for deviation, which is not proper. And so,  
14          we found a few of those and sent back RAIs that says,  
15          you know, if you want to do this, you really have to  
16          do a performance-based request and give us all the  
17          information that is required for that under C27 of  
18          50.48<sup>©</sup>.

19          Some licensees end up referring to their  
20          Appendix R program in their comparison to the nuclear  
21          safety performance criteria, which is not proper  
22          anymore.

23          Now that they're no longer an Appendix R  
24          plant, they shouldn't be using that as any part of  
25          their justification for meeting the nuclear safety

1 performance criteria. So, that's been kind of a  
2 generic RAI.

3 Based on comments from the ACRS when we  
4 ended up doing the Reg Guide, we ended up endorsing  
5 Rev 2 of NEI 0001. There were some minor nuances with  
6 Rev 2.

7 Licensees - first couple of licensees that  
8 came in did not have any kind of gap assessment or  
9 addressing any of the technical concerns in Rev 2.  
10 So, that ended up becoming a generic RAI.

11 There have been some of these that came up  
12 in the first couple of non-pilots that we're working  
13 through with template changes with 0402, which is  
14 good. The process is working. We're identifying  
15 concerns. They're making changes in the template and  
16 now we're seeing that they're being resolved.

17 The last licensee that we ended up  
18 receiving in, Nine Mile, ended up catching a lot of  
19 that and they're fixing it in their amendment. So,  
20 the process is actually working pretty good that way.

21 One thing that is kind of a concern is  
22 that we're seeing a general trend of putting less  
23 information in the B3 Table or actually Attachment C.

24 In the pilots, for example, the Harris  
25 plant gave us very detailed information on a VFDR

1 level and says this VFDR has a cable and that cable is  
2 not in a zone of influence of a risk-significant  
3 ignition source.

4 What we're getting from the non-pilots now  
5 is the risk is acceptable for the room. There's no  
6 details as to why, okay. We have to go down in the  
7 lower tier documents and actually understand how that  
8 happened versus having it in the LAR and laid out for  
9 us on a VFDR basis.

10 Well, this one is within a zone of  
11 influence. So, we're either protecting it or doing a  
12 modification, you know.

13 The level of information as provided in  
14 the Harris submittal is much higher than what we're  
15 seeing in these non-pilots, which is making us have to  
16 go to a much lower level in their SharePoint  
17 information.

18 And in many cases, causes us to ask more  
19 RAIs. Because once you get to that level of detail,  
20 you have more questions.

21 So, that's kind of a difference in  
22 philosophy in what the licensees have given us. And  
23 I think you're seeing the results of that and we're  
24 generating more RAIs because we're having to look at  
25 more detailed information.

1           Some fire brigade issues. For instance,  
2           I think one of the licensees ended up wanting to -  
3           well, almost all licensees have an administrative  
4           requirement that if you're down a man, you have two  
5           hours to get somebody in.

6           That's pretty much a standard tech spec  
7           thing and that was one of the issues that we ended up  
8           putting into a FAQ to try to get that so that  
9           everybody would do it the same way. First couple we  
10          didn't have that.

11          So, just give you an idea of the kinds of  
12          things that we're seeing and what we're asking.

13          MEMBER SCHULTZ: Harry, it seems like  
14          there's some pretty fundamental lessons learned that  
15          you've described as you've gone through that slide.

16          And you indicated that as the submittals  
17          have gone forward, then it doesn't sound like those  
18          lessons in fact have been learned if what the reaction  
19          has been is less information in submittals,  
20          requirements by the staff to do more digging.

21          And I'm a little concerned about the  
22          solution being asking more RAIs as a result of this  
23          less information that's being presented.

24          Alex, you talked about the meetings that  
25          are being held. These upper level lessons learned,

1 are they being covered, driven home by the staff to  
2 help to assure that the submittals coming in are -

3 MR. KLEIN: Yes.

4 MEMBER SCHULTZ: -- going to be addressing  
5 these issues?

6 MR. KLEIN: Yes, I think that over the last  
7 few public communications we've had with licensees,  
8 the examples I think that Harry has brought forward -  
9 maybe not all of them, Harry can correct me if I'm  
10 wrong, but many of these issues we've discussed with  
11 licensees.

12 Now, I think what is important to  
13 recognize is - and what we're seeing is because of the  
14 submittal dates the way we've got them staggered right  
15 now, is that the last few that have gotten in-house  
16 may not have caught up yet with these lessons learned  
17 because of the timing of it.

18 As Harry mentioned, we're still in the  
19 middle of the LIC-109 acceptance review for Nine Mile,  
20 but our initial observations are that they seem to be  
21 addressing a lot of the lessons that we brought  
22 forward in past communications.

23 But that's only one data point at this  
24 point. So, we're hopefully - we're cautiously  
25 optimistic that future licensees will note what has



1 occurred already, will have enough time to address  
2 these lessons learned going forward.

3 We'll have more knowledge by the end of  
4 September when additional licensees have come in. I  
5 think there were four that are due by the end of  
6 September.

7 MEMBER SCHULTZ: Thank you.

8 MR. RAY: Let me interject a question here  
9 that has been on my mind over the last few  
10 discussions.

11 There's a tremendous amount of detail.  
12 You've been going into it and how you have to dig down  
13 to find the information sometimes.

14 How is that handled from a standpoint of,  
15 I'll call it, compliance stability or five, 10 years  
16 down the road? Who knows what went into these  
17 assessments later so that a change would trigger a  
18 reassessment or -

19 MR. BARRETT: Well, actually that's one of  
20 the questions that we've had from a quality standpoint  
21 is that the vast majority of these analysis are done  
22 by contractors and the transfer of knowledge is a  
23 question.

24 Because once the contractors leave, the  
25 licensee needs to do modifications and pull new

1 cables. They've got to have somebody that understands  
2 the databases and the software that's used to end up  
3 doing this analysis. And they need to maintain the  
4 analysis up to date.

5 We don't want to have another Appendix R  
6 where people spend \$10 million doing an Appendix R  
7 study and then put it on the shelf and ignore it for  
8 ten years, and then find that their plant is no  
9 longer, you know, even close to what the analysis  
10 shows, you know.

11 805 has a very rigid requirement that this  
12 has got to be a living analysis and they need to end  
13 up having qualified people to maintain the analysis,  
14 you know, real time.

15 So, we've had numerous questions about  
16 that and there's RAIs out there. It's just tell us  
17 how you're going to end up maintaining this going  
18 forward and make sure that the right people with the  
19 right qualifications are available to make sure, you  
20 know, your analysis is valid.

21 MEMBER RAY: Well, you know, we get into  
22 sometimes really religious debates over applying 50.59  
23 to changes in the licensing basis, for example.

24 Well, this is another world that is very  
25 similar to that, but I don't know what the rules are

1 or how they've ever expected to be -

2 MR. BARRETT: Well, from -

3 MEMBER RAY: -- implemented.

4 MR. BARRETT: From a process standpoint, I  
5 think there is - I won't say it's rigid guidance, but  
6 there's some fairly good guidance in 0402 and in the  
7 Reg Guide as to exactly how that's supposed to be  
8 carried forward.

9 Plant change evaluations are the vehicle  
10 that you use to assess whether or not a change to the  
11 fire protection program ends up being allowable or  
12 not.

13 MEMBER RAY: Well, is it a part of 50.59,  
14 or is it -

15 MR. BARRETT: No, no.

16 MEMBER RAY: It's parallel to it though,  
17 right?

18 MR. BARRETT: It's --

19 MEMBER RAY: Functionally it's the same.

20 MR. BARRETT: --parallel only in the fact  
21 that it's self-approval. It's actually done through  
22 a license condition and is similar to the current fire  
23 protection license condition in that licensees can  
24 make changes so long as it's within the bounds of the  
25 license condition.

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1                   And the license condition for fire  
2 protection allows them various different avenues that  
3 they can end up assessing whether or not their change  
4 adversely impacts the fire protection program.

5                   MR. KLEIN: I think your question is an  
6 important one. And I think that we recognize it as  
7 important. I think that's why, you know, you've heard  
8 Harry's response. And even at the senior management  
9 level we've had conversations with the individual  
10 licensees. I've mentioned the bimonthly phone calls  
11 that we hold.

12                   We reemphasize the need for having  
13 qualified folks on their staffs so that this stays a  
14 very viable program moving forward.

15                   When we're at the audits, we do sit down  
16 with their senior management to emphasize that same  
17 point. And I think in terms of communication, you  
18 know, the staff here is trying very hard to make sure  
19 that that message gets across to the licensees.

20                   MEMBER RAY: Well, I'm sure you are and it  
21 probably is being done effectively. But, you know,  
22 five, ten years go by and it's hard for these things  
23 to stay in place unless there's something that causes  
24 that to happen.

25                   Okay, that's enough. I won't pursue it

1 further at this point.

2 MR. LAIN: Okay, we'll move on to the  
3 summary slide. I think so there's two sort of  
4 distinct processes going on here. We're staying  
5 within our process to review License Amendment  
6 Reviews. It's our LIC-101 process and we pretty much  
7 have discussed all the ins and outs with that.

8 But also, Alex discussed a little bit  
9 about our continued work with the stakeholders. Just  
10 a few other things besides our monthly FAQ meetings  
11 and our monthly management meetings is that we do hold  
12 periodic workshops.

13 There is straining that Research puts on,  
14 on NUREG/CR-6850 that we - is in our user's need with  
15 research. We also do attend the NEI Fire Protection  
16 Forum and give plenty of presentations there. So,  
17 we're continuing to try to work on these issues.

18 We are, I think, reviewing right now the  
19 LAR template for industry and looking at revisions to  
20 NEI-0402, which is the implementation guidance that  
21 our reg guide endorses.

22 And then also the EPRI unreviewed analysis  
23 method, also we're working with that.

24 MR. KLEIN: Can I just clarify something  
25 that Paul just said?

1 MR. LAIN: Yes.

2 MR. KLEIN: Paul, in terms of the license  
3 amendment template with the licensees -

4 MR. LAIN: The LAR template?

5 MR. KLEIN: The LAR template. We have not  
6 received a submittal yet from the industry on that.

7 MR. LAIN: Oh, okay.

8 MR. KLEIN: But we're certainly aware that  
9 they're working on it and that the staff is ready and  
10 prepared to work with the industry on that.

11 MR. LAIN: Any other questions? I think  
12 we've got 30 seconds left.

13 CHAIRMAN STETKAR: Actually, you have five  
14 minutes and 30 seconds.

15 (Laughter.)

16 CHAIRMAN STETKAR: Anything from the staff?  
17 Anyone?

18 (No response.)

19 CHAIRMAN STETKAR: Thank you very much.  
20 Summarized a lot of information in a good amount of  
21 time. So, we really appreciate that.

22 According to the agenda, we're scheduled  
23 for a break. Even as an old guy, it's a little bit  
24 early for a break for me.

25 So, I think what I'll do with DC Cook's

1 agreement is ask DC Cook to come up and start their  
2 presentation. And unfortunately, we'll break in the  
3 middle of it to keep the continuity going here,  
4 because it's just a little early, I think.

5 (Pause.)

6 (Discussion off the record.)

7 MR. MacDOUGALL: Before we get started just  
8 for information purposes, we do have handouts over on  
9 the table over there. And one of them is the full  
10 slides, and there was a second set where we had some  
11 examples of some transient fire modeling that we did  
12 and some fixed fire modeling. So, make sure you get  
13 both.

14 CHAIRMAN STETKAR: The fire modeling slides  
15 are public?

16 MR. MacDOUGALL: Yes.

17 CHAIRMAN STETKAR: Okay, just to make sure,  
18 because they will be put on the record and included  
19 with the meeting records.

20 MR. MacDOUGALL: Good morning. My name is  
21 Dan MacDougall and I'm the NFPA 805 project manager  
22 for DC Cook nuclear plant.

23 First, we'd like to express our  
24 appreciation on behalf of AEP and DC Cook for the  
25 opportunity to speak with ACRS, the staff once again

1 and our industry peers and work with them on these  
2 presentations. It's an opportunity for you to see our  
3 challenges and an overview of our project and where  
4 we're at. And I can't emphasize enough what a  
5 complex, iterative, intrusive process this is.

6 It's been a lot of work for everybody and  
7 it's taken enormous amount administry participation  
8 and rhetoric with the staff and our peers and I  
9 appreciate the opportunity.

10 That being said, the complexity behind  
11 this, I have some guests with me today representing DC  
12 Cook.

13 Our vice president of site support  
14 services, Mike Carlson is with us. Our regulatory  
15 affairs manager is sitting up here today.

16 With respect to the presentation itself,  
17 I will be doing the first eight slides on an overview  
18 of the station, how we're set up. Give you an idea  
19 how we safely shut down the plant in a fire event,  
20 alternate shutdown, some pinch points with risk.

21 Mark Schairer will be discussing about six  
22 slides, eight slides on fire modeling. Detailed fire  
23 modeling. We'll have a couple examples of challenges  
24 we're having with transient ignition sources and some  
25 fixed sources to walk through. And then Jeff Julius



1 with Sciencetech will be presenting about nine slides on  
2 PRA.

3 Just for information purposes, it's a  
4 total of 29 slides. Last night we did a dry run again  
5 and we did some questioning attitude-type things and  
6 we ran like an hour and a half, roughly.

7 So, just for time I don't -

8 CHAIRMAN STETKAR: You can't control this  
9 group. So, just plunge on and we'll finish.

10 MR. MacDOUGALL: First time evolution for  
11 me with ACRS, this information.

12 CHAIRMAN STETKAR: yes.

13 MR. MacDOUGALL: Presentation overview.  
14 I'm going to give you some background about DC Cook  
15 and the features of the station itself that impacted  
16 the PRA.

17 We will give you a quick summary of our  
18 transition of 805. Originally where we were headed  
19 with it, why we transitioned, what our original  
20 intent, our goals were.

21 Then our development of the PRA and the  
22 challenges of hitting the regulatory guidance  
23 initially.

24 And then RAIs as they came through, our  
25 LAR submittal challenges with that. Our LAR submittal

1 challenges with RAIs. Review of uncertainty, the  
2 challenges in that area.

3 And then kind of cover what Harry talked  
4 about later in his slides on the implementation  
5 challenges we're seeing at the station as we get  
6 closer to getting our SE. Like I said, probably about  
7 an hour and a half is what we've seen, but it's up to  
8 you.

9 DC Cook plant features, we are located in  
10 Bridgeman, Michigan. Beautiful southwest Michigan.  
11 Wine country. If anybody likes to visit that area  
12 this time of year, it's great.

13 We have two units. Total of 2150  
14 megawatts, approximately. We're a four-loop  
15 Westinghouse PWR with ice condenser containments,  
16 which kind of presented some challenges in our PRA.

17 The ultimate heat sink is Lake Michigan.  
18 All plant cooling is direct lake water heat exchange.  
19 Alternate shutdown relies on other unit systems for  
20 pump fluid services. For example, full alternate  
21 shutdown we cross-tie CVCS, CCW, ESW aux feedwater and  
22 ESW needed.

23 We do have a dedicated fire brigade that  
24 is independent from the operations staff. So, in our  
25 time feasibility validation, our fire brigade and fire

1 fighting activities are separate from our ability to  
2 safely shut down our independent staffing from the  
3 control room. The fire brigade does not credit any  
4 safe shutdown strategies.

5 We do not have a dedicated remote shutdown  
6 panel. So, we didn't meet the guidance for a primary  
7 control station on that. So, that impacted risk. We  
8 do have local indication panels, LSI panels that  
9 provide indication only.

10 CHAIRMAN STETKAR: Dan, you said the fire  
11 brigade is not credited in any of the safe shutdown  
12 strategies. That's deterministically.

13 Does the risk-informed part of the  
14 transition account for fire brigade suppression?

15 MR. MacDOUGALL: And response time.

16 CHAIRMAN STETKAR: It does, okay.

17 MR. MacDOUGALL: You are correct, yes.

18 CHAIRMAN STETKAR: Thanks.

19 MR. MacDOUGALL: Picked up in the  
20 monitoring program also.

21 Originally in 2005, we established goals  
22 for the transition. The objective adopting NFPA 805  
23 was to adopt a risk-informed fire protection program.  
24 Specifically, we were looking for a little more  
25 realism and full burnout in Appendix R. Full area

1 burnout. And notably we have multiple hot standby  
2 manual actions close to five, 600. And 2200 cold  
3 shutdown actions.

4 So, we were looking to get more realistic  
5 and basically quantify our margin and our risk and  
6 become safer.

7 Other part of that was we were trying to  
8 be responsive to the NRC industry request for people  
9 to transition. For stations to adopt NFPA 805 and our  
10 executive management team decided to do that. So,  
11 that was another big driver. Obviously, it takes  
12 their support from business case.

13 And we want to provide a more  
14 understandable licensing basis. The intent of that is  
15 a lot of our documentation and our exemptions, SERs,  
16 go way back into the early '80s, late '70s.

17 And to be perfectly honest, it's hard to  
18 go back and find a lot of that paper and make sure  
19 it's even valid for today's standards.

20 And we just - there were multiple SERs,  
21 multiple exemptions and it was a difficult maintenance  
22 issue for us as far as a licensing basis to maintain.

23 So, we were hoping to go back and  
24 reconstitute all that, which we have. We have been  
25 successful in that arena.

1           There were some business case issues we  
2           were hoping for or looking at, actually. Reduced fire  
3           protection test and maintenance cost. We've seen a  
4           huge paradigm shift with respect to suppression  
5           systems. On what used to be TRM-related is now no  
6           longer with significant.

7           And our non-TRM systems have become risk  
8           significant for us. For example, turbine building  
9           suppression and detection. Where before really  
10          availability and reliability wasn't tracked formally  
11          because we were focused on our PRM regulatory systems  
12          and compliance.

13          A big discussion there is we've got close  
14          to 40 CO2 systems, automatic CO2 systems. And in the  
15          risk-informed performance-based arena, I think we're  
16          down to eight is that number that are really risk  
17          significant. And 36 of those 40 are currently in our  
18          TRM. And all eight of them are in our TRM.

19          We've got close to almost 600 emergency  
20          light, fixed emergency light battery packs. Three to  
21          four heads on each one. Over 2200 heads that we  
22          maintain.

23          Not all of those are Appendix R related.  
24          Roughly a third, but almost, I'd say, in head space as  
25          far as not just pack heads, close to a thousand lamps

1 that we're maintaining. And eight-hour discharge  
2 testing. And we'd hoped with the -- no longer the  
3 requirement for fixed lighting, that we could use the  
4 hands-free lighting to gain some margin there.

5 And then reducing fire barriers through  
6 consolidation of analysis areas and fire domes whereas  
7 the old BTP three-hour-rated barriers now even into  
8 our new fire analysis area is different -- only one  
9 different, actually, but the fire zones we had hoped  
10 to reduce are our barrier maintenance.

11 One significant achievement was our  
12 reduction in manual operator - OMAs and our new  
13 recovery actions. Our feasibility study right now  
14 shows 157 recovery actions that are both time critical  
15 and defense in depth that we've evaluated and done  
16 feasibility on that our - in our RAI response plus the  
17 600 hot standby actions we had on our Appendix R. And  
18 of course no cold shutdown actions in 805 space.

19 Background on the station and where we're  
20 at in our LAR submittal, we did follow the 0402  
21 template in our submittal. We did have to issue one  
22 supplement because we did not include our aggregate  
23 CDF and delta LERF from our base PRA in our LAR  
24 submittal. So, we did issue a supplement September  
25 2nd to forward that to the staff.

1                   We did have some questions come up during  
2                   the LIC review, but no showstoppers. And it was  
3                   acceptable.

4                   We did use our base PRA applied during the  
5                   development of the FRES, which are included in  
6                   Attachment W of the LAR, which we'll discuss in the  
7                   next two slides just to give you background on the  
8                   FRES and the FSAs purely from the perspective of both  
9                   the maintenance and implementation, and then the rigor  
10                  that we had to put in our analysis.

11                  To date, we've received a total of 39  
12                  RAIs. Multiple subparts. So, roughly that comes to  
13                  78. 60 percent of those are PRA related. Of that 60  
14                  percent, ten percent are fire modeling V&V-type  
15                  questions.

16                  FYI. Subsequent to 39 RAIs, we got six  
17                  separate RAIs on radioactive release that we responded  
18                  to. And those had multiple subparts primarily  
19                  concerned with more detailed analysis and  
20                  quantification of capacity of sumps, suppression  
21                  system, manual suppression, that type of thing. Those  
22                  turned to be somewhat of a challenge, which we'll  
23                  discuss later.

24                  And we did have a site visit in December  
25                  of 2011 that proved to be very productive to discuss

1 fire modeling where the staff came down, Mr. Lain,  
2 Alex and several of the contractors. And we literally  
3 did a hand-over-fist walkdown of the station and spent  
4 a solid week going through both our main control room  
5 fire modeling calculations, our main control room  
6 ventilation equipment room fire modeling calculations  
7 and four kV switchgear rooms.

8 And it was very intrusive and we have  
9 responded to those and there was learnings for both  
10 sides out of that. And we found issues we did enter  
11 into our corrective action program and fixed them to  
12 respond to them.

13 And actually just informally I'll say that  
14 process worked very well. We were able to write the  
15 CR, get - or the corrective action document, get it in  
16 process, get the calc revived, fix our inputs and keep  
17 moving forward.

18 The next two slides are just a quick  
19 overview of our FRES and our fire safety analysis  
20 because they provide a lot of the basis for our  
21 program and where PRA fits in, and later on some of  
22 our challenges.

23 The fire risk evaluations were used to  
24 determine delta risk between the complaint plant and  
25 NFP 805 post-transition plant. We documented delta



1 and core damage frequency and LERF.

2 We had over 260 VFDR risk evaluations  
3 using 500 and 900 - or using 900 fire PRA scenarios.  
4 157 of those required either defense in depth or -  
5 required recovery actions to resolve.

6 CHAIRMAN STETKAR: Dan - Jeff, are you  
7 going to talk a little bit - explain a little bit more  
8 about how those 260 VFDRs map into what are  
9 characterized as 900 PRA scenarios?

10 MR. JULIUS: No, we -

11 CHAIRMAN STETKAR: The reason I ask is  
12 we're going to be hearing from three different  
13 licensees. And I at least as I went through the  
14 different applications, had a sense that the use of  
15 the PRA models might be - there may be different uses  
16 of the PRA models. Let me just put it that way.

17 I might be wrong, but I want to make sure  
18 that I understand, you know, how each of the licensees  
19 have used the models to drive those scenarios.

20 MR. JULIUS: No, we don't have a further  
21 slide or evaluation. So, this will be -

22 CHAIRMAN STETKAR: Well, I'll wait until  
23 you come up then and ask you this.

24 MR. JULIUS: Okay.

25 CHAIRMAN STETKAR: We're going to take a

1 break so you can think a little bit about it, but  
2 thanks.

3 MR. MacDOUGALL: In the end, it was based  
4 on Reg Guide 1.205 and 1.174 requirements. And then  
5 at the end we did meet the 1.174 risk assessment  
6 guidelines and we'll present the specific numbers to  
7 you later and show you we're on CDF for delta risk on  
8 Unit 1. We're close. We're on the bubble there and  
9 we'll discuss that in detail. Challenge, that  
10 specific challenge.

11 Our FSA is more of the old fire hazard  
12 analysis portion. We had a total of 57 fire areas  
13 that we did FSAs on both deterministically and then  
14 document some of the performance-based criteria.

15 The FSA is described by fire protection  
16 systems and features. Our NSCA compliance strategies  
17 discusses the VFDRs and what recovery actions are  
18 associated with them.

19 Our fire PRA FRE risk results, and then  
20 expands on some programs that are implementation items  
21 right now, radioactive release review, NPO Monitoring  
22 and defense in depth. That's just an FYI for later  
23 for when we get to a later slide.

24 In our License Amendment Request we have  
25 several implementation items. As far as hardware

1 modifications go, we've got approximately MOVs. We  
2 have to do 92-18 modifications too.

3 We've got fuse replacements that we've  
4 identified as a result of our coordination study. We  
5 do have four systems - two systems that we have to -  
6 to get the risk down, there are currently manual CO2  
7 systems that we have to change to automatic.

8 CHAIRMAN STETKAR: Can you tell us what  
9 areas -

10 MR. MacDOUGALL: Switchgear area.

11 CHAIRMAN STETKAR: Switchgear?

12 MR. MacDOUGALL: Yes.

13 Early on in the transition, 2009 I believe  
14 it was, we took enforcement discretion because we  
15 found a 250 full DC cable running in one of the other  
16 four K units and we had to change that to automatic.  
17 And this is the area right outside the MCC room. So,  
18 the same complex, basically.

19 We do have some procedural implementation  
20 items. And that's - well, we've got multiple  
21 transient combustible control and combustible free  
22 zone -- hot work free zones that we've got to get  
23 proceduralized and marked in the station and roll that  
24 out.

25 And then of course our monitoring and NPO

1 programs we've got to get our expert panel together,  
2 prioritize our monitoring process. And then our NOP  
3 identify, which we're working on these now is we've  
4 got a table that identifies the pinch points. And  
5 we've got to get with operations and the outage  
6 management group and see what compensatory actions  
7 we're going to institute in outage periods as a result  
8 of NPO.

9 And that's a real paradigm shift for them  
10 for us to step in the outage management schedule.

11 CHAIRMAN STETKAR: Let me ask Jeff again,  
12 are you going to talk a little bit about whether or  
13 not you used any risk insights for NPO modes?

14 MR. JULIUS: No, we hadn't planned to.

15 CHAIRMAN STETKAR: Okay.

16 MR. MacDOUGALL: That completes my portion  
17 of the presentation, and now we'll continue with -

18 CHAIRMAN STETKAR: Actually, now as an old  
19 guy, this is, I think, an appropriate time to take a  
20 break.

21 So, let's take a 15-minute break and we'll  
22 reconvene at 10:05.

23 (Whereupon, the above-entitled matter  
24 went off the record at 9:49 a.m. and resumed at 11:04  
25 a.m.)

1 CHAIRMAN STETKAR: Okay. Let's reconvene.  
2 I hope you all had an enjoyable hour. I know it was  
3 good for me.

4 In terms of time and schedule here, I  
5 think what we'll do is we'll let DC Cook finish up.  
6 I'm assuming that will happen - let's shoot for no  
7 later than 12:30.

8 We'll then break for lunch and I'll be  
9 generous. I'll give you 45 minutes for lunch. We'll  
10 reconvene at 1:15.

11 And then we'll plan to go until no later  
12 than 6:00. I want to make sure we get enough time  
13 allocated for the two presentations this afternoon.

14 Since VC Summer is last up on the agenda,  
15 I don't know - do we have people from Summer here? Is  
16 that going to cause any problems with flight schedules  
17 for you?

18 (Off-record discussion.)

19 CHAIRMAN STETKAR: Okay, good. Okay. So,  
20 let's do that. And with that, we're back in session.  
21 And, Dan, pick up wherever you were.

22 MR. MacDOUGALL: Okay. Looking at the  
23 slides, we were on Slide Number 9, fire PRA Peer  
24 Review. On the agenda, it puts us about a third of  
25 the way through.

1 CHAIRMAN STETKAR: That's okay. We'll be  
2 okay.

3 MR. MacDOUGALL: And Jeff Julius from  
4 Sciencetech will pick up that portion of it.

5 MR. JULIUS: Good morning. So, we're going  
6 to start with the overview of the fire PRA peer  
7 review, and then the fire PRA results followed by the  
8 discussion of the technical challenges.

9 We conducted our peer review in October  
10 2009. It was done by the PWR Owners Group. As Steve  
11 Dinsmore had mentioned, the fire PRA was built from  
12 the internal events PRA.

13 There's no significant or showstopper type  
14 of findings. We had 61 F&Os, 36 suggestions and 25  
15 findings. And all the impacts were resolved and  
16 documented as part of the LAR attachment V.

17 The PRA Owners Group indicated that  
18 overall the fire PRA quality was found to be very good  
19 and many of the elements being performed at that  
20 state-of-the-art level.

21 The peer review process provided a good  
22 independent look at the model and basis and the  
23 findings and comments were - gave us some good  
24 insights of things that we needed to address before  
25 applying the model to the fire risk evaluations.

1           The summary. So, this is kind of an  
2           overview of where I'm going with this was that the  
3           fire PRA results for Cook reflect and complement the  
4           deterministic defense in depth approach. And in that  
5           respect, the insights aren't surprising.

6           The fire PRA results are in many cases,  
7           influenced significantly by conservative data and  
8           modeling. And you'll see in the upcoming slides, we  
9           do account for the uncertainty in the analysis and in  
10          the transition, including the conservatism.

11          The insight or the thing I want to  
12          emphasize here is that we looked at the different  
13          pieces and including the uncertainty, and we're trying  
14          to make sure that the plant changes we make whether  
15          they're procedure changes or hardware changes, are not  
16          based solely on the calculated CDF. It's what's the  
17          drivers behind there.

18          So, we've got an additional slide where  
19          we'll further talk about that, but overall it's a  
20          success story. And based on the efforts of many, the  
21          plant, the industry and the NRC, we've come a long  
22          way, but we've still got a critical evaluation of the  
23          results is essential to ensure the PRA results are  
24          properly understood and characterized.

25          This is somewhat akin to the IPE era where

1 we got to the end of the IPEs and then we, you know,  
2 worked to further refine and reduce and make the  
3 models more robust.

4 So, in that respect, there are efforts  
5 underway for the NFPA 805 fire PRAs to be enhanced for  
6 future use in risk in management and risk-informed  
7 activities. And continued data and methods  
8 enhancements are needed, and EPRI is supporting those  
9 types of activities.

10 CHAIRMAN STETKAR: Jeff, you'll have to  
11 excuse my ignorance because, unfortunately, the ACRS  
12 was not involved in either of the pilot plant SERs or  
13 the review. So, we're not as familiar, perhaps, as we  
14 should be with some of the technical details or how  
15 the process works.

16 I tried to look through your slides and I  
17 didn't see anything on it, but I thought I'd ask you  
18 and perhaps somebody else can help. There are a large  
19 number of - and I always forget what they're called.  
20 The four Es, existing engineering equivalency  
21 evaluations that are cited in the application.

22 And in many cases, their evaluations to  
23 justify equivalency of a fire barrier or separation  
24 for an equivalent time or something like that.

25 How do those interface with the PRA, or do



1 they? Because in some fire areas, they're used for  
2 justification for deterministic resolution of a fire  
3 area because you have an equivalent fire barrier or  
4 adequate separation or coverage on suppression systems  
5 and that sort of thing.

6 But I noticed in many cases for fire areas  
7 that you have used the PRA, if you go to Appendix C  
8 they're interleaved for different VFDRs. Also account  
9 for the engineering -- whatever they're called. The  
10 four Es.

11 So, I was curious do they affect the PRA  
12 modeling? How do you use them when you develop the  
13 PRA models for those fire areas?

14 MR. JULIUS: That's a good question. One  
15 we hadn't really talked about. Mark, would you -

16 MR. SCHAIRER: Yes, I mean, I guess we can  
17 in general terms, those quad Es, you know, engineering  
18 equivalency evaluations are generally applied to the  
19 deterministic requirements for fire barriers. And  
20 they kind of fall into two categories adequate for the  
21 hazard or functional equivalent. And they apply  
22 really to Chapter 3 of NFP 805 for the most part.

23 The one that you kind of zeroed in on is  
24 the fire barriers if there's a fire barrier that may  
25 have, you know, less than adequate seal or a door that

1 may not be rated to the barrier, you know.

2 That may come into play partially in maybe  
3 plant partitioning where we evaluate the adequacy of  
4 the plant partitioning elements.

5 CHAIRMAN STETKAR: Okay. Let's follow up  
6 on that.

7 Do you then in the PRA when you define  
8 your fire area boundaries, account, you know,  
9 essentially take credit for that quad E conclusion?

10 MR. SCHAIRER: Yes.

11 CHAIRMAN STETKAR: You do.

12 MR. SCHAIRER: Right.

13 CHAIRMAN STETKAR: Okay.

14 MR. SCHAIRER: It's part of our assessment  
15 of the fire barrier -

16 CHAIRMAN STETKAR: It becomes a rated fire  
17 barrier in the sense of -

18 MR. SCHAIRER: Right.

19 CHAIRMAN STETKAR: -- defining your fire  
20 areas.

21 MR. SCHAIRER: It may not be three-hour  
22 rated, but it's shown to be adequate for the -

23 CHAIRMAN STETKAR: What about the - and I'm  
24 trying to skim through things here because  
25 unfortunately I get confused among the three things

1       that I've read.

2                   What    about    things    like    equivalent  
3   protection of cables, one-hour fire ratings and things  
4   like that?  Do you also account for that in the PRA as  
5   -

6                   MR. JULIUS: Generally, I think they were  
7   counted for when we looked at the development of the  
8   VFDR because most of ours were cable separation issues  
9   and we didn't have any of the -

10                  CHAIRMAN STETKAR: So, you didn't have any  
11   of the equivalent wrap or something?

12                  MR. JULIUS: None that I can recall.

13                  CHAIRMAN STETKAR: I'll ask somebody else.  
14   As I said, I'm trying to skim through things.

15                  MR. JULIUS: Yes.

16                  CHAIRMAN STETKAR: But the message is you  
17   do account for them if necessary to either define a  
18   boundary for a fire area or adequate separation.

19                  MR. JULIUS: That's right.  And I'm sure it  
20   would have come up during - in the development of the  
21   FRE, we had a multi-disciplinary or team approach.

22                  So, when we talk about an area, we had the  
23   fire safety evaluation and we start with the area  
24   characteristics and the fire protection features of  
25   the area.

1                   And we discuss all the, you know, any of  
2                   the factors like that that were associated with the  
3                   area and the VFDRs and then how we were going to  
4                   capture those in risk assessments.

5                   CHAIRMAN STETKAR: Have you used fire  
6                   modeling to justify any of the engineering  
7                   equivalents?

8                   MR. JULIUS: No, no.

9                   CHAIRMAN STETKAR: You haven't.

10                  MR. JULIUS: No.

11                  CHAIRMAN STETKAR: They're all based -

12                  MR. SCHAIRER: And I'll just touch upon one  
13                  other example. The fire barrier being one example,  
14                  and another one is there are some engineering evals  
15                  for, say, lack of full area suppression.

16                  Those would not get rolled into the PRA as  
17                  an assumption. Because when we do fire modeling,  
18                  we're doing field walkdowns to really assess where the  
19                  suppression is. So, we will - that's an example where  
20                  it would not be included in the PRA.

21                  CHAIRMAN STETKAR: Okay, okay. Thanks.

22                  Dan, have you had many questions from the  
23                  staff on the engineering equivalency evaluations?

24                  MR. MacDOUGALL: As far as RAIs, yes, we  
25                  have.

1 CHAIRMAN STETKAR: You have, okay.

2 MR. MacDOUGALL: Not several. We have had  
3 some.

4 CHAIRMAN STETKAR: Thanks, that helps.  
5 Because I wasn't quite sure how those two efforts  
6 dovetailed. And I would - I quite honestly didn't  
7 appreciate the number of those engineering evaluations  
8 that were performed to support, you know, the entire  
9 License Amendment Request until we dug into it.

10 Because as I said, we've not really  
11 addressed one of these before. So, thanks, that  
12 helps.

13 MEMBER SCHULTZ: Jeff, are you going to get  
14 into more detail related to the uncertainty analysis  
15 and the comment that's in that slide that --

16 MR. JULIUS: Yes.

17 MEMBER SCHULTZ: -- the results can be  
18 reduced? Is that an example you say they can be  
19 reduced, or is this an activity that's been applied in  
20 this case, the result of which is a reduction of a  
21 factor of five to ten?

22 MR. JULIUS: We've done a fair effort in  
23 this case and in several sensitivities, as well as  
24 parametric data on certainty. I've got a separate  
25 slide that speaks to that. So, I'm sure that will be

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1 an interesting topic.

2 MEMBER SCHULTZ: Thank you.

3 MR. JULIUS: In general, the fire PRA model  
4 attributes, the model, success criteria, the random  
5 failure probabilities come from the foundation PRA,  
6 which is the internal events PRA.

7 We followed NUREG-6850 and Supplement 1.  
8 And all the approved NEI frequently asked questions  
9 have been incorporated.

10 There is a separate PRA model for each  
11 unit, and the overall plant site has 57 analysis  
12 areas. And one of the interesting parts, some of the  
13 analysis area had cables for both units. So, when we  
14 got to those areas, we calculated impact to both Unit  
15 1 and to Unit 2.

16 Then we sum the CDF and LERF and the delta  
17 CDF and delta LERF was calculated in for each analysis  
18 area.

19 The ice condenser containment was more  
20 limited for LERF than other PWR containment designs  
21 and it did contribute - we added a couple of recovery  
22 actions specifically to address LERF and to make sure  
23 our overall LERF numbers were down.

24 But typically, the core damage frequency  
25 was the determining factor for the - or the limiting

1 factor for the risk metrics in an individual area.

2 MEMBER SCHULTZ: I'm sorry, you're talking  
3 about the absolute value of LERF, or the delta?

4 MR. JULIUS: I'm talking in general both.  
5 We use these recovery actions in general to bring the  
6 absolute value down.

7 The delta LERF, an interesting piece is  
8 that because the former licensing basis, the LERF  
9 wasn't part of - there's not a variance for  
10 deterministic requirements associated with LERF. And  
11 so, the delta LERF was not affected then by those  
12 actions.

13 MEMBER SCHULTZ: Okay, thanks.

14 CHAIRMAN STETKAR: One way of thinking of  
15 it.

16 MR. JULIUS: Well, we did make sure we  
17 captured that insight. We were taking care of LERF  
18 and not just saying there's no variance, no problem.

19 In terms of the risk metrics, the table on  
20 the top shows the fire CDF and the delta CDF, and the  
21 LERF and delta LERF for each unit as presented in the  
22 LAR. And then the follow-on question about how does  
23 that fire relate - fire contributions relate to the  
24 overall CDF and internal events and seismic.

25 And so, you can see the 3.55E-5 from Unit

1 1. That's a factor of three or four higher than the  
2 internal events CDF. And the total core damage  
3 frequency from all hazards at Unit 1 is 5.2E-5.

4 And you see where the four-and-a-half to  
5 5E-5 CDF for Unit 1 and Unit 2 from all hazards and  
6 LERF 7E-6 in Unit 1 and 6E-6 at Unit 2.

7 The interesting thing of note as Dan  
8 mentioned earlier, the delta CDF were below the 1E-5  
9 limit, but not a whole lot below.

10 So, we've got in terms of the margin or to  
11 the limits anyway, the CDF and LERF we have a fair  
12 margin. And then we're fairly tight on the delta CDF.

13 In terms of the contributors to these,  
14 it's interesting on the two slides, one on the top  
15 areas and one on the top scenarios.

16 The top 16 areas for Unit 1 contribute to  
17 greater than 95 percent of the risk. And it's roughly  
18 the same number also for Unit 2.

19 Out of the slide, you can see the  
20 different contributions in the - after the first three  
21 areas, it drops off and to the - each area is less  
22 than 10 percent.

23 Of note, the turbine building and the yard  
24 there while they contribute 20 percent and 11 percent,  
25 so almost a third of the total fire CDF, there are no



1 variances from deterministic requirements in there.

2 And so, there we stop the quantification  
3 at the whole fire zone burnout and we don't have  
4 detailed fire scenarios. That's an area where in the  
5 future we'll probably look to do some further  
6 refinement of the model. That's an example where  
7 there's different levels of detail in different pieces  
8 of the model.

9 CHAIRMAN STETKAR: That was just your own  
10 choice. You didn't want to spend any more time.

11 MR. JULIUS: We were at 4E-5 total fire -

12 CHAIRMAN STETKAR: Some of the conservatism  
13 in your results is just you didn't want to spend any  
14 more time.

15 MR. JULIUS: Well, because we were focusing  
16 our time on the -

17 CHAIRMAN STETKAR: I understand.

18 MR. JULIUS: But you're right. We stopped,  
19 yes.

20 CHAIRMAN STETKAR: And that's - anybody  
21 who's done these things knows how they're done.  
22 That's how they're done.

23 I'm assuming that's from loss of - fire-  
24 induced loss of offsite power, is it?

25 MR. JULIUS: That's correct.

1 CHAIRMAN STETKAR: Are you going to talk a  
2 little bit about some of these areas, or were you  
3 planning to do that, or no?

4 MR. JULIUS: We have some other areas that  
5 come up when we get to the specific examples on some  
6 of the -

7 CHAIRMAN STETKAR: Okay.

8 MR. JULIUS: -- technical challenges.

9 CHAIRMAN STETKAR: Going to talk about the  
10 control room, or not?

11 MR. JULIUS: No, we had not planned - we're  
12 showing the cable spreading room and that's got some  
13 analogies because it invokes some of the same actions.

14 But, you know, are you talking about the  
15 fire modeling on the control room?

16 CHAIRMAN STETKAR: It was just a little  
17 surprising because you don't - we'll hear later that  
18 some licensees have invoked the primary control  
19 station notion, and you've not done that in this PRA,  
20 right? I mean, other than the main control room.

21 But fires that affect the main control  
22 room, you don't relocate to a primary control station  
23 where the operators are perfect.

24 MR. JULIUS: That's correct.

25 CHAIRMAN STETKAR: And that's why I was a

1 little bit surprised that the control room with the  
2 relatively large number of recovery actions that you  
3 have is a relatively small percentage of the total.

4 It must mean that you did a heck of a lot  
5 of work on it.

6 MR. JULIUS: We did a heck of a lot of work  
7 on it. We do have some other areas that are leading  
8 to this similar type of actions that have a higher  
9 frequency.

10 CHAIRMAN STETKAR: Okay. Then I'll wait.  
11 Okay.

12 MEMBER SCHULTZ: Jeff, these results - I'm  
13 just going to keep coming back to the conservatisms in  
14 the models.

15 MR. JULIUS: Yes.

16 MEMBER SCHULTZ: So, this set of results,  
17 does it reflect what was obtained with conservative  
18 fire modeling, or after you've gone through and done  
19 the sensitivity analyses and made changes to provide  
20 more, whatever you want to call it, better estimate  
21 models.

22 MR. JULIUS: Generally, it's with the  
23 conservatism in the modeling and that we'll see in  
24 later slides, I mean, we did -- the first pass we did  
25 full zone whole room burn-up. And then when we

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1 started developing the areas where we did the fire  
2 modeling, did individual scenarios, we first  
3 quantified them at the 98th percentile heat release  
4 rates and reasoned it the T square growth model.

5 And then as you get to the top risk  
6 significant areas, the standard has you go and develop  
7 at least a two point model. But even the two point  
8 model that we use is typically the 98th percentile and  
9 the 75th percentile.

10 So, part of the concern is capturing the  
11 whole range of fires, you know, from the small fires  
12 to the bigger fires.

13 And so, as John mentioned when we got to  
14 the point where we had developed the model  
15 sufficiently to meet the risk acceptance criteria, you  
16 know, we stopped and did the submittal.

17 And so, then we're getting questions from  
18 the NRC and from internal we are still learning and  
19 looking at this model in terms of what's the  
20 sensitivity to the ignition frequencies, what's the  
21 sensitivity to the spurious actuation probabilities  
22 associated with the control power transformers, what's  
23 the sensitivity maybe to some of your limitations in  
24 your internal events PRA that you hadn't addressed?

25 So, we've done a series of five

1 sensitivity analyses and the parametric data on  
2 certainty to further probe and look at these, as well  
3 as the integrated results. You're looking at the  
4 importance of the areas and the importance of the  
5 actions.

6 CHAIRMAN STETKAR: Are you going to talk  
7 more about uncertainty?

8 MR. JULIUS: I have one slide that -

9 CHAIRMAN STETKAR: Okay. I'll wait.

10 MR. JULIUS: It's towards the end here.

11 So, let's go through the results and then  
12 we'll hit each of the technical challenges and then  
13 try to build this cumulative picture because we're  
14 trying to identify where - that's one of our  
15 challenges related to the conservatisms.

16 As the top scenarios, so on an area basis  
17 the turbine building and the yard weren't at the top  
18 on the scenario basis. They saw loss of offsite power  
19 in the yard and the turbine buildings that are two of  
20 the top four. Electrical cabinet fires contribute to  
21 a lot. And that's the 4kV bus 1B and the T11A and  
22 T11D again failing offsite power.

23 The interesting point here, so we have  
24 these losses of offsite power electrical challenges  
25 that would like to RCP seal LOCA.

1           We have a CVCS cross-tie and originally  
2           the internal events PRA hadn't done success criteria  
3           to use the cross-tie to mitigate a LOCA.

4           So, they expanded and redid additional  
5           success criteria analyses with amp and said that, you  
6           know, the more likely RCP scenarios are the smaller  
7           break sizes. But the really big break, the CVCS  
8           cross-tie doesn't provide sufficient flow. But for  
9           the smaller break sizes, we were able to use the CVCS  
10          cross-tie to mitigate the RCP seal LOCA.

11          CHAIRMAN STETKAR: Did you partition them  
12          in the - use the Westinghouse model for the range of  
13          break sizes or -

14          MR. JULIUS: Yes, it was the Westinghouse  
15          model for the break sizes.

16          CHAIRMAN STETKAR: It partitioned the break  
17          sizes in your model?

18          MR. JULIUS: It's based on functional  
19          impact.

20          CHAIRMAN STETKAR: Okay. And you said you  
21          didn't - did you go back and do that in the internal  
22          events also?

23          MR. JULIUS: We haven't fed that back into  
24          the internal events model yet.

25          MEMBER BLEY: Is the use of the cross-tie

1 procedure wholly supported?

2 MR. JULIUS: Oh, yes. That's part of the  
3 plant safe shutdown strategies.

4 The risk significant contributors come  
5 from the cable vaults and rooms with the electrical  
6 cabinets that are impacting both trains at the same  
7 unit.

8 So, this plant is a little different than  
9 some in terms of the - many plants have within a unit  
10 a Train A and Train B with separation here.

11 We've had several areas where both trains  
12 at the same unit are affected and the other unit works  
13 as the safe shutdown path so that these inter-system  
14 cross-ties effectively reduce risk and require  
15 refinement of success criteria. But they also  
16 required -- it's based on some feedback from the peer  
17 review.

18 The peer review commented, hey, wait a  
19 minute. Your Unit 2 modeling impact on Unit 1 was  
20 maybe a F&O Level C from the internal events. But  
21 since it's become so important in your fire PRA, you  
22 need to address this.

23 So, that was one of the findings in the  
24 things that we fixed before doing the fire risk  
25 evaluation.

1           In terms of looking at the recovery  
2           actions, we were following closely NUREG-1921 and the  
3           fire HRA approach there. And we followed that in our  
4           development of our recovery actions.

5           We followed 6850 and we have no unapproved  
6           methods. We had some discussion with the NRC about  
7           the data that was used or the data limitations. And  
8           so, we've had questions on how much credit we can give  
9           to the combustible free zones and the hot work  
10          restrictions especially on those transient fires in  
11          the critical areas.

12          We basically put transient fires  
13          everywhere and it's just the size of the fire and the  
14          impact.

15          So, this is one where Harry had mentioned  
16          there's a FAQ 12-0064, and we've provided comments and  
17          feedback back to the staff on that.

18          CHAIRMAN STETKAR: Your fire allocation  
19          report just to demonstrate, I mean, I'm assuming you  
20          had a rationale about how you distributed transient  
21          fires.

22          MR. JULIUS: Yes. Yeah, we have, I mean,  
23          we follow the weighting process and then we - we did  
24          pick one of the - between the hot -- maintenance  
25          occupancy and storage, we had a value less than one,



1 but the sum of all of them was at least one.

2 CHAIRMAN STETKAR: That would be good.

3 MR. JULIUS: I guess I want to distinguish  
4 one slide to capture the fire development tasks. So,  
5 these were the first tasks to develop the base fire  
6 PRA model and the data and to get ready for  
7 quantification.

8 And mostly these were straightforward  
9 tasks. And as you'll see in the next slide, really  
10 the challenges started to come during the  
11 quantification or the roll-up of all this input.

12 So, the 6850 tasks are listed there by  
13 their 6850 task number. And the first five there  
14 weren't many challenges.

15 The ignition frequency wasn't technically  
16 challenging from actually conducting the work or  
17 following 6850. It was more then the overall numbers  
18 that we were seeing at the end.

19 I've got two separate slides. One on  
20 ignition frequencies and one on the circuit failure  
21 likelihoods. I'll further explain those.

22 And the reason why the numbering doesn't  
23 follow sequentially with the 6850 is because all the  
24 quantification then is lumped onto the next slide.

25 So, our primary fire PRA technical

1 challenges can be really summarized into these three  
2 areas.

3 One, the first technical challenge - and  
4 these were somewhat chronologically introduced. So,  
5 in 2009 we're getting ready for the fire PRA peer  
6 review.

7 We had trouble or we had extra effort or  
8 it wasn't intuitively obvious that the plant total  
9 fire PRA CDF was below 1E-4.

10 And so, we came into this thinking, well,  
11 maybe we had maybe ten areas and maybe ten scenario  
12 are within an area. So, maybe a hundred total  
13 scenarios we were going to have to do to get  
14 reasonable results.

15 And as you saw from the earlier slide, we  
16 wound up modeling almost a thousand. So, we went from  
17 a hundred to a thousand.

18 We did additional fire modeling. We took  
19 the ignition frequencies from 6850 and we went to the  
20 FAQ-48 ignition frequencies.

21 CHAIRMAN STETKAR: Jeff, only because I  
22 haven't looked at FAQ-48 in a long time and I didn't  
23 have time to -

24 MR. JULIUS: 6850 Supplement 1.

25 CHAIRMAN STETKAR: Those are mostly high-

1 energy arcing faults and buses, weren't they?

2 MR. JULIUS: No, they -

3 CHAIRMAN STETKAR: Were there -

4 MR. JULIUS: Some of them went down, but  
5 some of them went up.

6 CHAIRMAN STETKAR: Yes, okay.

7 MR. JULIUS: They didn't all just go down.

8 CHAIRMAN STETKAR: Okay, okay.

9 MR. JULIUS: From a primary effort there  
10 was additional fire modeling, and then focusing on  
11 getting more than one train for good risk results in  
12 terms of the mitigation. Just one train alone or one  
13 train with a diesel, lots of offsite power scenarios  
14 that you had.

15 If you have the random failures, the  
16 diesel failed to run for 24 hours, it makes that  
17 relatively unreliable.

18 And so to get good, overall numbers, we  
19 had to get some additional either non-safety  
20 equipment, or to, you know, further refine the  
21 scenario.

22 CHAIRMAN STETKAR: Are there power cross-  
23 ties from the other unit and things like that?

24 MR. JULIUS: No, no, we don't have -

25 CHAIRMAN STETKAR: So, for example, in the

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1 diesel, let's follow up on it. What do you mean by  
2 one train plus for -

3 MR. JULIUS: Well, we have relatively - we  
4 expanded the offsite power modeling because initially  
5 from the internal events PRA you have pretty much as  
6 the point estimate initiator.

7 And then through the component selection  
8 process we went back to certain breakers and we  
9 expanded the impact so that if the fire was coming in  
10 and we knew there are certain cables, but still it was  
11 a relatively crude model.

12 Okay, if this cable gets hit, it's going  
13 to be a guaranteed loss of offsite power to one unit  
14 or both units.

15 And then we had - as we further got into  
16 it we'd say, well, you know, that's a control power  
17 and it really goes over to this function. Is that  
18 really going to have that impact, or is it - well, we  
19 still have that as one of the conservatisms.

20 So, fire-induced failure we don't recover  
21 offsite power. It's gone for the mission time.

22 CHAIRMAN STETKAR: I mean, that's not -  
23 I've seen burned cables. That's not necessarily what  
24 I would consider conservative.

25 MR. JULIUS: Well, that's right. But in

1 terms of the - if you look at the - is this the main  
2 power cable, the control power cable or could you go  
3 out and do something given this particular cable  
4 failure.

5 CHAIRMAN STETKAR: Okay.

6 MR. JULIUS: We started out with the first  
7 cut if that cable is touched, you know, all offsite  
8 power is lost.

9 CHAIRMAN STETKAR: Okay.

10 MR. JULIUS: So, we got the - in 2009 for  
11 the peer review, we got the fire CDF - total fire CDF  
12 below  $1E-4$ .

13 CHAIRMAN STETKAR: That's a big drop, as  
14 you know, as you start getting to smaller numbers. A  
15 decade difference is a huge difference -

16 MR. JULIUS: That's right.

17 CHAIRMAN STETKAR: -- in those small  
18 numbers.

19 Between the first and second bullets, what  
20 helped you the most in that decade?

21 MR. JULIUS: Well, the difference there  
22 between the two, the  $1E-4$  and the  $1E-5$ , the second one  
23 is a delta CDF. So, the first one was a total CDF.

24 CHAIRMAN STETKAR: Oh, I'm sorry. Never  
25 mind. I didn't see that delta. I'm sorry.

1 MR. JULIUS: But you're right. I mean,  
2 essentially you're right because we were even in the  
3 first one, we start out above 1E-4 and we got it down  
4 to the 1E-5. So, there was that decade drop.

5 And the primary emphasis there was on the  
6 additional fire modeling. That's where -

7 CHAIRMAN STETKAR: Additional - the fire  
8 modeling.

9 MR. JULIUS: We started out with maybe  
10 expecting hundreds of scenarios, and we had to go to  
11 a thousand.

12 CHAIRMAN STETKAR: Okay. But that's fire  
13 modeling in terms of - I want to try to be clear.  
14 People use the term "fire modeling" quite loosely.  
15 And we just had quite a bit of discussion with the  
16 staff on the NUREG on fire modeling.

17 When I think of fire modeling, I think of  
18 FIVE, FDT, CFAST. Is that the type of fire modeling  
19 that you're talking about, or are you talking about  
20 more finely subdividing the fire scenarios in the  
21 fault trees or event trees or whatever you -

22 MR. JULIUS: Really, all the above.

23 CHAIRMAN STETKAR: All the above.

24 MR. DINSMORE: Yes, you're right. Using  
25 the fire modeling tools like FDS, CFAST, is a specific

1 part of fire modeling to define your -

2 CHAIRMAN STETKAR: It's something like, you  
3 know, going from the 6850 sort of recommended values,  
4 to something you might get out of FIVE, to something  
5 that you might get out of CFAST or progressive,  
6 typically refinements in that notion of fire modeling.

7 Another notion of fire modeling is  
8 something that Jeff was talking about, or I'd call it  
9 modeling, subdividing different sizes of reactor  
10 coolant pump seal LOCAs, which had nothing to do with  
11 the fire and assigning different success criteria so  
12 that you can wring out a little bit more frequency.

13 MR. JULIUS: Well, we want -

14 CHAIRMAN STETKAR: And that's not fire - I  
15 don't consider the second fire modeling. That's more  
16 realistic and -

17 MR. JULIUS: That was like fire PRA  
18 modeling.

19 So, within the activity here we did both  
20 the fire PRA modeling requirements, but we did  
21 extensive real fire modeling where you see in this  
22 later slide the fire modeling is going from a more  
23 crude or a broader impact to individual sources and  
24 targets.

25 CHAIRMAN STETKAR: Okay, okay. Thanks.

1 MR. JULIUS: So, then our next  
2 quantification hurdle was on the delta CDF and getting  
3 the deal CDF below 1E-5.

4 We addressed the peer review findings and  
5 the idea here was that the plant had a pretty good  
6 program, it was a good plant going in, and we were  
7 trying to do the transition without doing extensive  
8 plant modifications.

9 And the third area as was brought up, is  
10 the challenge with some of the uncertainty  
11 considerations. So, each of the next couple slides  
12 then develop further each of these three technical  
13 challenges.

14 MEMBER SCHULTZ: In terms of results, the  
15 PRA peer review F&Os, did they seem to drive the  
16 results up or down?

17 In other words, did the peer review  
18 identify as many improvements to the models that would  
19 benefit the result or -

20 MR. JULIUS: It was a mixed bag. I mean,  
21 there was - many of them were documentation. There  
22 weren't as many modeling changes. There were some on  
23 the fire modeling where - or some places where we had  
24 the unknown cable types, for example, where we -- the  
25 treatment of whether -- the thermoplastic or thermoset



1 we further went in and did some refinements, but it  
2 was a mixed bag.

3 MEMBER SCHULTZ: And some were neutral in  
4 proving the documentation and supporting requirements  
5 associated with the analysis.

6 MR. JULIUS: That's right.

7 MEMBER SCHULTZ: Okay, thank you.

8 MALE PARTICIPANT: We didn't see any  
9 significant impacts.

10 MR. JULIUS: Now, there was a good one -  
11 there was one - a couple we were concerned about.  
12 There was one from Kiang Zee where we had, you know,  
13 if a component has multiple cables and it was the  
14 mapping of the multiple cables to the component.

15 And when we first had done the mapping, we  
16 had looked at the spurious impact that fire damage on  
17 each of these cables. But when to the PRA code, it  
18 didn't do any sorting or check. It just picked, you  
19 know, whatever the top failure mode is.

20 And so, the top failure mode could be a  
21 0.03 and then the third one down could be a 0.3. And  
22 so, we did - we said, hey, we were worried about that  
23 one. And it turned out either the numbers or the  
24 cables, that didn't have as big an impact as we  
25 thought.

1           We had to go back in and map to make sure  
2           that the multiple cables were treated properly in  
3           their mapping to the components.

4           In terms of ignition frequencies, I think  
5           this one is fairly straightforward. So, we started  
6           with the first set of ignition frequencies from NUREG-  
7           6850. And then we took the results from FAQ-48.

8           And in addition to FAQ-48 besides it says  
9           you can use these lower numbers, but in your  
10          application you need to do sensitivities for ones that  
11          have a high alpha factor.

12          So, we had done that as part of our  
13          License Amendment Request and the required  
14          sensitivities showed that they didn't change our  
15          decision making. We still were within the risk limits  
16          and within the delta risk limits.

17          There's work still being done on the  
18          initiating vent frequency. And the ones we're  
19          wrestling with and you hear the discussion on more  
20          recently is the transients.

21          And the size of the fire and what kind of  
22          credit can be taken for the precautions and the worth  
23          of eliminating hot-work free or transient combustible  
24          free zones. So, that's the interchange with the NRC  
25          staff on FAQ-1264.

1 Another example of the effect of the fire  
2 - or transient fire suppression of personnel in the  
3 area who may have caused the fire in the first place.

4 Well, effectively that's rolled into the  
5 data. But if the plant was doing some practice or  
6 procedure, you know, add some additional people, would  
7 that further change it or not. And right now we  
8 haven't reflected anything in change.

9 And the last bullet there is there's no  
10 distinction in the data between running and standby  
11 components. One of the first areas we quantified,  
12 Analysis Area 1, that's the RHR and the containment  
13 spray pump room. And the initiating event frequencies  
14 for those pumps were the same as an operating  
15 component cooling water pump or a zirc water pump.

16 Okay. The next couple of slides I'm going  
17 to let Mark Schairer introduce and this is the  
18 development of the fire modeling.

19 And so, we did this full zone burn-up, but  
20 then we further developed the fire growth trees and  
21 the fire damage states.

22 So, Mark.

23 MR. SCHAIRER: Right, thanks, Jeff.

24 Yes, so this task here is really the  
25 beginning here of fire modeling. And the first step

1 is to start to break down the whole-room burn-up  
2 assumption into individual fire scenarios.

3 And our goal going into it was to try to  
4 keep it simple, because we understood the long-term  
5 configuration control that the plant would have to  
6 face as we, you know, got into a more complex method.

7 So, initially we set out with a fire  
8 growth tree which kind of mapped out the different  
9 fire damage states.

10 CHAIRMAN STETKAR: Mark, can I interrupt  
11 you for just a second?

12 MR. SCHAIRER: Sure.

13 CHAIRMAN STETKAR: Because Jeff mentioned  
14 something that I wanted to ask him about. It's one of  
15 those things where you give me an example and then  
16 I'll come back at you.

17 Fire area AA-1 was screened out based on  
18 the deterministic approach. So, you didn't model that  
19 area in the PRA. So, I'm not sure what you're talking  
20 about in terms of fire frequencies.

21 What I wanted to ask you - and I  
22 understand why it screens out for a full power model,  
23 because there's nothing in there that basically  
24 affects your full power model.

25 How did you treat it for low-power and

1 shutdown modes, non-power operation modes, since it  
2 does have both RHR pumps in it?

3 Did you quantify it?

4 MR. JULIUS: Well, it wasn't quantified  
5 with the fire PRA, but it did go into the pinch point  
6 analysis for the cables.

7 CHAIRMAN STETKAR: Okay.

8 MR. MacDOUGALL: We kind of basically  
9 identified the key safety functions required in -

10 CHAIRMAN STETKAR: Yes, I understand. I  
11 know how you treated that. I was just curious because  
12 it -

13 MR. JULIUS: And actually back to that, in  
14 terms of the quantification for the PRA even though it  
15 made the transition deterministically, initially that  
16 first challenge to get the areas below the 1E-4, it  
17 was - again, because of some of the relative  
18 conservative factors, we assumed the fire in there  
19 would lead to reactor trip and then we had a wider  
20 influence before we did - we wound end up doing some  
21 fire modeling to just reduce the overall fire CDF in  
22 that area.

23 CHAIRMAN STETKAR: Because of a reactor  
24 trip - well, probably would lead to a manual reactor  
25 trip since you're losing both of your trains of safety

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1 systems. So, the tech specs would require you to shut  
2 down anyway.

3 MR. JULIUS: At the whole zone burn-up  
4 level, right, right.

5 CHAIRMAN STETKAR: But that's - okay. I'm  
6 sorry, Mark. Thanks.

7 MR. SCHAIRER: No problem.

8 CHAIRMAN STETKAR: It was a question as I  
9 was skimming through Attachment C, originally wanted  
10 to ask you about the shutdown notion of it. Because  
11 as I said, I can understand - I don't know the whole  
12 history of how you got to why it was, you know,  
13 disposed or dispositioned as a deterministic criteria.  
14 And then when you mentioned the quantified things, I  
15 was curious.

16 Thank you.

17 MR. SCHAIRER: Okay. So, on the fire  
18 growth trees depending on the complexity of the  
19 scenario, we could dive into these different aspects  
20 of fire modeling.

21 Of course their initial frequency being  
22 the initiating event. And then as necessary, roll in  
23 different heat release rates.

24 As Jeff mentioned, we began with looking  
25 at the 98th percentile. And if we could live with

1 that, that was where we stopped. If we had to dig  
2 deeper into the next group of heat release rates, we  
3 would do that to try to refine the zone of influence.

4 So, that would be the severity factor  
5 application of 6850. Then of course all this was  
6 captured with fire modeling tools and we basically  
7 documented this in various other workbooks or Excel,  
8 basically tools that could capture some of this  
9 information that wasn't provided by the FDS or CFAST  
10 or one of those other -

11 CHAIRMAN STETKAR: Well, I'll let you  
12 finish this slide and then -

13 MR. SCHAIRER: Yes, I'll just cover  
14 detection/suppression is also, you know, on the onset  
15 of the fire scenario we may have looked as a  
16 sensitivity, can we live without  
17 detection/suppression.

18 And then, again, trying to keep it simple,  
19 but ultimately we rolled in quite a bit of suppression  
20 where we had to gain some CDF margin.

21 CHAIRMAN STETKAR: In Attachment J, did you  
22 use FDS?

23 MR. SCHAIRER: Yes.

24 CHAIRMAN STETKAR: You did?

25 MR. SCHAIRER: We used it -

1 CHAIRMAN STETKAR: Why? Okay, tell me why  
2 and where did you have to use it? How much did it buy  
3 you, if anything?

4 MR. SCHAIRER: Yes, we used it in six  
5 compartments for specific reasons to analyze hot gas  
6 layer timing. We wanted to get a better handle on  
7 exactly how we could roll in, say, ventilation  
8 aspects.

9 There were some unique - there was a  
10 damper - one of the barriers has a series of fire  
11 dampers that we wanted to roll that into the model.

12 The FDTs don't allow you to analyze things  
13 over time and then bring into these ventilation  
14 aspects. So, that was one part of it.

15 The other reason is we did a generic study  
16 across all the areas that could have a hot gas  
17 layer/plume interaction. And that's one of the  
18 limitations of the NUREG-1805 hot gas air models is  
19 they don't have the ability to roll that in.

20 You can make a gross assumption that you  
21 can add the hot gas layer temperature to, say, a  
22 plume, but we felt that was overly conservative. So,  
23 we used FDS to look at that interaction.

24 CHAIRMAN STETKAR: And CFAST didn't buy you  
25 enough?



1 MR. SCHAIRER: The CFAST does not provide  
2 a plume temperature that we can - that was V&V'd  
3 anyway.

4 CHAIRMAN STETKAR: Oh, okay, that was  
5 V&V'd.

6 MR. SCHAIRER: Yes. So, we used FDS for  
7 that purpose.

8 CHAIRMAN STETKAR: Okay. Because my - of  
9 the three we looked at, I think you're the only ones  
10 who used FDS. And it's - I've never used it, but I've  
11 heard it's - it will take some time.

12 MR. SCHAIRER: Yeah, it takes a little more  
13 energy and time to set it up. And just to run it on  
14 the computer can take days to weeks.

15 CHAIRMAN STETKAR: Just out of curiosity  
16 from your experience, was it worth the effort, I mean,  
17 in terms of the benefit?

18 MR. SCHAIRER: Yes, absolutely.

19 CHAIRMAN STETKAR: It was?

20 MR. SCHAIRER: I mean, we had no other way  
21 to look at those unique kind of challenges with the  
22 fire modeling without making gross conservative  
23 assumptions that, okay, we have -

24 CHAIRMAN STETKAR: No, but I mean the delta  
25 in terms of delta damage or however you want to

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1 measure it from the gross assumptions that you'd have  
2 to make compared to the more refined assumptions was  
3 worth that modeling effort?

4 MR. SCHAIRER: Yes, we believe so. It got  
5 us to where we needed to be, I think.

6 CHAIRMAN STETKAR: Well, that's worth the  
7 effort then, I guess.

8 MR. SCHAIRER: Yes, main control room was  
9 done with CFAST for -

10 CHAIRMAN STETKAR: Oh, it was?

11 MR. SCHAIRER: -- control room abandonment  
12 analysis.

13 CHAIRMAN STETKAR: That was CFAST though.

14 MR. SCHAIRER: Yes.

15 CHAIRMAN STETKAR: CFAST.

16 MR. SCHAIRER: So -

17 CHAIRMAN STETKAR: That's probably okay  
18 then. Just out of curiosity, you said you met six  
19 areas you looked at using FDS or -

20 MR. SCHAIRER: Right. So, the control  
21 room, HVAC rooms, both the 600-volt MCC rooms and then  
22 I think two of the 4kV switchgear rooms.

23 CHAIRMAN STETKAR: Okay. Thanks.

24 MR. SCHAIRER: So, our focus was to use  
25 primarily the V&V'd models. And these were within

1 NUREG-1824 for the most part. However, there are some  
2 in NUREG-6850, which I would call empirical  
3 correlations maybe that aren't part of that suite of  
4 models that were V&V'd.

5 So, this has been kind of - part of the  
6 subject of the RAIs is to demonstrate that they are  
7 used within their validation ranges.

8 I heard you kind of label it as, I think,  
9 Joe's Grocery Store. They're not that type of model.  
10 We're using still, you know, models that are published  
11 in the Society of Fire Protection Engineering  
12 Handbook. And they've got other studies outside of  
13 the 1824 experimental series that we're pointing to  
14 there.

15 So, I think Harry mentioned one of them  
16 which is the detection correlation not V&V'd.

17 CHAIRMAN STETKAR: Are you pretty well on  
18 track with the staff in terms of getting, you know,  
19 recognizing where you are in the exchange process  
20 here, getting resolution of the use of those models?

21 MR. SCHAIRER: Well, we've responded to  
22 their questions and I don't think we've received full  
23 feedback yet.

24 CHAIRMAN STETKAR: Okay.

25 MR. SCHAIRER: I can't -

1 CHAIRMAN STETKAR: Have you received -  
2 again, part of this I'm trying to understand technical  
3 issues, but also areas where there might be  
4 impediments on both sides.

5 Have you received any just blatant  
6 feedback that, no, you absolutely cannot use that  
7 model?

8 MR. SCHAIRER: No, we have not gotten that  
9 level of feedback. It's really provided additional  
10 justification for using this particular model.

11 We felt that at the time when we used it,  
12 we understood all the models required, you know, 805  
13 required V&V, but not necessarily limited to what was  
14 in 1824.

15 CHAIRMAN STETKAR: Sure.

16 MR. SCHAIRER: So, I mean, quite a few of  
17 the models within 1805 are not in 1824.

18 CHAIRMAN STETKAR: Yes.

19 MR. SCHAIRER: So, it was a challenge, no  
20 question, to make sure we were comfortable with using  
21 those models.

22 CHAIRMAN STETKAR: What types of  
23 applications did you find that you needed to use the  
24 other models for?

25 Can you generalize? I mean, you know, is

1 it cables? Is it cabinet fires? Is it -

2 MR. SCHAIRER: Yeah, some of them are like  
3 the 6850, you know, fire propagation empirical rule  
4 set where we, you know, you often hear the five, four,  
5 three, two, one method.

6 That, to me, is a - kind of a fire model  
7 that we definitely used across many of the scenarios,  
8 but CHRISTIFIRE and FLASHCAT ended up being what we  
9 thought was the verification or validation of that  
10 model.

11 So, again, that's not in 1824, but it did  
12 have a testing complete for that.

13 CHAIRMAN STETKAR: Okay.

14 MR. SCHAIRER: So, that's one of them.  
15 Yeah, we listed them all in Attachment J as you have  
16 there.

17 CHAIRMAN STETKAR: Yes.

18 MR. SCHAIRER: And they're not always  
19 pointed to 1824.

20 CHAIRMAN STETKAR: No, that's right.  
21 That's why I was asking. You have a good list there.

22 MR. SCHAIRER: Okay.

23 MR. MacDOUGALL: Just to respond to one  
24 question on feedback from the staff was during our  
25 fire modeling investigation we did, in our CFAST model

1       there was an issue identified where - a partitioning  
2       issue.

3               It wasn't against using CFAST itself, but  
4       it was an error we had in the calculation. We had to  
5       go back and revise the calculation and clean it up  
6       because it was a showstopper.

7               Although it was insignificant to the  
8       results, we submitted incorrect information. We made  
9       a mistake.

10              CHAIRMAN STETKAR: Yes, that happens.

11              MR. SCHAIRER: So, the 57 fire areas across  
12       both units, 18 of those ended up transitioning  
13       deterministically. So, basically whole room burn-up.  
14       39 of those were performance based. And in all cases  
15       we followed the 4242 methodology.

16              CHAIRMAN STETKAR: That's what I was going  
17       to ask, because we're going to hear from another  
18       applicant who distinguishes 4241 from 4242. And they  
19       call it, you know, they're both sort of performance-  
20       based. One is risk-informed performance-based. The  
21       other one is just using fire models.

22              And you did not - you always use the PRA  
23       model when you talk performance.

24              MR. SCHAIRER: 4242, correct.

25              CHAIRMAN STETKAR: Okay.

1 MR. SCHAIRER: 4241 would be the maximum  
2 expected fire -

3 CHAIRMAN STETKAR: Right.

4 MR. SCHAIRER: We did not do that.

5 CHAIRMAN STETKAR: You did not do that.

6 MR. SCHAIRER: Right.

7 CHAIRMAN STETKAR: Just out of curiosity,  
8 was it more expedient to use the PRA model? I mean,  
9 you know, because you're using the fire - what I call  
10 fire model, CFAST or FDS or whatever, in both kinds of  
11 applications to get a zone of influence in one or  
12 something like that.

13 MR. SCHAIRER: Yes, 4241 we just learned  
14 early on it wasn't going to work because you basically  
15 have to show the fire, you know, the VFDR cable  
16 survives the fire. That's to the maximum expected  
17 fire. And then the limiting fire scenario has to show  
18 margin.

19 CHAIRMAN STETKAR: Yes.

20 MR. SCHAIRER: And we were not going to be  
21 able to succeed in all the fire areas using that  
22 methodology.

23 CHAIRMAN STETKAR: Okay.

24 MR. SCHAIRER: So, that's why we went to  
25 4242.

1 CHAIRMAN STETKAR: Okay. Thanks.

2 MR. SCHAIRER: We did follow 6850  
3 methodology. Task 11 is the really - Chapter 11 is on  
4 fire modeling and then various, you know, appendices  
5 within 6850 and the FAQs that related to the PRA that  
6 have since rolled into Supplement 1. And then we did  
7 follow the fire PRA standard. Jeff touched upon the  
8 peer review results.

9 Our fire models were developed for  
10 scenarios specific to ignition sources. So, we didn't  
11 do generic fire modeling across many scenarios. We  
12 walked down each individual fire source, looked at the  
13 specific cables that were impacted. Fire growth was  
14 done for any scenario where it needed to be, and that  
15 was also specific.

16 So, we ended up with about 900 individual  
17 fire scenarios.

18 CHAIRMAN STETKAR: This is an area I asked  
19 Jeff earlier. How did this exchange work? You said  
20 you developed scenarios for input to the fire PRA.

21 MR. SCHAIRER: Right.

22 CHAIRMAN STETKAR: In fire PRAs that I've  
23 done in the past. they use the PRA and say, look, you  
24 fire modelers go tweak this thing and subdivide this  
25 because I need to get something over here.

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1           It sounds like you took a different  
2           approach that you - did you go into an area and say  
3           this is a problem area from the first cut in the PRA  
4           and I'm now going to do a complete fire modeling of  
5           this area and then feed back into the PRA?

6           MR. SCHAIRER: Essentially, yes. We went  
7           into any fire area that didn't screen out in the first  
8           phase.

9           Now, we're going to - again, we're trying  
10          to use a tiered approach where, you know, we're not  
11          going to do multi heat release rates. I'm not saying  
12          we need to, but we do a 98th percentile heat release  
13          rate, identify - everything is done at a cable level.  
14          We need to use raceways to identify them out in the  
15          field. So, cables and conduit.

16          We would load that into our cable raceway  
17          software and we'd have a unique scenario, unique  
18          scenario ID. The logics within the software would  
19          translate the cables into what equipment where it  
20          could be logically failed based on that cable.

21          CHAIRMAN STETKAR: Okay.

22          MR. SCHAIRER: That would then be generated  
23          into what we call a Level 1 failure report, which  
24          would be transmitted over to Jeff's group. And then  
25          he would - he would basically take the equipment from

1       there and map that to his basic event.

2               MEMBER BLEY: Let me ask John's question a  
3       little differently.

4               If you had it to do all over again, would  
5       you do it the same way, or would you see ways to get  
6       nearly to the same place with less effort?

7               MR. SCHAIRER: Interesting question.

8               Yes, I think given the approach we've  
9       taken and the lessons learned, you know, we'd still  
10      follow a similar approach.

11              MEMBER BLEY: Okay.

12              MR. JULIUS: The only additional comment I  
13      have, and this is kind of spread across a couple  
14      plants, is that typically the scoping or the general  
15      severity may be applied like in a Task 8 in terms of  
16      a 6850 task.

17              We had tried that a couple times and we  
18      were getting maybe a 20 percent or 40 percent  
19      reduction. And as you commented on the earlier slide,  
20      we were looking for an order of magnitude reduction.

21              So, we kind of skipped that, but where we  
22      are seeing that coming back into play at the end or  
23      current stage is - and we had a list of a hundred  
24      different areas and then we did the detailed fire  
25      modeling on these and they went down to the various

1 levels. Some of them went down, way down. And others  
2 were - and the ones that are now in the middle are  
3 coming across and you've got a stairwell that has a  
4 steam generator blowdown cable in it and, you know,  
5 you're saying that's right in between two areas where  
6 you did detailed fire modeling on it.

7 And we're looking back at those now and  
8 doing some refinement.

9 CHAIRMAN STETKAR: Well, that's what a  
10 little bit, you know, when you were talking about the  
11 overall results you said, well, the turbine building  
12 and the yard are excessively conservative because we  
13 treated them all as a single area, burned them all up  
14 and, gee, they contribute 20 percent as the turbine  
15 building.

16 And yet, it sounds like in many other  
17 areas you did extensive fire modeling where you said,  
18 you know, you looked at some of the results and they  
19 went way, way down. Well, maybe they didn't need to  
20 go that far down.

21 And I think, you know, what Dennis and I  
22 are asking, is there a more balanced exchange possible  
23 between the PRA modeling process and the fire  
24 modeling, if I'll call it that, process that would  
25 more, you know, give you a more balanced evaluation

1 across the whole plant, you know, rather than getting  
2 very, very detailed in some locations that initially  
3 show up very high. And then discovering after you've  
4 really find tuned those that other things that you  
5 haven't looked at are still really, really  
6 conservative, but you decide to stop because you met  
7 your numerical targets.

8 MR. JULIUS: In general as Mark said --  
9 that's a good question. We generally haven't been  
10 because we've been responding to the questions about  
11 the different contributors and an opportunity to go  
12 back and do the review or the mining to say what would  
13 be a more balanced approach, I think.

14 CHAIRMAN STETKAR: Yes, I mean, I think  
15 part of the reason for this subcommittee meeting is  
16 that we've heard a lot of concerns both from the staff  
17 and from industry about conservatisms and a tremendous  
18 amount of effort to do these analyses.

19 And I think we're trying to understand  
20 from a technical perspective, what are the sources of  
21 those concerns?

22 Are they numerical? Is it counting  
23 cables? Is it doing FDS-type, you know, 500 FDS-type  
24 calculations? You know, where are they?

25 MEMBER BLEY: Is it fully inherent in the

1 problem, or is there some way around some of that?

2 MR. JULIUS: Some of those we did know  
3 ahead of time and it's like, well, these are the top  
4 ones and we're going to - well, we need to get, you  
5 know, there's this time schedule. We're going to do  
6 all these and not do - just chip away at it.

7 Because we were concerned early on in the  
8 process that some of these like the sculpting  
9 approach. Okay, you go in there and you're just kind  
10 of chipping away at the results.

11 And it's just like, you know, that's not  
12 getting us there. So, okay, let's bring out a bigger  
13 tool.

14 CHAIRMAN STETKAR: Okay. Thanks.

15 MR. SCHAIRER: All right. We've already  
16 touched on some of this. This is really again  
17 mentioning the tiered approach where the first cut was  
18 conservative. And as we needed to, we drilled down.  
19 Time to damage calculation was coming too late.

20 The first set of scenarios would assume  
21 damage virtually at time zero. So, we didn't credit  
22 fire brigade response or anything like that.

23 But as we got more complex, we would take  
24 detailed measurements in the field of the cables and  
25 figure out the exact time to damage and roll in

1 suppression timing.

2 But a challenge with that was, you know,  
3 the cable damage was often limited by the spatial  
4 knowledge of those cables. So, we had drawings -  
5 raceway drawings that we could work with.

6 However, as is common, you know, conduit  
7 is field routed. So, we couldn't rely on the drawings  
8 extensively for that purpose. The trays were pretty  
9 good.

10 But out in the field, too, you were  
11 challenged with being able to visually put your eyes  
12 on everything. So, again, that led to conservative.

13 If we can prove that it was outside the  
14 zone of influence, we had to, you know, include it in  
15 our damage set.

16 So, what we ended up doing was focusing  
17 the effort on really the risk drivers in the  
18 scenarios. And that required coordination between the  
19 fire modeling and PRA group to take a look at, all  
20 right, we're not going to, you know, some zones may  
21 have had 400 cables. We're only going to look at  
22 these maybe 50 that are really driving the risk. So,  
23 we're going to take a hit and basically assume all the  
24 other are failed each time.

25 And then the engineering effort of going

1 in to figuring out where those cables are help to  
2 focus that scope. So, that was one of the things that  
3 helped us work around that issue.

4 CHAIRMAN STETKAR: Dan or Mark, this  
5 obviously is a very resource-intensive effort, the  
6 whole process, as you've learned.

7 Do you have any estimate what fraction of  
8 those resources were required for basic cable tracing?  
9 Because that's necessary for both the deterministic  
10 and the risk-informed approach.

11 MR. SCHAIRER: Yes, I mean, I can't  
12 possibly maybe give it on a fraction, but a good  
13 portion of the fire modeling effort is not, like you  
14 say, working with FDS and tools. It's taking the  
15 results of the fire models and then going out and  
16 applying that to what cables are affected, and that is  
17 a huge effort.

18 CHAIRMAN STETKAR: Did you have a pretty  
19 good cable routing database going in, or did you have  
20 to develop that?

21 MR. MacDOUGALL: We did.

22 CHAIRMAN STETKAR: You did.

23 MR. MacDOUGALL: And actually we had a good  
24 - we rolled into EdisonSAFE. We had had our Appendix  
25 R database, and then we rolled it over to EdisonSAFE

1 and then kept it. And so, we were fortunate in that  
2 respect.

3 MR. JULIUS: But anyway, it supplemented  
4 with the PRA insights in Task 2. So, the additional  
5 LERF components are -

6 CHAIRMAN STETKAR: You had those in.

7 MR. JULIUS: Right.

8 MR. SCHAIRER: Yes, cable to raceway was  
9 good, cable to fire zone. But once we got down to  
10 like unique scenarios in the room, that's where we had  
11 - that was a challenge.

12 CHAIRMAN STETKAR: Okay.

13 MR. SCHAIRER: So, as we found that we  
14 needed to basically do a lot of complex fire modeling  
15 because of the number of areas where we had to do it  
16 to get the - we did a lot, you know, we did 39 areas,  
17 basically.

18 And kind of touching upon your point once  
19 you leave the arena of whole room damage and you're  
20 going into fire scenarios, you need to do them all, in  
21 my opinion. Because unless you can show that a  
22 certain part of the room does not have any cables you  
23 need to worry about, you know, you're stepping through  
24 and trying to put geometrical spatial relationships.

25 You don't know what scenarios to focus on

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1 until you do that effort. So, even some of the areas  
2 that were lower down on the list once they broke into  
3 that fire modeling list, that was quite a bit of  
4 effort.

5 MR. JULIUS: You can do that a little bit  
6 with the transients where the, you know, move those  
7 areas around more than, I mean, the fixed sources.

8 CHAIRMAN STETKAR: Fixed sources are fixed  
9 sources.

10 MR. SCHAIRER: So, the level of detail in  
11 the fire modeling also varied by location depending on  
12 the VFDRs.

13 So, initially we set out supporting the  
14 fire PRA and getting the CDF down. But as we got into  
15 fire risk evaluations, then the new focus turned to  
16 some of the VFDR cables and that resulted in  
17 additional fire modeling to go back and look at those.

18 Because the first cut may have, you know,  
19 grouped targets into scenarios where now we had to go  
20 back and look at individual cables, maybe, and pick  
21 those out.

22 So, again, the cable routing detail was an  
23 issue, but ultimately we were able to get that done.  
24 It probably took us almost 12 months to get through  
25 the VFDR for a review process with multiple, you know,

1 we'd meet, decide which cables to go after, come back  
2 and there might be a new group to go after because,  
3 you know, the fire modeling results don't always come  
4 back with, hey, everything is fine.

5 MR. JULIUS: And just to expand upon that  
6 as to your first question, you asked about the 260  
7 VFDRs and the 900 scenarios. So, I mean, we developed  
8 the set of fire scenarios as far as getting the  
9 overall fire PRA CDF. And as Mark said, we went in  
10 and took each VFDR and you went in and did an  
11 evaluation. And, you know, was that sufficient level  
12 of detail and information to disposition that VFDR, or  
13 do we have to do some additional fire modeling?

14 It was that maybe we'd lump that VFDR,  
15 maybe we had to revise the min set or protect it so we  
16 can get some, you know, walk down the particular  
17 cables associated with that VFDR.

18 So, there were additional model  
19 refinements that were done and actually that FRE  
20 process of looking at those areas was insightful  
21 because the initial fire PRA kind of did things  
22 globally, and then you're looking at specific areas  
23 and specific issues.

24 CHAIRMAN STETKAR: Thanks.

25 MR. SCHAIRER: The last bullet here really

1 touches upon the fire PRA quantification of the  
2 scenarios. And we talked a little bit about that, but  
3 it's relatively automated straightforward process of  
4 once we identify the cables to going back on these  
5 iterative approaches.

6 Ultimately, the result is a refined damage  
7 set and now the PRA model would re-quantify the CCDP  
8 for that.

9 Okay. So, some of you have the second  
10 handout. And that's really I just wanted to - we  
11 wanted to share a couple kind of unique challenges we  
12 face with the fire modeling that didn't necessarily  
13 fall into the regular fire modeling toolbox that we  
14 had.

15 The first example is a transient fire in  
16 the main control room cable vault. And that is a  
17 normally locked hatch. You can see the picture there.  
18 To gain entry there, it's actually in the control room  
19 corridor and requires operations approval. And a fire  
20 brigade member actually stand there while you're in  
21 the room.

22 But using the 6850 methodology we used,  
23 you know, assigned maintenance storage, so we had a  
24 transient fire. The challenge was if you see the top  
25 right photograph, unscheduled raceways.

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1 So, we did that -

2 CHAIRMAN STETKAR: Or for those of us who  
3 done this, the typical rat's nest.

4 MR. SCHAIRER: Yes, rat's nest.

5 CHAIRMAN STETKAR: That's a good one.

6 MR. SCHAIRER: So, the bottom right corner  
7 photo, there are a few trays in there which we could  
8 break out and basically use to assign it a different  
9 scenario.

10 But when we did that, we realized quickly  
11 that CCP was driven by the unscheduled cable. So, we  
12 didn't - we weren't able to use our typical transient  
13 methodology which was to break up the room, because  
14 there was no difference between one side of the room  
15 and the other.

16 The second page kind of shows you the  
17 whole room. What we ended up doing was just - there's  
18 just one big transient scenario.

19 CHAIRMAN STETKAR: On the handout.

20 MR. SCHAIRER: On the handout, yeah. The  
21 second page there.

22 MR. MacDOUGALL: On the back side of the  
23 handout.

24 MR. SCHAIRER: So, typically you'd see a  
25 room. This would be chopped up into maybe 10 to 20

1 scenarios where we could focus on pinch points. Not  
2 be able to do that in this case.

3 There is suppression in the room.

4 CHAIRMAN STETKAR: Ah, there you go.  
5 Thanks.

6 MR. SCHAIRER: I think there's a couple  
7 suppression systems. We ended up modeling the Halon  
8 suppression system. And what we ended up doing there  
9 was calculating the time to detection, time to  
10 suppression. And then crediting the trays that were  
11 covered with the delay. According to 6850, you had  
12 some delay rules there.

13 But again, that provided minimal benefit.  
14 The end state was really driven by the unscheduled  
15 raceways.

16 So, just as an example on Page 3, you  
17 know, again this is the kind of Excel spreadsheet we  
18 use to apportion transient scenarios across a floor  
19 area.

20 And if there were 20 scenarios, we could  
21 break up the frequency by that weighting factor.  
22 Again, we've got one line in this room.

23 The next page is really the quantification  
24 summary. And then the fire event tree is a typical  
25 fire event tree for a transient where we do credit

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1 suppression if possible and even manual fire brigade  
2 response for 20 minutes.

3 So, we were not able to really exercise  
4 all the fire modeling tools that we had generally  
5 applied to other areas. And the ultimate solution was  
6 to provide these fractional occupancy storage and  
7 maintenance factors which Jeff touched upon earlier.

8 And that, in our opinion, got the risk  
9 down to more realistic where, you know, we could then  
10 quantify that CDF based on that.

11 CHAIRMAN STETKAR: And ultimately all your  
12 fractions do finally add up to one depending on how  
13 you move things around.

14 MR. JULIUS: That's right. We didn't make  
15 any 0.01 or 0.1 percent.

16 CHAIRMAN STETKAR: Okay.

17 MR. SCHAIRER: Yeah, we didn't do any - I  
18 mean, we preserved the plant-wide frequency for all  
19 the -

20 CHAIRMAN STETKAR: yeah, I mean, that's  
21 good.

22 MR. SCHAIRER: Second scenario here is a  
23 fixed source scenario. And this is a 250-volt DC  
24 lighting distribution panels on the wall of the - this  
25 is a 600-volt MCC room.

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1           And what you see here is something that  
2 looks close to what might be well sealed and robustly  
3 secured, but it doesn't quite meet the FAQ-42  
4 discussion.

5           So, there are some, you know, minor gaps  
6 in the walls. So, there's possibility for the fire to  
7 get out.

8           So, that basically rendered us to do a  
9 fully developed fire for that. Each of these panels  
10 has a riser coming into the top of it with exposed  
11 cable.

12           So, we could not apply a severity factor  
13 to secondary combustibles which we normally do,  
14 because there is no distance between the source and  
15 the combustible.

16           All these panels are up against the wall.  
17 We're required to multiply the heat release rate by  
18 two for the wall corner effects.

19           And essentially what happens is each of  
20 these panels will spread up into the riser and there's  
21 trays above it that you can't see in this picture.  
22 And the resulting heat release rate leads to whole hot  
23 gas layer temperatures for thermoplastic cable, which  
24 essentially meant whole room damage at the time of  
25 that analysis.

1           So, that was the challenge with each of  
2           these seemingly harmless cabinets, which they all led  
3           to whole room damage.

4           You can see on the fire growth tree here,  
5           they're right around 20 minutes. So, we could apply  
6           fire brigade response using the fire brigade  
7           methodology.

8           But ultimately the solution was, all  
9           right, we had to differentiate between what was  
10          thermoplastic and what was thermoset so that we could  
11          gain - we didn't quite reach 300 - and I'm talking  
12          degrees Celsius here. We didn't quite reach the  
13          thermoset temperature.

14          So, that was an extensive cable material  
15          impact review.

16                 CHAIRMAN STETKAR: Is that with the 98th  
17          percentile heat release rates from those cabinet  
18          fires?

19                 MR. SCHAIRER: It didn't make a difference  
20          because any of the fires would lead to the riser, and  
21          then in the cable trays.

22                 CHAIRMAN STETKAR: Oh.

23                 MR. SCHAIRER: And that dominated the heat  
24          release rate. Combustible you have, but the cable  
25          trays, you can see there's about six trays involved.

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1 And they quickly dominate the fire.

2 CHAIRMAN STETKAR: Okay.

3 MR. SCHAIRER: And there's no severity  
4 factor on --

5 (Simultaneous speaking.)

6 CHAIRMAN STETKAR: Yes.

7 MR. SCHAIRER: So, that was, as I  
8 mentioned, extensive. We went through each cable,  
9 figured out what the jacketing and insulation were  
10 classified as thermoset, thermoplastic. I think the  
11 report ended up being about 6,000 pages.

12 And for each fire area we had by tray, by  
13 conduit, what we could apply. We did a multi-zone of  
14 influence here. So, you've got thermoset zone of  
15 influence, thermoplastic zone of influence.

16 So, that was a challenge we met. That's  
17 how we ultimately, you know, we were able to gain at  
18 least some CDF reduction with that methodology.

19 CHAIRMAN STETKAR: Did you get enough for  
20 6,000 pages?

21 MR. SCHAIRER: That remains to be seen.

22 CHAIRMAN STETKAR: Some of the sense of the  
23 questioning here is have you - in conclusion, do you  
24 feel that you did in some sense way too much in some  
25 areas for the purpose of this particular licensing

1 application?

2 In that sense, you know, 6,000 pages of  
3 records for every cable jacketing material insulation  
4 is a heck of a lot of information. And if you, you  
5 know, if you needed to generate that to get 9.0  
6 whatever the heck it is times 10 to the minus six  
7 delta CDF, that's fine. It was worth the effort.

8 If you didn't need to do that, that's also  
9 information, you know, in terms of lessons to be  
10 learned going forward about - it's too late for you  
11 guys, but other folks coming into the mill over the  
12 next year or so might - maybe they've done it already,  
13 maybe they haven't.

14 MR. JULIUS: The experience, as Mark  
15 expressed earlier, most of these requirements were  
16 needed to make the numbers.

17 MR. SCHAIRER: Yes.

18 MR. JULIUS: We didn't have many -

19 MR. SCHAIRER: I mean, the alternate is to  
20 assume everything is thermoplastic. And I don't have  
21 any, you know, sure answer for what the CDF would be,  
22 but it would not be -

23 CHAIRMAN STETKAR: It would be higher.

24 MR. SCHAIRER: Yeah, definitely be higher  
25 and, you know, using thermoplastic affects everything.

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1 It affects the heat release rate, the spread rates, as  
2 well as the damage time.

3 MR. JULIUS: Well, the other option he's  
4 asking about is say it's a lower voltage and we  
5 treated them as ventilated, but to do some things that  
6 get them into the non-ventilated lower voltage -

7 CHAIRMAN STETKAR: I think might be a  
8 different way to skin the cat.

9 MR. JULIUS: Yes.

10 Well, the next slide then transitions back  
11 to the fire PRA. So, we have these fire damage states  
12 and you can see between the selection of the heat  
13 release rates and the T-square, the growth model and  
14 the fire damage state frequency accounts for  
15 suppression. And so, the ignition frequency is  
16 developing to the point to being a large damaging  
17 fire.

18 And then they're coming in and we found  
19 that some of the - even the deterministically  
20 compliant areas can't have a higher than anticipated  
21 CDF due to the conservative fire damage state  
22 frequency combined with the unreliability.

23 The example being the bottom line there  
24 where you were limited to a safety train powered by a  
25 diesel generator for 24 hours getting a good PRA

1 result was a challenge.

2 And you can see for the lower ones,  
3 sometimes we look into maybe non-safety train  
4 equipment supplementing them.

5 CHAIRMAN STETKAR: It's not necessarily -  
6 I have to be real careful about time here, but, you  
7 know, just saying an area is deterministically  
8 compliant, doesn't mean that its risk is zero.

9 In fact, it's not surprising that  
10 deterministically compliant areas have higher risk  
11 than other areas.

12 Deterministically compliant is just an  
13 artifice. So, you know, saying that it's excessively  
14 conservative because it had a relatively high risk  
15 because it was deterministically compliant, isn't  
16 necessarily surprising.

17 MR. JULIUS: No, no, we're not saying it's  
18 excessively conservative in that case. We're saying  
19 again we had to take some of the conservatisms and the  
20 damage state frequency was leading into that.

21 Many of these fire damage state scenarios  
22 that we have are fires progressing so fast that we're  
23 not getting much credit, if any, for suppressions.  
24 So, you go to additional things.

25 So, you're coming into that and some of

1 your fire protection features aren't being recognized  
2 or reflected in the damage state frequency. And  
3 because of that, then it's not surprising that -

4 CHAIRMAN STETKAR: That part as well.

5 MR. JULIUS: Right.

6 The circuit fire likelihood was an  
7 interesting challenge in that we followed the 6850  
8 process and developed the cables. And we got to the  
9 point of the highest single spurious cable likelihood  
10 probability was used following the FAQ-47.

11 We assigned - both the spurious close and  
12 spurious open were both assigned the same probability.  
13 And generally these were in the 0.3 range or below.  
14 And in some of the sensitivities, we had them up to -  
15 double it to a 0.6.

16 And there, you know, crediting a 0.6 for  
17 spurious closing and a 0.6 for spurious opening, we  
18 get a limit to total failure probability to one.

19 Those numbers being the 0.3 or the 0.6,  
20 you start getting into the challenge with the rare  
21 event approximation and the impact. And so, we had  
22 some conservatism in the model initially in terms of  
23 not addressing the rare event approximation.

24 And when we did one of the sensitivities,  
25 we went further and looked to take that out to get a

1 truer measure of that so we weren't having some of  
2 these conservatisms propagate.

3 MEMBER BLEY: Make sure I understood. When  
4 you had these high probabilities, you abandoned the  
5 rare event approximation and did the real calculation.

6 Is that what you said?

7 MR. JULIUS: No, in general - we kept it  
8 and generally there was the affected one cable or  
9 maybe one valve in the AFW. And the other valves -  
10 there's other randoms and other things in there. So,  
11 there wasn't like we had cut sets that had, you know,  
12 4.6s or 4.3s in them.

13 So, in our initial cut, we kept the rare  
14 event approximation and we knew we were living on the  
15 edge in terms of the impact of the CDF.

16 MEMBER BLEY: Off the top, you don't have  
17 an idea of how much overestimate you have because of  
18 that, I assume, if you didn't do any -

19 MR. JULIUS: That's right. We haven't  
20 evaluated that.

21 MEMBER BLEY: Any time you get over 0.1,  
22 you're going to have some.

23 MR. JULIUS: That's correct.

24 MEMBER BLEY: Okay.

25 MR. JULIUS: Okay. Here's the slide where

1 I talk about the fire PRA uncertainty. And as we've  
2 come up to this point, we've talked about potential  
3 conservatisms or conservatisms in the 6850 approach  
4 regarding the higher ignition frequencies, the  
5 spurious actuation probabilities, the heat release  
6 rates in the fire growth model.

7 We do - we're looking at a balanced  
8 approach at this and we do recognize that there's -  
9 well, I guess the comment I want to make first on the  
10 ignition frequencies and the spurious actuation, for  
11 example, some of these are explicit and you could  
12 maybe treat with data. The ignition frequencies, you  
13 know, it's easier to do a sensitivity if these are  
14 facts scaled up or down.

15 Some of the things are implicit like the  
16 heat release rates and the fire growth model to say  
17 that you've got a lower heat release rate and what's  
18 the difference in the damage set. That's not just  
19 something that's easily scalable within the model.

20 CHAIRMAN STETKAR: It's not easily scalable  
21 within what model?

22 MR. JULIUS: Well, in the existing  
23 conditional core damage probability cut sets that we  
24 had in terms of working with an equation because the  
25 equations are developed based on the fire damage set.

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1 But if the fire damage set changed, you'd have to go  
2 out and make sure you had the raceway mapping and the  
3 zone of influence.

4 And so to get that additional data set,  
5 just dropping the heat release rate wasn't something  
6 you cranked in.

7 We did some of that with the three point  
8 models, didn't we, Mark, in one or two areas?

9 MR. SCHAIRER: Right.

10 MR. JULIUS: And how was that done? You  
11 just - when you evaluated at the 50th percentile heat  
12 release rate -

13 MR. SCHAIRER: Yes, it wasn't always like  
14 a specific severity factor. It may have been  
15 dependent on the dimensional -

16 CHAIRMAN STETKAR: You didn't do anything  
17 like take the full uncertainty distribution for the  
18 heat release rate and propagate it through the - if  
19 you're just using an algebraic correlation, it's kind  
20 of brainless to do it.

21 When you have a conditional probability of  
22 damage over the whole range of the heat release rate,  
23 do you feed that in? It's either damaged, or it's not  
24 if you're looking at plume temperature or plant height  
25 or something like that.

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1 MR. SCHAIRER: That's why we measure the  
2 distance to the target we were interested in.

3 CHAIRMAN STETKAR: But, I mean, that's  
4 known.

5 MR. SCHAIRER: We use the gamma  
6 distribution to figure out the severity factor, right.  
7 6850 provides the gamma distribution for the heat  
8 release rate.

9 CHAIRMAN STETKAR: Right.

10 MR. SCHAIRER: So, we would use that.

11 CHAIRMAN STETKAR: But you didn't -

12 MR. SCHAIRER: The one area where we did do  
13 what you're mentioning is -

14 MEMBER BLEY: I didn't understand what you  
15 just said. I thought you just said you did use the  
16 gamma distribution.

17 MR. SCHAIRER: To identify - yes, we worked  
18 backwards.

19 MEMBER BLEY: Oh, and then you picked a  
20 point off it.

21 MR. SCHAIRER: Identified the distance to  
22 the target, the heat release that were required for  
23 damage, and then used the gamma to look up that heat  
24 release rate severity factor.

25 MEMBER BLEY: Do you have any wild idea how

1 conservative you are because of not using the whole  
2 distribution?

3 MR. SCHAIRER: Jeff.

4 MEMBER BLEY: Might be worth just a couple  
5 hand calcs just to see for yourself one time.

6 MR. SCHAIRER: No, at this point we haven't  
7 done that.

8 MEMBER BLEY: Okay. Might be a lot.

9 MR. SCHAIRER: Yes.

10 MR. JULIUS: That's what I'm saying. We're  
11 looking at some of these where the - and also these  
12 aren't - some of the distribution - I'll take the  
13 spurious actuation failure probabilities. I mean,  
14 with a value of the 0.3 or the 0.6, these are going to  
15 be relatively skewed.

16 You're already at the high end. And so,  
17 to say it's an error factor of five, you know, you're  
18 not going to go - you're limited to one on the high  
19 end and then - so, they've got unique distributions  
20 associated with some of these elements.

21 CHAIRMAN STETKAR: But there are  
22 distributions.

23 MR. JULIUS: And there are distributions,  
24 true.

25 So, we did a thorough, though,

1 identification of sources of modeling and uncertainty.  
2 And that was commented on in the peer review. That  
3 was a good job there.

4 And in the sources, we also identified  
5 through the HRA process, you know, recognizing that  
6 the operator response, environments with either  
7 degraded instrumentation or multiple spurious cable  
8 failures, you know, the methods were limited. And we  
9 could use the methods in NUREG-1921, but recognizing  
10 that the operator response could be higher or lower.

11 So, when we got to the end, we looked at  
12 the importance tables of the operator actions and  
13 looked at the areas where we had higher risk  
14 achievement worse and risk reduction to double-check  
15 the HRA modeling in those areas.

16 CHAIRMAN STETKAR: Jeff - well, I'm going  
17 to run a little bit longer. That's okay.

18 MR. JULIUS: We've only got two more  
19 slides.

20 CHAIRMAN STETKAR: Yes, I wanted to ask -  
21 one of the things I noticed and things I'm a little  
22 sensitive to, there were, I believe, for control room  
23 fires some recovery actions where you had people go  
24 de-energize - I think they were characterized as  
25 panels in the control room, and I was curious is it

1 actually de-energizing a whole panel section?

2 MR. JULIUS: For individual -

3 CHAIRMAN STETKAR: And you brought up  
4 human reliability and I was curious how you factored  
5 that back into, you know, did you look at what else  
6 was on those panels and how that might affect  
7 integrated -

8 MR. JULIUS: In terms of the hardware  
9 operability given the impact of doing that?

10 CHAIRMAN STETKAR: Not the hardware. It's  
11 how it affected the people in the control room. I'm  
12 assuming these are scenarios where the operators  
13 remain in the control room.

14 MR. JULIUS: Generally the ones that were  
15 in the control room were these that were leading to  
16 the control room abandonment. We didn't further  
17 distinguish -

18 CHAIRMAN STETKAR: Oh, okay.

19 MR. JULIUS: It was quantified as a single  
20 panel, but we -

21 CHAIRMAN STETKAR: Oh. So, they're de-  
22 energizing the panel just to get rid of a hot short or  
23 something like that, but still responding -

24 MR. JULIUS: The large in the shutdown.

25 CHAIRMAN STETKAR: That, I didn't

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1 understand. Thanks.

2 MR. JULIUS: That's all right.

3 CHAIRMAN STETKAR: Then my question is  
4 irrelevant.

5 MR. JULIUS: Okay. Then the key point I  
6 want to make on this slide is that we're using the PRA  
7 as an input to the risk-informed decision making.

8 And in the Reg Guide 1.174 guidance or the  
9 risk acceptance criteria, it's to account for the  
10 quantification and meet the risk acceptance criteria  
11 and account for uncertainties.

12 So, the way we accounted for uncertainties  
13 was to identify the key sources and to develop error  
14 factors and to develop an estimate of parametric data  
15 uncertainty.

16 We did get an RAI. We had questions that  
17 we haven't done the rigorous statistical propagation.  
18 And we're doing that as a separate site calculation.

19 But the sensitivity cases that we did, we  
20 did five sensitivity cases with ignition frequencies,  
21 the transient weighting factors, impact of internal  
22 events PRA, quality issues, circuit failure likelihood  
23 and RWST level indicators. And then we have an  
24 estimation of the parametric data uncertainty.

25 And with each of those cases, not only the

1 point estimate, but the point estimate and the  
2 increased CDF, we looked at the increased CDF/LERF,  
3 delta CDF and delta LERF. And we've met all the risk  
4 acceptance criteria for CDF and LERF and delta LERF  
5 for both units.

6 For one unit, for the parametric data  
7 uncertainty on the delta CDF for Unit 1, we are a  
8 little above the limit. And so, we're making the  
9 argument that we've addressed the sources of  
10 uncertainty and that now given that information, what  
11 do we do about it?

12 So, since it's the delta CDF, to quantify  
13 in the uncertainty in the delta CDF is a little more  
14 of a challenge because there you typically had two  
15 separate Boolean equations and you're taking the  
16 arithmetic difference. And now you're saying, well,  
17 what's the uncertainty in this arithmetic difference?

18 Well, the approach we've taken is that the  
19 ignition frequencies and the spurious actuation  
20 probabilities, you know, would affect both the  
21 compliant plant and the post-transition plant. And  
22 the biggest difference in the two where they're  
23 affecting the delta risk is the recovery actions.

24 So, in terms of managing or controlling  
25 the uncertainties, we've got - we're looking at these

1 recovery actions. And when we first did a couple of  
2 sensitivity studies, for example, we exceeded the Unit  
3 1 delta CDF limits. And by applying one additional  
4 recovery action, we were able to revise our recovery  
5 action list and keep within the delta CDF limits or  
6 within all the limits.

7 And so, now we still have activities in  
8 the implementation phase to improve the procedures,  
9 improve the training. And so, we have a follow-up in  
10 implementation phase to redo the HRA and to redo the  
11 fire PRA calculation to make sure that the actions  
12 we've taken to change the procedures and change the  
13 training will help keep not only the point estimates  
14 in the CDF and the LERF down, but also the delta CDF  
15 and delta LERF.

16 So, we're challenged in doing some of the  
17 parametric uncertainty in the delta risk primarily.  
18 And that the - and then the question is, what do you  
19 do once you have that?

20 And so, we try to translate that back into  
21 actionable or things that the plant can address in  
22 terms of the procedures and the training or maybe  
23 additional engineering analyses. For example, the  
24 success criteria maybe to change the timeline.

25 So, from that perspective, we've addressed

1 the Reg Guide 1.177 concerns and met the guidance for  
2 not only accounting for the risk, but then the  
3 treatment of uncertainty in the fire PRA.

4 I'm sure there's some questions.

5 CHAIRMAN STETKAR: I quite honestly didn't  
6 follow that whole discussion. But because of the time  
7 -

8 MR. JULIUS: There was a lot packed in  
9 there.

10 CHAIRMAN STETKAR: There was. And I think  
11 because of the time constraints, we probably have to  
12 move on.

13 MEMBER BLEY: Just one short question. You  
14 talked about areas where you're going to make  
15 improvements.

16 Is there a schedule on -

17 MR. JULIUS: The areas where we're making  
18 improvements are, I mean, the procedures and the  
19 training implementation, that's part of the  
20 implementation phase.

21 MEMBER BLEY: Okay.

22 MR. JULIUS: So, there is a schedule on  
23 that.

24 I guess one of the higher levels maybe  
25 basically understood technical challenges, was that



1 especially in the peer review process, was that peer  
2 reviews typically on the as-built, as-operated plant,  
3 and we're developing the analysis for the post-  
4 transition plant.

5 So, this is a plant of the future in some  
6 respects with regard to the procedures and the  
7 training. Some of the procedures -

8 CHAIRMAN STETKAR: Procedures in HRA,  
9 that's certainly the case.

10 MR. JULIUS: That's right.

11 CHAIRMAN STETKAR: At least you're not  
12 posing any substantial hardware modification to sites  
13 as-built, as-operated in that sense.

14 MR. JULIUS: But even like the recovery  
15 action that - these MOV - the 92.18 valves, I mean, if  
16 we were taking credit for recovery action and go and  
17 operate a valve, that you wanted to ensure that the  
18 hardware operability supported that recovery action.

19 I'll turn the floor back over to Dan to  
20 talk about some of the implementation challenges.

21 MR. MacDOUGALL: I'll be quick.

22 These implementation challenges are  
23 basically what we're seeing now and today, and then as  
24 we move into the implementation phase. And they're  
25 somewhat consistent with what the pilot saw and very

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1 consistent with what Harry discussed earlier today  
2 with respect to we're taking and trying to find  
3 availability data on non-TRM systems that are now risk  
4 significant that support - all of this is in support  
5 of all our assumptions and analysis that we did to try  
6 and maintain that moving forward.

7 Configuration management right now is  
8 getting more and more difficult because we have a LAR  
9 sitting out, we've got modifications coming through.  
10 Some of them are quite major and we're still trying to  
11 be safe today.

12 And for a single-unit utility - or dual-  
13 unit, single nuclear station utility without the  
14 luxury of a corporate staff or backup, we are heavily  
15 - the point being we're heavily relying on contract  
16 staff. I mean, we are. And our bench strength.

17 We've been unfortunate and we've had three  
18 positions that were primaries working Appendix R that  
19 either got transferred out, left the company or  
20 unforeseen events.

21 And we did have some bench strength, but  
22 now we're trying to rebuild that back up as well as  
23 we're growing. So, that's a real challenge.

24 CHAIRMAN STETKAR: That's important. As  
25 Harold mentioned, you know, it's - back in the flurry

1 of activities when all the original internal events  
2 PRAs were being done, you naturally rely on  
3 contractors because they've got the people, they've  
4 got the expertise.

5 But if you don't develop your own in-house  
6 staff to take ownership over the PRA model or, in this  
7 case not only the PRA model, but all of the supporting  
8 information, you've in trouble because eventually  
9 these two guys are going to drive into a tree  
10 someplace and that's a problem.

11 (Laughter.)

12 MR. MacDOUGALL: In summary, most  
13 challenges were data conservative, were data  
14 limitations. We simply couldn't find it and we had to  
15 be conservative.

16 As we forward in implementation, some  
17 paradigm shifts are going on at the station and the  
18 guys are trying to understand beyond core damage LERF  
19 actions, recovery actions. That's new news. And the  
20 NPO getting with the outage folks and saying that, you  
21 know, we got to do this.

22 And then of course as we discussed,  
23 configuration management right now is a real  
24 challenge.

25 We're not in the change evaluation process

1 yet. We're making changes to a LAR that's pending  
2 approval. We've got modifications coming through.

3 I will say this: without the industry  
4 participation and the networking we've done as a  
5 single station, everybody, the committee working  
6 together, the staff working with us, the visits,  
7 that's been - it's almost been a challenge to make all  
8 the meetings and take the learnings and read the facts  
9 and it's been complex, and I want to thank you for the  
10 opportunity.

11 MEMBER SCHULTZ: Dan, just one question on  
12 the last slide. You mentioned you're obviously  
13 setting up a program for all the implementation  
14 challenges.

15 Over what time frame does your current  
16 program - does that envision?

17 MR. MacDOUGALL: We're looking at June of  
18 2013. Between now and 2013.

19 MEMBER SCHULTZ: 11 months on through with  
20 - still with interactions with the staff ongoing.

21 MR. MacDOUGALL: Yes.

22 MEMBER SCHULTZ: Okay. Thank you.

23 MR. MacDOUGALL: That's unvalidated, that  
24 schedule, if I remember correctly. He's smiling. My  
25 reg affairs manager is looking at me.

1                   Thank you for asking. that was off the  
2 cuff. End of presentation then for us.

3                   CHAIRMAN STETKAR: Well, thank you very,  
4 very much. That was an awful lot of material into a  
5 challenging time slot.

6                   Any of the members have any more questions  
7 for DC Cook folks?

8                   MR. LAI: Can I say one thing?

9                   CHAIRMAN STETKAR: You may.

10                  MR. LAI: Can you give me the supplemental  
11 sheets that I can put in the records?

12                  CHAIRMAN STETKAR: And with that, we will  
13 recess for lunch and we'll reconvene at 1:15.

14                  (Whereupon, the above-entitled matter went  
15 off the record at 12:37 p.m. and resumed at 1:15 p.m.)

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A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

1:15 p.m.

CHAIRMAN STETKAR: We are back in session and we're going to hear from Duane Arnold. Whoever wants to take it.

Anil.

MR. JULKA: Okay, I'll start then.

My name is Anil Julka. I'm the PRA manager for Next Era Fleet. Vinny Rubano is with me here. He's the program manager for NFP 805. And we also have - we're going to keep this at a - we developed this at a very high level, but we do have our contractors who worked on it here.

Kiang Zee from ERIN, and also people from Kleinsorg Group are here in case we need any information on fire modeling. And even licensing, Laura, is here and another person.

What we're going to cover is we're going to give you the background of Duane Arnold. It was the first BWR, as you know, as a non-pilot we submit not too many BWRs were really transitioning to NFP 805.

As part of our big fleet, we have eight plants with five sites. And this is the only BWR we have. So, seven of the plants are transitioning, with

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1 one plant not transitioning to. We're just  
2 incorporating the, you know, MSOs there. So, Duane  
3 Arnold is the only BWR and we are transitioning.

4 I'm going to give you the background. Risk  
5 reduction history, I think that plays an important  
6 role when we do the fire PRA, you know, what the  
7 internal events history has been.

8 So, there was tremendous amount of work  
9 done there as well. So, we're going to kind of  
10 highlight that what type of things were done and what  
11 improvements we made while we were doing that, which  
12 did help us when we did the fire PRA.

13 PRA peer reviews, I think, John, you  
14 talked about that earlier, peer reviews and how they  
15 impact that. And we're going to talk a little bit  
16 about peer reviews and how, you know, things were  
17 transitioning at the same time while we were trying to  
18 comply with Reg Guide 1.200f2 at the same time. That  
19 did pose some challenges for us, and I think maybe  
20 other sites as well.

21 New analysis methods, we did use two  
22 methods outside of 6850 not really defined in 6850.  
23 So, there was lot of discussion. Lot of our  
24 discussions at NRC staff during the review, RAI  
25 responses and stuff. We will talk about that, which

1 two were there and why we use them.

2 We'll talk a little bit about HRA  
3 methodology. What type of sensitivity we use for the  
4 fire model.

5 And then I think we -- what we did was we  
6 developed, you know, said - we said, okay, let's see  
7 what can we gain from all of this from fire PRAs.

8 So, we tried to make up a list ranking,  
9 you know, see what is the high risk ranking areas for  
10 us and see what insights we can gain from it.

11 There is tremendous amount of work done.  
12 That's why we need to really look at it from a big  
13 picture perspective. What does it really tell us?  
14 So, we'll show you what that, you know, told us which  
15 areas were the highest risk areas.

16 So, what risk insight and modifications,  
17 there were really very few as compared to a PWR. Like  
18 I said, in our fleet we are working on other PWRs as  
19 well and they are getting much more involved, a lot  
20 more modifications needed to get to the compliance  
21 arena as opposed to a BWR which is very nominal.

22 Site overview, it's approximately six  
23 miles northwest of Cedar Rapids. It's a General  
24 Electric NSSS and turbine. Bechtel was the original  
25 constructor. It's Mark 1 containment. 630 megawatts

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1 electric. And it's been a good plant.

2 This shows the Cedar River which is, you  
3 know, the ultimate heat sink. And we got the forced  
4 draft cooling towers. This is just to give you a  
5 perspective where the plant is.

6 Now, one thing which is important to note  
7 here is we started doing Reg Guide 1.200 Rev 2 upgrade  
8 for internal events and we started the fire PRA at the  
9 same time. So, that was a real big challenge for us.

10 Internal events peer review was done  
11 before we had really completed all the Reg Guide 1.200  
12 improvements - Rev 2, I mean. Rev 2 was not really  
13 issued at that time.

14 So, as a result, that kind of interfaced  
15 with, you know, getting us to go back and forth  
16 between the fire model and the PRA model, revising  
17 both models at the same time.

18 The peer review, again for the fire PRA  
19 peer review was also done up front in 2010. That was  
20 like two years before. So, that is another challenge  
21 that a lot of sites did that. We did fire PRA peer  
22 reviews not before we were really completed with it or  
23 at the point where we were pretty much done as opposed  
24 to, you know, really methodology was set at that time,  
25 but really we did not have quantification in a lot of

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1 the results.

2 So, that did challenge, you know, as far  
3 as later on responding to findings, and ultimately  
4 RAIs.

5 So, what we did was internal events, like  
6 I said, we did that a long time before we really had  
7 the complete compliance for Reg Guide 1.200 Rev 2.  
8 So, what we did was focused peer review.

9 And I think Steve Dinsmore mentioned that  
10 this morning that, you know, they need some sort of a  
11 justification that if you have a lot of findings.

12 So, we had quite a few findings. So, what  
13 we want to do was narrow that down. So, we knew that  
14 based on the industry looking at pilots and some other  
15 plants, the RAIs were kind of directly proportional to  
16 number of findings people had.

17 So, although we had fixed those findings,  
18 we wanted to make sure that they were appropriately  
19 incorporated. And in areas where we had - there were  
20 too many findings in one element, one supporting  
21 requirement, what we did was we looked at the entire  
22 element. And I think that was consistent with what  
23 NRC's expectations were at that time when we were  
24 talking about the peer reviews.

25 The LAR was submitted in August 2011. And

1 we touched base this morning about the audit. We had  
2 the audit in December last year. It was very  
3 comprehensive audit. In fact, this is the first one  
4 we have seen which was that detailed. We went through  
5 a lot of details which we don't normally do with other  
6 applications.

7 We had about 120 total RAIs to respond to,  
8 which we did. Which is significant amount of effort  
9 for us. They were separated between two areas. One  
10 was 60 days, and 90 days. And we did submit all of  
11 them on time.

12 And there was a second audit which was  
13 done in May of 2012 which was mostly with fire  
14 modeling. It was not as comprehensive as the first  
15 one, but this one was like, you know, just two  
16 inspectors coming as opposed to 12 people in the  
17 initial audit. And in June, we had that fire modeling  
18 walkdown.

19 So, this is kind of the timeline of the  
20 history and right now I think we are waiting for, you  
21 know, the resolution of the RAIs and SER is supposed  
22 to be due next year sometime. I believe next year in  
23 June time frame.

24 So, I said we started both at the same  
25 time. It's been a challenge to keep both of these

1 updated at the same time. So, at certain point we had  
2 to make a call saying, okay, this is the frozen model  
3 now and we're not going to update fire PRA along with  
4 the revision to the internal events.

5 So, in this case like you see the 1.200  
6 focused peer review, when that was done we said, okay,  
7 that will be the model used for fire PRA.

8 So, although we did a significant  
9 reduction as you see further on, that is not in our  
10 fire PRA model at this time. That was again the  
11 modeling change and the procedure change for RHR  
12 cross-tie valve. And I will go over that, what that  
13 was, but this shows kind of the history of internal  
14 events changes.

15 You have a question, John?

16 CHAIRMAN STETKAR: Yes, I do a little bit.

17 The sense that I'm getting is that now  
18 your so-called fire PRA model is fundamentally somehow  
19 different than your so-called internal events PRA  
20 model.

21 So, you have two different models?

22 MR. JULKA: That's correct.

23 Now, also we have to also think about the  
24 fire PRA model is including all the modifications.  
25 So, our internal events model is as-built, as-operated

1 plant right now. So, those two are inherently  
2 different.

3 CHAIRMAN STETKAR: What I'm concerned  
4 about, are any of the conclusions or modifications  
5 whether they're hardware modifications or procedural  
6 modifications in your fire PRA model, could they be  
7 influenced one way or the other by - if the fires were  
8 evaluated in the context of your as-built, as-operated  
9 internal event PRA model?

10 In other words, are you in danger of  
11 making the wrong kinds of decisions from your fire PRA  
12 especially considering this rather dramatic change,  
13 you know, between April 2010 and June of last year in  
14 the internal events model?

15 MR. JULKA: No, our plan is to for during  
16 the implementation phase, make them combined together.

17 CHAIRMAN STETKAR: I understand that.

18 Have you, I mean, after all, these are PRA  
19 models. And if you have a PRA model in place - okay.  
20 I was going to say it's not our role to question about  
21 how easy changes might be, but it's a bit troubling to  
22 see things diverging.

23 MR. JULKA: Uh-huh, uh-huh.

24 CHAIRMAN STETKAR: Especially in the  
25 context of major changes that may or may not affect

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1 conclusions from the fire modeling exercise. I mean,  
2 I have no idea.

3 MR. JULKA: Right, right.

4 MEMBER BLEY: Could you help me understand  
5 a little what it means to have two different models?

6 I thought you started with the internal  
7 events model as of last year; is that right? And then  
8 you made the fire-related changes to that, but it's  
9 actually got that same - everything else of that  
10 original model is still there; is that right?

11 MR. JULKA: But except for the last change.  
12 Like I said, that was done after we -

13 MEMBER BLEY: Oh, that was done afterwards.  
14 Okay. So, you got the model before that.

15 MR. JULKA: Right.

16 MEMBER BLEY: So, you have to when you  
17 merge them together, you've got to adopt these changes  
18 and then the fire mod changes in.

19 MR. RUBANO: The fire PRA model is built on  
20 the Rev 5 delta internal events PRA model and not the  
21 Rev 6 internal events model.

22 So, you're right. So, any changes that  
23 were created between five delta and six have to be  
24 incorporated into the fire side before we can combine  
25 the models and to keep it as one consistent set.

1                   MEMBER BLEY: I assume that's pretty clean  
2                   and you know how to do that.

3                   MR. JULKA: We know how to do that and we  
4                   do have a plan schedule laid out for implementation of  
5                   NFP 805 where we will, you know, finally carry only  
6                   one model forward.

7                   All right. We are finding that with other  
8                   sites, too, you have to kind of make the call where do  
9                   you say, okay, this is the model, so fire PRA people  
10                  can start working on it.

11                  Once we continuously keep changing it, I  
12                  think it changes all the numbers and we have to revise  
13                  that and then it becomes a very cumbersome effort.

14                  CHAIRMAN STETKAR: I mean, there's one  
15                  school of thought that says there is the PRA model.  
16                  The PRA model evaluates LOCAs, it evaluates losses of  
17                  offsite power, it evaluates loss of feedwater  
18                  transient, it evaluates fires in this room, it  
19                  evaluates fires out in that corridor, but it is the  
20                  PRA model.

21                  And indeed when you, you know, you have to  
22                  have a model of record especially for a licensing  
23                  submittal, certainly. But it's an evolving model, but  
24                  it's only a single evolving model. It's not multiple,  
25                  different models.

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1 MR. JULKA: Right. I agree. Yes, we need  
2 to bring it together.

3 CHAIRMAN STETKAR: So be it. Again, the  
4 only concern would be is if any changes between 5D and  
5 6 might affect the conclusions from the fire PRA model  
6 either positively or negatively in terms of reordering  
7 importance of specific fire areas in the plant or - I  
8 know you don't have any formal recovery actions at the  
9 moment.

10 MR. JULKA: Right.

11 CHAIRMAN STETKAR: Identifying other needs,  
12 for example, is always a concern, but at least we  
13 understand where you are.

14 MR. JULKA: Okay.

15 MR. RUBANO: But that's, I mean, to further  
16 that point, every utility, every site that's  
17 transitioning to NFP 805 has the same problem because  
18 we had to draw a line in the sand.

19 But in addition to that as was stated this  
20 morning and we'll tell you again this afternoon, is  
21 that the fire PRA supporting NFP 805 is a forward-  
22 looking model, it has the modifications incorporated,  
23 whereas the internal events model is an as-built, as-  
24 operated plant.

25 So, there's an inherent difference and it



1 won't come together until the modifications and  
2 changes that are scheduled for 805 are actually done.  
3 And then the models can be brought together.

4 CHAIRMAN STETKAR: Okay.

5 MR. JULKA: But I think I see your point.  
6 You're saying if you're making changes now --

7 CHAIRMAN STETKAR: I mean, quite honestly  
8 --

9 MR. JULKA: -- how are we going to see the  
10 difference between the two.

11 CHAIRMAN STETKAR: -- if you were talking  
12 about the difference from 5A to 5B to 5C since this is  
13 kind of a, you know, those are essentially no  
14 different. Those are fine tuning.

15 MR. JULKA: Pretty much the same, yes.

16 CHAIRMAN STETKAR: 5D to 6 looks like some  
17 sort of fundamental major change in the model.

18 MR. JULKA: Yes.

19 CHAIRMAN STETKAR: And I hope you  
20 understand whether or not that might affect the  
21 results of the fire -

22 MR. JULKA: It helps.

23 CHAIRMAN STETKAR: It would help?

24 MR. JULKA: It would help. Yeah, that we  
25 do know.

1 I'll show you what the change - on this  
2 page, I have that. And what that is, is a cross-tie  
3 to RHR system. You know, it spread from one division,  
4 but we did not have credit in the system for allowing  
5 recovery for operators to be manually able to align  
6 that to that evaluation.

7 So, that itself gave us a tremendous  
8 benefit once we have recovery on that valve to be able  
9 to use both sides of RHR system. So, that was the  
10 main -

11 CHAIRMAN STETKAR: Would that help you much  
12 in suppression pool cooling for your fire PRA?

13 MR. JULKA: Yes.

14 So, like I said, internal events was done  
15 on December. And we had 57 SRs which were not met,  
16 and 66 findings for F&Os.

17 We did a focused peer review because we  
18 had done a lot of work between 2007 and 2011. We had  
19 incorporated all the changes. And so, we did a  
20 focused peer review and then we finally came up with  
21 12 F&Os which were remaining, which the peer review  
22 team felt that they were not completely closed out.

23 So, that was a big, you know, significant  
24 effort for us to get there and we did not want to go  
25 into, you know, have NFP 805 submittal done with that

1 many internal events finding.

2 And we had a similar number of findings  
3 for the fire PRA which was done by the PWR OG. 89  
4 findings which were again, like I said, that was done  
5 before we were really completely done quantification,  
6 before we completely had all the solutions, what we  
7 were going to do.

8 And the RAIs ranged from, you know, you  
9 got complete PRA evaluations, quantified results  
10 versus, you know, documentation.

11 CHAIRMAN STETKAR: Okay. I have to ask why  
12 did you have the peer review done at that stage in  
13 your PRA model development?

14 MR. RUBANO: Basically it was schedule  
15 pressure. So, as 805 has developed, we've had  
16 different regulatory deadlines when we've had to be  
17 done.

18 So, based on what we thought the deadline  
19 was going to be at that time, that's when we scheduled  
20 the peer review.

21 And in addition, there was a lot of people  
22 doing peer reviews and you really had to grab a peer  
23 review window pretty early to ensure that you actually  
24 had the coverage to get the peer review. So, purely  
25 schedule pressure-type stuff.

1                   If I had to do it again, I'd move the peer  
2 review all the way out to the end.

3                   CHAIRMAN STETKAR: I suspect people have  
4 gotten that message. But I've heard some of that  
5 undercurrent in the peer review process, and I wanted  
6 to - that's why I asked to get your -

7                   MR. RUBANO: All of my sites have had  
8 similar problems. Their peer reviews were done very  
9 early. And, in fact, at Turkey Point we did a second  
10 full-scope peer review because the first one was so  
11 early.

12                  MR. JULKA: And had a lot of findings.

13                  CHAIRMAN STETKAR: Well, naturally. I  
14 mean, it's not surprising.

15                  MR. JULKA: And we found out that, you  
16 know, if you really look at it, you know, taking away  
17 not ultimately hundred percent, but most of the  
18 findings, they are directly proportional to number of  
19 RAIs we got.

20                  Now, I'm going to have, I guess, two, I  
21 think it was called, methods in the morning. We gave  
22 it a new name. New analysis methods. It looks a  
23 little bit better.

24                  So, I'm going to have Vinny go through  
25 which ones we used and -

1 MR. RUBANO: Okay. So, at Duane Arnold we  
2 applied at the time of the application, there were two  
3 analysis methods that are not 6850 compliant or don't  
4 follow the exact guidance 6850.

5 One was a hot work cable spreading room  
6 pre-initiator, and I'll talk a lot about that one, and  
7 then a transient heat release rate and we used a  
8 reduced transient heat release rate.

9 Since that time, the transient heat  
10 release rate and the placement of transients has been  
11 a lot of discussion with the industry and the  
12 regulators over that subject.

13 And DC Cook pointed out this morning that  
14 we're still discussing the amount of credit you get  
15 for hot work controls and transient controls leading  
16 to the ability to use either a reduced placement or a  
17 reduced heat release rate for a transient.

18 So, that's sort of still a work in  
19 progress even though we did use it. And we've gotten  
20 several RAIs, we've responded to the RAIs. We're  
21 waiting for a response to that, to our response, but  
22 that is a - I would call it sort of a generic topic.

23 CHAIRMAN STETKAR: When you say the  
24 transient heat release rate, we'll come back to this  
25 notion of uncertainty distributions, do you mean that

1 the value that you used is lower than the 98th  
2 percentile transient heat release rate in 6850, or did  
3 you use -

4 MR. RUBANO: That is correct.

5 CHAIRMAN STETKAR: - an entirely different  
6 uncertainty distribution?

7 MR. RUBANO: No, we used a reduced heat  
8 release rate from the 98th percentile that's in NUREG-  
9 6850.

10 CHAIRMAN STETKAR: But did you use a  
11 different heat release rate uncertainty distribution,  
12 or did you just pick another number off the 6850  
13 curve?

14 MR. JULKA: Do you want to answer that,  
15 Kiang?

16 MR. ZEE: Yes, let me clarify a little bit.

17 CHAIRMAN STETKAR: You have to identify  
18 yourself.

19 MR. ZEE: This is Kiang Zee with ERIN  
20 Engineering.

21 Where it all really came from is - and I'm  
22 going to go with a little bit of detail so you can  
23 understand the context.

24 When we got to this requirement to deal  
25 with transient ignition sources, transient frequency

1 and so forth, we went and looked at what the required  
2 treatment was. And the tests that formed the basis  
3 for distribution function in 6850, are a series of  
4 industry tests where general occupancy trash, I guess  
5 I will call it, burning trash bags, form the basis of  
6 it.

7 If we went back and looked at the industry  
8 events which were counted to generate the frequency of  
9 the event we were evaluating, what we found was the  
10 events were actually what we would better characterize  
11 as transient ignition sources.

12 Generally speaking, they were not burning  
13 trash bags, but instead they were miscellaneous, small  
14 ignition sources which did not occur in sufficient  
15 frequency to warn its own bin. So, they were  
16 generally grouped into a bin called "transient fires."

17 So, my characterization is that treatment  
18 is actually transient ignition sources, it's not  
19 transient combustible fires.

20 So, what we wound up doing was we made the  
21 connection between transient ignition sources and we  
22 went looking for another - a heat release rate  
23 distribution function in 6850 that we thought might be  
24 representative for transient ignition sources, and  
25 what we found is there is a bin in 6850 for motor

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1 fires. And that motor fire bin would be applicable  
2 for any electric motor fire generally regardless of  
3 size.

4 So, we made the logical connection that  
5 that would probably be a better representation for a  
6 distribution function for transient ignition sources.

7 Going a little bit deeper, some of the  
8 events that were counted that were used to generate  
9 this transient fire frequency involved things such as  
10 space heaters reaching end of life and smoking,  
11 catching fire. Extension cords catching on fire.  
12 Little work lamps catching on fire, things like that.

13 So, we felt the natural connection was  
14 connected to the distribution function for electric  
15 motor fires.

16 And so in that context, the heat release  
17 rate value that was used was the 98th percentile heat  
18 release rate for that distribution function, the  
19 electric motor fire bin.

20 CHAIRMAN STETKAR: Okay. Well, at least we  
21 know what you did.

22 What we're trying to understand here is -  
23 obviously there's an ongoing dialogue between you and  
24 the staff over these things. And as I mentioned this  
25 morning, the purpose of the subcommittee meeting is for



1 us to understand technical issues that have arisen  
2 over these three different applications and how those  
3 issues are being addressed.

4 MR. RUBANO: So, on that, just to go a  
5 little further on that, that was the original logic  
6 that they used to develop that heat release rate  
7 distribution for -

8 CHAIRMAN STETKAR: They've used the motor  
9 heat release rate distribution for transient -

10 MR. RUBANO: But since that time, it's sort  
11 of evolved to a larger question of how much credit you  
12 get for specific transient controls like DC Cook this  
13 morning discussed transient free zones or stricter  
14 controls.

15 So, can I, you know, is there a method or  
16 is there a logic to apply that lower heat release rate  
17 for special areas that have special controls versus  
18 the general area which may have the larger heat  
19 release rate or - so, that's an ongoing discussion  
20 right now.

21 CHAIRMAN STETKAR: But that's sort of two  
22 different issues.

23 MR. RUBANO: Right.

24 CHAIRMAN STETKAR: One is control of things  
25 that you call transients, the other is given, you

1 know, given the ignition to this pile of paper here,  
2 what sort of heat release rate do you get from that  
3 burning pile of paper or trash bags or canvas  
4 coveralls or whatever is in that pile.

5 MEMBER SCHULTZ: Vinny, in terms of  
6 sequence, these new methods were in place in the  
7 methodology prior to the industry peer review of the  
8 fire PRA?

9 MR. RUBANO: Yes, they were.

10 MEMBER SCHULTZ: And were there any  
11 particular industry comments related to them in the  
12 PRA?

13 MR. RUBANO: Yes, we did - they were  
14 findings.

15 MEMBER SCHULTZ: Findings, okay.

16 MR. JULKA: I think they were -- it's just  
17 the policy that if, you know --

18 MEMBER SCHULTZ: It's a matter of course.

19 MR. JULKA: Yes, if they find it, but not  
20 necessarily every time. I think they may talk  
21 tomorrow more about it on how they do that, but they  
22 were listed here as findings.

23 MR. RUBANO: Correct me if I'm wrong,  
24 Kiang, but the transient heat release rate was  
25 submitted to the EPRI panel for review; is that

1 correct?

2 MR. ZEE: That is correct.

3 CHAIRMAN STETKAR: I think we understand -  
4 or at least I understand what you did.

5 (Laughter.)

6 MR. RUBANO: Okay. So, the first one -  
7 really the first one we list is the hot work cable  
8 spreading room pre-initiator. We'll show you a  
9 picture of the entrance to the cable spread room at  
10 Duane Arnold.

11 The cable spread room at Duane Arnold is  
12 sort of a special room. It truly is a cable spread  
13 room. There is nothing in there but cables. It has  
14 a total flooding CO2 system to protect it. And it has  
15 very restricted access.

16 So, it requires operations' permission to  
17 even go in the room. And, in fact, the card reader at  
18 the door of that room has an elevated access  
19 requirement so that you have to go talk to security,  
20 too, to get temporary elevated access to even get  
21 through the door.

22 So, based on that we came up with  
23 basically an adjustment because 6850 really has no  
24 real adjustment for that.

25 And this is very similar to the issue

1 that's in FAQ-64 now about the influence factors of,  
2 you know, all the areas where transients are really  
3 difficult and hot work fires and things like that are  
4 really difficult to happen because of either the  
5 controls or the difficulty of getting there or things  
6 like that that some credit - we should be able to get  
7 some credit for areas that are special.

8 As I said before, it's a highly restricted  
9 area. You do need control room operator permission to  
10 get in there. You usually need security permission to  
11 get in there.

12 There is really nothing in the cable  
13 spread room that requires hot work. As I said,  
14 there's only the cables in there. In fact, there's  
15 not even instruments in there. So, there's not even  
16 technicians going in to do calibrations and stuff like  
17 that. So, it's basically all by itself.

18 If we had to do hot work in that room for  
19 whatever oddball reason that would come up, that would  
20 be a very specialized evolution that would require  
21 lots of controls and lots of precaution.

22 So, it's not something that you would just  
23 send a bunch of people out in the plant and say, hey,  
24 go start grinding on this thing and put up a new  
25 support or something like that.

1                   That would be pretty rare and would have  
2                   very special controls.

3                   CHAIRMAN STETKAR: Do you work in there  
4                   during shutdown?

5                   MR. RUBANO: Even during shutdown there's  
6                   very little work in that area.

7                   If we had a - if we pulled a new cable or  
8                   something, it probably wouldn't even involve hot work.  
9                   I mean, there's lots of spare capacity cable trays and  
10                  stuff like that.

11                  We put a 0.01 pre-initiator in there  
12                  basically for potential failure of administrative  
13                  controls. As the PRA guys always tell me, they don't  
14                  like zero. So, there's always some possibility that  
15                  something is not going to go right.

16                  We did actually do a sensitivity on that  
17                  and we've determined that through that sensitivity,  
18                  that the 0.01 factor is relatively conservative and is  
19                  appropriate. There's nothing - it's not - it doesn't  
20                  really change the results very much at all.

21                  CHAIRMAN STETKAR: I'm sorry, if you  
22                  increased it to one, how much would it affect the  
23                  results?

24                  MR. RUBANO: Well, so, one, you would end  
25                  up with the full frequency distribution for hot work

1 in there and we didn't go that far, but the difficulty  
2 in going that far is that you would have to go and do  
3 all the scenarios and put the locations of the fires  
4 and it's a relatively big analysis.

5 The cable spread room at Duane Arnold is  
6 mostly one division. It has one small corner that has  
7 the second division.

8 So, even considering that, you would not -  
9 the results would not be significantly different  
10 because you - the default for most of the fires in  
11 that room, the default would be single-train shutdown,  
12 you know, potentially relying on the diesel. And that  
13 drives the risk number regardless of how you got  
14 there.

15 MEMBER RAY: Could you describe what the  
16 administrative controls are just generally that you  
17 were relying on?

18 MR. RUBANO: The administrative controls in  
19 this room is that this room is normally not accessed  
20 during operation. In fact, it's usually not - there's  
21 the entrance right there.

22 It's card-reader-controlled. The card  
23 reader has a higher level of access so that it's, you  
24 know, very few people on the site actually have access  
25 to that room on a normal basis.

1           To get in that room, you have to talk to  
2 security to get an elevated access on your key card  
3 and you need operations' permission. Operations has  
4 to get a clearance to allow you in the room. It's a  
5 big deal to get in that room.

6           MEMBER RAY: Is that because of this fire  
7 concern, or for other reasons?

8           MR. RUBANO: That's for other reasons.

9           MR. JULKA: Other reasons.

10          MR. RUBANO: It's a CO2 area.

11          CHAIRMAN STETKAR: It's a CO2. They don't  
12 want people dying.

13          MR. RUBANO: So, we don't want people in  
14 there.

15          MEMBER RAY: Yeah, okay. I'm just trying  
16 to understand what the -

17          MR. RUBANO: And in reality, I mean, when  
18 you go in the room, the first part of the room you can  
19 move around. But to get to some of the areas, you  
20 really have to work hard to get to those areas.

21                 If you were in that area and the CO2  
22 system would get off, you would not get out. So, as  
23 a result, we don't allow people in there.

24          CHAIRMAN STETKAR: I just - I want to ask  
25 a little bit about this, because it does have - is it

1 an automatic CO2 system, or is it -

2 MR. RUBANO: It's an automatic CO2 system.

3 CHAIRMAN STETKAR: Automatic CO2.

4 I guess, you know, why the concern about  
5 transient combustibles? You have an automatic  
6 detection and suppression system and you couldn't put  
7 out the fires fast enough if they happened in there?

8 MR. RUBANO: 6850 basically would drive you  
9 to a relatively large fire. The suppression system is  
10 not super fast. So, some damage would occur before  
11 the suppression system actuated. So, when you go put  
12 all those pieces together, it drives you down this  
13 risk path.

14 Now, part of it stems from the original  
15 Appendix R-type assumptions. So, if you took a full  
16 room burn-out, you have mostly one division, but there  
17 is a little piece of the second division there. So,  
18 you would have big problems.

19 So, if you have any fires that drive you  
20 in that direction, the risk goes up. That's an  
21 automatic kick-you-over-the-edge-type situation.

22 CHAIRMAN STETKAR: I understand, but  
23 that's, you know. We heard 900 fire scenarios from  
24 fire modeling from DC Cook to address those types of  
25 issues.



1 MR. RUBANO: There are at least 500  
2 scenarios at Duane Arnold. It's not - fire modeling  
3 scenarios like you had talked about basically are  
4 taking the frequency and breaking it up into smaller  
5 and smaller pieces throughout. And not every part of  
6 that frequency results in that significant damage.

7 The problem you have is that we've  
8 generated a mountain of data with just what we have  
9 now to do that on an extensive basis. You keep  
10 generating more and more data that you have to keep  
11 configuration control over.

12 It's a balancing act of how much effort  
13 you want to put in to do that versus how much effort  
14 it's going to be to maintain that going forward.

15 And that's a real concern of ours that the  
16 more data we generate, the harder it's going to be to  
17 maintain this going forward.

18 CHAIRMAN STETKAR: That's certainly true.

19 MR. RUBANO: So, we'd like to take big  
20 swipes and big things that it's hard to - it's hard to  
21 make the configuration control difficult.

22 As far as the restriction in this room,  
23 this room's got restrictions for all kinds of reasons.  
24 So, it's going to be restricted. It's not something  
25 that's going to change.

1 And because of the CO2 system, it's  
2 basically restricted during non-power operations also  
3 unless you really have to go in there.

4 MR. JULKA: Which is rare.

5 MR. RUBANO: And it's rare. And if we do  
6 got to go work in there, that's a special occasion.  
7 We'd have to do - there would be all kinds of pre-  
8 planning and stuff that had to be done to do that.  
9 So, it's not something we'd casually just go and do.

10 This is also the room where the NRC  
11 questioned about the placement of the transient fire.  
12 So, the part with the second division is back in the  
13 back. You have to crawl underneath a bunch of cable  
14 trays to get there. It's really difficult to get to.

15 It's hard to get in the room to begin  
16 with, but then to get to that particular area is very  
17 hard. So, we did put a transient back there to answer  
18 the RAI.

19 When they had done the analysis on the  
20 cable spread room, they had taken a bounding CCDP on  
21 the cable spread room. And the damage from that  
22 transient in that location is no worse than the  
23 bounding CCDP that we had already used the analysis.  
24 So, essentially there's no result in the end.

25 MR. JULKA: We already talked about this.

1 Do we need to talk anymore on this?

2 MR. RUBANO: So, at Duane Arnold, the only  
3 other factor - at Duane Arnold, only one percent of  
4 the CDF/LERF values are transient fires. And that's  
5 probably due to the fact that it's a BWR. It has very  
6 large fire zones. It's very hard to -

7 CHAIRMAN STETKAR: That's what I noticed.  
8 You only have a handful of fire areas.

9 MR. RUBANO: Yes.

10 MR. JULKA: 13 or 14, I think.

11 CHAIRMAN STETKAR: Yes. Well, I said  
12 handful. A small number.

13 MR. RUBANO: So, the reactor building is  
14 four-by-four. It's like it's tremendous size areas.  
15 All right. The smallest fire areas are the switchgear  
16 rooms. They're basically all by themselves, but the  
17 areas are typically very large. Even with the large  
18 fire areas, Duane Arnold has very good separation.

19 So, even within the reactor building which  
20 is each floor or each two floors is a single fire  
21 area, there's enough separation between the divisions  
22 that you can't get a fire that does significant damage  
23 to both divisions at the same time.

24 So, that's the - that's really an  
25 advantage of a BWR. BWRs are naturally better suited

1 for that.

2 I couldn't make the same statement about  
3 the one percent for - my PWR is certainly more than  
4 one percent for transient fires. So, this is - Duane  
5 Arnold is a unique case.

6 We did go back and use - looked for  
7 specific areas where a larger fire would make a  
8 significant difference in the target set. And there  
9 was very few, because the areas are so big and the  
10 ceilings are high.

11 So, unless you - and almost impossible to  
12 form a hot gas layer. So, unless you're directly in  
13 the plume, you don't see much damage from those fires.

14 CHAIRMAN STETKAR: Given the fact that your  
15 fire core damage frequencies are relatively low -  
16 well, I won't ask that.

17 MR. RUBANO: Anything else on that?

18 MR. JULKA: I think we already touched base  
19 on that, that the models are out of synch at this  
20 point. And there are certain changes which are not in  
21 the internal as well as the external.

22 Right now we do not have any of the B.5.b  
23 type in our model, internal or fire at this point in  
24 time. Although some sites are trying to include that  
25 at this time, we have not done that as yet because of

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1 certain things have to be met before we use that as  
2 far as having it in the maintenance rule or places  
3 like that.

4 So, we are not at that point where we have  
5 utilized. So, that will be something which we'll be  
6 thinking about in the future. These three items, I  
7 think they're going to give us a good amount of  
8 benefit as far as risk impact.

9 (Discussion off the record.)

10 MR. JULKA: Sensitivity analysis, I think  
11 we touched base this morning. We did do a sensitivity  
12 analysis on several of the areas.

13 Kiang Zee, you want to offer any more  
14 detail on the sensitivity assumptions?

15 MR. ZEE: I guess if this were an analysis  
16 for a different plant, this discussion might be a lot  
17 more interesting, but it is a little bit of a  
18 softball.

19 Duane Arnold because of all the issues  
20 that Vinny mentioned, happens to be a pretty well-  
21 behaving plant with respect to having to do fire PIA  
22 on it.

23 Desensitivity studies are pretty much  
24 parametric things that can be simply propagated  
25 through the analysis. So, unless there's something

1 specific you want to explore, I don't know that  
2 desensitivity studies are necessarily - are going to  
3 provide a tremendous insight into anything in  
4 particular.

5 CHAIRMAN STETKAR: And, Kiang, you did  
6 propagate all of the parametric uncertainties through  
7 the model, or did you not?

8 MR. LEE: Well, be careful now. We  
9 propagated the uncertainties parametrically that we  
10 can do mathematically with the tools that were  
11 available.

12 Now, I say this carefully, because in an  
13 earlier discussion I got an impression from where you  
14 wanted to go with this.

15 So, as an example, if I wanted to deal  
16 with the entire heat release rate distribution  
17 function, for example, and wanted to do uncertainty  
18 there, what would happen is I would have to run that  
19 part of the uncertainty analysis. And the results of  
20 that fire model with that set of uncertainty would get  
21 mapped to, if you will, a set of discretized results  
22 of the damage factor.

23 Because I could play as much as I want  
24 within the distribution function. But until I change  
25 the definition of the damage vector or damage set that

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1 that fire causes, I don't have a calculable change in  
2 my CCDP solution.

3 So, conceptually you can think about it in  
4 the sense of fire modeling leads to a damage set which  
5 leads to a flag file that I want to propagate to a  
6 quantification. And until the definition of that flag  
7 file changes, there's really nothing to put in, in a  
8 continuous function.

9 So, it becomes a little difficult to try  
10 to integrate the two uncertainty analyses because  
11 they're actually detached and you have to actually  
12 intercept that uncertainty analysis and insert in that  
13 different solution to the CCDP model and then switch  
14 over and continue the uncertainty analysis, and switch  
15 again when you get to the next one. And while it can  
16 be done and it practically -- it can be done, but it  
17 can't practically be done.

18 If I want to take my half, I wanted to do  
19 this and you sent me away, I might be able to come  
20 back in six months and give you the solution for one  
21 fire area, but I would have to intercept that  
22 uncertainty analysis with each time the flag file has  
23 to change.

24 CHAIRMAN STETKAR: Okay. I hear what  
25 you're saying. I hear what you're saying.

1 MR. ZEE: It conceptually can be done.

2 CHAIRMAN STETKAR: Yes, it can be done.

3 And people have done it. And it doesn't take six  
4 months to do. That's all I'm saying.

5 If you think about how to do it, it  
6 doesn't take six months to do. But you have to want  
7 to think about how to do it.

8 MR. RUBANO: So, a couple of things that  
9 are mentioned on this slide, I want to point out the  
10 second bullet there, potential impact to switchgear  
11 room modifications to provide additional source of AC  
12 power.

13 What you'll see in the next couple slides  
14 is the fact that the switchgear rooms account for the  
15 majority of the risk at Duane Arnold. And it's  
16 basically similar to what DC Cook described this  
17 morning on loss of offsite power and then relying on  
18 a single diesel. And then the diesel reliability  
19 terms and the out-of-service time for maintenance,  
20 stuff like that becomes a driver for the risk.

21 So, we actually thought about - we looked  
22 at what we could do to reduce risk in those rooms.  
23 And those rooms are very sensitive to this.

24 The problem is, is that it's tough to  
25 define a solution to that if cable trays aren't across



1 the top of the switchgear. For some of the fire bins,  
2 we could come up with some protection. But the ones  
3 that are particularly difficult, the high-energy  
4 arcing faults, it's tough to define how much  
5 protection you really need to protect some of that  
6 stuff in that situation.

7 So, how to get that benefit is a little  
8 bit of a concern being able to convince everybody that  
9 that particular shield, that design or something like  
10 that would actually pass those requirements.

11 So, that's the difficulty in that. It's  
12 a big driver in risk. Those areas are in fact  
13 deterministic. So, you know, there's no - it didn't  
14 drive delta CDF. It just drove CDF and LERF.

15 CHAIRMAN STETKAR: And you said high-energy  
16 arcing faults are driving the switchgear rooms. Did  
17 I understand that right?

18 MR. RUBANO: That's one of the scenarios  
19 that's driving the switchgear rooms.

20 CHAIRMAN STETKAR: Okay.

21 MR. RUBANO: There's several scenarios.  
22 All the bins that involve the fires from the  
23 switchgear drive the results in the switchgear rooms.

24 CHAIRMAN STETKAR: Yes.

25 MR. RUBANO: There are potential solutions

1 to some of those fires.

2 CHAIRMAN STETKAR: Some of the smaller  
3 ones.

4 MR. RUBANO: Some of the smaller ones. But  
5 the high-energy arcing fault, basically there's no  
6 good solution to that right now.

7 CHAIRMAN STETKAR: Right. As demonstrated  
8 by a few fires we've had in real plants.

9 (Laughter.)

10 MR. JULKA: So, in order to understand that  
11 we said, let's draw total picture. What does it look  
12 like? Sit back and see what does it look like from  
13 fire?

14 So, this is the picture which we are  
15 getting for the entire hazard distribution for the  
16 site. And I think looking at other sites, we are  
17 pretty much getting the same information on a - this  
18 is a BWR. So, PWRs are pretty much getting even worse  
19 than this right now. We're saying over 90 percent of  
20 the risk is driven by fire.

21 Now, like I said, we have some  
22 improvements to make, which we will be, but they are  
23 incremental. They are not really big picture. I  
24 think if you're going to do something, we got to look  
25 at it, see what can be done.

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1           It's like we've talked to all the PRA  
2 analysts, we're looking back and saying, well,  
3 something is not right about this picture.

4           CHAIRMAN STETKAR: Why is something not  
5 right about that picture?

6           MR. JULKA: Is that true that based on the  
7 industry data, is fire driving the majority of the  
8 risk? We're questioning ourselves. Is this true, or  
9 is it not true?

10          MR. RUBANO: My original thoughts back in  
11 the beginning of like 2005 time frame, was that fire  
12 risk was going to be on the same order of magnitude as  
13 the internal events risk.

14          And what we're finding now, right now with  
15 the existing numbers we have, is that fire risk is  
16 considerably larger than that, and some of it may be  
17 where we stopped the analysis.

18          MR. JULKA: yes, I think that's -

19          MR. RUBANO: And as I said before, we've  
20 generated a mountain of data. We're trying to prevent  
21 generating a second mountain of data to make that fire  
22 risk section go down.

23          MR. JULKA: And I think like we were  
24 talking earlier, you know, we stopped at a certain  
25 point when the risk numbers were, you know,

1 acceptable.

2 CHAIRMAN STETKAR: Go back to your Slide  
3 Number 7.

4 MEMBER BLEY: You're about where internal  
5 events used to be.

6 MR. RUBANO: Right.

7 CHAIRMAN STETKAR: So, back to - and you  
8 haven't incorporated those changes into this model.

9 MR. JULKA: Right.

10 CHAIRMAN STETKAR: Nor have you thought  
11 ever in your life about how you might focus plant  
12 improvements, procedure - either hardware  
13 modifications, procedure modifications, whatever, on  
14 fire.

15 MR. JULKA: Right, right.

16 CHAIRMAN STETKAR: Because you've never had  
17 these insights.

18 MR. JULKA: Uh-huh.

19 CHAIRMAN STETKAR: So -

20 MR. JULKA: Yes, as we gain insights, I  
21 think it's going to, you know. Yeah, you are right.  
22 That's where we started out when we did the IPE and  
23 IPEEEs, you know, in the late '90s.

24 We have come significant ways from where  
25 we were based on the insights we have gained.

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1 (Discussion off the record.)

2 CHAIRMAN STETKAR: It's, you know, people  
3 say, well, I don't believe the fire risk is this high.  
4 This picture here, this red picture, is basically your  
5 understanding of what the fire risk is based on the  
6 analyses you've done to date.

7 MR. JULKA: Yes.

8 CHAIRMAN STETKAR: And if there are  
9 conservatisms left in those analyses, they can be  
10 addressed.

11 MR. JULKA: Yes.

12 CHAIRMAN STETKAR: If there are some real  
13 issues like high-energy arcing - if, for example,  
14 high-energy arcing faults in switchgear rooms are  
15 driving this, there may not be much to, you know,  
16 there's some elements of probably realism here. Some  
17 elements of conservatism.

18 MR. JULKA: Yes, there are some insights we  
19 get from the analysis, definitely. You know, in the  
20 historical data up until now, what we have been doing  
21 is for significant determination process.

22 We take the internal events. We double it  
23 saying this is our total risk. Can we do that  
24 anymore? Probably not.

25 So, that's where we are. So, what we

1 wanted to do was further look at it, you know. We do  
2 this full-panel chart, we call it. We do that for  
3 internal events for ops people to look at.

4 And one of the fellows who is there, Ted,  
5 he came up with the idea, hey, let's look at full-  
6 panel chart for this and see what does it show us.

7 So, this shows that essential switchgear  
8 room, you know, Div 1 and Div 2, they contribute most  
9 of the risk.

10 CHAIRMAN STETKAR: I'm going to ask you a  
11 little bit about this, actually. Dug in a little and  
12 you might need some help.

13 The - I'm terrible with colors. The CRS,  
14 CR, CB, HVAC, the three percent wedge in the upper  
15 left-hand corner from - that includes the cable room -

16 MR. RUBANO: Cable spread room.

17 CHAIRMAN STETKAR: Cable spread -

18 MR. RUBANO: Control room.

19 CHAIRMAN STETKAR: Basically fire area CB1.

20 MR. RUBANO: That's correct. It's CB1.

21 CHAIRMAN STETKAR: In your analyses, you do  
22 have a - I've forgotten what you call it. Your  
23 alternate shutdown.

24 MR. RUBANO: Remote shutdown panel.

25 CHAIRMAN STETKAR: Yes, remote shutdown

1 panel.

2 That, in the PRA model, essentially for -  
3 is it all fires in there people relocate to the remote  
4 shutdown panel the way they're treated?

5 MR. RUBANO: No.

6 CHAIRMAN STETKAR: No?

7 MR. RUBANO: So, there's several things we  
8 did for the control room. For the control room, we  
9 did the required abandonment criteria based on  
10 habitability. So, density and/or smoke and whatever  
11 else, heat. So, you've got a set of you have to leave  
12 the control room.

13 Then we came across a couple of panel  
14 fires within the control room that if you left the  
15 control room or had to leave the control room because  
16 of that panel fire, there's a low likelihood that even  
17 if you successfully got to the remote shutdown panel,  
18 that you actually could mitigate the consequences of  
19 that fire because the damage would be too quick, too  
20 soon. By the time you got there, you could not gain  
21 enough control, all right?

22 Some of those panel fires were more  
23 successful - you would be more successful in the  
24 control room because you had more equipment still  
25 available in the control room than on the remote

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1 shutdown panel.

2 So, all those cases were considered.

3 CHAIRMAN STETKAR: Okay.

4 MR. RUBANO: All right. So, there are some  
5 panels where essentially leaving the control room -  
6 the CCDP is one. There's essentially no recovery.

7 CHAIRMAN STETKAR: Okay.

8 MR. RUBANO: If you had to leave for that  
9 panel - if you left for that panel, the probability of  
10 success is very, very low.

11 CHAIRMAN STETKAR: Okay, okay.

12 But for the action when the operators did  
13 abandon the control room and go to the remote shutdown  
14 panel, in the PRA they were guaranteed to be  
15 successful; is that right?

16 MR. RUBANO: No.

17 CHAIRMAN STETKAR: No? You assigned an  
18 HEP?

19 MR. RUBANO: We actually assigned a  
20 surrogate which we did backup. So, in the industry  
21 floating around for a long time has been a CCDP of 0.1  
22 for abandoning the control room and using the remote  
23 shutdown panel.

24 So, we went and actually looked at the  
25 actions. And if we did real calculations for HEPs,



1 we'd come up with a number that is considerably less  
2 than 0.1. And we used 0.1 as a bounding factor.

3 CHAIRMAN STETKAR: 90 percent success.

4 MR. RUBANO: Right.

5 CHAIRMAN STETKAR: I was -

6 MR. RUBANO: And at Duane Arnold, it's  
7 reasonable at Duane Arnold because the remote shutdown  
8 panel is relatively well-equipped and the normal  
9 isolate switches are relatively easy.

10 It's not exotic as some of the other  
11 places are.

12 CHAIRMAN STETKAR: Let me ask you - I was  
13 thinking about this. I used to work in a plant and  
14 I've seen a few older plants that have backfit - your  
15 remote shutdown panel was backfit, right? It wasn't  
16 built when you built the plant.

17 I didn't see any fire scenarios in the -  
18 I know the remote shutdown panel is someplace out in  
19 the reactor building. I couldn't figure out exactly  
20 where it was, because I couldn't. I couldn't find any  
21 fire scenarios that seem to affect the remote shutdown  
22 panel.

23 Is the remote shutdown panel at Duane  
24 Arnold - in some older plants, what they did is they  
25 installed a remote shutdown panel basically in series

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1 with the control room.

2 Control signals start at the control room  
3 and went to the remote shutdown panel and went to the  
4 cabinets or motor control centers or switchgear or  
5 wherever they were going such that if you had to  
6 abandon the control room, you basically cut the tie  
7 from the control room and controlled from the remote  
8 shutdown panels.

9 In other plants, the remote shutdown panel  
10 is effectively in parallel with the control room such  
11 that you have to actually enable the remote shutdown  
12 panel.

13 MR. RUBANO: It's a mix, but mostly the hot  
14 shutdown panel is -- wrong plant. Remote shutdown  
15 panel is mostly de-energized. So, it's mostly in  
16 parallel.

17 CHAIRMAN STETKAR: Okay, okay.

18 MR. RUBANO: And I know what you're talking  
19 about. So, if you have a -

20 CHAIRMAN STETKAR: If you have a fire at  
21 the remote shutdown panel, it's worse than the main  
22 control room because you can't do anything.

23 MR. RUBANO: Right, right. I have - one of  
24 my sites has that problem.

25 CHAIRMAN STETKAR: Duane Arnold isn't -

1 MR. RUBANO: No.

2 CHAIRMAN STETKAR: Okay.

3 MR. RUBANO: But one of my sites has that  
4 problem. The remote shutdown panel turns out to be a  
5 pretty significant scenario.

6 CHAIRMAN STETKAR: Yes, okay. Thanks.

7 MR. JULKA: Then I guess we needed to get -  
8 say, okay, essential switchgear room dominates the  
9 risk. Why is that?

10 So, we started looking at all the cut  
11 sets.

12 CHAIRMAN STETKAR: Let me - I'm sorry.

13 MR. JULKA: No, that's fine.

14 (Discussion off the record.)

15 CHAIRMAN STETKAR: One thing I was trying  
16 to understand - do you have a separate slide that  
17 you're going to talk about the control room, or are we  
18 done with the control room?

19 MR. JULKA: No, we didn't have specific  
20 slide on the control room.

21 MR. RUBANO: The only thing we're talking  
22 about a control room is the modification we're making  
23 for detection.

24 CHAIRMAN STETKAR: Let me ask this then.  
25 And I may have misinterpreted what I was reading. I

1 thought that I read that in fire area CB1 there were  
2 systems and trains of systems that were not credited  
3 in the PRA analysis.

4 And in particular, I thought that I read  
5 that Division 1 AC electric power was not credited.  
6 In other words, that you assumed Division 1 AC  
7 electric power was guaranteed to be failed for all  
8 fires in fire area CB1.

9 Is that true, or was I misreading  
10 something?

11 MR. RUBANO: I don't think that's true.

12 CHAIRMAN STETKAR: Okay.

13 MR. RUBANO: The cable spread room in  
14 particular is mostly Division 1.

15 CHAIRMAN STETKAR: Yes.

16 MR. RUBANO: So, fires in there would tend  
17 to disable all of Division 1, but that's not a - we  
18 did not make that a universal assumption. It actually  
19 had to be the consequence of the scenario.

20 CHAIRMAN STETKAR: Okay, okay. Thanks.  
21 All I was reading was Attachment C. And a lot of  
22 times, you know, it's kind of abbreviated information.

23 MR. RUBANO: Yes.

24 CHAIRMAN STETKAR: So, thanks. That helps.

25 Again, what I'm trying to do at least some

1 of the questions I'm asking, is to try to understand  
2 from these three different applications are there any  
3 kind of shortcuts or simplifications or kind of hold-  
4 overs from Appendix R think, if you will, that are  
5 being pulled over into the PRA models either  
6 simplifying assumptions or something that might make  
7 the PRA results more conservative, but simplify the  
8 models.

9 MR. RUBANO: Well, one of - I mean, one of  
10 the common things that - and we haven't said much  
11 about that at Duane Arnold, but DC Cook talked about  
12 the conditional circuit failure probabilities this  
13 morning. Same issue at Duane Arnold.

14 So, we basically when you first do your  
15 cable mapping, basically you got a component, you got  
16 cables. Okay, if I damage those cables, the component  
17 does the wrong thing, right?

18 You can go back and you can get more  
19 sophisticated. You could still put a conditional  
20 probability of actually getting that state in based on  
21 that cable. You can take a closer look at what the  
22 cable actually does to that component's function and  
23 things like that. But again, first cut is I damaged  
24 the cable, component is bad.

25 And you typically don't go past there

1 unless you really have to. Again, you start - we have  
2 concerns about configuration management and stuff like  
3 that going forward.

4 Because if I take a particular cable and  
5 they say it's got a conditional damage probability  
6 because it's this and that and because it only does  
7 this function on the component and if I change the  
8 circuit around, now I have to worry about all those  
9 assumptions again. It sort of locks me into now I  
10 have to make sure that they actually fail that same  
11 way each time.

12 CHAIRMAN STETKAR: Yes.

13 MR. RUBANO: We use it when we have to, but  
14 we typically do not start that way.

15 CHAIRMAN STETKAR: Yes, okay.

16 MR. JULKA: So, then we want to understand,  
17 I guess, what are the further insights into this, what  
18 is this chart telling us?

19 And what we found out was that essential  
20 switchgear room, we already talked about it, was the  
21 dominant scenario of the LOOP, like I think DC Cook  
22 talked about earlier, due to fire with opposite  
23 standby diesel generator in maintenance.

24 So, we see that 46 percent of the risk is  
25 driven when I come to the maintenance. These

1 scenarios involve the loss of offsite power. And due  
2 to fire damage opposite diesel as in maintenance, that  
3 contributes too.

4 So, I think we haven't really fully  
5 evaluated, okay, well, you know, how do we - what do  
6 we do about it? I think it's something we can do  
7 something with it. It's risk insight which is coming  
8 to us. What do we do with it? I think we still have  
9 to think about it a little more on how we evaluate  
10 this.

11 But it does show us that, you know, there  
12 is consistent - separation is there in the plant based  
13 on, you know, things we have seen so far. And the top  
14 contributors are diesel. We expected that. River  
15 water which is our ultimate heat sink, and service  
16 water maintenance dominates, you know, maintenance  
17 dominates. I guess that's the key thing we found out.

18 CHAIRMAN STETKAR: What does your internal  
19 - your internal events PRA results show similar  
20 combinations. I mean, you know, there are no internal  
21 - well, I have to be careful, but -

22 MR. JULKA: Pretty much. Pretty much.

23 CHAIRMAN STETKAR: -- for loss of offsite  
24 power, combinations of diesel maintenance and hardware  
25 failure.

1 MR. JULKA: SBO, station blackout.

2 MR. RUBANO: But the resulting risk is much  
3 lower because to --

4 CHAIRMAN STETKAR: True.

5 MR. RUBANO: You have a single diesel in  
6 maintenance. The other one is available that may have  
7 a failure.

8 CHAIRMAN STETKAR: Right.

9 MR. RUBANO: But now you got the rate of  
10 failure probability combined with the maintenance  
11 term.

12 CHAIRMAN STETKAR: Sure.

13 MR. RUBANO: Where the failure of the first  
14 train is essentially set to one by the fire.

15 CHAIRMAN STETKAR: That's why fires are so  
16 interesting.

17 MR. JULKA: So, yes, you know, it shows us  
18 that separation does exist in cables. Usually we  
19 didn't expect that based on the older plant. A lot of  
20 the plants are having issues with cable separations.  
21 And I know we are, but other PWRs tremendous problem  
22 with cable separation.

23 MEMBER BLEY: I've just been stewing over  
24 your cable spreading room. The reason I'm stewing is  
25 because even though you say these are a lot bigger

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1       than your internal events, these are really small  
2       numbers. They are.

3               So, if once every ten years you do hot  
4       work in that cable spreading room, and I would guess  
5       you would tag out the CO2 system if you're going to  
6       send a guy in there to do hot work -

7               MR. RUBANO: Yes.

8               MR. JULKA: Definitely.

9               MEMBER BLEY: -- you might be talking  
10       about numbers right in the same ballpark, you know.  
11       All your reasoning sounded good until you look at the  
12       numbers we're comparing it to, and I'm not so sure  
13       it's a reasonable thing to pitch it.

14               And I know you don't want to leave the CO2  
15       on when a guy goes in there. At least I wouldn't want  
16       to be the guy.

17               CHAIRMAN STETKAR: Not with that size door,  
18       you wouldn't.

19               (Laughter.)

20               (Discussion off the record.)

21               MR. JULKA: There will be firewatch there.

22               MEMBER BLEY: There would be a fire watch  
23       there.

24               MR. JULKA: There will be fire watch.

25               MR. RUBANO: In addition, the way they tag

1 out the CO2 systems, they'll put it to manual. So,  
2 even if we were to have a fire there and we got  
3 everybody out, we could actually -

4 MEMBER BLEY: Close the door and pop it,  
5 yes. Okay. It was just nagging at me since you  
6 talked about it.

7 MR. RUBANO: It's not a total disablement  
8 of the system. It's just -

9 MEMBER BLEY: These small numbers trick us  
10 sometimes because they're a lot smaller than our  
11 everyday experience.

12 MR. JULKA: So, like we said, you know, if  
13 you combine them both right now, fire does dominate  
14 the way it is right now. So, yes, John, we may make  
15 changes in the future or improve it.

16 And also if you look at it, 6850 was  
17 developed a long time ago. And I think industry is  
18 learning more. So, as we go along, I think things  
19 will be updated in the future.

20 CHAIRMAN STETKAR: You did look at multi-  
21 compartment fires?

22 MR. JULKA: Yes.

23 CHAIRMAN STETKAR: Okay. I mean, the way  
24 you defined your fire areas, you probably didn't have  
25 many multi-compartment fires.

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1                   MR. RUBANO: I mean, I said this before,  
2                   the smallest fire areas are the switchgear rooms and  
3                   battery rooms, stuff like that, but those rooms are  
4                   basically totally enclosed. So, the battery  
5                   reliability is very good.

6                   MR. JULKA: We're going to talk about some  
7                   modifications.

8                   MR. RUBANO: Modifications. So, we have  
9                   essentially just two modifications that we have  
10                  proposed at Duane Arnold.

11                  The first one is incipient detection in  
12                  the main control room, and I know some of the staff  
13                  doesn't like the name incipient detection, it's a very  
14                  early warning system, but essentially the same thing,  
15                  and emergency service water circuit modification, and  
16                  I'll just tell you about the service water  
17                  modification first.

18                  It's basically just adding some fuses to  
19                  the circuit to prevent the circuit from being taken  
20                  out by a fire in the turbine building. That's just  
21                  the way the cables are run. We're just going to get  
22                  rid of the problem by putting a couple fuses in. So,  
23                  we just got rid of that problem.

24                  Incipient detection in the control room,  
25                  so there was challenges. We came across challenges,

1 as I said before, between getting to the ultimate  
2 shutdown capability that we have versus what some of  
3 the multiple spurious combinations that we could come  
4 up with in the control room specifically like the SRV  
5 control panel and stuff like that.

6 So, the GE analysis that was originally  
7 done for Duane Arnold had a certain number of SRVs  
8 opening, had so much time to get isolation switches on  
9 the way to the remote shutdown panel. So, the  
10 isolating, you've got the remote shutdown panel, now  
11 you have control.

12 When you take a hard look at that, as I  
13 said before, if all those valves were to open, getting  
14 to those isolation switches and then getting to the  
15 remote shutdown panel, you may not have enough  
16 equipment left to mitigate the consequences of that  
17 particular event.

18 And we found several panels in the control  
19 room with similar type situations where the amount of  
20 equipment lost could put the plant in a very bad  
21 position and not as easily recoverable from the remote  
22 shutdown panel as you would think it would be.

23 So, what we're doing - what we did for  
24 that is to basically put this detection system - we're  
25 putting this detection system in those panels to

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1 ensure that we don't get that panel fire that  
2 encompasses the panel.

3 This also reduces the fraction of fires  
4 that would cause control room abandonment. By  
5 catching the fire in an incipient stage, you lower the  
6 probability that the fire will grow to a size that  
7 would cause the control room to be abandoned.

8 There was an RAI on this. We were  
9 challenged by the staff on the credit we took for the  
10 incipient detection. We based it on the fact it was  
11 on incipient detection.

12 It was pointed out to us that that fact  
13 was based on non-control room locations. So, some of  
14 the prompt suppression credit that is in the FAQ  
15 shouldn't be applied for the control room, because the  
16 control room is continuously manned.

17 So, we went back and we did an event tree  
18 type of analysis to show that the factors we use even  
19 when you take that credit out of there for that prompt  
20 suppression is still within the bounds that we have  
21 done in our original analysis and that we had  
22 submitted that response in the RAI.

23 We haven't heard back on that discussion  
24 yet. I'm sure we'll have more discussion on that  
25 going forward.

1           The industry is working on a FAQ to put  
2           forth the logic for how much credit you can get for a  
3           control room incipient detection system, and also how  
4           much credit you can get for an area-wide incipient  
5           detection.

6           Right now the FAQ only encompasses low-  
7           voltage cabinets, in-cabinet detection and we're  
8           trying to expand that to control room cabinets and  
9           area wide.

10          We believe incipient detection is a very  
11          good safety improvement. It's a much better detection  
12          system than the detection system we have.

13          It will detect a lot of equipment failures  
14          at a very early stage and allow you to essentially  
15          prevent the bad consequences.

16          CHAIRMAN STETKAR: I understand there's  
17          some evidence that works pretty well in cabinets. You  
18          mentioned area wide.

19          MR. RUBANO: Yes.

20          CHAIRMAN STETKAR: Has any testing been  
21          done about how effective it is for a larger -

22          MR. RUBANO: it is used area-wide in other  
23          industries. Obviously, we'd have to go and look,  
24          figure out how to credit that here.

25          One of my plants actually has an area-wide

1 system. We actually use it in lieu of the detection  
2 system that was there, because the detection system  
3 there did not meet code.

4 Very difficult area to make it meet code  
5 because of the beam pockets. It's relatively high-  
6 radiation area, scaffolding. It would be very  
7 difficult.

8 We put that system in and, let me tell  
9 you, it picks up an awful lot of stuff.

10 MR. JULKA: It does. I think Canadians use  
11 it and they're very happy with that system. And  
12 Calvert has it in the intake structure area. And Nine  
13 Mile, too, installed it then for the feedwater area.

14 CHAIRMAN STETKAR: I've seen it put in.  
15 I'm sure they have it cabinet-specific.

16 MR. RUBANO: Right.

17 CHAIRMAN STETKAR: In the main control  
18 room, you're only going to selectively install it in  
19 the most risk-significant panels, or are you going to  
20 -

21 MR. RUBANO: It's selected panels. And I  
22 believe it's basically the risk-significant panels,  
23 plus one adjacent to each - we're still working on the  
24 exact details of that, but the purpose is to make sure  
25 that we have some defense for fires that if they were

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1 to develop in those particular areas, the risk to core  
2 damage is pretty high and there's not a lot of things  
3 you can do to mitigate that.

4 CHAIRMAN STETKAR: One last question. That  
5 third sub-bullet where you say "full credit for  
6 incipient detection was challenged by the NRC," when  
7 I see words like "full credit," numbers like zero come  
8 to mind or 100 percent.

9 MR. RUBANO: No, no, this is the full  
10 credit that was in the FAQ. So, the FAQ said you can  
11 multiply the frequency by this much, and they  
12 challenged it. No, you can't. It's got to be less  
13 than that.

14 CHAIRMAN STETKAR: Okay. So, there was  
15 still some chance that it didn't -

16 MR. RUBANO: Oh, yes.

17 CHAIRMAN STETKAR: Okay.

18 MR. RUBANO: There's two issues in there -  
19 there's a whole host of issues of why the system won't  
20 fail. One, the system itself has a reliability. Two,  
21 even if the system alarms, you know, someone responds  
22 and doesn't find it, you know.

23 Three, even if they do, they don't get the  
24 fire out, you know. There's a whole host of things.

25 CHAIRMAN STETKAR: But your model had -



1 MR. RUBANO: Right.

2 CHAIRMAN STETKAR: -- that stuff in it.

3 MR. JULKA: So, those are the only two  
4 mods. I guess it's something that you will not hear  
5 in any PWRs.

6 CHAIRMAN STETKAR: I think we heard one  
7 this morning that had zero.

8 MR. RUBANO: No, they got a bunch of - DC  
9 Cook?

10 CHAIRMAN STETKAR: DC Cook.

11 MR. RUBANO: No, they're modifying some  
12 valves. A bunch of valves.

13 (Discussion off the record.)

14 MR. RUBANO: None of my other PWRs have  
15 those, are going to get away with a few mods.

16 MR. JULKA: So, this just says that, you  
17 know, the Kleinsorg Group and ERIN Engineering did the  
18 fire PRA development.

19 CHAIRMAN STETKAR: Anil, there was -

20 MR. JULKA: Modifications?

21 CHAIRMAN STETKAR: No, the fire PRA.

22 MR. JULKA: Okay.

23 CHAIRMAN STETKAR: Somewhere, and I can't  
24 find my reference right now, there was reference made  
25 to a couple of different codes that I think were cited

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1 as EPRI codes. Fran something or other.

2 MR. RUBANO: FRANK.

3 MR. JULKA: FRANK.

4 CHAIRMAN STETKAR: FRANK.

5 MR. RUBANO: Yes.

6 CHAIRMAN STETKAR: I don't know what FRANK  
7 is. I've never - is that -

8 MR. RUBANO: That's the -

9 CHAIRMAN STETKAR: Is that a preprocessor  
10 or a post-processor?

11 MR. RUBANO: No, that sits on top of CAFTA.

12 MR. JULKA: Quantification -

13 MR. RUBANO: Pulls the CCDPs out of CAFTA  
14 to do the -

15 MR. JULKA: It's just a quantification -

16 MR. RUBANO: It's a quantification  
17 essentially.

18 MR. JULKA: Helps with the quantification.

19 CHAIRMAN STETKAR: Okay.

20 MR. JULKA: It's EPRI tool.

21 CHAIRMAN STETKAR: Okay.

22 MR. JULKA: In fact, we made up another one  
23 now, FRANK. We're going to be going to that probably  
24 very soon.

25 CHAIRMAN STETKAR: Okay.

1 MR. RUBANO: FRANK has some limitations.

2 CHAIRMAN STETKAR: All codes have  
3 limitations.

4 MR. RUBANO: And FRANK, which is - it's the  
5 newer version, had some bugs. Probably those have  
6 been worked out and it does - it has better  
7 capabilities, but the data transfer is not - does not  
8 just flop the data over into the next program. So, it  
9 takes some thought to make the transfer.

10 CHAIRMAN STETKAR: Okay.

11 MR. RUBANO: So, as Anil was saying, fire  
12 PRA was developed by ERIN Engineering. They were part  
13 of a - they were subcontracted as part of a bigger  
14 transition contract and that basically supplements in-  
15 house resources.

16 We do not have the in-house resources and  
17 did not have in-house resources capable of doing this  
18 type of work.

19 A fire PRA from scratch is a very time-  
20 consuming effort. And our experience is that it's a  
21 much larger effort than originally thought because -  
22 well, again, you run through with the first cut and  
23 the numbers don't look the way you want them to look,  
24 and then you start going back and refining it.

25 And every time you refine it, you're

1 adding another layer of detail to where you are and it  
2 gets to be a very big animal very quick.

3 So, the fire PRA did use the current safe  
4 shutdown analysis as input. This is a little bit  
5 different than some people. Some people using the  
6 current fire PRA, some people have redone their safe  
7 shutdown analysis either as a precursor to going into  
8 NFP 805, or as part of NFP 805.

9 Duane Arnold used the real existing safe  
10 shutdown analysis as input because that - we did a  
11 sampling of that analysis, and the analysis was pretty  
12 solid. So, we could use that information.

13 And we - part of that is to make sure that  
14 the PRA model modeled failures that were in the safe  
15 shutdown analysis.

16 So, one of the difficulties you have when  
17 you base the fire PRA based on the internal events  
18 PRA, is that fire can cause failures that the internal  
19 events PRA never sees. So, we've had to go back to  
20 the internal events PRA, put stuff in there so the  
21 fire PRA could properly quantify what some of those  
22 failures are.

23 And that turns out especially when we were  
24 doing the 1.200 upgrade at the same time. Lot of  
25 moving parts.

1 CHAIRMAN STETKAR: That'S one of the  
2 reasons for my initial question about diverging  
3 models.

4 MR. RUBANO: That is a concern. We're  
5 working hard to make sure that we know what the  
6 differences are and keeping track of that, but that is  
7 a concern.

8 We put it all back together again, and we  
9 could have another surprise.

10 MR. JULKA: That will be our priority in  
11 the implementation, make sure we do that.

12 MR. RUBANO: Duane Arnold is in a  
13 relatively good position in that respect, because the  
14 modifications are not exotic and they're not very long  
15 term. So, the time frame is shorter than some other  
16 utilities, other sites.

17 I know my other sites, they have a much  
18 longer window for some of the modifications. So, the  
19 internal events model won't catch up to the fire model  
20 for several years, because we've got to wait for those  
21 modifications to be complete.

22 CHAIRMAN STETKAR: I still like to think of  
23 one PRA model that has evaluated a bunch of stuff.  
24 Some better than other things.

25 MR. RUBANO: We would like to keep it that

1 way, too, but it's difficult right now. There's a lot  
2 of moving pieces.

3 And we did the teamwork pretty well. We  
4 got some good cooperation between the PRA analysts and  
5 the safe shutdown analysts. They worked pretty  
6 closely together trying to understand why the PRA  
7 wasn't telling us sometimes the same thing the safe  
8 shutdown analysis was or vice versa.

9 So, we were able to work through a lot of  
10 those issues and we feel that we've captured all the  
11 information.

12 Challenges, all right. So, MSO list. The  
13 infamous MSO list is being updated at the same time as  
14 the review is being performed.

15 So, we performed an expert panel based on  
16 the MSO list that existed at the time. Came up with  
17 stuff we had to change in the PRA model. Came up with  
18 stuff we had to change in the safe shutdown analysis.  
19 Cranked in all those changes and the MSO list was  
20 revised. In fact, it was revised twice since the time  
21 we did the analysis. We'll probably have to go back  
22 and do some of that stuff again.

23 CHAIRMAN STETKAR: When did you have your  
24 final expert panel MSO evaluation in calendar time?

25 MR. RUBANO: 2010.

1 CHAIRMAN STETKAR: Two years ago.

2 MR. RUBANO: And we had to go back and do  
3 sort of a gap analysis for the latest revision to make  
4 sure we captured everything.

5 MR. JULKA: PWR OG.

6 MR. RUBANO: PWR OG maintains that list.

7 CHAIRMAN STETKAR: I know they've updated  
8 the MSO list in the last couple -

9 MR. RUBANO: Yes, PWR OG has updated that  
10 list also.

11 CHAIRMAN STETKAR: Right. But what I was  
12 asking is, you have not reconvened another expert  
13 panel for Duane Arnold to look at that updated list.

14 MR. RUBANO: No, we basically looked at the  
15 differences between the old list and the new list and  
16 the gaps.

17 The changes were not that significant so  
18 that we'd have to do the process again.

19 CHAIRMAN STETKAR: Okay.

20 MR. RUBANO: Again, it's a judgment call.  
21 And if you added one MSO or one item to it or  
22 something like that, it's not - convening the expert  
23 panel doesn't gain you anything. If they did a  
24 dramatic revision, then you would have to reconvene  
25 the panel and start again.

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1 CHAIRMAN STETKAR: Okay.

2 MR. RUBANO: The review process for the  
3 analysis methods was certainly more involved than  
4 envisioned.

5 When EPRI first started down with that  
6 review panel, they were talking about an 11 or a 13-  
7 week schedule for getting it done end to end, and none  
8 of them even came close to that schedule.

9 CHAIRMAN STETKAR: I guess I had a  
10 question, you know, as I was going through whatever it  
11 is, Attachment J, I think, that lists the different  
12 fire models that are used at least among the three  
13 that we're discussing today, your list was much, much  
14 longer in terms of NAMs, if you call them, compared to  
15 either of the other sites.

16 And one of the questions that I had going  
17 in was, why? I mean, why did you feel that it was  
18 necessary to use different tweaks on correlations that  
19 are used in, you know, FIVE or FDT or CFAST or things  
20 like that, you know?

21 MR. RUBANO: Excellent question.

22 So, what's not - hasn't been expressed  
23 here is that - is the fire modeling that underlies the  
24 fire PRA at Duane Arnold, right?

25 So, the control room had the traditional



1 CFAST model to determine optical density and things  
2 like that for the control room.

3 The remainder of the plant was done using  
4 a generic fire model and treatment. Basically, a pre-  
5 solved set of - for each bin a - if you want to call  
6 it a damage footprint, but a zone of influence for  
7 each bin that's in 6850.

8 So, for an electrical cabinet with a heat  
9 release rate of whatever that number is, all right,  
10 the - and that treatment considers both qualified  
11 cable and unqualified cable. Actually, thermoset and  
12 thermoplastic is the proper term, all right.

13 So, when the PRA analyst goes - does a  
14 walkdown, he has basically a checklist with that  
15 information and says, okay, so if I have an electrical  
16 cabinet that is not well sealed, all right, and I have  
17 thermoplastic cable, all right, the zone of influence  
18 for this fire is so many feet above and so many feet  
19 to the side and one of my targets within that area,  
20 all right.

21 There are limitations to that, because  
22 that's based on a host of correlations and CFAST runs  
23 and things like that, that put a bound around that  
24 whole thing.

25 And that's why there's a lot of that stuff

1 in there, because those form the boundaries of that  
2 analysis.

3 CHAIRMAN STETKAR: But I guess my question  
4 is that couldn't you have done the same thing, or am  
5 I misinterpreting perhaps that list?

6 Rather than saying, well, this correlation  
7 was documented in a certain contractor report, rather  
8 than using either the same correlation or a slightly  
9 different version of that correlation that's  
10 documented in FIVE or FDTS, you know, that had already  
11 been going through the V&V process.

12 I mean, you still have to do the  
13 calculation -

14 MR. RUBANO: Right, right.

15 CHAIRMAN STETKAR: -- whether you use this  
16 tool or this tool.

17 MR. RUBANO: That methodology that was used  
18 at Duane Arnold was originally developed for Ocone.  
19 That's where it started.

20 In fact, that was submitted to the staff.  
21 That general fire tree was submitted to the staff as  
22 a separate document.

23 CHAIRMAN STETKAR: Again, we're at a bit of  
24 a disadvantage here because we haven't -

25 MR. RUBANO: No, I understand.

1 CHAIRMAN STETKAR: -- formally seen the  
2 Ocone or Shearon Harris submittals. So, I mean,  
3 we've seen them, but not seen them.

4 MR. RUBANO: And we've used that same  
5 treatment generically at two of our other sites. So,  
6 it's not a Duane Arnold-specific analysis.

7 CHAIRMAN STETKAR: With the same suite of -

8 MR. RUBANO: Yes.

9 CHAIRMAN STETKAR: -- tools, okay.

10 MR. RUBANO: So, it's basically a common  
11 set of tools which we basically can transport from  
12 site to site to site.

13 CHAIRMAN STETKAR: Okay.

14 MR. RUBANO: All right. So, the bounds in  
15 there are a little bit wider, little bit slightly  
16 different in order to try to encompass the  
17 possibilities.

18 The questions we got from the staff - the  
19 fire modeling group that reviewed it at Duane Arnold  
20 liked the information. In fact, they thought it was  
21 very well done.

22 The biggest comments we got from the staff  
23 was not how did you come up with that information. It  
24 was how did the PRA analyst actually use it in the  
25 field? Did he understand the limitations that were

1 built into that treatment?

2 CHAIRMAN STETKAR: Right.

3 MR. RUBANO: That treatment says you can  
4 use it as long as the room size is no bigger than  
5 this, no smaller than that, no wider than, you know.

6 Did the PRA analyst actually go out and  
7 say, well, this room doesn't fit this, so I shouldn't  
8 use it here? That's the questions we really got from  
9 the staff.

10 CHAIRMAN STETKAR: Okay.

11 MR. RUBANO: And we went back a couple of  
12 times now with actually the author of those documents  
13 with the PRA staff to ensure ourselves that we in fact  
14 captured all the limits and the analyst actually  
15 applied it the right way.

16 There's multiple ways you can attack this,  
17 all right? So, you can have the PRA guys doing PRA  
18 work and the fire modeler doing fire modeling work and  
19 then transmitting information that way.

20 CHAIRMAN STETKAR: I've heard that.

21 MR. RUBANO: You can have PRA guys doing  
22 walkdowns and developing the scenarios themselves with  
23 the fire modeling dividing the input there. There's  
24 multiple ways to attack it.

25 It's a tool to help simplify walkdowns and

1 gathering information and what's in the box. So, that  
2 helps us with a little bit of configuration control  
3 going forward, because that box size which is somewhat  
4 conservative is not highly dependent on everything  
5 that's in that room, because it's generic enough that  
6 it fits multiple places.

7 So, I don't have to worry about if I  
8 change something small in that room, am I really  
9 impacting the whole analysis?

10 The more exacting the analysis gets, the  
11 more you have to be conservative with configuration  
12 management going forward.

13 So, this was an attempt to not burden  
14 ourselves with that going forward. It was a little  
15 bit different.

16 CHAIRMAN STETKAR: Yes, I was going to -  
17 that helps a little bit at least understand. Thanks.

18 MR. RUBANO: So, as we said before, the  
19 process for reviewing the analysis methods was a lot  
20 more involved than envisioned. The schedule took a  
21 lot longer.

22 The panel had lots of comments, changed  
23 lots of things, you know. So, again, every time they  
24 would change something, we'd have to go back and  
25 shuffle things around to see what we could do to

1 encompass that.

2 We've got some NRC staff disagreeing with  
3 some of the conclusions. So, it sort of puts you in  
4 a funny place sometimes when you use that.

5 Here you got a group of experts that say,  
6 hey, it's okay to do this. And then the NRC says,  
7 well, we're not really sure. We're maybe not going to  
8 accept this. It puts you in a little bit of a box you  
9 got to be careful of.

10 So, the responses to peer review findings  
11 required more rigor than previous submittals. That's  
12 something that Anil had mentioned that we were  
13 surprised at the depth of the questions on the peer  
14 review response findings. It appeared to be a lot  
15 more depth than we had originally expected from this  
16 type of application. So, it was challenging.

17 CHAIRMAN STETKAR: Sounds like you got a  
18 good peer review.

19 (Laughter.)

20 MR. JULKA: Yes, normally for risk-informed  
21 applications what we do is only identify open items,  
22 open findings, not findings we have closed.

23 MR. RUBANO: We identified them all.

24 So, we had made a comment before about the  
25 concurrent Reg Guide 1.200 internal events update and

1 the fire PRA development was - helped provide  
2 integrated results.

3 So, even though the models have some  
4 divergence, they're really not that bad because they  
5 were really, really developed together, but again gave  
6 us some difficulties in coordination. Now, we had a  
7 lot of moving parts.

8 So, the fire guys are like, hey, you know,  
9 Anil, I need to get this into the internal events  
10 model because I have no place to put that damage. And  
11 the internal events guy says, well, I'm changing that  
12 part of the tree right now. Can you add - it was  
13 quite a coordination challenge.

14 MR. JULKA: And it came at the same time.  
15 Reg Guide 1.200 Rev 2 came at the same time. So,  
16 everybody in the industry was really going after that  
17 at the same time we started developing the fire PRA.

18 CHAIRMAN STETKAR: Does Duane Arnold have  
19 any other risk-informed applications in-house right  
20 now?

21 MR. JULKA: We have - voluntary  
22 applications, we only have the 5 bravo.

23 CHAIRMAN STETKAR: Okay.

24 MR. JULKA: But, you know, we have ISI,  
25 risk-informed ISI and, you know.

1 CHAIRMAN STETKAR: Yes, but, I mean, that's  
2 less sensitive to the models.

3 MR. JULKA: Yes, right. So, the only one  
4 is 5 bravo. We have not done the 4 bravo as yet.  
5 That will be the next one, but that does need the fire  
6 PRA for 4 bravo.

7 So, we have not applied for 5069 as yet,  
8 but that's in the plan.

9 MR. RUBANO: Okay, implementation  
10 challenges. Right now we believe the fire PRA is very  
11 conservative. Some of it is due to the fact that we  
12 stopped where we stopped, some of it is due to the  
13 factors that go into 6850, some of it's due to the way  
14 we handled some of that stuff.

15 Regardless of how we got there, we have  
16 more work to do to make it more realistic.

17 CHAIRMAN STETKAR: And you didn't quantify  
18 uncertainties, propagate uncertainties through. So,  
19 you believe it's conservative, but you're not sure how  
20 conservative it might be.

21 MR. RUBANO: That's one of the problems.  
22 If I could put my finger on it saying that's the spot,  
23 you know, that's what I need, you can't.

24 When you examine everything that goes into  
25 this piece by piece, each piece looks reasonable.



1 Each piece doesn't look like it's out of whack or has  
2 anything like that.

3 But when you put them altogether and you  
4 get a result, you look at it and you say, well, you  
5 know, what is it trying to tell me?

6 We believe that the insights are valid.  
7 So, the insight we have that the switchgear room is  
8 the high risk and it's due to loss of offsite power  
9 with the opposite diesel in maintenance, that's a real  
10 insight.

11 We think the whole set of numbers is  
12 probably a little bit too high, but what it's telling  
13 us as far as what the real risk in the plant, is  
14 probably true.

15 CHAIRMAN STETKAR: That's an important  
16 conclusion. I'm glad to hear you say that.

17 MR. JULKA: And like you said, John, you  
18 know, we started with internal events high. I think  
19 that's a very good point. And where we are now, you  
20 know, it's order of magnitude improvement since we  
21 started.

22 MR. RUBANO: But as a result right now, the  
23 fire PRA numbers are very large compared to internal  
24 events, and we're not planning on using those as part  
25 of the upcoming maintenance rule (a)4 modification.

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1 We're not using the fire PRA for that because it would  
2 basically swamp the internal events and you would see  
3 nothing but fire risk when you try to do something  
4 like that, which would actually tend to mask internal  
5 events and events changes due to a maintenance item.

6 You wouldn't see it on the internal  
7 events, because the fire would be the only thing that  
8 would show up. So, that's not - they really don't  
9 want to do it that way.

10 As said before, most of the work was  
11 performed by consultants. Technology transfer is  
12 going to be a challenge. It's going to be a challenge  
13 in two ways. One, we got to learn. And, two, we have  
14 to have the staff. Right now the staff is going to be  
15 stretched pretty thin.

16 We have two models, keeping them up to  
17 date. And until we get them together, is also going  
18 to stretch the staff further.

19 We have implemented, I would call it,  
20 crude intermediate configuration control to make sure  
21 that we're not doing anything in the plant that would  
22 invalidate our application, but it's not the full-  
23 blown change evaluation type process yet. We're still  
24 working on that. And that's going to come together at  
25 about the same time as we get the SE.

1                   MEMBER SCHULTZ: Vinny, what leads it to  
2                   become an effort that's greater than envisioned? What  
3                   was missed?

4                   Is it the magnitude of the evaluation, all  
5                   the different pieces that have to be addressed, or  
6                   what in particular makes it that -

7                   MR. RUBANO: It's -

8                   MEMBER SCHULTZ: -- so much larger?

9                   MR. RUBANO: I don't think anybody will  
10                  recognize that when we first cranked through this  
11                  stuff, that the results we got were - when we looked  
12                  at them we said, well, this can't be right. There's  
13                  got to be something else wrong. And it caused us to  
14                  go back and look at it again and again and again doing  
15                  more and more refinements. It's not as simple as it  
16                  seems on the surface.

17                  Just like DC Cook said, you started off  
18                  with a couple scenarios. And then as you look at the  
19                  numbers, you're like, well, I can't live with that  
20                  number. So, you crank in some more scenarios. You  
21                  crank in some more conditional probabilities on  
22                  failure probabilities of cables, you know. You crank  
23                  in better fire modeling to see if I can not damage so  
24                  much stuff. And it evolves over time and it becomes  
25                  very big.

1           It's much - the data that's behind the  
2           fire PRA is much larger than the data that's behind  
3           the internal events PRA. And I think utility sites  
4           and groups were structured, you know, based on how  
5           hard or how much time it takes to do an internal  
6           events PRA and how much hard is it to update it and  
7           how do we keep that data going?

8           And when we got to the fire side, we  
9           discovered that that concept is wrong. It's not even  
10          close.

11          MEMBER SCHULTZ: Okay.

12          MR. RUBANO: And just keeping track of all  
13          the scenarios - so, if I have to - if I put a new  
14          cable in the plant - example this morning, put a new  
15          cable in the plant. Do I impact any of the scenarios?

16          Well, to determine that, I have to know  
17          where all the scenarios are, and there's a lot of  
18          them. That's something the design side of the house  
19          is going to have to learn how to look up and how to  
20          find out.

21          MEMBER RAY: Have you given any thought to  
22          how the NRC would oversee this from an ROP standpoint?

23          MR. RUBANO: Yes. So, there is a new  
24          inspection procedure out for the triennial that was  
25          piloted at Shearon Harris this year, I believe.

1 This year, Harry?

2 MR. BARRETT: Yes.

3 MR. RUBANO: This year and I think it was  
4 pretty successful. We probably have more work to do  
5 on it.

6 Shearon Harris, I mean, I think one of the  
7 reasons why it was successful at Shearon Harris is  
8 because a lot of people paid attention to it because  
9 it was new.

10 But ten years down the road when it  
11 becomes routine, we may find some bumps in the road  
12 because we don't have, you know, not everybody is  
13 paying attention.

14 So, I mean, I have that concern that how  
15 are we going to expect this in the future? How are we  
16 going to control it on both sides of the house?

17 MR. JULKA: But it's expected to be part of  
18 the inspection, I guess, qualified inspections people.  
19 And NRC does triennial -

20 MEMBER RAY: Well, it's become a lot more  
21 sophisticated with this change.

22 MR. JULKA: Right, uh-huh.

23 MEMBER RAY: At least first reaction is.

24 MR. JULKA: So, I presume they will need  
25 more people other than fire, like PRA people coming

1 along with that.

2 So, I think some of the stuff we have  
3 already talked about. Lessons learned, in summary, is  
4 upgraded internal events. We'll have to incorporate,  
5 like we said, implementation plan. We'll have to  
6 incorporate the rest of them.

7 We did get some risk insights, positive  
8 risk insights for looking at, like we said, 46 percent  
9 of the risk from maintenance, which is something we  
10 can do about as far as going forward.

11 I think we need to talk about this new  
12 analysis method. It's something I think as an  
13 industry we need to look at. What is the process  
14 going to be going forward?

15 Because as we move forward, are we going  
16 to find things we can do better? Better evaluations,  
17 you know. NFP 6850 was developed in early 2000. It's  
18 significant time lapse since then. So, I think we're  
19 going to learn more of industry. There's more data  
20 gathering going on. I think the industry is going to  
21 learn more.

22 Further improvements in testing is going  
23 on at the same time. So, I think we're going to learn  
24 so much more. So, it will be good to develop a  
25 process whether it's a revision to 6850 or some

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1 process to evaluate these changes in an expedited  
2 manner so people can use it, people who have not done  
3 it as yet, or even us that will like to improve.

4 John, like you mentioned, you know, we've  
5 got to have significant improvement in where we are as  
6 far as fire risk estimates are.

7 Next year, Vinny talked about it, (a)4  
8 implementation has to be done for all sites. And it  
9 does not have to be the quantitative model. People  
10 are using qualitative right now and NEI is engaged in  
11 industry process to see how that's going to be done  
12 and there's some pilots going on.

13 So, even for -- Duane Arnold will not be  
14 using the model as we have right now. It will just be  
15 used for NFP 805 application at this point. So, we  
16 are developing a qualitative - or going to  
17 qualitative. That's going to be next year.

18 Again, we talked about conservatisms, but  
19 some of it might be where we stopped, like you said,  
20 John. We did not - I'm not sure we're going to have  
21 the resources at this point to even go and refine it  
22 any further. Everybody has moved on to other things.  
23 Now, it's a matter of just keeping it up.

24 A lot of the work in the entire industry  
25 since there was a large amount of work and millions of

1 hours, it was done by contracted staff with the  
2 overview by the utilities.

3 We understand that. We are hiring people  
4 right now and training them in fire PRA. We have  
5 hired two people already. We have added to our  
6 corporate staff. We don't know how many more we're  
7 going to need, but right now looking at pilot plants,  
8 they have not made many changes to their fire PRA  
9 since they implemented it couple years ago.

10 So, it's estimated that not too many  
11 changes, modifications coming in the plants will be  
12 impacting fire PRAs that much because, you know, major  
13 modifications are not really that common anymore after  
14 this set of modifications.

15 (Laughter.)

16 MR. JULKA: Fukushima will be coming up,  
17 initiatives they're driving a lot of. We do not have  
18 any of those at any of our sites. That's something I  
19 think we need to look at it in the future. That can  
20 drive the risk down and it is there.

21 So, I know in the past there was a concern  
22 whether people will be able to find equipment,  
23 affordable equipment whether it's battery chargers or  
24 a new diesel. Everybody did buy a diesel, you know,  
25 as part of the Fukushima activities going forward.



1                   So, we have to - those are the things I  
2                   think we have to look at and see how we incorporate  
3                   those into our fire PRA and internal events, for that  
4                   matter.

5                   CHAIRMAN STETKAR: For PRA.

6                   MR. JULKA: I hear you.

7                   That's it. That's all we have, unless you  
8                   guys have any questions.

9                   CHAIRMAN STETKAR: I don't.

10                  Any of the members?

11                  MALE PARTICIPANT: Nothing.

12                  CHAIRMAN STETKAR: Thank you, and you're  
13                  getting us back on schedule. So, that was good. And,  
14                  again, I really appreciate your coming here. I know  
15                  it took a lot of effort to put this presentation  
16                  together and I do really appreciate that.

17                  What I'd like to do before we take a  
18                  break, I was originally planning to open up the bridge  
19                  line after each of the three presentations to see if  
20                  we had any comments or questions from anyone who's on  
21                  the bridge line.

22                  I failed to do that at lunch because of  
23                  the strange events of the morning. So, I'd like to  
24                  open up the bridge line right now to accommodate  
25                  people who perhaps don't want to sit around until six

1 o'clock out there.

2 If there's anyone out there, could you  
3 just do us a favor and say a word so we have  
4 confirmation that the bridge line is indeed open. We  
5 have no other way of knowing that.

6 MR. KALANTARI: This is Bob Kalantari from  
7 EPM.

8 CHAIRMAN STETKAR: Thank you, Bob.

9 Now, is there anyone out there who has  
10 either any comments or questions on either the DC Cook  
11 presentation or Duane Arnold?

12 (No response.)

13 CHAIRMAN STETKAR: Hearing none, I will  
14 assume that there aren't any.

15 Is there anybody in the room here, member  
16 of the public, anybody? If not, what we'll do is re-  
17 close the bridge line, and then we'll open it up again  
18 at the end of the Virgil Summer presentation.

19 And we will recess until - I'm going to be  
20 generous - 3:15.

21 (Whereupon, the above-entitled matter  
22 went off the record at 2:54 p.m. and resumed at 3:18  
23 p.m.)

24 CHAIRMAN STETKAR: We're back in session  
25 and we'll hear from Virgil Summer.

1 MR. KAMMER: Good afternoon. My name is  
2 Mike Kammer. I'm the NFP 805 project manager for VC  
3 Summer nuclear station up in Jenkinsville, South  
4 Carolina. A very well-populated area.

5 I've got Gerald Loignon with me. Gerald  
6 is the PRA supervisor and he'll be talking to the fire  
7 PRA technical issues, which is the subject of our  
8 discussion today.

9 Just to give you a little bit of  
10 background, the VC Summer station is nominal 1,000  
11 megawatt electric three-loop Westinghouse pressurized  
12 water reactor.

13 Our LAR was submitted in November 2011 for  
14 NFP 805. Our NRC onsite review was conducted in June  
15 of 2012.

16 We did have similar observations with  
17 regard to our cable spreading room that Vinny had.  
18 It's a very - just noting similarities with some of  
19 the previous discussions. Very limited application,  
20 very limited access. We took a little bit different  
21 approach, but we'll talk about that in a little bit.

22 The other thing I noted in the earlier  
23 presentations, people were talking about 800 to a  
24 thousand scenarios. We ended up with about 1500  
25 scenarios at our station, fire scenarios, in doing our

1 calculations.

2 Little background about VC Summer station,  
3 with our Appendix R analysis we were kind of termed as  
4 a self-induced station blackout plant. So, we kind of  
5 focused on shutting down the plant on bravo train and  
6 taking equipment away from operations that they may be  
7 able to utilize during shutdown, but that's not the  
8 way our original Appendix R analysis was built.

9 We had many operator manual actions in the  
10 plan. And we had also one really good benefit. We  
11 had a cable routing database that existed and we knew  
12 where cables actually existed in the plant. There was  
13 no assumptions, there was no unknowns with regard to  
14 cable routing. And we took advantage of that in doing  
15 the NSCA analysis, non-power operations analysis and  
16 also the fire PRA analysis. And we built upon that to  
17 move forward into the NFP 805 analysis.

18 As far as our project goals for 805, it's  
19 not only just the transition to 805. That's one of  
20 the goals. And transition within the bounds of the  
21 rules of engagement with regard to 805, namely 6850  
22 and the other requirements of NFP 805, but we also  
23 wanted to eliminate the SISBO strategy, which we did.

24 Along with eliminating the SISBO strategy,  
25 it comes along with a little bit of complication. It

1 was that we didn't transition Appendix R. We didn't  
2 transition our existing analysis. We more or less  
3 started from scratch, and I'll talk about that in a  
4 second.

5 One of the goals is that we want to  
6 eliminate as many operator manual actions as we could  
7 at the station. We saw that as an operator challenge  
8 and that was one of the goals going into the project  
9 to see what we could do to accomplish that.

10 We wanted to maximize the usage of our  
11 existing tools. Again, I mentioned the routing  
12 database that we had and knowing where the circuits  
13 are is a great benefit to the 805 analysis.

14 The other goal that I had for our  
15 contractors was we want to stay within the box of  
16 6850. We don't want to step outside and draw a lot of  
17 attention to a lot of issues that maybe some other  
18 utilities are experiencing. And we thought that was  
19 a good strategy and we kind of adhered to that  
20 strategy at VC Summer station.

21 Real quick, our approach to NFP 805, we  
22 started with a clean sheet of paper. We didn't take  
23 any assumptions. We didn't drag any baggage from our  
24 Appendix R analysis forward. We started from scratch,  
25 okay, including looking at critical safety factors,

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1 safety functions, developing our models, looking at  
2 our circuit analysis. We started from scratch.

3 We looked at this as a fresh, clean plant.  
4 Nothing we're going to do to kind of destroy what  
5 we're going to take forward into the future.

6 We didn't credit some of our fire  
7 protection features in doing these fire PRA analysis,  
8 and also the NSCA analysis first pass through. And  
9 when I say that, you know, there's some discussion  
10 about taking credit for fire wraps and unqualified  
11 fire wraps.

12 The way we approached the analysis was  
13 those fire wraps don't exist. Even though they may  
14 exist in the field, let's see what happens if we don't  
15 take credit for those. And we'll add those features  
16 and take credit for those features as we're doing the  
17 analysis. And kind of build that into the analysis on  
18 an as-needed basis to resolve deterministic issues or  
19 resolve fire PRA issues.

20 So, then we start defining what's required  
21 for VC Summer station to be compliant with these  
22 commitments going forward.

23 CHAIRMAN STETKAR: Mike --

24 MR. KAMMER: Yes.

25 CHAIRMAN STETKAR: -- since you mentioned

1 it, and I was going to ask you later, and I don't know  
2 whether you have a slide for it or not. I doubt it.

3 As I was going through Attachment C for a  
4 number of fire areas, statements to the nature of  
5 automatic suppression systems exist in several of the  
6 fire zones in this fire area. However, they were not  
7 credited in the fire PRA.

8 Is that true? The fire PRA doesn't take  
9 credit for existing automatic suppression systems?

10 MR. KAMMER: Based on a given fire area if  
11 they didn't take credit for it - they may exist in  
12 that area, but they didn't take credit for it to get  
13 the PRA number for that area, whatever that area is.

14 CHAIRMAN STETKAR: Hm, okay. Again, I'm  
15 trying to understand. You have people talk about  
16 conservatism in PRA models and - okay, but that's  
17 true. You did not -

18 MR. KAMMER: It's a little less  
19 conservative if you really think about it.

20 CHAIRMAN STETKAR: Huh?

21 MR. KAMMER: It's more challenging for the  
22 station.

23 MR. LOIGNON: And conservatism isn't always  
24 equally bad in one place or another. So, if I'm in a  
25 room where the components don't impact my CDF and even

1       though I've got a sprinkler system there, it doesn't  
2       really matter to CDF space.

3               So, if I'm not crediting it in 805 space,  
4       then I don't need to maintain it and surveil it and  
5       all of that good stuff. It reduces the scope of my  
6       program for monitoring.

7               MR. KAMMER: That wasn't one of our  
8       original goals. It was just a matter of let's see  
9       what impacts those features have on the CDF numbers.

10              CHAIRMAN STETKAR: Okay, thanks.

11              MR. KAMMER: One of the other things we  
12       took in our approach is we wanted to test the waters  
13       on doing performance-based fire modeling, and we did  
14       that also.

15              So, a couple areas we tried to do 4241,  
16       Section 4241 of NFP 805.

17              CHAIRMAN STETKAR: Are you going to talk a  
18       little bit about that?

19              MR. KAMMER: We'll talk briefly to that.  
20       It's part of the presentation.

21              CHAIRMAN STETKAR: Yes, okay.

22              MR. KAMMER: So, again, I just want to give  
23       you a little bit of framework, where we came from and  
24       where we started out, before we get into the fire PRA  
25       and trying to resolve some of the deterministic



1 challenges we had in the plant after we went through  
2 the NSCA analysis.

3 Okay, any questions to start off with?

4 (No response.)

5 MR. KAMMER: Okay, Gerald.

6 MR. LOIGNON: When we were first asked to  
7 talk, it was bout fire PRA technical issues. So,  
8 these are the five things I think I wanted to talk a  
9 little bit about. There's probably a lot more we  
10 could talk about and we'll talk about each one of  
11 these bullets individually.

12 But in our discussion with the staff and  
13 John in particular, there were a couple other things  
14 he wanted - or I thought might be of interest to you.  
15 So, insights that we might have found through the  
16 project, the performance-based fire modeling we'll  
17 talk about in a little bit, plant mods and then  
18 implementation challenges. So, they're not really  
19 fire PRA per se, but we'll talk about them at the end.

20 One of our biggest challenges at least  
21 initially was what piece of software do you use. And  
22 we chose to use FRANX as a quantification tool. I was  
23 involved in the IPEEE fire model and we used FRANK  
24 back then with X in it. And FRANX has basically got  
25 them merged together.

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1                   And back in that day, early '90s, we  
2                   couldn't make FRANX work. It had some - we ended up  
3                   doing all of the scenarios one at a time by hand in  
4                   the background without a nice tool to automate it.

5                   And so I said, you know, we ought to go  
6                   look and see what EPRI's got and make sure it will  
7                   work and see what's going on there.

8                   And the reason I wanted to use it was  
9                   because it was supposed to be designed to work with  
10                  CAFTA, which my base model is in, and it had some  
11                  applications where I know I'm probably going to end up  
12                  in the seismic world. So, I might as well figure out  
13                  how to use it because I've got another tool or another  
14                  model I'm going to have to build with lots of  
15                  scenarios.

16                  And so, I needed to get familiar with it  
17                  and be able to use it. So, that's kind of why we  
18                  chose FRANX as a tool.

19                  CHAIRMAN STETKAR: Gerald?

20                  MR. LOIGNON: Yes, sir.

21                  CHAIRMAN STETKAR: Kind of little side  
22                  conversations out in the hallway. Will FRANX support  
23                  quantification of uncertainty, actual propagation of  
24                  uncertainty distributions through the results?

25                  MR. LOIGNON: It's supposed to. Let me get

1 to my next slide here.

2 CHAIRMAN STETKAR: Okay, I'm sorry.

3 MR. LOIGNON: It says I have issues.

4 (Laughter.)

5 CHAIRMAN STETKAR: Never mind.

6 MR. LOIGNON: When we started, FRANX was in  
7 the beta version of 4.0. And the earlier versions we  
8 already knew weren't going to do what we needed to do.  
9 They weren't robust enough.

10 So, we decided there was an earlier  
11 version of FRANK with X in it that might have done it.  
12 And we said, you know, we might as well go with the  
13 latest tool.

14 So, as we built the model and started  
15 progressing and we get more and more scenarios, it  
16 eventually overcame the limits of the software. It  
17 can't handle 1500 scenarios.

18 When I did my tree, it's a single top tree  
19 and I did mutually exclusives at the very top of the  
20 tree, so I've got this mandate that says here's all my  
21 cut sets - my failure sets, but it's not this. Not  
22 mutually exclusive.

23 Well, it didn't like that mandate at all.  
24 So, I ended up having to push it down a level. I'm  
25 not sure why or what was going on in there. But

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1 working with EPRI if you pushed it down a level, it  
2 was okay. So, we ended up just putting another layer  
3 in there to move that mandate down. But, you know,  
4 working through those errors or issues, it just takes  
5 a while.

6 My mutually exclusive file is pretty  
7 large. And usually there's only three or more or less  
8 things that are in there. So, A and B not in  
9 maintenance at the same time.

10 Well, when FRANX comes in there it sets a  
11 lot of things to tree and prunes the tree. My  
12 mutually exclusive all of a sudden becomes a single  
13 event. That's not a good thing either.

14 So, you got to go look for those and you  
15 can get runs and there are zero cut sets, because  
16 mutually exclusive made them all go away.

17 We couldn't - QRECOVER wouldn't work for  
18 a long time. We had to work a long time with EPRI to  
19 get the recovery file to work.

20 The way our basic names were structured,  
21 FRANX didn't like that. So, we ended up having to  
22 expand the basic names.

23 And there were issues with checking and  
24 un-checking things. So, if I'm doing a what-if  
25 scenario or if I'm inputting a file that says, these

1 are the impacts, I can go in there and un-check them  
2 and see is this going to help me a lot? Should I  
3 protect that cable?

4 We had issues with trying to make those  
5 kind of things work.

6 MEMBER BLEY: In the end, were you able to  
7 resolve these issues?

8 MR. LOIGNON: Most of them we got resolved.

9 It took us a lot of time working with EPRI  
10 to make things work. I still cannot do a one top  
11 model with the version of FRANX that I have.

12 They are now at 4.1. I'm still at 4.0.  
13 4.1 supposedly can't handle all 1500 cut sets or  
14 scenarios. I don't know yet because some of the  
15 things I had to do in 4.0 as work-arounds, don't work  
16 in 4.1.

17 So, I've got to go undo some of my work-  
18 arounds so that I can make my transition and figure  
19 that part out. I haven't done that part yet.

20 So, because I can't run all 1500 scenarios  
21 in one big pass, I end up with multiple cut set groups  
22 that I can't merge together because I've got different  
23 basic event values in the same basic event name. And  
24 so, I can't really propagate uncertainties.

25 So, technically I got a problem. It's a

1 big manual work-around.

2 CHAIRMAN STETKAR: I mean, these are all  
3 things that - I'm not familiar with FRANX. I'm not a  
4 CAFTA user. So, these are all things that sound -  
5 make me feel a bit uneasy.

6 What are the real benefits of FRANX?

7 MR. LOIGNON: What is the supposed benefit?

8 (Laughter.)

9 MR. LOIGNON: I can import all of my  
10 scenarios into one file and crank through all of them  
11 at one time.

12 CHAIRMAN STETKAR: Which is different -

13 MR. LOIGNON: And I get one big cut set  
14 file that I can do importances and propagation and  
15 that kind of thing.

16 CHAIRMAN STETKAR: Forget FRANX. FRANX is  
17 something that interfaces with CAFTA.

18 MR. LOIGNON: Right.

19 CHAIRMAN STETKAR: If you just run a CAFTA  
20 model, don't you get the same cut sets that you can -

21 MR. LOIGNON: One scenario at a time.

22 I've got a fire with an initiating event,  
23 and that fire has consequences on these cables mapped  
24 to those basic events. I can put that in there and  
25 crank it to - turn the crank. That's one scenario.

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1 I can't tell it 1500 different  
2 combinations.

3 CHAIRMAN STETKAR: Oh, you cant.

4 MR. LOIGNON: Not at one time.

5 CHAIRMAN STETKAR: Okay.

6 MR. LOIGNON: Not easily anyway.

7 CHAIRMAN STETKAR: Thanks.

8 MR. LOIGNON: CAFTA is a small event tree-  
9 large fault tree combination. And so, when I start  
10 trying to parse initiators into different scenarios,  
11 I basically have to have 1500 initiators.

12 Okay. The mitigating strategy. Since  
13 we're moving away from SISBO to a non-SISBO strategy  
14 keeping both trains available, that's basically a  
15 culture change and a big change in whole philosophy on  
16 what we're doing. So like Mike said, we basically had  
17 to just set aside Appendix R and start from scratch.

18 6850, though, in the 805 process is  
19 assuming I'm taking my current strategy and just  
20 migrating it over.

21 So, when it's looking at delta risks for  
22 me to do a delta risk of where I am, I'd have to have  
23 an Appendix R model, which is SISBO, plus I'd have to  
24 have my 805 model.

25 And we didn't see any benefit in trying to

1 do two PRA models to get a delta risk. So, we worked  
2 with the industry and NRC and we went through an FAQ  
3 and said, okay, you don't have to do that current  
4 plant model. Just do a compliant 805.

5 CHAIRMAN STETKAR: Which, you know,  
6 depending on how you read -

7 MR. LOIGNON: It's the intent.

8 CHAIRMAN STETKAR: -- 805 is the intent of  
9 -

10 MR. LOIGNON: Is the intent.

11 CHAIRMAN STETKAR: -- that anyway.

12 MR. LOIGNON: But when you read the text,  
13 that's not the way I would have tried to impose it.

14 CHAIRMAN STETKAR: Yes.

15 MR. LOIGNON: So, we made sure it was clear  
16 that was good enough.

17 MEMBER BLEY: You'll probably tell me  
18 later, but did you have to make hardware changes in  
19 the plant to get rid of SISBO?

20 MR. LOIGNON: No, not to get rid of SISBO.

21 MEMBER BLEY: Okay.

22 MR. LOIGNON: Now, there were probably some  
23 hardware changes that I'm going to make as a result of  
24 moving away from SISBO.

25 MEMBER BLEY: Well, maybe that's what I



1       meant.

2                   MR. LOIGNON: Well, then, yes, there are  
3       some that I'm doing.

4                   MEMBER BLEY: But you'll talk about those  
5       in a bit?

6                   MR. LOIGNON: Yes, we'll talk about those.

7                   MEMBER BLEY: Okay.

8                   MR. LOIGNON: But specifically it's because  
9       MSOs and hot shorts don't happen when I de-energize  
10      the train. So, there are some things, but mostly it's  
11      cable wraps and rerouting --

12                  MEMBER BLEY: Okay.

13                  MR. LOIGNON: -- for things that I would  
14      have de-energized under the old strategy that I leave  
15      hot under the current strategy.

16                  My HRA also because this is almost like a  
17      new plant, so my HRA had to make assumptions about  
18      procedures and techniques that just don't exist right  
19      now. And we have them conceptualized, but there's not  
20      a real procedure written out for them.

21                  So, we had to make some assumptions which  
22      I think are well-founded, but we'll have to - we have  
23      a step later on in the process that says, go validate  
24      that step that is still - that does the way you  
25      modeled it. So, we've actually already talked about

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1       this. This is the resolutions for it.

2               We do have a change management plan. It's  
3       a pretty detailed plan of how we're going to get from  
4       where we are to the new strategy. It includes  
5       procedures and training.

6               Some of our modifications, and we'll talk  
7       about those in a little bit more detail, are to  
8       mitigate deterministic requirements or because of this  
9       change in strategy that I need to do. Others are just  
10      so that I can reduce my overall CDF to 1.17 for  
11      considerations. And so, I can make the transition in  
12      strategy without those being completed.

13              Cable location data. As Mike alluded, we  
14      had a database. And in this case, this is not a  
15      hindrance to us. This was a great benefit to us. And  
16      so, I wanted to point it out.

17              Our database is three-dimensional down to  
18      every cable that leaves and enters the cable tray. I  
19      have a note at that location.

20              So, I don't have to walk the plant down  
21      except to validate, you know, spot check my queries.  
22      I can query by volume and I know every cable that  
23      enters and leaves that volume.

24              MEMBER BLEY: And this was used during  
25      construction.

1 MR. LOIGNON: Well, it was built on  
2 construction.

3 CHAIRMAN STETKAR: And it's kept up to  
4 date.

5 MR. LOIGNON: It's been kept up to date.

6 MR. KAMMER: Part of our design process is  
7 to manage that information.

8 MR. LOIGNON: So, that's already in our  
9 change management process. It's a living database.  
10 It's in our change management plan. So, I mean, it's  
11 part of our ECR or engineering change request.

12 So, every time we do a mod, do I have to  
13 in fact update this database? It's already in our  
14 process. It's second nature now.

15 So, we built on that and expanded it. So,  
16 okay, well, this cable is tied to this component,  
17 which is a PRA component. It's got these failure  
18 modes and it's got - this is tied to this basic event  
19 in my PRA model. We just put all of that in there and  
20 tied it also to the NSCA model.

21 So, now when I want to come back and I'm  
22 doing a modification, I go look at that database and  
23 it's just a matter of pulling out another query, push  
24 it into FRANX, turn the crank and I know what the  
25 change in CDF is - well, it's not quite that simple,

1 but it's almost that simple.

2 CHAIRMAN STETKAR: The point is to be  
3 generating any cut sets, right?

4 MR. LOIGNON: Right.

5 MR. KAMMER: One of the bigger benefits if  
6 you kind of think about it from a fire modeling  
7 standpoint, you pick a fire anyplace in the plant.  
8 And we've picked all these scenarios and we put a fire  
9 at that location. We pick coordinates in the plant  
10 that say, give me all the circuits that are impacted  
11 from here to the ceiling. And we can pull that  
12 information out and run it through FRANX.

13 CHAIRMAN STETKAR: That's better than I've  
14 seen.

15 (Laughter.)

16 MR. KAMMER: We'll run it through the NSCA  
17 model from a deterministic standpoint and see if I  
18 have any hits in that area or that zone of influence.  
19 Let's put it that way. So, that was a tremendous  
20 help.

21 The downside of that is you have to have  
22 accurate data in that database. And there was some  
23 missing - there were some holes in data that we had to  
24 fill to follow that approach and philosophy.

25 So, what was a - we would call it a

1 challenge was to fill all those holes and gaps to make  
2 everything work true to the analysis that we set up.

3 MR. LOIGNON: So, we had to expand this  
4 database, expand the reports. And so, there are  
5 regular software kind of V&V controls that had to go  
6 into that part of the project. And like I said, it's  
7 tied to the NCSA and the PRA and the non-power  
8 operations analyses.

9 Conduits weren't quite as well done in  
10 that database. So, we did have to do a fair amount of  
11 field walkdowns to validate conduit. We had drawings  
12 for them. So, I mean, it's not like we didn't know  
13 where they were. It was a matter of transferring that  
14 data into the database.

15 So, it became - it is the single  
16 repository for all of that data, all our design data.  
17 And I've got another one for the fire modeling data  
18 with extracts from both of those that feed into FRANX.  
19 So, you just turn the crank. There's not a lot of  
20 manual inputting of data.

21 Methods, like Mike said, one of the things  
22 that we decided to do was basically stay within the  
23 box of 6850. And a lot of that had to do with - we  
24 were relatively early, but it didn't look like there  
25 was a lot of easy ways to get things approved that

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1 were different or variations. So, we basically said  
2 we didn't want to fight that battle.

3 So, we're still watching what's going on  
4 with things like heat release rates and influence  
5 factors and circuit power transformers. And we did  
6 take credit for those in our LAR. So, we understand  
7 we're going to end up having to do a revision for that  
8 when it's finally resolved.

9 We are primarily kerite cable. So, we did  
10 have to figure out how we were going to handle that.  
11 We consider it damaged at thermoplastic, but we  
12 consider it thermoset for propagation and flame spread  
13 and that kind of stuff. So, we treat it both ways  
14 depending on what it is we're looking for.

15 And that became - that was the way we  
16 ended up resolving that with the regulators. So, that  
17 path we took turned out to be the correct path, but we  
18 knew there was some risk when we started down that  
19 path that we wouldn't end up there with the  
20 regulators, but we did.

21 Unknown cable qualifications. Early in  
22 the game we probably had about ten percent of our  
23 cable we weren't sure what it was. We're down to less  
24 than three percent now. So, we're treating everything  
25 as kerite and we've done some sensitivity looks that

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1 said even that three percent is just not going to  
2 change your insights or your consequences. So, we're  
3 pretty comfortable with that. That was one of those  
4 unknowns that might have had a problem earlier.

5 And, again, resolution is we're just  
6 following what's going on with the industry. As  
7 things get resolved if we can take advantage of  
8 something that might be able to reduce our risk,  
9 we'll, you know, or at least our calculated risk,  
10 we'll go back and modify our modeling and take a  
11 benefit for those when we can.

12 Some of them will probably - may turn out  
13 to be things that might make our risk go up and we'll  
14 accommodate those too.

15 CHAIRMAN STETKAR: Again, when I - I've  
16 come to think of fire models as things like FIVE and  
17 FDS and CAFTA.

18 MR. LOIGNON: Yes, I do the same.

19 CHAIRMAN STETKAR: Okay. I notice if I  
20 recall correctly, you use FDTS, the 1805, and CAFTA,  
21 is that right, as far as your tools?

22 MR. KAMMER: CFAST.

23 CHAIRMAN STETKAR: I'm sorry, CAFTA is the  
24 -

25 MR. LOIGNON: Yes, CFAST.

1 (Discussion off the record.)

2 MR. LOIGNON: CFAST and 1805; is that  
3 right?

4 MR. LOIGNON: I don't think we actually  
5 ever applied FDS anywhere though.

6 MR. KAMMER: We did not apply -

7 CHAIRMAN STETKAR: No, not FDS. FDTs.

8 Do you use CFAST for everything?

9 MR. LOIGNON: Or even simpler.

10 CHAIRMAN STETKAR: Or even simpler.

11 MR. KAMMER: We did some simplifying  
12 walkdown information with FDT tools and that was about  
13 it.

14 CHAIRMAN STETKAR: So, that's -

15 MR. NAJAFI: I think what -

16 CHAIRMAN STETKAR: You have to identify  
17 yourself so we got you on the -

18 MR. NAJAFI: Bijan Najafi, SAIC.

19 What you're referring to is FDT.

20 CHAIRMAN STETKAR: FDT.

21 MR. NAJAFI: NUREG-1805. And that is the  
22 simple model Mike is referring to, but it's been used  
23 for many of the fire modeling as 1805, simple  
24 Heskestad equations and things like that.

25 CHAIRMAN STETKAR: Yes, and you did use



1       that.

2                   MR. KAMMER: We did use that.

3                   MR. NAJAFI: Yes, that's the main use.  
4       There are CFAST in certain cases to calculate hot gas  
5       layer, control room evacuation, things like that.

6                   CHAIRMAN STETKAR: So, just to make sure I  
7       understand, it's mostly algebraic - empirical  
8       correlations with some application of CFAST.

9                   MR. NAJAFI: Correct. We didn't do  
10      anything any more exotic than that.

11                  CHAIRMAN STETKAR: Okay. What I wanted to  
12      ask is, you know, you've been through the process now.  
13      We've heard kind of two other presentations today.  
14      One with miles of control room where they felt they  
15      needed to go all the way to the computational fluid  
16      dynamics.

17                  MR. NAJAFI: Right, we didn't go there.

18                  CHAIRMAN STETKAR: Another application that  
19      used - let me call it as far as - and licensee can  
20      correct me if I'm wrong, a different suite of  
21      empirical correlations that have some similarities and  
22      perhaps some differences to the tools that are in FDTS  
23      or in FIVE.

24                  And you guys just sort of took the more  
25      straight-line approach -

1 MR. NAJAFI: We took the cookbook and we  
2 put in - stayed with the recipe.

3 MR. KAMMER: We stayed within the box that  
4 was defined.

5 CHAIRMAN STETKAR: Now, how upset are you  
6 about using that approach? Did it cause you any  
7 problems?

8 MR. KAMMER: We have solutions.

9 CHAIRMAN STETKAR: Okay.

10 MR. KAMMER: We have solution documentation  
11 and try to operate within the parameters.

12 CHAIRMAN STETKAR: I'm trying to - because  
13 we hear a lot of things about this fire modeling about  
14 how difficult it is, about not verification and  
15 validation of certain models, of conservatisms, and  
16 yours is sort of the simplest approach that I can  
17 think about in terms of application of those models.

18 Do you think it's because of a particular  
19 - that the configuration of your plant, or did you  
20 have to actually struggle with really complex  
21 geometries, but the simple tools were good enough for  
22 you?

23 MR. LOIGNON: I think most of our  
24 geometries were pretty simple. So, I don't think we  
25 had any particular outliers in that regard.

1 I'm the PRA guy, not the fire modeling  
2 guy. So, let me tell you what my impression is. My  
3 impression is that the methodology in 6850 is pretty  
4 conservative, which is different than I do anything  
5 else in PRA space. I do best estimates.

6 So, I look at this one as a different  
7 animal just from that perspective, but I follow the  
8 cookbook. And if the cookbook tells me I got a  
9 problem, I figure out how to fix it.

10 I might be able to fix it by doing a more  
11 rigorous CFAST. I might have had to go to something  
12 greater than that. We were prepared to, but we didn't  
13 use that. We chose something else instead.

14 We may have wrapped something. I may have  
15 changed a procedure or looked for an operator action,  
16 which we did not do, but those are two things that  
17 were in my toolbox.

18 I could have done a PRA delta risk that  
19 said it's okay to leave it, which we did some of  
20 those.

21 So, we looked at what tools were available  
22 in 6850 and used whichever one we felt most  
23 appropriate for that particular issue, but we stayed  
24 within the confines of 6850.

25 Do I think that's conservative? Yes, I

1 do.

2 Do I have a real technical basis for that?

3 No, I'm not the fire PRA guy - I mean the fire  
4 modeling guy.

5 But from my discussions with those who  
6 are, I think those methods are very conservative. And  
7 so, I am concerned about how I am going to treat this  
8 number compared to other numbers in the future. I'm  
9 not sure how I'm going to do that part.

10 But did we follow the cookbook? Yes.

11 Were there tools there? Yes.

12 Were they the best tools? I couldn't tell  
13 you.

14 MR. KAMMER: There are some parameters we  
15 did challenge. We also went back and took a look at  
16 those with regard to, say, height of rooms versus  
17 floor area, those type of things and using the models.  
18 And went back and challenged those to make sure that  
19 we're not on the non-conservative side. And  
20 documented that, too, as part of our documentation  
21 package.

22 So, we weren't exactly clean between the  
23 goalposts in every case, but we did take a look at  
24 those and make sure that we're doing the right thing,  
25 is really the bottom line.

1 CHAIRMAN STETKAR: Thanks.

2 MR. LOIGNON: And I guess we've actually  
3 already talked about whether you want to call them  
4 improved methods or alternate methods or whatever.  
5 And you'll probably have some more discussion tomorrow  
6 about the fire methods panel, but it seems to me that  
7 there was a high level of justification done in the  
8 discussions that were in that panel. There was a lot  
9 of challenging of each other, from what I've heard  
10 about it anyway, to reach a consensus. It took them  
11 a long time.

12 And again as an almost disinterested third  
13 party, but not quite disinterested, I'm still the PRA  
14 guy. I'm a little bit distant from some of this  
15 stuff.

16 It seems to me that the NRC is treating  
17 this a lot different than they do the rest of PRA  
18 applications in that if I'm doing a PRA application  
19 anywhere else, I'm free to choose my own methodology,  
20 use it and defend it.

21 Usually if I can go in there and say do a  
22 sensitivity study and say, this really isn't a big  
23 deal in the results, nobody questions it anymore.

24 Here, I'm being told this is the  
25 methodology. Use it or, you know, here's the

1       cookbook. If you deviate from the cookbook, you got  
2       to defend it whether it's important or not. And  
3       that's a lot different at least philosophically to me.

4               So, it puts different controls on my  
5       program and process that I didn't have to consider  
6       before. So, it's just a different animal in my point  
7       of view.

8               Can we work with it? Yes.

9               Do we necessarily like it? Probably not  
10       always, but we can work with it.

11              So, we're just following the resolution of  
12       the issues as they come out and work timely enough for  
13       us to use many of them. Because like Mike says, we're  
14       a pretty conservative utility. We like to stay pretty  
15       close to the cookbook.

16              We're not going to go out there and spend  
17       lots of dollars to try and argue with somebody else  
18       over a process.

19              But as the things get resolved, we'll have  
20       to look and see, well, is this good, bad, indifferent,  
21       is it important enough for me to go back and update to  
22       that new methodology?

23              Insights. I've got them kind of separated  
24       into surprises versus others. Considering the vintage  
25       of our plant, there were a few deterministic open

1 items. So, I thought that was pretty amazing from my  
2 point of view.

3 Three things that kind of jumped out at me  
4 when I was thinking about this was, it was we have -  
5 7.2kV is our top level switchgear. It's a great big  
6 ol' breaker. It's got a nice anti-pump circuit,  
7 because it doesn't like to sit there opening and  
8 closing. So, somebody built that into it.

9 And when we were doing circuit analysis  
10 for those, we figured out that you can actually bypass  
11 that and there are remote failures that will make that  
12 kind of just keep re-closing. You can't turn it off.

13 Water reactor coolant pumps are 7 kV. So,  
14 I had to postulate those because I could not turn off  
15 a reactor coolant pump in certain fire scenarios.  
16 That's not a good thing.

17 CHAIRMAN STETKAR: That's not a good thing.

18 MR. LOIGNON: So, that was a surprise. I  
19 never would have thought that I could do that when  
20 that remote - I mean it had pump circuits interval to  
21 the breaker. I never would have thought to look for  
22 that. So, it was a surprise to me.

23 When we do IPEEE since we're blacking out  
24 things, that kind of makes all the failures go away.  
25 So, we actually found some failures that would prevent

1 us from energizing both buses at the same time from  
2 offsite power. And I didn't expect to find that  
3 either.

4 And then some failure combinations -

5 CHAIRMAN STETKAR: Is that because of  
6 cross-tie logic and stuff, or is it -

7 MR. LOIGNON: No, it's just the cable  
8 routing.

9 CHAIRMAN STETKAR: Oh, cable routing.  
10 Okay.

11 MR. LOIGNON: Yes, we run offsite power  
12 from both offsite circuits in a place where they T  
13 together so I can get to both buses.

14 CHAIRMAN STETKAR: Okay.

15 MR. LOIGNON: It's primarily in the turbine  
16 building where you're trying to get into the  
17 buildings.

18 And then we had disconnect switches from  
19 Appendix R where I could divorce the controls from  
20 outside and still be able to run the plant. We found  
21 some holes in the way some of those were designed.

22 CHAIRMAN STETKAR: As long as you brought  
23 that up - I have to remember to keep each one of these  
24 straight. Did you characterize all of your operator  
25 actions as recovery actions, or did you -

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1                   MR. LOIGNON: Mike said one of the  
2 objectives was to reduce operator actions.

3                   CHAIRMAN STETKAR: Well, I -

4                   MR. LOIGNON: So, what I'm getting ready to  
5 say it -

6                   CHAIRMAN STETKAR: Given whatever inventory  
7 there are -

8                   MR. LOIGNON: I have no remote operator  
9 actions if I am staying in the control room.

10                  CHAIRMAN STETKAR: That's true.

11                  MR. LOIGNON: None. So, all of my operator  
12 actions are really associated with leaving the control  
13 room, going to the remote shutdown panel which has  
14 fewer controls.

15                  And therefore if I go there, I do have to  
16 send operators to do some remote operations, but  
17 they're pretty limited.

18                  MEMBER BLEY: I'm just curious. How did  
19 you handle that first failure mode? It seems to me  
20 many different things could happen if you start  
21 cycling that big ol' breaker.

22                  MR. LOIGNON: Yes, they can.

23                  MEMBER BLEY: Including it could blow up or  
24 you might get some overload somewhere else opening the  
25 circuit.

1                   What did you do with it?

2                   MR. LOIGNON: We're protecting the  
3                   circuits.

4                   MEMBER BLEY: Okay. You're fixing that  
5                   one.

6                   MR. LOIGNON: We're fixing that.

7                   MR. KAMMER: Some of the challenges we have  
8                   as some pretty easy fixes is protect the circuit from  
9                   the effects of fire in certain areas or certain zones  
10                  of the plant.

11                  Part of our - if you look at our enclosure  
12                  chart, is basically just to identify all those impacts  
13                  regardless of what they're impacting downstream. It's  
14                  just saying here's my vulnerability in this area.

15                  So, that's some of the insights you get  
16                  from doing the NSCA analysis.

17                  MR. LOIGNON: Other insights. Kind of like  
18                  everybody else when you start doing this, you use a  
19                  more conservative, easier to do type modeling and you  
20                  get all these rooms up here that are risk significant,  
21                  got CCDPs in one and whatever.

22                  Then you start beating them down a few at  
23                  a time. And when you run out of time, money or your  
24                  number is as good as you want to get it, you stop.

25                  The second most risk significant area in

1 my plant basically turns out to be a hallway with a  
2 motor control center.

3           Wouldn't have expected that to be that way  
4 not based on what I did in previous IPEEE stuff, but  
5 it's just a matter of do I want to go spend modeling  
6 and make that number go down.

7           The initiating events that are 95 percent  
8 of my CDF are dominated by consequential LOCAs,  
9 reactor coolant pump seal LOCAs. And about half of  
10 them are remote shutdown control room evacuation  
11 scenarios, which is kind of what you would have  
12 expected from the IPEEE.

13           MR. KAMMER: When Vinny was talking about  
14 control room, cable spreading room, access areas,  
15 those are the types of areas we're talking about too.

16           There is very little work, not a normally  
17 occupied area, suppression system. In our case, it's  
18 pre-action sprinkler systems. Detection throughout  
19 the whole area. It's just not a highly-traveled area,  
20 but that's - those are some of our highest risk  
21 contributors.

22           MR. KAMMER: Some of those areas are  
23 actually dominated by transients because there's no  
24 real fixed ignition sources. So, they're transients  
25 and you're saying, does this really make sense?

1                   So, that's one of those things that makes  
2                   me believe some of the fire modelers are saying this  
3                   is conservative.

4                   MR. LOIGNON: But even for the transient  
5                   fires, maybe Vinny took a different approach, we said  
6                   317 kilowatts is our fire regardless of where it's at.  
7                   We didn't take a non-crude method in that case.

8                   Do you have another question before we go  
9                   on?

10                  CHAIRMAN STETKAR: I do. You mentioned  
11                  control room evacuation.

12                  I had a question as I was going through  
13                  Attachment C and I was trying to look to where I have  
14                  the reference here for a second. And this holds for  
15                  a couple different fires. I wanted to ask you  
16                  something.

17                  In one of the fire areas, and again stop  
18                  me if I get too detailed for a variety of reasons, let  
19                  me just say there's a couple of cable spreading areas  
20                  where as I read through Attachment C, there are words  
21                  in there that say things like, due to a potential  
22                  control room evacuation for this fire scenario,  
23                  recovery actions are credited for alternate shutdown  
24                  capability.

25                  What does that mean in practice? I mean,

1       what did - I read those words, but then I don't see  
2       recovery actions.

3               Was control room evacuation modeled for  
4       fires in that area, or was - it was?

5               MR. KAMMER: Actually, in all actuality  
6       with VC Summer, we have four areas of the plant where  
7       we're going to be transitioning out of the control  
8       room. Those areas are control room, the upper cable  
9       spreading room, the relay room and the lower cable  
10      spreading room. We have cross-divisional trains of  
11      circuits through those areas.

12              So, when we talk about recovery actions  
13      when you say no manual action, outside of those four  
14      areas we've eliminated all those manual actions in the  
15      plant.

16              CHAIRMAN STETKAR: Okay.

17              MR. KAMMER: If we had a fire in those four  
18      areas, there's a decision process we'd have to go  
19      through to make a conscious decision to evacuate the  
20      control room to go to alternate shutdown because of  
21      the potential risk.

22              CHAIRMAN STETKAR: How did you treat that  
23      in the PRA? Did you just assume that the control room  
24      would be evacuated, or did you -

25              MR. LOIGNON: No, we did some modeling and

1       like in the control room itself -

2               CHAIRMAN STETKAR: No, I understand the  
3       control room. I know how people do that. You  
4       mentioned that you use -

5               MR. LOIGNON: Even the others we did some -  
6       we did some different transient fires in different  
7       places and different sizes and determined whether or  
8       not they were propagated to a point where we thought  
9       we'd lose -

10              CHAIRMAN STETKAR: And what criteria did  
11       you use for abandoning the control room, because it's  
12       not - it's not visibility or habitability. It's  
13       something else, right?

14              MR. KAMMER: I would say there is a certain  
15       decision process you have to make with regard to  
16       recognizing you could be losing control of the plant.  
17       And that's up to the shift supervisor given the  
18       complete information that's coming to him.

19              Plus taking a wrong decision, either  
20       venting too early or too late, that's one of the  
21       challenges that we have with regard to rewriting our  
22       procedures and making sure we're making the right  
23       decision consistently throughout.

24              CHAIRMAN STETKAR: What I'm trying to do is  
25       understand how you actually treated that in the PRA,

1 because I understand CFAST. You said you use CFAST  
2 for the main control room. And there's some criteria  
3 in 6850 about visibility and habitability requirements  
4 where you assume if you reach those conditions, people  
5 will evacuate, but these other areas are different  
6 from that.

7 MR. KAMMER: We didn't treat those other  
8 areas any different than any other area of the plant  
9 with regard to fire modeling or fire PRA scenario,  
10 development, failures and losses, but it's just a  
11 matter - what you're asking is.

12 MR. LOIGNON: Let me let Paul answer that.  
13 The question is outside of the control room when the  
14 other three areas we have control room abandonment,  
15 what did we use for the criteria that said  
16 abandonment?

17 So, we - all of them are control room  
18 abandonment scenarios.

19 MR. AMICO: Yes, the criteria -

20 CHAIRMAN STETKAR: You have to -

21 MR. AMICO: Oh, Paul Amico, SAIC.

22 So, for the criteria the way the procedure  
23 is written, it refers to shift manager discretion  
24 based on a loss of control of the plant. A belief  
25 that he can no longer shut down from the control room.

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1           Now, it doesn't matter whether the fire is  
2           in the control room. It says for these four areas, if  
3           there are fire in these four areas that cannot be  
4           controlled and they believe they have lost control  
5           from the control room, then they would abandon at  
6           shift manager discretion.

7           The way we modeled that is there's a  
8           likelihood that they will fail to abandon when they  
9           should. Also, there is a likelihood that they may  
10          abandon when they should not for every scenario that  
11          takes place in these four areas.

12          So, that's the way we modeled it to make  
13          sure -

14          CHAIRMAN STETKAR: Okay, that's what I was  
15          looking for.

16          MR. AMICO: Yes.

17          CHAIRMAN STETKAR: It wasn't just a switch  
18          that you presumed that they abandoned.

19          MR. AMICO: No, no. There was a  
20          probability of failure to abandon, and there was a  
21          probability they abandoned when it wasn't necessary  
22          for all scenarios in those four areas.

23          CHAIRMAN STETKAR: Okay.

24          MR. LOIGNON: That's actually a carryover  
25          from our IPEEE model. We actually did that back then.



1 CHAIRMAN STETKAR: Okay. Thank you.

2 MR. KAMMER: Okay. Briefly talk about  
3 performance-based fire modeling. We saw this as a  
4 tool and actually a onetime shot to really kind of  
5 roll this out as an option to resolve open items in  
6 certain areas.

7 We picked a couple areas in the plant to  
8 see if we could utilize this tool, and basically it  
9 comes down to using the rules out of 805, defining  
10 your limiting fire scenario and maximum expected fire  
11 scenario and making sure you had margin between the  
12 two that you're not going to damage the equipment and  
13 cables that might be in proximity to that fire  
14 location where that fire location is.

15 The four areas we picked in the plant were  
16 three control building cable chases that are adjacent  
17 to control room, okay, and one air handling cooling  
18 unit.

19 I will make one mention that we tried it  
20 in another area and it didn't work. So, what I will  
21 tell you is this tool isn't good for any place you  
22 want to use in the plant. I mean, it's going to be  
23 configuration-specific. Obviously the tools do have  
24 some limitations, but we did find that we could be  
25 successful.

1           And really, it comes down to you really  
2           got to manage the fire itself in some regards whether  
3           it's a fuel package size or even a fire location. And  
4           that's the way we kind of ended up in those specific  
5           areas.

6           Again, one of the implications there is  
7           the more assumptions you have in your analysis, you've  
8           got to translate that information into actual  
9           application if you're going to try to manage the fire  
10          location and size.

11          And you do that normally through transient  
12          combustible controls or storage area requests or  
13          anything else that's going on in the plant too. So,  
14          it's consistent with the way we kind of manage fuel  
15          packages today.

16          CHAIRMAN STETKAR: And I was trying to - I  
17          was listening to what you're saying. And as I was  
18          going through the Attachment C, I was trying to  
19          understand was there - let me ask the question this  
20          way: Did you actively think about whether it was more  
21          beneficial to take the 4241 performance-based approach  
22          for, let's say, this room versus the PRA model, 4242  
23          approach for this room, or did you just do it  
24          intuitively?

25          You know, because, for example, there are

1 many component failure modes if I look at the  
2 inventory of equipment in this room where you applied  
3 the fire modeling, let's say, the 4241.

4 In many other locations you made the  
5 determination, well, I have to use the PRA model to  
6 address those, you know. Obviously that's a  
7 simplification because it's whatever else is going on  
8 in the area.

9 You're the only one of the three who used  
10 the performance-based fire modeling, the 4241. And I  
11 was curious what kind of rationale went into those  
12 selections.

13 MR. KAMMER: If you kind of took a look at  
14 the model itself, we kind of wanted to, number one,  
15 exercise the model and see if we could utilize that  
16 possibly in future applications. Don't know.

17 But at the same time, the areas that we  
18 picked didn't have a lot of ignition sources, so we  
19 were kind of bound to transients for the most part in  
20 these particular areas.

21 We looked at a couple factors as, you  
22 know, some that could be viewed as being challenging  
23 because we had cable trays in these areas.

24 So, we're trying to look at certain  
25 factors that may come into play utilizing this tool.

1 And I think we were successful. It remains to be seen  
2 after staff reviews of our applications, but could we  
3 have used the fire PRA? Probably.

4 CHAIRMAN STETKAR: Well, you certainly  
5 could have used the fire PRA. I was trying to  
6 understand what the decision process was for a given  
7 fire area to take one approach versus another.

8 MR. KAMMER: If you think about it, you  
9 have - when we went through - after we went through  
10 our NSCA analysis, we had kind of drew up a long  
11 laundry list of options or tools to resolve the open  
12 items that came out of the NSCA.

13 The fire PRA when we made our first pass,  
14 wasn't even available at the time. They were still  
15 working on developing. So, you're running parallel  
16 paths trying to create solutions.

17 So, we came up with a number of different  
18 areas, kind of solution sets for these open items.  
19 And this one we said, why don't we give this a whirl  
20 and see if we can make this work.

21 We come back later on and some of the  
22 deterministic solutions we turn into fire PRA  
23 solutions instead.

24 So, to us, it was just another tool in the  
25 toolbox to resolve open issues. And at the same time

1 from a project standpoint, from a station standpoint,  
2 we looked at it as here's a tool that might be useful  
3 in the future. Not a lot of people are going to be  
4 trying to utilize it. And we felt that if you're  
5 going to get into your license, now is the time to do  
6 it. Now or never.

7 So, we opted for the effort to make it  
8 work and we think we've shown it can work. It's just  
9 a matter of where and how we apply it in the future if  
10 we choose to use it again.

11 CHAIRMAN STETKAR: Okay, thanks.

12 MR. LOIGNON: Well, we can look at the  
13 modifications that we're going to have to implement.  
14 Like I said, some of them are there to resolve  
15 deterministic issues. And some of them are there just  
16 to reduce overall CDF.

17 CHAIRMAN STETKAR: Before - I'm sorry,  
18 Gerald.

19 MR. LOIGNON: Yes.

20 CHAIRMAN STETKAR: Before you start, I had  
21 one other question on things in Attachment C, and only  
22 -- I'm trying to get my hands around words in some  
23 places.

24 There were several entries there that say  
25 things like for an alternate shutdown scenario, the

1 following action has been evaluated in the fire PRA  
2 and is not required to prevent core damage.

3 And in the location that I pulled out, one  
4 example of that is locally start the emergency diesel  
5 generator. Another one is locally energize a  
6 switchgear at the bus, but those are not actions that  
7 are identified in Attachment G.

8 So, what does all that mean? Were they  
9 things you thought about? Are they actually in the  
10 PRA? Are they things that you put in the model and  
11 turned off or - I was trying to understand what they  
12 were or what they aren't.

13 MR. LOIGNON: That's why we have to look at  
14 it a little bit more myself for me to answer that one  
15 right off the top of my head.

16 CHAIRMAN STETKAR: It's, you know, all I  
17 have is the brief summaries. And that kind of phrase  
18 appears in quite a few places and I just had no idea  
19 what that meant.

20 MR. LOIGNON: Well, right now I'm not sure  
21 I do either.

22 CHAIRMAN STETKAR: Okay.

23 MR. LOIGNON: But I could get back to you.

24 CHAIRMAN STETKAR: I'd appreciate - well,  
25 but the key is they're not in the PRA model at all.

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1 MR. LOIGNON: Yes.

2 CHAIRMAN STETKAR: Okay.

3 MEMBER SCHULTZ: Gerald, before you start  
4 on this section -

5 MR. LOIGNON: Sure.

6 MEMBER SCHULTZ: -- with respect to the  
7 plant modification process, you've got the fire PRA  
8 and you've got, admittedly, fire modeling methods that  
9 are conservative that you've chosen to use throughout.

10 So, when we get to making choices of plant  
11 modification to reduce CDF, how do you know that in a  
12 relative sense you're making the right choices given  
13 that you've got the conservative fire modeling  
14 techniques that are in place versus best estimate or  
15 better estimate?

16 MR. LOIGNON: I think because of those  
17 choices, some of these deterministic ones we probably  
18 are going things we may not have to do.

19 But do I know which ones they are? No.

20 MR. KAMMER: One of the things recognized  
21 as part of the project is you could always go back and  
22 iterate, fine tune and tweak, but you're not getting  
23 to the end and making this whole process converge.

24 And there are some tough choices.  
25 Obviously there are some probably features that we --

1       what Gerald said is true - we may not need to protect.  
2       But at the same time if we do protect it, it  
3       eliminates that issue from a deterministic standpoint  
4       and we'll just keep moving on type of thing.

5               So, we've had to make some tough  
6       decisions. Do we have to go back and justify every  
7       one of those, you know, hindsight is always 20/20.

8               MEMBER SCHULTZ: You might not be making  
9       the very best decision, but you're making a decision  
10      that -

11              MR. KAMMER: We think we're making a  
12      conservative decision based on the information we had  
13      at the time.

14              MR. LOIGNON: We're certainly making a safe  
15      decision, but there are things that we probably  
16      wouldn't have to do if we spent money to do a more  
17      best estimate kind of an analysis. But then I have to  
18      also figure out what is it going to cost me in  
19      regulatory space to make that fly.

20              And we said it's just not worth the effort  
21      and the time required given the schedule that we're  
22      trying to do. It's just cheaper to wrap it. I'm  
23      already wrapping stuff anyway. So, the incremental  
24      costs may or may not be that high. We just don't  
25      know.



1                   MEMBER BLEY: I think - correct me if I'm  
2 wrong. I think 6850 invites you to do uncertainty  
3 analysis and I suspect that deals directly with almost  
4 all those areas you've talked about as being  
5 conservative in the approach.

6                   MR. LOIGNON: And in some cases, I can do  
7 sensitivities. I can't do - easily, I can't do  
8 uncertainties.

9                   MEMBER BLEY: I don't know quite what you  
10 mean by easily, but -

11                  MR. LOIGNON: Because of the way FRANX had  
12 to make me do things in pieces, parts, it's a long -

13                  MEMBER BLEY: So, it's the code you're  
14 using that -

15                               (Simultaneous speaking.)

16                  CHAIRMAN STETKAR: The hammer that you're  
17 using won't saw this board all that well.

18                  MR. LOIGNON: That's right.

19                               For me, it's a long, arduous, manual  
20 process to go in and merge all of that stuff together  
21 so that I can propagate the list.

22                  MEMBER BLEY: It's a shame to be  
23 constrained by your tools.

24                  MR. LOIGNON: Yes, it is.

25                               Ten years ago we were constrained by tools

1 in internal events. The tools have gotten better.  
2 We're just further behind the curve in fire modeling  
3 tools.

4 MR. KAMMER: One of the reasons we picked  
5 the tools we did was not only to achieve the goal of  
6 the project, but also to manage it forward. How can  
7 we make it easier to manage forward?

8 So, there's pluses and minuses for every  
9 decision you make.

10 MEMBER BLEY: I guess it bothers me a  
11 little to hear people say they do PRA with best  
12 estimate. To me, that means best estimate includes  
13 the uncertainty.

14 If you just pick a point off your  
15 uncertainty card and call that the most likely one  
16 from all you've done in risk assessment, the rest of  
17 us say there are cases where the tail of the  
18 distribution drives the risk.

19 So, just picking a spot in the middle can  
20 really be deceptive.

21 MR. LOIGNON: It can.

22 MEMBER BLEY: So, to me when I hear I want  
23 to do best estimate, it's saying with uncertainty, and  
24 I'm sensing that that's not what you mean.

25 MR. LOIGNON: No, that is. I agree with

1       you. I understand the point and I do agree with it.

2               MEMBER SCHULTZ: That's what I hear you  
3 would like to do, but the tool doesn't lend itself to  
4 that at this point.

5               MR. LOIGNON: Yeah, I definitely understand  
6 you do have to take that into consideration and  
7 account.

8               CHAIRMAN STETKAR: FRANX is just the set of  
9 and things, right? You have a cut set, A and B and C.

10              MR. LOIGNON: What FRANX does it takes  
11 input and changes your PRA, your CAFTA model, turns  
12 the crank. And then it says, okay, what's the next  
13 set of input? And it changes the model again and  
14 turns the crank and adds the cut sets together.

15              So, if I tell it I've got a scenario in  
16 the turbine building and these are the three things  
17 that are impacted, it says, okay, I got this fire, it  
18 comes at this frequency, and here's the basic events  
19 that are impacted. It fails those and cranks out a  
20 number.

21              CHAIRMAN STETKAR: Just a number.

22              MR. LOIGNON: Just gives you the cut sets,  
23 but it gives you the total number for that scenario  
24 with these cut sets.

25              CHAIRMAN STETKAR: Okay, but it does give

1       you cut sets.

2                   MR. LOIGNON: It does give you cut sets.  
3       It's running whatever solution engine you have.

4                   CHAIRMAN STETKAR: A cut set is basically  
5       an algebraic expression.

6                   MR. LOIGNON: Yes, it is.

7                   CHAIRMAN STETKAR: Okay.

8                   MR. LOIGNON: But it has a name and a  
9       value.

10                  CHAIRMAN STETKAR: Sure.

11                  MR. LOIGNON: It doesn't have the same  
12       value for the same name in all of those times that  
13       FRANX runs it.

14                  So, when I merge it together, I've got the  
15       same name with multiple values and now that makes my  
16       math all hosed up.

17                  CHAIRMAN STETKAR: Yes.

18                  MR. LOIGNON: That's the issue.

19                  CHAIRMAN STETKAR: That's the issue.

20                  MR. LOIGNON: As long as it's doing it all  
21       by itself and doing all 1500, it takes care of that.  
22       But when I say I do 600 in this group and 600 in that  
23       group and I try and merge those into 1200, they are  
24       not consistent.

25                  CHAIRMAN STETKAR: Okay.

1 MR. LOIGNON: So, I've got to go through  
2 all 1200 scenarios and all the thousands of cut sets  
3 and make sure that the basic events get all  
4 straightened up.

5 CHAIRMAN STETKAR: Okay. All right.

6 MR. LOIGNON: So, mods. From my point of  
7 view, they fall into two categories. I'm resolving  
8 deterministic issues, or I'm just lowering CDF.

9 Deterministic ones fall in the categories  
10 of some system feature improvements like I got a  
11 sprinkler system that didn't quite cover the whole  
12 fire zone. I'm going to extend it out five more feet  
13 so that I can take credit for it over there.

14 Circuit and tubing protection is basically  
15 fire wrapping and barrier work. That scenario I told  
16 you about where I can remove power from both ESF buses  
17 from offsite power, we're rerouting some of that cable  
18 to make that go away.

19 The disconnect switches where we found  
20 some holes in the logic the way they were designed  
21 initially, we're fixing those, and some communication  
22 enhancements.

23 MR. KAMMER: Let me make a comment. You  
24 said the way it was designed initially. Actually,  
25 we're taking different failure modes out of NEI-0001.

1 MR. LOIGNON: That's true.

2 MR. KAMMER: And found some insights that  
3 we didn't -

4 MR. LOIGNON: We didn't know we were -

5 MR. KAMMER: -- have back in Appendix R  
6 days.

7 MR. LOIGNON: That's true.

8 (Discussion off the record.)

9 MR. LOIGNON: Rev 1 was available at the  
10 time, but we were working toward Rev 2 information.  
11 We had the experts available to us.

12 CHAIRMAN STETKAR: So, I mischaracterized  
13 that. I apologize.

14 MR. LOIGNON: For CDF reductions, we're  
15 committing to do reactor coolant pump seal  
16 replacements that are - whether we use the  
17 Westinghouse shutdown seal or a different seal, but  
18 something that will address consequential LOCAs.

19 Incipient detection in the relay room  
20 cabinets. An alternate seal injection system which is  
21 actually almost installed right now. Should be  
22 installed before we get to our refueling outage this  
23 fall.

24 And auto start on the instrument air  
25 compressor. We have a diesel-driven compressor that

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1 we have to manually start now. We're going to put an  
2 auto start on that.

3 And those really weren't being driven by  
4 VFDRs or anything like that. It's just they do have  
5 some significant risk reduction and just help in  
6 general.

7 CHAIRMAN STETKAR: And all of these are -  
8 you've included them in the PRA models.

9 MR. LOIGNON: Yes, they are included in our  
10 model. So, just like the other utilities, I do have  
11 two models that I'm trying to merge together.

12 So, I've got my current at-power model  
13 that I use right now in E00S and (a)4 space, and I've  
14 got one that I have at the end of my transition from  
15 SISBO to 805. And that model includes all of these  
16 mods.

17 So, as I get the -

18 CHAIRMAN STETKAR: But the only difference  
19 is if I can think of those as a serial progression -

20 MR. LOIGNON: Exactly.

21 CHAIRMAN STETKAR: -- they're not - from  
22 what I heard with Duane Arnold -

23 MR. LOIGNON: Yes.

24 CHAIRMAN STETKAR: -- it's more of a  
25 parallel serial.

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1 MR. LOIGNON: Right, mine is a serial  
2 progression. If there are other mods that happen,  
3 I'll put it in both places.

4 CHAIRMAN STETKAR: Yes, okay.

5 So, you've actually committed to some  
6 substantial capital costs for these modifications.

7 MR. LOIGNON: Yes. The alternate seal  
8 injection mod was actually in process before we even  
9 made the LAR submittal, but we included it just so we  
10 could show the numbers right. We took credit for it  
11 for the number part.

12 CHAIRMAN STETKAR: Were you doing that also  
13 for internal events?

14 MR. LOIGNON: Yes.

15 CHAIRMAN STETKAR: Okay.

16 MR. LOIGNON: Like I said, it's being  
17 installed now and the model will be updated. Right  
18 after it goes operational, it will be updated.

19 It was being driven before 805 because of  
20 MSPI margin concerns. So, that's really what was  
21 driving it to start with.

22 Reactor coolant pump seal replacement has  
23 been on our radar screen for quite some time. So,  
24 we're going to do something about it now.

25 MEMBER SCHULTZ: Independent of this



1 project.

2 MR. LOIGNON: Yes. It's been on our radar  
3 screen for a while. Just we weren't sure which way we  
4 wanted to go. I think we finally came to a  
5 conclusion, but we're going to install it in the next  
6 couple outages.

7 MEMBER SCHULTZ: You mentioned earlier,  
8 Gerald, that with regard to what are the typical  
9 deterministic modifications, that you are doing those  
10 in selected areas where they'll make the most  
11 difference based upon the 805 work, things like the  
12 circuit tubing protection, wrapping.

13 MR. LOIGNON: We have specific circuits  
14 that we want to wrap that we're doing, yes. And  
15 they're basically because of deviations from  
16 separation criteria or whenever that weren't apparent  
17 before when we were doing Appendix R, because we de-  
18 energized them.

19 MEMBER SCHULTZ: Okay, thank you.

20 MR. LOIGNON: Implementation challenges,  
21 ours are similar to everybody else's. Maybe a little  
22 bit more in some respects because of the change in  
23 philosophy. The knowledge transfer from the vendor  
24 did most of the work.

25 We did a pretty good job, I think, of

1 shadowing the vendor. So, when they were doing the  
2 PRA model, we were watching what they were doing.  
3 They came and trained us. We made sure we know how to  
4 do it.

5 In fact, we are running the model now as  
6 part of our plant modification control. I am running  
7 two programs. I have an Appendix R program and an 805  
8 program.

9 Appendix R they don't talk to me about too  
10 much. But when it comes to 805, I am in the process.  
11 They don't do mods without talking to me.

12 It used to be, you know, you want to put  
13 a cable, I didn't care. You want to touch a cable?  
14 I didn't, you know, we're talking a fair amount of  
15 work for me to say I like it or not and we're in the  
16 process.

17 So, just like they're updating the  
18 database, they come and make sure that they talk to  
19 the PRA guys and it's okay.

20 Because we're doing that operational  
21 response strategy change, there's a lot more procedure  
22 revisions for us, I think, in those. Our FEPs are  
23 basically going to be thrown away and be replaced.

24 Fire free plans have a little bit more  
25 insights. We put some insights in them from IPEEE,

1 but they're slightly different now because we're  
2 keeping both trains alive.

3 The configuration management part of it we  
4 actually hadn't implemented, like I said. So, we've  
5 done some changes to our administrative programs and  
6 modification space to make sure that 805 concerns are  
7 captured right up front.

8 And we'll keep even during the transition  
9 that's going to be a couple years, we'll keep all the  
10 data on the fire stuff up to date.

11 MEMBER SCHULTZ: Gerald, who's the owner of  
12 that program?

13 MR. LOIGNON: Design Engineering owns the  
14 configuration management part. But PRA is  
15 specifically in their procedure, in their checklist.  
16 They can't go without us. Even though we're not part  
17 of design for Summer station, we're in their  
18 procedure.

19 MEMBER SCHULTZ: Okay, thank you.

20 MR. LOIGNON: The physical modifications,  
21 we obviously made some assumptions about what they  
22 were going to look like when we modeled them.

23 So, as they model them, we'll go back and  
24 make sure that we did it correctly or, you know, tweak  
25 on it if we have to.

1                   There's a lot of things going on in the  
2                   industry now that are keeping us busy. So, there's  
3                   just lots on our plate to distract us and we need to  
4                   make sure we keep our eye on it and get it done.

5                   And that might be the end of it.

6                   (Discussion off the record.)

7                   CHAIRMAN STETKAR: Thank you. Any other  
8                   members have any comments, any questions?

9                   (No response.)

10                  CHAIRMAN STETKAR: Well, thank you very,  
11                  very much. That was a good summary and you've  
12                  miraculously returned us to even ahead of schedule.  
13                  So, I don't know what to do.

14                  (Laughter.)

15                  CHAIRMAN STETKAR: I can stand here and  
16                  talk for an hour. You know I can do that.

17                  (Discussion off the record.)

18                  CHAIRMAN STETKAR: What I would like to do  
19                  is one last time open up the bridge line and see if  
20                  there are any comments from anyone out there.

21                  While we're getting that done, is there  
22                  anybody in the room that has anything to offer? I'm  
23                  hearing clicks up there. Just again would somebody  
24                  out there wherever you are, just say something so we  
25                  can confirm that we have the bridge line open?

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1 Anybody?

2 MR. JOGLAR: This is Francisco Joglar from  
3 Hughes Associates.

4 CHAIRMAN STETKAR: Thank you, Francisco.  
5 I appreciate that. You'd think we'd have some better  
6 way of doing this, but we don't.

7 Now that we know it's open, is there  
8 anyone on the bridge line who has any comments or  
9 questions regarding the Summer presentation?

10 (No response.)

11 CHAIRMAN STETKAR: Okay. Hearing nothing,  
12 no comments or questions from any of the other member,  
13 again while we're on the record, I really do want to  
14 again thank all of - especially the licensees bringing  
15 all the people you brought, expertise to answer  
16 questions.

17 It was, I think, certainly very useful for  
18 us and we really appreciate the effort you put into  
19 this. And I think we had a good discussion. And with  
20 that, we will recess until tomorrow morning.

21 (Whereupon, the above-entitled matter went  
22 off the record at 4:26 p.m.)

23

24

25



Stephen Dinsmore, Sr. Risk Analysis Engineer

PRA Licensing Branch

Harold Barrett, PE Sr. Fire Protection Engineer

Paul Lain, PE Sr. Fire Protection Engineer

Fire Protection Branch

Division of Risk Assessment

Office of Nuclear Reactor Regulation

## **NRC Staff Observations on NFPA 805 LAR Reviews**

*Technical Findings on NFPA 805 Transition*

*ACRS Reliability and PRA Subcommittee Brief*

*July 26 & 27, 2012*



# Topics for Discussion

- Program Status
- LAR Acceptance Reviews
- Site Audit Observations
- RAIs & RAI Responses
- Summary

# NFPA 805 Program Status

LAR Submittals	LAR Review Status
1. D. C. Cook 1 & 2	SE & RAI Development (2 <sup>nd</sup> Round)
2. Duane Arnold	SE & RAI Development (2 <sup>nd</sup> Round )
3. Callaway	SE & RAI Development (2 <sup>nd</sup> Round )
4. Fort Calhoun	SE & RAI Development (2 <sup>nd</sup> Round )
5. V. C. Summer	Awaiting RAI Responses & SE Development
6. Waterford 3	Awaiting RAI Responses & SE Development
7. Arkansas Nuclear One 2	Reviewing LAR Supplemental Information
8. Cooper	Reviewing LAR Supplemental Information
9. Nine Mile Point 1	LAR Acceptance Review
10. Turkey Point 3 & 4	LAR Acceptance Review
11. Arkansas Nuclear One 1	LAR due 8/31/12
Brunswick, Beaver Valley, Farley, & Prairie Island	LARs are due 9/30/12



# LAR Acceptance Reviews

- PRA Supplement Requests
  - RG 1.200 Compliance Paths
  - Incomplete Total Risk & Change in Risk Information
  - Not Identifying Relevant Sources of Model Uncertainty
    - Unreviewed Methods
    - Key Assumptions
  - Not Providing Required Sensitivity Study Results

# LAR Acceptance Reviews

(cont.)

- Fire Modeling Observations
  - Deviations from Accepted Methods
  - Quality Issues
- Other Observations
  - Programmatic
  - Nuclear Safety Criteria Assessment
  - Fire Protection Program

# Site Audit Observations

- Information Integration During Analysis
- Fire Modeling
- Program Quality after Transition

# RAIs & Responses

- PRA RAIs
- Fire Modeling RAIs
- Nuclear Safety Criteria Assessment
- Fire Protection Baseline Program

# Summary

- The Staff will continue the License Amendment Review Process (LIC-101) to resolve site specific issues.
- The Staff will continue to work with stakeholders to resolve generic issues so future applicants can incorporate the necessary information.

# Donald C. Cook Nuclear Plant

## NFPA 805 LAR Insights & Issues

*July 2012*



*Project Team Lead: Dan MacDougall – NFPA 805 Project*

# Presentation Overview

## DC Cook Features

## NFPA 805 Transition Project Summary

- NFPA 805 Transition Objectives
- LAR Development, RAIs and Implementation
- Fire PRA Overview & Results
- Fire PRA Technical Challenges
  - Ignition Frequencies
  - Fire Modeling
  - Spurious Actuation Failure Probabilities
- Uncertainty
- Implementation Challenges
- Summary

# DC Cook Plant Features

- Two units, Total ~2150 Mwe, 4-loop Westinghouse PWRs with Ice Condenser Containments
- Ultimate heat sink is Lake Michigan.
- All plant cooling is direct lake water heat exchange.
- Alternate shutdown relies on other unit systems for pumped fluid services.
- Dedicated Fire Brigade is independent of operations shift staffing, not credited for safe shutdown strategy



# Transition Objectives

- November 2005 study established goals for the transition.
- Objectives of Adopting NFPA 805:
  - Adopt a Risk Informed Fire Protection Program
  - Respond to NRC Industry Request for Transition to NFPA 805
  - Provide for an understandable Licensing Basis
  - Reduce Fire Protection Test and Maintenance Costs
    - Reducing suppression systems
    - Reducing emergency lighting
    - Reducing Fire-Rated Barriers
  - Reduce Operator Manual Actions

# LAR Submittal

Used the NEI 04-02 LAR Template

- Submitted July 1, 2011, Supplement 1 issued Sept. 2, 2011 to include specific plant risk values.
- Some questions but no issues during LIC-109 review
- Fire PRA applied during the development of Fire Risk Evaluations (LAR Attachment W)
- Total 39 RAIs (~60% PRA & fire modeling related)
- 6 Separate Rad Release related RAIs
- Site Fire Modeling Evaluation, resulted in formal response to 11 questions
- Site audits were valuable meetings for the NRC & reviewers to discuss & understand the CNP approach

# Fire Risk Evaluations

- Determined Delta Risk between Compliant Plant and NFPA 805 Post-Transition Plant
  - Delta in Core Damage Frequency
  - Delta in Large Early Release Frequency
- Over 260 VFDR Risk Evaluations using the 900 Fire PRA scenarios
- Based on RG 1.205 & RG 1.174 requirements for 805 transition & risk-informed PRA applications
- Cumulative delta-CDF & cumulative delta-LERF compared to RG 1.174 risk acceptance limits
- Close to the limit on acceptable delta-risk increase

# Fire Safety Analysis

- 57 FSAs Document Each Fire Area
- Summary of deterministic/design and risk insights
  - Fire Protection Systems and Features
  - NSCA Compliance Strategy
    - VFDRs and Recovery Actions
  - Fire PRA Risk Evaluation Results
  - Radioactive Release Review
  - NPO Compliance Review
  - Monitoring Program Input
  - Defense-In-Depth and Safety Margin Review

# NFPA 805 Implementation

- Modifications and Implementation Items
  - MOV IN 92-18 Mods
  - Conversion of CO<sub>2</sub> Systems from Manual to Automatic
  - Transient Combustibles Control with Combustible Free Zones (CFZ)
  - Fuse Replacement – Coordination Study Deficiencies
  - Develop Monitoring and NPO Programs
  - Update Procedures and Other Documentation
  - Training After Receipt of NRC SE

# Fire PRA Peer Review

- Fire PRA Peer Review - October, 2009
  - Conducted by the PWR OG
  - Fire PRA built from the Internal Events PRA
  - No Significant Findings
  - 61 F&Os - 36 Suggestions, 25 Findings – All Impacts Resolved
- PWROG Indicated That Overall, the Fire PRA Quality was Found to be Very Good with Many Elements Being Performed at the State-of-the-Art Level
- Fire PRA Peer Review process provided a good, independent look at the CNP model and basis

# Fire PRA Summary

- Fire PRA Results Reflect & Complement D-I-D Approach
  - Insights are Not Surprising
- Fire PRA Results, in Many Cases, are Influenced Significantly by Conservative Data and Modeling
- Need to account for uncertainty, including conservatism:
  - Do not make changes based on overly conservative results.
  - Formal uncertainty analysis can reduce calculated results by factor of 5 to 10.

Based on the Efforts of Many (Plant, Industry and NRC) – we have come a long way, *but*

- ✓ Critical Evaluation of Results is Essential to Ensure PRA Results are Properly Understood and Characterized
- ✓ “NFPA 805 Fire PRAs” will need to be enhanced for use in Risk management and other Risk Informed Activities
- ✓ Continued Data and Methods Enhancements are needed

# Fire PRA Model Attributes

- Plant model, success criteria, random failure probabilities are based on the Internal Events PRA.
- Follows NUREG/CR-6850, with Supplement 1.
- Approved NEI-FAQ's have been incorporated.
- There is a separate fire PRA model for each unit.
- Overall plant site includes 57 analysis areas (AA)
  - Some AA have cables for both units
- CDF & LERF ( $\Delta$ CDF &  $\Delta$ LERF) for each unit is calculated for each AA.
- Ice Condenser Containment is more limiting for LERF than other PWR containment designs.



# Fire PRA Results–Risk Metrics

Unit	Fire CDF (per year)	NFPA 805 Delta-CDF (per year)	Fire LERF (per year)	NFPA 805 Delta-LERF (per year)
Unit 1	3.55E-5	9.01E-6	3.43E-6	6.85E-7
Unit 2	2.86E-5	8.46E-6	2.23E-6	5.97E-7

	<u>Unit 1</u>	<u>Unit 2</u>
Internal Events CDF	1.322E-05/yr	1.323E-05/yr
Fire CDF	3.55E-05/yr	2.86E-05/yr
Seismic CDF	3.17E-06/yr	3.17E-06/yr
Total CDF	5.2E-05/yr	4.5E-05/yr
Internal Events LERF	2.701E-06/yr	2.700E-06/yr
Fire LERF	3.43E-06/yr	2.23E-06/yr
Seismic LERF	9.82E-07/yr	9.82E-07/yr
Total LERF	7.1E-06/yr	5.9E-06/yr

# Fire PRA Results–Top Areas

- Unit 1 Fire PRA

- Top 16 areas contribute >95% of the fire risk
- Top 10 areas (each area between  $7.5\text{E}-6/\text{yr}$  &  $1\text{E}-6/\text{yr}$  CDF):
  - 21% Unit 1 4kV AB Switchgear Room (El. 609'-6")
  - 20% Turbine Building
  - 11% Yard
  - 7% U1 Engr Safety System & MCC Room (El. 609'-6")
  - 7% U1 Control Rm Cable Vault & HSD Panel (El. 624' & 633')
  - 6% U1 ESW Pump Area & U1/U2 Basement MCC (El. 591' & 575')
  - 5% U1 Containment
  - 4% U1 Swgr Rm Cable Vault & Aux Cable Vault (El. 626' & 621')
  - 4% U1/U2 Aux Bldg & Fuel Handling Area (El. 609', 633' & 650')
  - 3% U1 Control Room (El. 633')

# Fire PRA Results–U1 Top Scenarios

- Fire in Yard causes Loss of Offsite Power to both Units
  - Fire damage is limited to the offsite power supply
  - EDG failures lead to Station Blackout
- 4kV Bus 1B Fire fails Train B power & Offsite Power
  - Train A EDG random failures lead to loss of RCP seal cooling
  - Fail to locally trip RCP leads to seal LOCA
    - LOCA too big to mitigate via CVCS cross-tie
- 4kV Bus T11A Fire – same scenario as Bus 1B
- Turbine Bldg Fire Damages to AC Power
  - Random failures lead to Station Blackout
  - Failure to cross-tie AFW & CVCS leads to core damage
- Bus T11D High Energy Arcing Fault
  - Fire fails AC power to both safety trains, losing RCP seal cooling
  - Fail to locally trip RCP (fire fails control power) leads to seal LOCA
    - LOCA too big to mitigate via CVCS cross-tie

# Fire PRA Results Insights

- Risk Significant Contributors
  - Cable vaults and rooms with 600V buses that impact both trains at the same unit (demanding cross-ties)
- Inter-unit system cross-ties effectively reduce risk
  - Required refinement of success criteria
- Recovery Actions credited (Draft NUREG-1921 used)
- Combustible Free Zones & Hot Work Restrictions minimized effects of transient fires in critical areas

# Fire PRA Model Development

- First tasks of NUREG/CR-6850 developed the base fire PRA model and data
- Mostly straight-forward tasks, but some challenges
- Fire PRA Model Input development (by task number)
  - 1: Plant Boundary Definition and Partitioning (PP)
  - 2: Component Selection (ES)
  - 3: Cable Selection (CS)
  - 4: Qualitative Screening (QLS, not used at DC Cook)
  - 5: Fire-Induced Risk Model (PRM)
  - 6: Ignition Frequencies (IGN)
  - 9 & 10: Circuit Failure & Circuit Failure Likelihood (CF)

# Fire PRA Technical Challenges

- 1<sup>st</sup>-Reducing total Fire PRA CDF below  $1\text{E-}4/\text{yr}$ 
  - ~ 2009, prior to Fire PRA Peer Review
  - Ignition frequencies shifted from NUREG/CR-6850 to FAQ-0048 Initiating Event Frequencies (IEFs)
  - Additional fire modeling needed
  - Need 1 train+ for good risk results (see #26)
- 2<sup>nd</sup>-Ensure LAR Delta-CDF below  $1\text{E-}5/\text{yr}$ 
  - ~ 2010 for LAR supporting analyses
  - Address Fire PRA Peer Review F&Os
  - Transition with as few plant modifications as possible
- 3<sup>rd</sup>-Uncertainty Considerations

# Fire Ignition Frequency

- Based on NUREG/CR-6850 methods
  - First developed a set of IEFs from NUREG/CR-6850
  - Then developed a set of IEFs from FAQ-0048
- Current results use FAQ-0048 IEFs (NUREG/CR-6850 Supplement 1)
- IEF data still conservative for some contributors:
  - Crude rules for frequency & size of transient fires in an area when all precautions have been taken to eliminate them reduces worth of hotwork free and transient combustible free zones (FAQ-0064).
  - Effect on transient fire suppression of personnel in the area who may have caused the fire in the first place (such as during maintenance or hotwork).
  - No distinction between running & standby components

# Fire Growth Trees

- **Complex Development & Quantification of Fire Damage States (FDS)**
  - Developing Ignition Frequencies into Cable Damage (and thus SSC Damage)
  - Fire Growth Trees address:
    - Frequency of the Ignition Source
    - Progression to Reactor Trip (assumed)
    - Fire Progression to Targets, which includes:
      - Propagation & Severity Factors
      - Captured via Fire Modeling
      - Includes Detection and Suppression
  - Fire Modeling is the key to Fire Damage States



# Fire Modeling

- Used Verified & Validated (V&V'd) Fire Models
- 57 Total Plant Fire Areas
  - 18 Deterministic (evaluated at whole room burn-up)
  - 39 Performance Based (evaluated with fire models)
- Process followed NUREG/CR-6850 and the Fire PRA Standard
- Fire models developed scenarios consisting of specific ignition sources & targets
- Developed over 900 scenarios as input to Fire PRA quantification

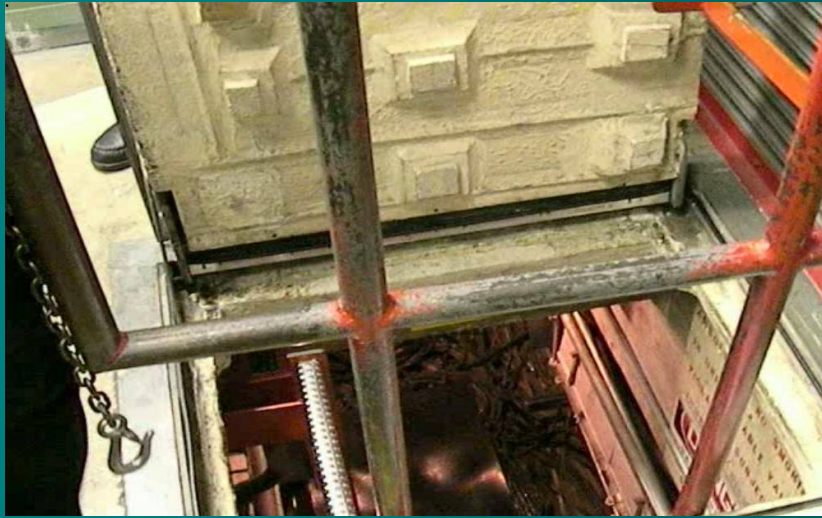
# Fire Modeling (cont'd)

- First cut done with conservative data:
  - Published Heat Release Rate, taken at 98%
  - T-square growth model
- Produces time to damage, governs failure probabilities for suppression
- Associated target (cable) damage often limited by spatial knowledge of cable raceways
  - Sometimes multiple raceways high in the overhead, so initially assume all are affected
  - If CDF after first cut is too high, Fire PRA provides information of “minimum protected set” of cables, and walkdowns conducted to identify their location

# Fire Damage State

- Complex Development & Quantification of Fire Damage States (FDS)
  - Analysis of Individual Fires with Fire Modeling is Needed for Many Areas
- Level of Detail in Fire Modeling & associated SSC Impacts varies by Fire Location (Level of Effort Issue)
  - Iterative Process unless All Locations with NSCA SSCs are Modeled in Detail,
  - But not all cable routing known in detail
  - Summation of Results for Areas with Smaller CDF Results can Create Unrealistic Overall Calculated Results and thus Many Areas Typically Need Refinement.
- PRA Modeling
  - Straightforward for quantifying fire damaged data sets

# Transient Source Fire Modeling Example





# Fixed Source Fire Modeling Example



# FPRA Insights into Mitigation

- Deterministically compliant areas can have Higher than Anticipated **Calculated** CDFs due to Conservative Fire Damage State Frequencies combined with Unreliability/Unavailability of Undamaged Mitigating SSCs

Mitigating Equipment	CCDP	PRA Risk Metric Results
Redundant Safety Trains, Non-Safety Train, & OSP Available	1E-4 to 1E-5	Good PRA Result
Redundant Safety Trains, and OSP Available	1E-3 to 1E-4	Good PRA Result
Redundant Safety Trains Available but without OSP	1E-2 to 1E-3	Good PRA Result Depends on Fire Damage State (FDS) Frequency
Safety Train with OSP Available	~1E-2	Good PRA Result Requires Very Low FDS Frequency
Safety Train Powered by EDG	~1E-1	A Good PRA Result is a Challenge

# Circuit Failure Likelihood

- Detailed circuit analysis was performed on the risk significant components from the First Quantification (Task 7)
  - Cables that could cause spurious actuation
  - Note whether internal or external faults required
- In quantification process, probability for spurious actuation was assigned based on whether selected cables were involved in fire scenario
- Highest single spurious likelihood probability was used (FAQ-08-0047)
- Spurious open – Spurious close & spurious open were both assigned same probability.
- **Issue – large spurious actuation probabilities**
  - Challenge the rare event approximation
  - Total sum of all failure states should not exceed 1

# Fire PRA Uncertainty

- Many conservatisms in NUREG/CR-6850 Approach
  - Ignition Frequencies
  - Spurious Actuation failure probabilities
  - Heat Release Rates & Fire Growth Model
- Also potential non-conservatisms
  - Operator response with degraded instrumentation & spurious cable failures
- Parametric data uncertainty addressed by estimation instead of rigorous statistical propagation
  - No value-added insights from statistical propagation as modeling assumptions dominate (e.g., fire modeling)



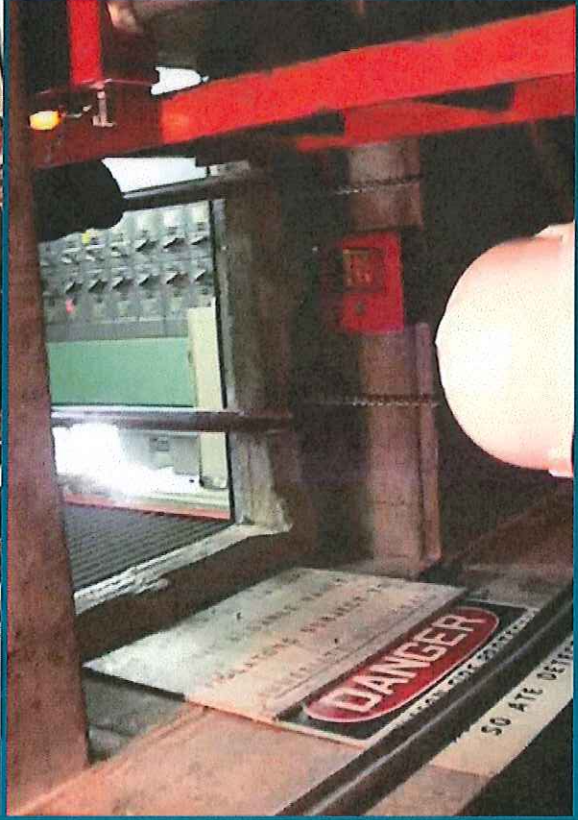
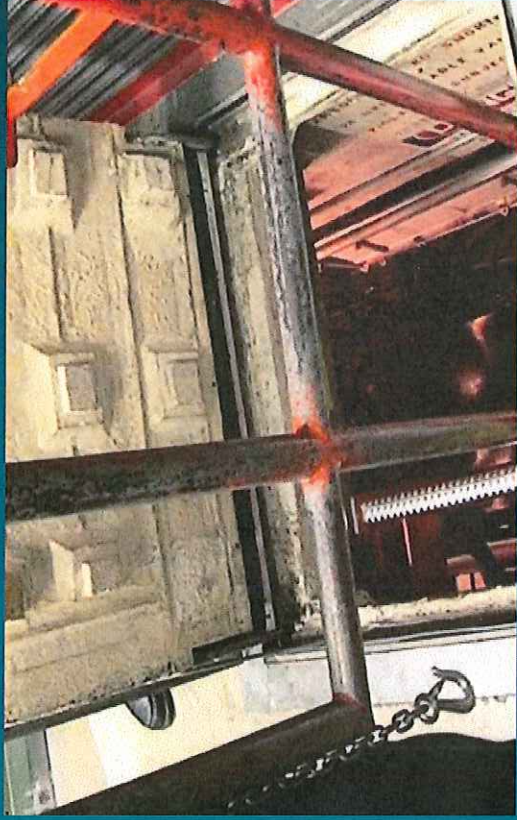
# Implementation Challenges

- Paradigm Shifts
  - Non-TRM Systems Risk Significant
  - Configuration Management (currently two programs)
  - Industry Participation
  - Qualification (Single Nuclear Plant Utility)
  - Qualitative 86-10 vice Change Evaluation
  - Recovery/Compensatory Actions (LERF/NPO)
  - Training (Ops, Engr., Outage Management, Work Control, Fire Brigade, etc.)

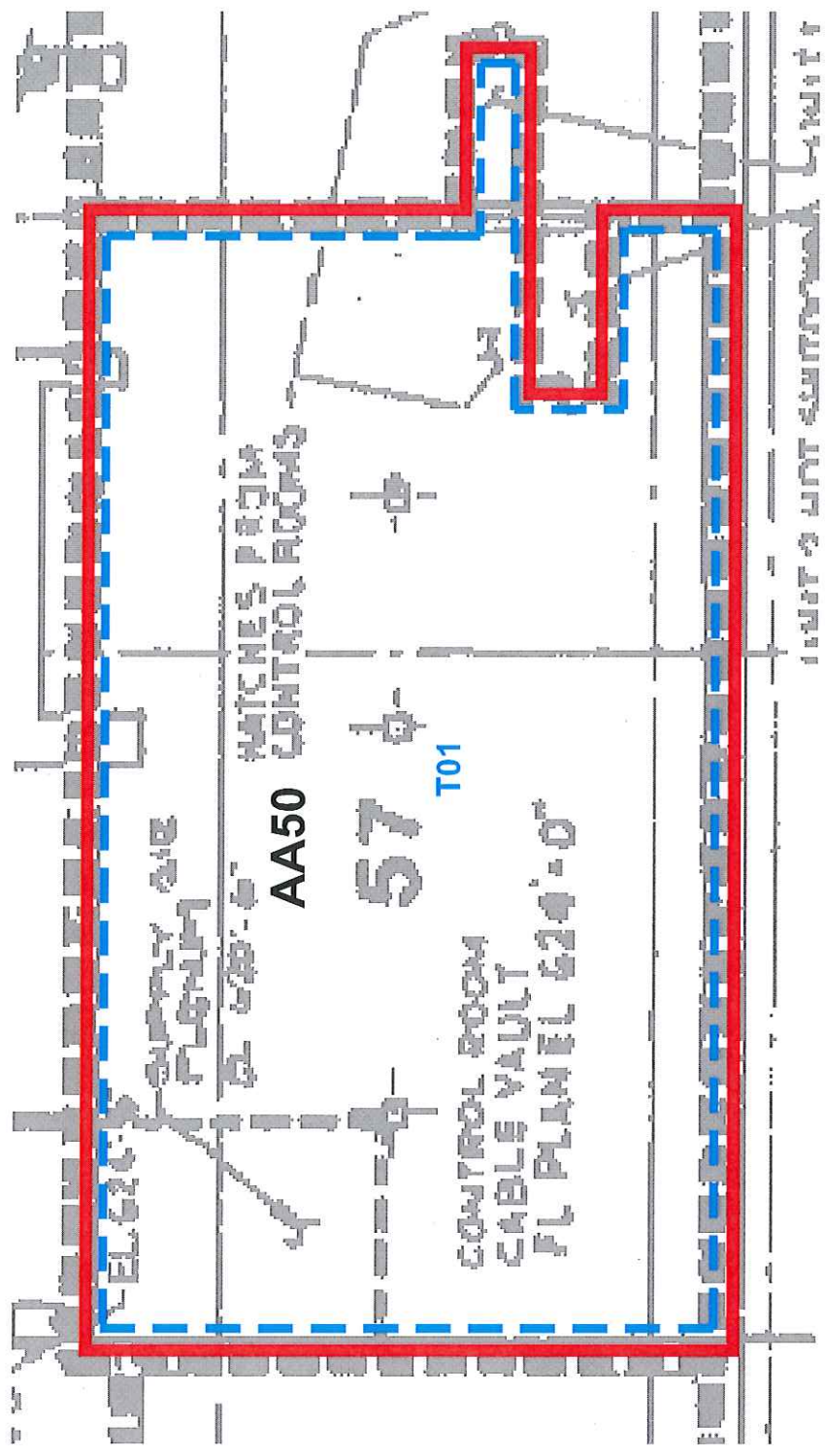
# CNP NFPA 805 Summary

- NFPA 805 LAR submitted 6/29/2011
- Most Challenges were data conservatisms or data limitations (regulatory guidance, fire modeling & unknown cable locations)
- Paradigm Shifts (risk informed performance based)
- Configuration Management (RAI responses, FAQ/NEI 04-02 changes, two programs, qualifications)


# Fire Modeling Example







Legend	
—	Transient Scenario Boundary
- - -	Fire Compartment Boundary
—	AAxx
—	Fire Compartment

Cook Nuclear Plant	
Technical Eval. R1900-0411-AA50	
Attachment 3	
Fire Modeling Sketch of Compartment	
AA50 (Zone 57) EL. 624'-0"	
 EPM Engineering Planning and Management, Inc. ■ 99 Canal Street, Framingham, MA 01901 TEL 508/875-1111	Rev. 0
	Sheet 1 of 2

ACAD-AA50a

Transient Fire Quantification

Cook Nuclear Plant  
Fire Area AA50 - Technical Evaluation R1900-0411-AA50  
Attachment 7: Transient Quantification  
Rev. 0

Plant	Cook Nuclear Plant
Fire Area	AA50
Ignition Source	Transient Quantification

Prepared:	EMM - 7/24/2009
Reviewed:	ARB - 7/28/2009

Description of Fire Scenario

Only regular solid transient fires are postulated in this room. The 98th percentile heat release rate for transients is 317 kW. All uncovered trays and conduits are failed before suppression occurs. Successful suppression at 4 minutes prevents failure to thermoplastic cables. If suppression fails after 20 minutes, a transient fire will spread to surrounding combustibles to create a hot gas layer and cause whole room damage. The fire risk quantification below is to credit automatic suppression in order to limit target damage for a the transient fire scenarios in Fire Zone 57.

Fire Modeling Input Parameters		Fire Ignition Frequency and PRA Input Data	
98th Percentile HRR (kW)	317	Influence factor	1.00
Damage temperature (°C)	330	Cable fire caused by welding and cutting	1.00E+00
Ambient temperature (°C)	25	Transient fires caused by welding and cutting	1.00E+00
Damage heat flux (kW/m²)	11	Transients	1.00E+00
Radiative heat release rate fraction	0.4	Total Transient (Bin 6 + Bin 7):	2.00E+00
Fire elevation (ft)	2.00	Room CCRP (from FPRA Summary Sheet) =	1.00E+00
Fire diameter (ft)	2.26	Room CLERP (from FPRA Summary Sheet) =	1.00E+00

Lambda (Mean)		Reference	
Bin 5	0.188	From FAQ-08-	
Bin 6	0.188	0050	
Bin 7	0.126		

Time to Det (Min)	
Bin 5	0
Bin 6	0
Bin 7	15
Manual Det	15

Transient Quantification Assuming Whole Room Damage

Scenario Floor Area									
Scenario ID	Location Factor	Length (ft)	Width (ft)	Area (ft2)	Wg	Shortest Target Distance (ft)	Fire Condition	Critical Q (kW)	SF
Bin 5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AA50-57-701	1	N/A	N/A	4410	1.00E+00	0.00	Radiant	0	1.00E+00
Total Area (Zone 55)					4410 ft²				

Time to Det (Min)		Reference	
Bin 5	0	From FAQ-08-	
Bin 6	0	0050	
Bin 7	15		
Manual Det	15		

Time to Det (Min)	
Bin 5	0
Bin 6	0
Bin 7	15
Manual Det	15

Wg x SF x Pns		Time to Damage (min)	
Bin 5	1.00E+00	0.00	0.00
Bin 6	1.00E+00	0.00	0.00
Bin 7	1.00E+00	0.00	0.00
Manual Det	1.00E+00	0.00	0.00

Total Trans Freq, A		CDF using Room CCRP	
Bin 5	1.00E+00	1.00E+00	1.00E+00
Bin 6	1.00E+00	1.00E+00	1.00E+00
Bin 7	1.00E+00	1.00E+00	1.00E+00
Manual Det	1.00E+00	1.00E+00	1.00E+00

LEBF using Room CLERP		Fire Propagation	
Bin 5	1.00E+00	Yes	Yes
Bin 6	1.00E+00	No	No
Bin 7	1.00E+00	No	No
Manual Det	1.00E+00	No	No

Scenario Description	
Bin 5	Cable fires caused by welding and cutting
Bin 6	Transient fire encompassing all of Fire Zone 57.
Bin 7	Transient fire encompassing all of Fire Zone 57.
Manual Det	Transient fire encompassing all of Fire Zone 57.

Total CDF	3.00E+00	3.00E+00	3.00E+00
-----------	----------	----------	----------

Fire Event Tree

Cook Nuclear Plant  
Fire Area AA50 - Technical Evaluation R1900-0411-AA50  
Attachment 9: Fire Event Tree  
Rev. 0

Plant	Cook Nuclear Plant
Fire Area	AA50
Ignition Source	Transient Fires

Prepared:	EMM - 7/24/2009
Reviewed:	ARB - 7/28/2009

**Description of Fire Scenario**  
All uncovered trays and conduits are failed before suppression occurs. Successful suppression at 4 minutes prevents failure to thermoplastic cables. If suppression fails after 20 minutes, a transient fire will spread to surrounding combustibles to create a hot gas layer and cause whole room damage. The fire event tree and fire risk quantification is to credit automatic suppression in order to limit target damage for a the transient fire scenarios in Fire Zone 57. Multiple fire damage states are analyzed to credit suppression at 4 minutes and at 20 minutes. This zone contains thermoplastic raceways and cabling suppression at 4 minutes provides benefit by limiting damage to thermoplastic cables. Industry guidance indicates that tray enclosures on thermoplastic cables are capable of delaying damage until 4 minutes. Enclosures on thermoset cables can delay damage until 20 minutes. The fire will be detected by the nearest smoke detector in 11 seconds once the fire reaches 27 kW. The fire reaches 27 kW in 2.4 minutes (Attachment 6 f growth with the peak occurring at 8 minutes). The 4 minute delay to damage provided by the tray covers is assumed to be sufficient to bound all potentially challenging fire sizes including fires smaller than 27kW that may not activate suppression. The time to automatic suppression is rounded to 4 minutes (2.6 minutes for detection plus a 50 second delay time pre-discharge). Automatic detection is required to activate the Halon system. Manual detection is assumed to occur at 15-minutes. When the suppression system is unavailable, a fire watch is present and prompt detection is credited.

Detailed Fire Modeling Risk Quantification - Scenario Specific

Scenario	Total Trans Fire	Wg	SF	Pns	CCDP	COF	CLERP	LERF	Description of Damaged Targets and Associated Components
Bin5	1.00E+00	n/a	n/a	n/a	1.00E+00	n/a	1.00E+00	n/a	Worst Single Tray (TO BE DETERMINED)
AA50 57-T01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	2.00E+00	1.00E+00	2.00E+00	Attachment 8, Target Impacts, lists the damage for this scenario

Total 1.00E+00 2.00E+00 2.00E+00

FDT 10 Inputs (Detection)	
HRR of Fire [kW]	27
Radial Distance [ft]	10
Height Above Fuel [ft]	4.0
Temp [°F]	104

Fire Protection System Data	
Suppression Unavailability:	1.00E-02
Suppression Unreliability :	5.00E-02
Linked Detection Unavailability:	1.00E-02
Detection Unreliability:	5.00E-02
Unlinked Detection Unavailability:	1.00E-02

Time to Detection and Suppression	
Time to Auto Detection (ionization detector):	2.6 min
Time to Prompt Manual Detection:	0.0 min
Time to Manual Detection:	15.0 min
Fire Brigade Response:	0.0 min
Time to Suppression:	4.0 min
Lambda (Mean) Prompt Detection Succeeds:	0.188
Lambda (Mean) Prompt Detection Fails:	0.126

FDT 10 Results (Detection)	
Activation Time (sec)	11

# Fire Event Tree

Cook Nuclear Plant  
Fire Area AA50 - Technical Evaluation R1900-0411-AA50  
Attachment 9: Fire Event Tree  
Rev. 0

Fire Event Tree for General Transients (Bin 7): Tree Applies to Fire Zones 57

Fire	FI	Task 8 Severity Factor	System Available	Prompt		Automatic		Manual		End State	Description of End State
				Detec	Suppr	Smoke Detection	Suppr	Detec	Fire Brigade Response at or before, min		
		FS		PD	4.00	AD (smoke)	AS	MD	20		
1.00E+00		1.00E+00	9.00E-01				9.50E-01			9.47E-01	Automatic suppression is successful. No targets damaged after 4 minutes.
							5.00E-02			2.31E-02	Automatic suppression fails, manual suppression is successful. All thermoplastic cables are damaged, however thermostat cables are not damaged and whole room damage is prevented.
									4.67E-01	2.64E-02	Automatic suppression fails, manual suppression is unsuccessful. Whole room damage occurs.
									5.33E-01	5.29E-03	Automatic suppression and detection systems are unavailable. Prompt detection and prompt suppression are successful. Damage is prevented to all protected cables.
			1.00E-02	1.00E+00	5.29E-01					4.71E-03	Automatic suppression and detection systems are unavailable. Prompt detection is successful and prompt suppression is unsuccessful. Whole room damage occurs.

1.00E+00

## Detailed Fire Modeling Risk Quantification

FDS	Time (m)	Damaged Targets and Associated Components	SAPE scenario ID	(Task 6) λ	SF x Pns	CCDP	CDF	CLERP	LERF
FDS1/4	4	All unprotected cables within ZOI.	AA50.57-T01-S4		9.46E-01				
FDS2	20	All unprotected cables within ZOI as well as all thermoplastic cables.	AA50.57-T01-S20	1.00E+00	2.31E-02				Refer to Final Quantification
FDS3	21	Whole room damage.	Whole room damage		3.11E-02				



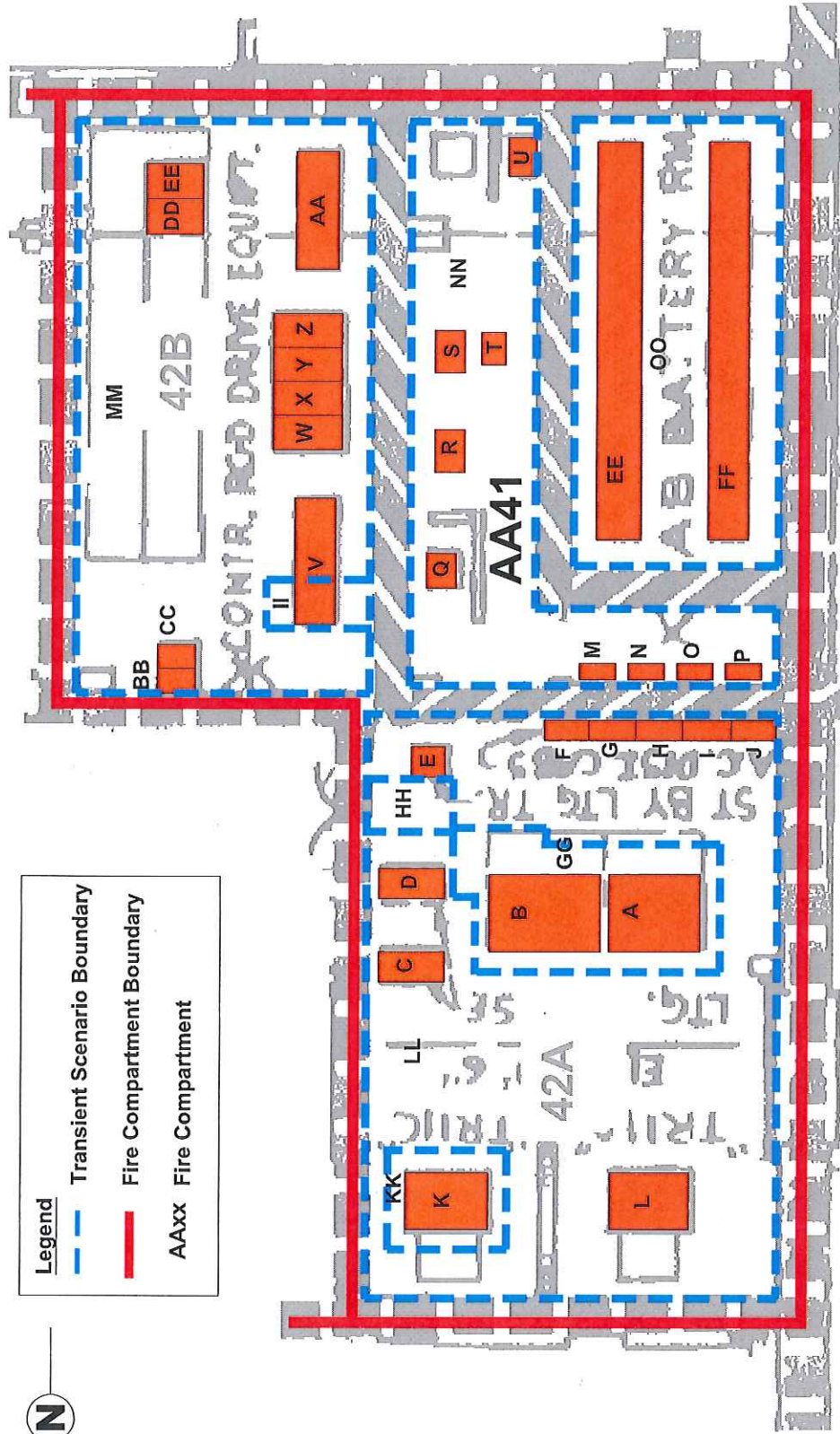






**Legend**

- Transient Scenario Boundary
- Fire Compartment Boundary
- AAxx** Fire Compartment



**Key:**

SIGNIFICANT IGNITION SOURCES			
A. Bus 11A	H. 1-PSBW	O. 1-MCAB	V. 1-CRDMG-1N
B. Bus 11C	I. 1-TE1E	P. 1-DAB	W. 1-52-BYA
C. 1-TR-LTG-9N	J. 1-TE1W	Q. 1-CRID-4-INV	X. 1-52-RTA
D. 1-TR-LTG-9S	K. 1-TR11C	R. 1-CRID-2-INV	Y. 1-CRDSWGR-G2
E. 1-TR-LTG-8	L. 1-TR11A	S. 1-CRID-1-INV	Z. 1-CRDSWGR-G1
F. 1-AB1E	M. 1-TDAB	T. 1-CRID-3-INV	AA. 1-CRDMG-1S
G. 1-AB1W	N. 1-MDAB	U. 1-CCRP-INV	BB. 1-RCS-PL-PC
			CC. 1-RCS-PL-CC
			DD. 1-RCS-LC
			EE. 1-RCS-DCH
			FF. 1-BATT-AB
			GG. 42A-T01
			HH. 42A-T02
			II. 42B-T01
			KK. 42A-T03
			LL. 42A-00
			MM. 42B-00
			NN. 42C-00
			OO. 42C-00

Cook Nuclear Plant  
Technical Eval. R1900-0411-AA41  
Attachment 3

Fire Modeling Sketch of  
Compartment AA41 - EL. 587'-0"



Rev. 0

Sheet 1 of 1

ACAD-AA41

## Attachment 6: Cook Fire Growth Analysis Worksheet

Compartment:	AA41	Fire Zone:	42C
Fire Scenario:	AA41.42C-5		
Ignition Source:	1-MCAB		
Description:	250VC Dist Panel MDCAB		

**Description of Fire Scenario**

A fire starts in 1-MCAB and burns for 40 minutes. Cable trays 1ELC93 drops directly down into the ignition source and ignites in one minute after being exposed to temperatures in excess of 915°F (NUREG 6850 Table H-5). Cable tray 1EL-D3 and 1EL-D1 run vertically into adjoining cabinets which are located directly adjacent to 1-MCAB. These trays are exposed to a radiant heat flux greater than 18 kW/m² and ignite after 1 minute (NUREG 6850 Table H-7 and H-8). Cable tray 1ELC94 is located directly above 1EL-D3 and approximately 18 inches from 1-MCAB. The tray is also exposed to a radiant heat flux greater than 18 kW/m² and ignites after 1 minute (NUREG 6850 Table H-7). After the listed cable trays ignite, the fire grows after one minute which causes a heat flux of 11 kW/m² which occurs 4' away from the fire. This heat flux causes cable tray 1EM-C118 to fail in 19 minutes (NUREG 6850 Table H-7). Cable tray 1EM-D9 contains thermoplastic cables and is also located 4' away from the fire. This tray fails at 4 minutes (NUREG 6850 Table H-8).

Source Type	Source	HRR per Unit (kW)	Unit	Vertical Separation of Tray (in)	Tray Width (in)	Tray Length (in)	Directions of Spread	Fire Spread Rate (in/min)	Number of Units	Ignition Time (min)	Duration (min)	SI	English
Cabinet	1-MCAB	211	Cabinet	N/A	N/A	N/A	N/A	N/A	1.00	0	40	0.91	36
Cable Tray	1EL-D1	25	ft	0	12	12	1	2.13	1.00	1	75	0.30	12
Cable Tray	1ELC94	20	ft	0	12	144	1	0.71	12.00	1	75	2.36	93
Cable Tray	1ELC93	20	ft	0	12	20	1	0.71	1.67	1	75	0.60	23
Cable Tray	1EL-D3	20	ft	0	12	12	1	0.71	1.00	1	75	0.51	20.00
Cable Tray	1EM-D9	25	ft	0	12	12	1	2.13	1.00	4	75	0.51	20.00
Cable Tray	1EM-C118	20	ft	0	12	12	1	0.71	1.00	19	75	0.57	22.6

Fire Spread		Vertical Separation of Tray (in)		Tray Width (in)		Tray Length (in)		Directions of Spread		Fire Spread Rate (in/min)		Number of Units		Ignition Time (min)		Duration (min)		SI		English	
SI	English	SI	English	SI	English	SI	English	SI	English	SI	English	SI	English	SI	English	SI	English	SI	English	SI	English
0.91	36	0.91	36	0.91	36	0.91	36	0.91	36	0.91	36	0.91	36	0.91	36	0.91	36	0.91	36	0.91	36
0.30	12	0.30	12	0.30	12	0.30	12	0.30	12	0.30	12	0.30	12	0.30	12	0.30	12	0.30	12	0.30	12
2.36	93	2.36	93	2.36	93	2.36	93	2.36	93	2.36	93	2.36	93	2.36	93	2.36	93	2.36	93	2.36	93
0.60	23	0.60	23	0.60	23	0.60	23	0.60	23	0.60	23	0.60	23	0.60	23	0.60	23	0.60	23	0.60	23
0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00
0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00	0.51	20.00
0.57	22.6	0.57	22.6	0.57	22.6	0.57	22.6	0.57	22.6	0.57	22.6	0.57	22.6	0.57	22.6	0.57	22.6	0.57	22.6	0.57	22.6

Compartment Parameters		SI		English	
Ambient Temperature [°C]:	32	90			
Room Width [m]:	3.7	12.0			
Room Length [m]:	13.4	44.0			
Room Height [m]:	3.7	12.0			
Vent Height from Floor [m]:	2.13	7.0			
Vent Height [m]:	2.13	7.0			

Compartment Material:		SI		English	
Thermal Conductivity [kW/mK]:	0.0016				
Density [kg/m³]:	2400				
Wall Thickness [m]:	0.30				
Specific heat [kJ/kg]:	0.75				
Heat transfer coefficient [kW/m²-K]:	0.02				

Damage Criteria		SI		English	
Temperature [°C]:	330	205			
Heat Flux [kW/m²]:	11	6			

Attribute:		SI		English	
Vertical Sections:	1				
Intervening Combs?:	Yes				
Open or Closed Doors:	Closed				

Cable Qualification:		SI		English	
HRR [kW]:	211				
Fire location factor:	2				
Cable Bundles:	One				
Convective HRR fraction:	0.7				
Radiative HRR fraction:	0.4				

Flow Rate [kg/sec] [cfm]:		SI		English	
Flow Rate [kg/sec] [cfm]:	4.206	7700			

Time (minutes)		SI		English	
0	10	10			
20	20	20			
30	30	30			
40	40	40			
50	50	50			
60	60	60			
75	75	75			
85	85	85			

Thermoset Zone of Influence		SI		English	
Flame Height (ft):	5.82	5.82			
Plume (ft):	10.41	11.78			
Plume Radius (ft):	1.85	2.05			
Ceiling Jet (ft):	3.45	4.49			
Flame Radiation (ft):	3.16	3.60			
Hot Gas Layer Temperature (NV - MCH) (°C):	94	129			
Hot Gas Layer Temperature (CC - NV - Beyer) (°C):	47	78			
Hot Gas Layer Temperature (FV - FPA) (°C):	61	79			
Hot Gas Layer Temperature (FV - D and B) (°C):	45	64			

Thermoplastic Zone of Influence		SI		English	
Plume (ft)	13.77	15.52			
Plume Radius (ft)	1.97	2.19			
Ceiling Jet (ft)	7.80	10.16			
Flame Radiation	4.27	4.87			





## DAEC Fire PRA - NFPA 805

July 26-27, 2012

## NEXT ERA ENERGY REPRESENTATIVES

<b>Anil Julka</b> <i>[presenter]</i>	Nuclear Reliability and Risk Manager – Corporate
<b>Vinny Rubano</b> <i>[presenter]</i>	NFPA 805 Engineering Manager - Corporate
<b>Laura Swenzinski</b>	Nuclear Licensing - DAEC
<b>Ted Kulczycky</b>	Nuclear Staff Engineer – PRA – Corporate
<b>Kiang Zee</b>	ERIN Engineering - PRA

# TOPICS



- **Background**
- **Risk Reduction History**
- **Risk Reduction Improvements**
- **PRA Peer Reviews**
- **New Analysis Methods (NAM)**
- **HRA**
- **Fire Model Sensitivity**
- **DAEC Hazard Risk Distribution**
- **Fire PRA Risk Insights**
- **Modifications**
- **Summary**

# SITE OVERVIEW

- Approximately 6 miles NW of Cedar Rapids, Iowa
- General Electric (NSSS & Turbine Generator)
- Bechtel (AE and Constructor)
- BWR- Mark I Containment
- 1912 MWt Thermal Power; ~ 630 MWe
- Staff Complement: approximately 650





Cedar River is ultimate heat sink and water makeup source

Approximately 6 miles NW of Cedar Rapids, Iowa



Forced draft cooling towers for condenser cooling

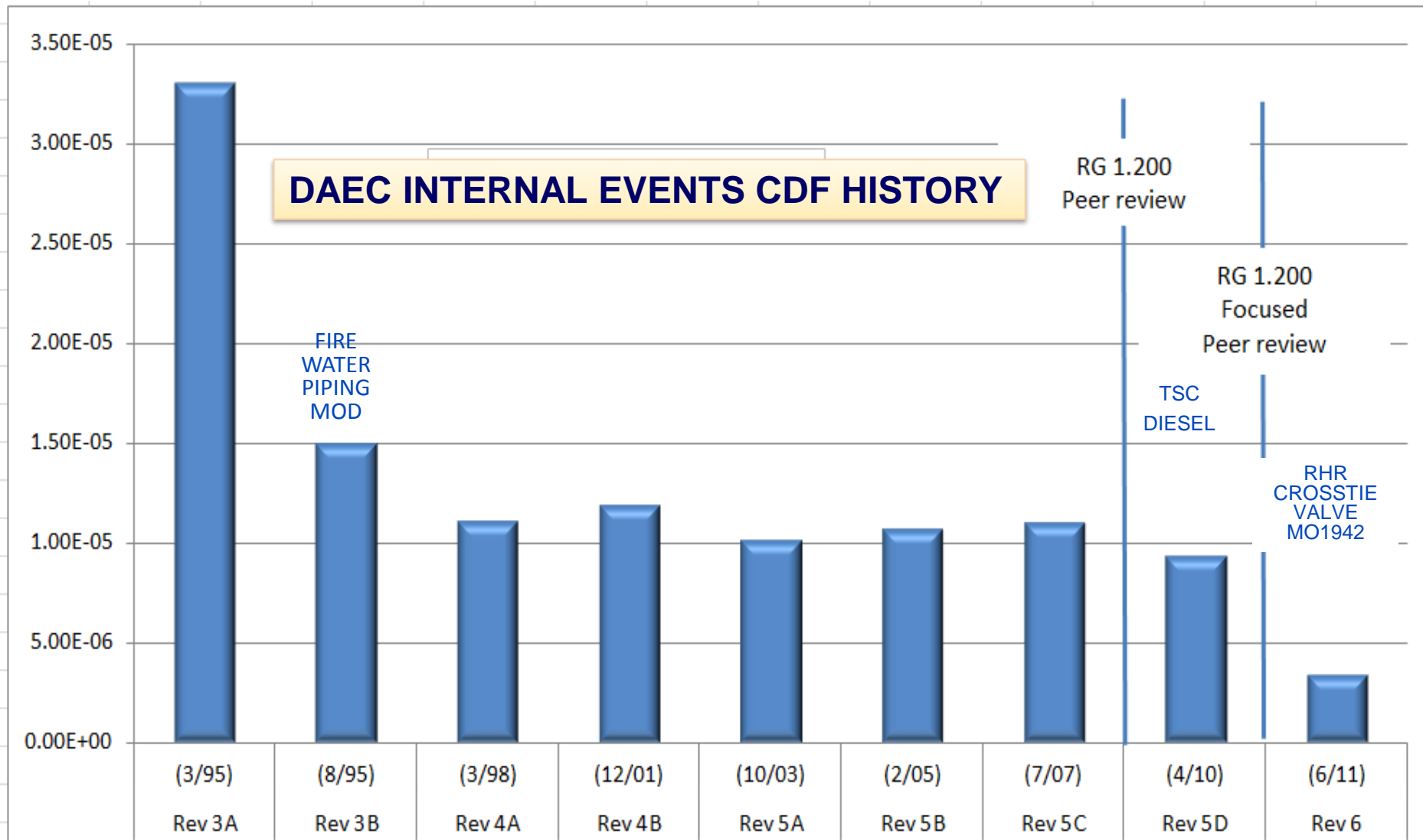
# FIRE PRA TIMELINE



- **RG 1.200 rev 2 upgrade for Internal Events PRA and Fire PRA developed concurrently – started 2007**
- **Project Milestones:**
  - Internal Events Peer Review – Dec 2007
  - Fire PRA Peer Review – Jun 2010
  - Internal Events Focused Peer Review – Mar 2011
  - LAR submitted – Aug 2011
  - Initial NRC LAR Audit – Dec 2011
  - RAI's rec'd – 120 RAIs – Feb 2012
  - 60 day RAI responses submitted – Apr 2012
  - 90 day RAI responses submitted – May 2012
  - NRC Fire Modeling Audit – May 2012
  - NRC Fire Modeling Questions/Walkdown – June 2012



## DAEC INTERNAL EVENTS CDF HISTORY



Note: RHR Crosstie credit not included in Fire PRA – will be updated post LAR

# Key PRA Driven Risk Reduction Improvements



## FIRE WATER PIPING

Fire water piping configuration changed in the Control Building HVAC room to eliminate possibility of flood water propagation to essential switchgear rooms.

## TSC DIESEL

AOP-301.1 upgraded to direct alignment of TSC Diesel Generator to battery chargers to extend battery life in the event of a station blackout.

## RHR SERVICE WATER CROSSTIE TO RHR SYSTEM

Procedures upgraded to direct operators to manually open RHRSW crosstie valve to the RHR system MO1942 in the event Division 1 power to the valve is unavailable. Implemented July 2011. *[Not credited in the FPRA]*

# PRA PEER REVIEW HISTORY



## INTERNAL EVENTS

### Initial Peer Review - Dec 2007

- *57 SRs Not Met*
- *66 Findings*

### Focused Peer review - March 2011

- *4 SRs Not Met*
- *12 Findings*

## FIRE PRA

### Peer Review - June 2010

- *89 SRs Not Met*
- *89 Findings*

# New Analysis Methods (NAM)

## Two NAMs Applied:

1. Hot Work Cable Spreading Room (CSR) Pre-initiator
2. Transient Heat Release Rate (HRR)

# Hot Work Cable Spreading Room (CSR) Pre-initiator



- **NUREG/CR 6850 Hot Work Methods :**
  - Adjusts for frequency and manual suppression,
  - No adjustments for procedural controls.
- **DAEC CSR:**
  - Highly restricted area controlled by the control room operators.
  - Nothing is in the CSR that requires hot work
  - CSR hot work would NOT be authorized without detailed planning, analysis and compensatory actions.
- **Hot Work Pre-Initiator adjusted.** Credited CSR procedural controls by applying an HEP of 0.01 to all scenarios involving cable fires caused by welding and cutting.
- **Sensitivity performed in response to an RAI.** Result was that applying 0.01 factor was conservative but acceptable estimate for application.
- **CSR hot work scenario is not associated with any VFDR's**

## Entrance to Cable Spreading Room



***Note that door says NO ENTRY and requires prior approval required by operations. Shortened door is due to ductwork above the door.***

## Transient Heat Release Rate (HRR)

- NUREG/CR 6850 based on testing of transient combustibles and measurement of fire characteristics
- No guidance on reasonable measures to mitigate
- 69KW vs. 317KW used. Walkdowns provided input to estimate HRR for motor fires.
- 1% of CDF/LERF are Transient fires. Sensitivity showed that larger value results in CDF/LERF change of no more than 1%
- Industry data has not found that large (317KW) fires happen - the data shows most are much smaller.

## Key Modeling Improvements – Planned -- Current Conservatisms --

*Fire PRA does not implement this risk important action:*

**MO1942 RHRSW CROSS TIE VALVE.** MO1942 must be opened to allow RHRSW alternate low pressure RPV injection. However no credit is given to manually opening this valve w/o AC power [e.g. if lost due to fire]. Credited in post FPRA internal events model – significant impact on reducing CDF and addressing modeling uncertainty.

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*Internal Events and Fire PRA do not implement the following risk important actions:*

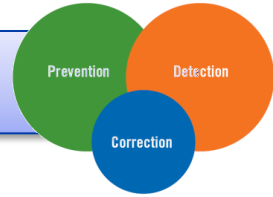
**EMERGENCY SRV OPERATION USING PORTABLE DC POWER.** Procedures provide guidance to depressurize the RPV using SRVs when normal DC power is unavailable or when operation from the Control Room and/or the Remote Shutdown Panel is not available. This procedure is NOT credited in Internal Events PRA or Fire PRA.

**CONTAINMENT VENTING DURING SBO.** DAEC procedures provide detailed direction for venting PC given an unavailable pneumatic supply – can be used during SBO but is NOT credited in the internal events model. The procedure provides direction for using compressed air or nitrogen bottles to allow operating valves required for venting.

**PORTABLE DIESEL FIRE PUMP.** Procedures provide instructions for using the portable diesel fire pump. B5b action is not credited in the internal events model



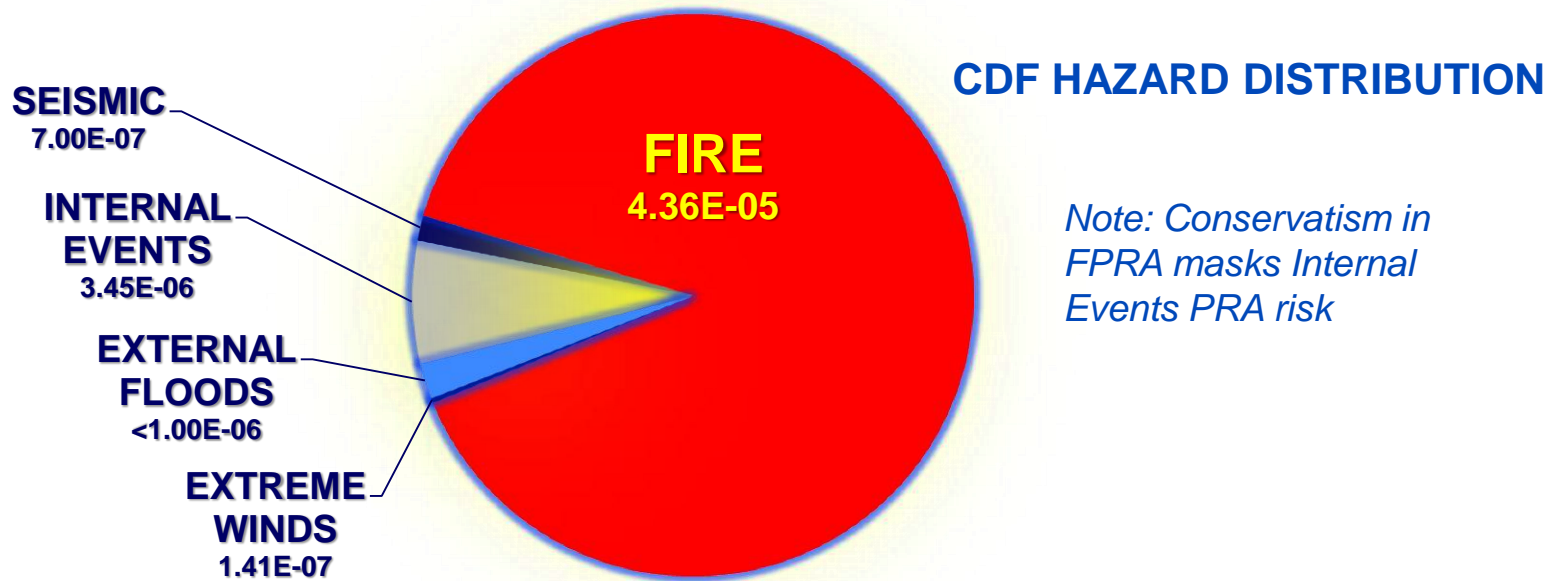
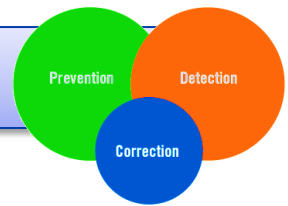
# FIRE MODEL SENSITIVITY



## Sensitivity Analysis Performed these Assumptions:

- Use of NUREG/CR 6850 fire ignition frequency
- Potential impact of switchgear room modifications to provide additional source of AC power
- Application of circuit failure mode conditional probability
- Treatment of assumed cable routing (unknown locations)
- Use of refined HRR for general transient fires

# DAEC PRA Hazard Risk Distribution



	Internal Events	Seismic	Fire	Extreme Winds	External Floods
CDF	3.45E-6	7.0E-7	4.36E-05	1.41E-7	< 1E-6
LERF	1.21E-6		1.59E-05		

*Note: Values for each hazard were updated at different time frames:*

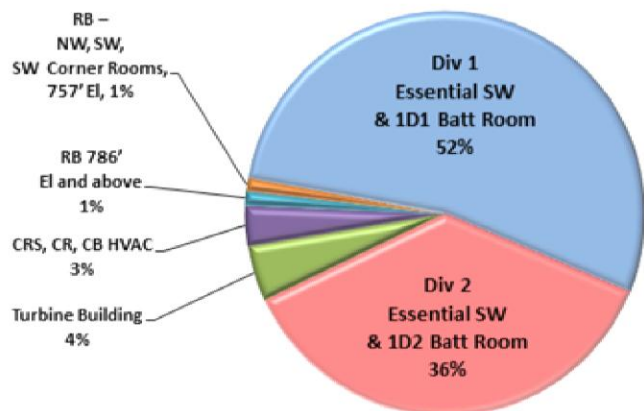
- Fire CDF/LERF is not based on most current Internal Events model –LAR was submitted prior to latest internal events update.
- External Floods and Extreme Winds CDF values are from the original IPEEE submittal.
- Seismic CDF value is based on a post IPEEE update.

# DAEC - Key FIRE PRA Results

Core Damage Frequency (CDF) =  $4.36\text{E-}05$  /yr  
 Large Early Release Frequency (LERF) =  $1.59\text{E-}05$  /yr



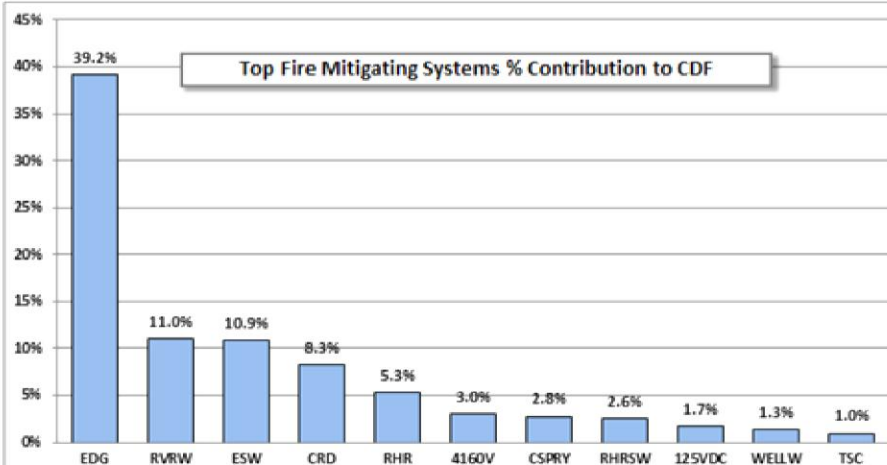
Significant Fire Locations % Contribution to CDF



Top Fire Event Mitigating Components % Contribution to CDF

	Description	CDF %
1	DIESEL GENERATOR 1G21 Fails to START/RUN/LOAD	8.0%
2	DIESEL GENERATOR 1G31 Fails to START/RUN/LOAD	5.7%
3	FUEL OIL TRANSFER PUMP 1B44B FAILS TO START/RUN	2.8%
4	FUEL OIL TRANSFER PUMP 1P44A FAILS TO START/RUN	2.0%
5	ESW CV2081 FAILS TO OPEN ON DEMAND	1.6%
6	4160V Circuit Breaker 1A411 Fails to close on Demand	1.6%
7	CV 4914, 1P-117B/D INLET TO STILLING BASIN Fails To Open	1.5%
8	ESW CV2080 Fails To OPEN ON DEMAND	1.2%
9	4160V Circuit Breaker 1A311 Fails to close on Demand	1.1%
10	CV 4915, 1P-117A/C INLET TO STILLING BASIN Fails to open	0.8%

Top Fire Mitigating Systems % Contribution to CDF



Top Fire Event Operator Mitigating Actions % Contribution to CDF

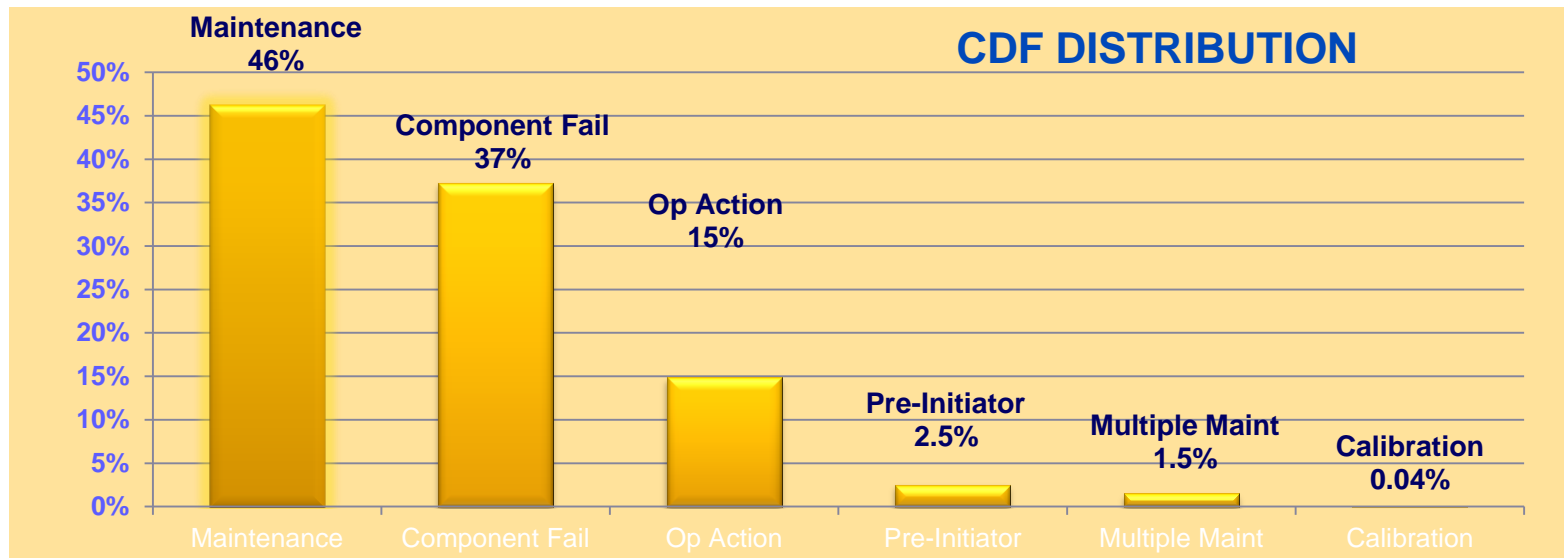
	Operator Action	CDF %
1	ALIGN STANDBY 125VDC BATTERY CHARGER	5.0%
2	INITIATE RPV EMERGENCY DEPRESS (TRANSIENTS)	4.9%
3	MAXIMIZE CRD FLOW FOR TRANSIENTS AND SLOCA-ST	3.2%
4	CONTROL FEEDWATER FOLLOWING SCRAM	2.7%
5	SHED BATTERIES PER AOP 301 DURING SBO	1.3%
6	OPEN LPCI INJ MOV-1904(-2004) GIVEN MOV-2004(-1904) FAILS	1.1%
7	ALIGN ALT LP INJECTION (TRAN, SLOCA, MLOCA, IORV)	0.8%
8	INITIATE FEEDWATER	0.8%
9	CROSS TIE ESW TRAINS	0.6%
10	OPEN PUMPHOUSE DOORS	0.5%

# Fire Risk Insights



## ■ Essential Switchgear Room Fires Dominate Risk.

- ✓ *Dominant scenarios are LOOP due to fire with opposite standby diesel generator in maintenance.*
- ✓ *EDG, River Water, and Service Water maintenance dominate top cutsets.*
- ✓ *Maintenance unavailability contributes to ~46% of the Fire Risk*



# Fire Risk Insights

*(continued)*



- Fire PRA indicates sufficient separation exists between divisional cables and equipment, consistent with fire safe shutdown analysis.
- Multi compartment fire is a small contributor to fire risk
- When combined with internal events, fire dominates:
  - Internal Events CDF = 3.45E-6
  - Fire PRA CDF = 4.36E-5

# Modifications

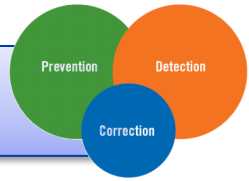


- **Incipient detection in Main Control Room**
  - Mitigate potential multiple spurious actuation challenges to the current alternate shutdown capability (ASC) design and procedures
  - Mitigate challenges to potential loss of ASC in several control room panels
  - Full credit for incipient detection was challenged by the NRC. Performed sensitivity and results were acceptable.
- **Emergency Service Water Circuit Modification**
  - Postulated fire in turbine building has a potential to impact both trains of emergency service water

## Fire PRA Development

- **Fire PRA developed by ERIN Engineering**
  - Subcontract as part of larger NFPA 805 transition contract
  - Supplements in-house resources
- **Fire PRA utilized the current safe shutdown analysis as input**
  - Ensured PRA modeled failures that the SSA identified
  - Developed team work between contracted PRA resources and utility expertise

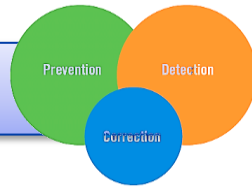
# Developmental Challenges



- MSO list was being updated at the same time review was being performed.
- Review process for NAMs is more involved than envisioned
- Responses to peer review findings required more rigor than previous submittals.
- While the concurrent R. G. 1.200 internal events update and fire PRA development helped provide an integrated result, there are difficulties with coordination.



# Implementation Challenges



- Fire PRA is very conservative.
- Fire PRA CDF/LERF is large compared to internal events.
- Inability to use as calculated for upcoming maintenance rule requirement for online risk management
- Most of the work performed by consultants, as such technology transfer will be a greater effort than envisioned.
- Keeping Internal Events PRA and Fire PRA updates aligned will stretch the ability and resources of the current PRA staffs.
- The amount of data developed is well beyond what was originally envisioned – concerns for future data maintenance

# SUMMARY



- Upgraded internal events model used for Fire PRA; further improvements to be incorporated prior to implementation.
- Risk insights have led to safety improvements.
- Need to streamline the approval process for NAM
- Fire PRA in its current form cannot be integrated with internal events and applied for maintenance rule implementation in 2013. Conservative bias in the Fire PRA will overshadow Internal Events Risk.
- Eliminate compounding conservatism to allow “apples-to-apples” comparison to other hazards and internal events. Conservatisms will complicate risk-informed decisions.
- Implementation will be challenging due to major work done by contractors with limited availability of in-house staff for turnover due to other high priority projects, e.g. necessary upgrades and updates, Fukushima initiatives, etc.







# NRC ACRS Meeting

Reliability and PRA Subcommittee  
Rockville MD July 26, 2012

VC Summer NFPA805 Project  
FPRA Technical Issues

Gerald A. Loignon, Jr., PRA Supervisor

Michael Kammer, NFPA 805 Project Manager

# Fire PRA Technical Issues

- Quantification Software
- Mitigation strategy change
- Cable location data
- Fire PRA: Fire Modeling Methods
- Improved Fire PRA Methods: Slow progress

# Other Project Issues

- Insights
- Performance Based Fire Modeling
- Plant Modifications
- Implementation Challenges

# Quantification Software

## Quantification Platform: FRANX

- Base PRA model uses CAFTA/EOOS
- Desire: Single top fire model
  - Combines cutsets for risk ranking and HRA dependency analysis
- Future Utilization
  - EOOS
  - Internal Flooding and Seismic PRA models

# Software Challenges

## FRANX issues

- Software: Initially the only functional version was a beta of 4.0

## Challenges:

- Unable to quantify all (~1500) scenarios in one pass
- Could not handle NAND gate at top of tree (used for mutually exclusive logic)
- Single events sometimes turned mutually exclusive logic true
- QRECOVER would not function
- Basic event names had to be expanded
- Problems “un-checking” components



# Software Challenges: Status

## Resolutions

- Early feedback to assist EPRI in development of software fixes
- Devise workarounds
- Deferral of One Top Model

## Future Direction

- Implement FRANX version 4.1

# Mitigation Strategy Change

## Challenges

- Industry Guidance assumes the existing shutdown strategy is being transitioned
- $\Delta$  risk of current SISBO strategy to the new NFPA 805 strategy would require two new FPRA models
- HRA: Required assumptions regarding Operations procedures that have not yet been developed

# Mitigation Strategy Change

## Resolutions

- FAQ 09-0052 developed/approved to use the  $\Delta$  risk of a “compliant” plant to the post transition “as built/operated” plant
- HRA insights provided to Operations Procedure writers for consistency during procedure development
- Separate Change Management Plan to coordinate:
  - Final Procedure development/ issuance
  - Modifications implementation
  - Operations Training

# Cable Location Data

## Background

- Comprehensive cable routing database with three dimensional coordinate data at nodes where cables enter/exit trays
- Project Decision: Manage all NFPA805 Cable information within the common cable routing database (Long Term CM)

## Challenge

- Software Version did not support NFPA805 Development/Data Migration
- Missing Data to support Fire PRA Analysis

# Cable Location Data

## Resolution

- Cable routing software development and V&V
- Incorporate data fields to support NSCA, Fire PRA and NPO Analysis
- Define, develop and correct as built data to support circuit analysis (e.g. Conduit)

## Benefits

- Single repository for all station cable information
- Same tool historically used by Engineering personnel
- Direct inputs for NFPA805 software packages

# Fire PRA: Fire Modeling Methods

## Challenges

- Untimely Fire Methods Review Panel Decisions
- 6850 guidance artificially increases Transient Combustible Importance
  - HRR vs. frequency mismatch
  - Influence Factor [FAQ 12-0064]
- Circuits with Control Power Transformers
  - Nearing consensus [LAR revision]
- Kerite cable
- Unknown cable qualification
- Electrical Cabinet Peak HRR

# Fire PRA: Fire Modeling Methods

## Resolution

- VCSNS FirePRA development followed issued industry guidance
- Finished Fire PRA Analysis in 2010 without benefit of new methods
- Monitoring industry movement/RAI on issues
  - Control Power Transformers
  - Kerite cable
  - Flammable liquid spill fires
  - Electrical Cabinet Peak HRR

# Slow Progress: Improved Fire PRA Methods

## Background

- The Fire Methods Review Panel was established to review/approve new Fire PRA methods through a consensus process
- Peer review per RG 1.200 determines that, as implemented, the methods meet the requirements of the standard



# Slow Progress: Improved Fire PRA Methods

## Challenges

- The high level of technical justification required for the Fire Methods Review Panel to reach consensus takes a very long time
- NRC endorsement/rejection also takes time and adds considerable uncertainty
- NRC endorsement at this point in the PRA model development process is inconsistent with previous applications of PRA in risk-informed regulation

## Resolution

- VC Summer Fire PRA analysis follows NUREG 6850 without benefit of the new methods
- Monitoring for future impacts

# Surprise Insights

## Summary

- Considering the plant vintage, there were few significant deterministic requirement open items

## Circuit Analysis

- 7.2 kV circuit breaker anti-pump logic, contained within the breaker itself, could be defeated by a specific remote short circuit
- Failures that could prevent energizing the 7.2 kV ESF busses from both the 115kv and 230kv off-site power sources
- Failure combinations could impact Control Room Evacuation isolation switches

# Other Insights

## Risk Insights

- The second most risk significant area of the plant is a hallway with a nearby Motor Control Center, and overhead cable trays
- “Fire Initiating Events Representing 95% of the Calculated Fire Risk (CDF)”
  - Loss of RCP Seal Cooling events resulting in a consequential small LOCA is the most common scenario
  - 27 of the 50 scenarios involve fires in alternate shutdown areas [Restricted Access/ Online work]

# Performance Based Fire Modeling

## Application

- Tool to disposition deterministic analysis open items
- Conservatively calculate a limiting scenario and maximum expected scenario,
  - Evaluate the margin between the two to ensure that it is sufficient to bound the uncertainty
- Four fire areas
  - Three control building cable chases
  - One air handler/cooling unit area [B SWBP]

# Performance Based Fire Modeling

## Insights/Controls

- Not for every area of the plant [Room configuration]
- May be forced to manage the fire itself
  - Fuel Package Size/Heat Release Rate
  - Fire Location
- Workable solution within defined analysis boundaries

# Plant Modifications

## Support Shutdown Strategy/New Analysis

- Resolve deterministic issues
- Reduce CDF

## Typical Deterministic Modifications

- Fire protection system feature improvements
- Circuit/ tubing protection
- 7kV ESF bus feed reroute (TB Fire)
- CR Disconnect switch rework
- Communication enhancements

# Plant Modifications

## Core Damage Frequency Reductions

- RCP seal replacement
- Incipient detection (Control Complex)
- Alternate seal injection system
- Diesel driven instrument air compressor auto start

# Implementation Challenges

## Station Challenges

- Shift in “Operational Response” strategy
- Knowledge transfer from vendors to plant personnel
- Transition requires extensive documentation updates (e.g. Administrative Controls, Response Procedures, Fire Pre-Plans, Configuration Management)
- Physical modifications required assumptions about final design that will have to be “trued-up”
- Competing priorities/ demands for staff attention/resources