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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)

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7 RELIABILITY AND PRA SUBCOMMITTEE

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9 THURSDAY

10 SEPTEMBER 18, 2014

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12 ROCKVILLE, MARYLAND

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14 The Subcommittee met at the Nuclear

15 Regulatory Commission, Two White Flint North, Room T2B1,

16 11545 Rockville Pike, at 8:30 a.m., John W. Stetkar,

17 Chairman, presiding.

18 COMMITTEE MEMBERS:

19 JOHN W. STETKAR, Subcommittee Chairman

20 RONALD G. BALLINGER, Member

21 DENNIS C. BLEY, Member

22 HAROLD B. RAY, Member

23 JOY REMPE, Member

24 STEPHEN P. SCHULTZ, Member

25

1 DESIGNATED FEDERAL OFFICIAL:

2 JOHN LAI

3

4 ALSO PRESENT:

5 VICTORIA ANDERSON, NEI

6 HAROLD BARRETT, NRR

7 SUSAN COOPER, RES

8 STEPHEN DINSMORE, NRR

9 RAY FINE, FENOC

10 ELLIOTT FLICK, Exelon

11 JOSEPH GIITTER, NRR

12 J.S. HYSLOP, NRR

13 ANIL JULKA, NextEra

14 ALEX KLEIN, NRR

15 STUART LEWIS, EPRI

16 ASHLEY LINDEMAN, EPRI

17 BOB RISHEL, Duke

18 MARK SALLEY, RES

19 MIKE SAUNDERS, ERIN

20 RICHARD STREMPLE, FENOC

21 Elizabeth Kleinsorg, Hughes

22 Patrick Baranowsky, ERIN

23 Nick Rochford, FENOC

24

25 *Present via telephone

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

2 (8:30 a.m.)

3 CHAIR STETKAR: The meeting will come to
4 order. This is a meeting of the Reliability and PRA
5 Subcommittee. I am John Stetkar, Chairman of the
6 Subcommittee meeting. ACRS members in attendance are
7 Steve Schultz, Dennis Bley, Ron Ballinger, Harold Ray
8 and Joy Rempe.

9 John Lai of the ACRS staff is the designated
10 Federal Official for this meeting.

11 The staff and industry will discuss the
12 status of NFPA 805, License Amendment Request reviews,
13 and key Fire PRA technical challenges.

14 There will be a phone bridge line. To
15 preclude interruption of the meeting, the phone will
16 be placed in a listen-in mode during the presentations
17 and committee discussions.

18 We have received no written comments or
19 requests for time to make oral statements from members
20 of the public regarding today's meeting. The
21 subcommittee will gather information, analyze relevant
22 issues and facts and formulate proposed positions and
23 actions as appropriate for deliberation by the full
24 committee.

25 The rules for participation in today's

1 meeting have been announced as part of the notice of this
2 meeting previously published in the *Federal Register*.
3 A transcript of the meeting is being kept and will be
4 made available as stated in the *Federal Register* notice.
5 Therefore, we request that participants in this meeting
6 use the microphones located throughout the meeting room
7 when addressing the subcommittee.
8 The participants should first identify
9 themselves and speak with sufficient clarity and volume
10 so that they may be readily heard.
11 Before we start, I want to thank everybody
12 for the effort that you put into this meeting, both the
13 staff and the industry. It has been a while since we
14 have gotten together on this topic. And I know it takes
15 a lot of time and effort to prepare the materials for
16 this meeting, get ready for it. And everyone continues
17 to be really busy with this topic these days. So, we
18 really appreciate your effort in coming together to have
19 this briefing.
20 We will now proceed. I guess I will ask Joe
21 Giitter if you have something to say.
22 MR. GIITTER: Good morning. I'm Joe
23 Giitter, the Director of the Division of Risk Assessment
24 in NRR. And this morning I would like to give you a
25 status of where we are in the NFPA 805 reviews and talk

about some of the challenges from a staff perspective.

I think this context is going to be important as you hear from the staff later this morning and from industry later this afternoon.

I want to start my discussion with an emphasis on safety. Our overall experience with the review of NFPA 805 license amendment requests show that the transition to NFPA 805 is a positive step to improving plant safety. Licensees are making plant modifications and have reduced their reliance in operator manual actions as a result of reanalyzing their plants.

Some of the plant modifications resolved long-standing fire protection issues such as fire induced circuit failures or reliance on operator manual actions. Licensees do this by relocating circuits, adding fuses or installing fire barriers. In addition, some plants are strengthening administrative controls, for example, by limiting or prohibiting combustible material that may be temporarily located in a given area, such as packing containers.

However, in many cases, licenses are making major plant system modifications. Examples are the installation of reactor coolant pump seal injection systems or shutdown seals to mitigate the effects of a

station blackout that might result from a fire. Some plants are installing sensitive incipient detection systems that can detect fires well before they produce a flame.

In some cases, plants are making major hardware changes, such as adding a new auxiliary feedwater pump to ensure that the plant can be safely shut down, even if both trains of safety systems are affected by a fire. Many of those modifications dovetail with post-Fukushima mitigation strategies.

The photograph on this slide shows the construction of the new 160,000 gallon condensate storage tank at Ginna. The tank provides a new source of water for the existing AFW pumps and is also part of the plant's Fukushima mitigation strategies. This tank is part of a plant change that also includes two new diesel generators to provide emergency power to the existing AFW pumps.

One more point that I would like to make about safety. This afternoon you may hear some industry representatives suggest that the Fire PRA conservatisms are causing them to make the wrong decisions about which modifications to make. When I first heard this complaint, it caused me a great deal of concern. I have bimonthly calls with the site vice presidents and I have

had discussions with probably 20 site vice presidents and I have asked them if they feel that the modifications they are making for NFPA 805 are the wrong mods. And my assumption is that the site vice presidents have a pretty good handle on what goes on at their plants and have a pretty good understanding of the safety implications of some of those mods. And they have all told me that they believe that those mods are, indeed, improving safety. And when I look at examples of those mods, I come away with the same conclusion.

So, I want to make that case now because I know you are going to hear more about this afternoon. It, perhaps, provides a different perspective.

As part of the NFPA 805 process, licensees reanalyze their plants for fire protection. And in that process, they better understand their plan configuration and fire risks. And this has, we believe, resulted in greater awareness of the risks and the importance of fire protection programs to the plant staff. And I have heard that from plant staff and I have heard it from plant management as well.

We conduct on-site audits of each licensee's NFPA 805 submittal. Although licensees rely on contractor support and expertise, we have noticed the licensees are taking a stronger ownership role of their

1 program. This is partially demonstrated by licensee
2 personnel interacting directly with our technical
3 experts during the audits. In addition, we have
4 observed a positive top-down culture at some licensee
5 sites, as demonstrated by senior licensing management
6 support to put in place qualified and technically
7 capable staff who understand the NFPA 805 program. They
8 recognize a strong ownership of the NFPA 805 program as
9 essential to the continued success of the program.
10 There is one other aspect of knowledge and
11 ownership I would like to mention. The transition to
12 NFPA 805 licenses basis doesn't end when the licensees
13 receive our approval. The licensee still needs to
14 finalize and implement certain actions, such as
15 developing or updating procedures. A good practice
16 that the staff has observed is the readiness
17 self-assessment conducted by licensees to determine how
18 ready they are to make that transition. We have observed
19 two assessments and we noticed that they were strongly
20 supported by licensee senior management and by experts
21 from other licensees. The lessons learned and
22 knowledge gained were then brought back to their own
23 plants.
24 We observed that the transition teams
25 established by these two licensees were

1 multidisciplinary dedicated and effective. We have
2 encouraged other licensees to learn from these
3 assessments and we are aware that other licensees are
4 planning similar assessments.
5 We have got 60 staff in my division and I
6 would say nearly half of them are working in some respect
7 on NFPA 805, many of them full-time. We also rely on
8 support from the Division of Operator Reactor Licensing,
9 from OGC, and from our contractors at PNNL and the
10 Southwest Research Institute.
11 Our experience has been that the NFPA 805
12 non-pilot reviews have been more complex and
13 resource-intensive than we anticipated. As you can see
14 from the figure on this slide, we are currently at the
15 peak of the review effort, as planned by the staggered
16 approach approved by the Commission.
17 The resource estimates and schedule for
18 reviewing the non-pilot NFPA 805 applications were based
19 on a premise that the Fire PRA submitted as part of the
20 NFPA 805 applications would follow the guidance in
21 NUREG/CR-6850 what was developed jointly by the NRC and
22 industry. This guidance was developed in support of the
23 NFPA 805 transition effort, was validated by the two
24 pilot applications, and was endorsed by the ACRS for use
25 in the non-pilot reviews. However, the Fire PRAs

1 developed by licensee contractors utilized many methods
2 that were never reviewed or approved by the NRC staff.
3 While licensees always had the option of proposing
4 technically defensible alternatives to NRC guidance
5 documents, the magnitude and number of deviations from
6 the guidance have required significant additional
7 resources to resolve and have been the number one driver
8 of the scheduled delays in the reviews.
9 The industry and the NRC have been working
10 through the Fire PRA FAQ process to address these
11 deviations, which you will hear more about from Steve
12 and J.S. later this morning.
13 At the outset of the non-pilot reviews, we
14 were challenged by the Commission to find efficiencies
15 in the reviews. And we did find efficiencies, which I
16 will describe later on; however, we are not resting on
17 our laurels and we continue to challenge ourselves to
18 identify and implement further process improvements on
19 the remaining reviews.
20 Towards this end, we have developed a set
21 of metrics to help ensure that we sustain our efforts
22 to continually improve.
23 My last area of emphasis is communications.
24 Consistent with the principles of good regulation, the
25 NRC staff has held numbers public meetings with industry

1 to resolve issues related to NFPA 805, including
2 frequent meetings to address deviations from accepted
3 methods and monthly NRC/NEI management meetings. I
4 hold calls every two months with senior management at
5 the sites to discuss the progress of the review and
6 discuss any concerns we may have.
7 This slide illustrates the status and
8 progress made by the staff on the NFPA 805 reviews.
9 Today, we have issued a total of eight NFPA 805 license
10 amendments. Within the next three to four months, we
11 expect to complete six more. I know that is ambitious
12 but we have a lot of safety evaluations that are being
13 finalized and packages going through the concurrence
14 process.
15 If you look at the left side of the pie
16 chart, you can see that there is 13 license amendments
17 that are still going to be under review into next year
18 and we expect to receive two more applications in the
19 next couple of years. In fact, there may be more than
20 that.
21 What this slide doesn't show is that those
22 13 amendments that are going to be under active review
23 in 2015 are going to be -- are currently being worked
24 right now concurrent with us trying to get out the
25 six-year term license amendments. So, each review is

in its own unique status.

We are going to be going to Robinson next week for an NFPA 805 audit, while we are working to get out the safety evaluations for several of the NFPA 805 LARs. So, it is a multi-tasking effort. We have, as I said, we have staff that are very dedicated and very focused on getting these safety evaluations completed and the LARs issued.

CHAIRMAN STETKAR: Joe, these 29 items on the pie chart here, are those sites?

MR. GIITTER: Yes. Good question. Those are sites, so they represent roughly half the fleet. By the time we are done, roughly half the fleet will have transitioned to NFPA 805.

CHAIRMAN STETKAR: At one time the count was something like 40 or so, wasn't it?

MR. GIITTER: We had a couple of licensees that pulled out. Well, one case was Kewaunee, another case was -- you know plants have decided not to continue to operate. There was one, I think a couple of plants I want to say Monticello --

CHAIRMAN STETKAR: Monticello. I remember Monticello but I thought I remembered a number of sort of around 40-ish, wasn't it?

MR. BARRETT: Yes, at one time it was 52.

1 Then a couple dropped out.

2 CHAIRMAN STETKAR: Yes.

3 MR. BARRETT: But this also includes some

4 --

5 CHAIRMAN STETKAR: But that was 52 units?

6 MR. BARRETT: Yes, not sites.

7 CHAIRMAN STETKAR: Okay, I got it.

8 MR. BARRETT: That is 52 unique licensees.

9 CHAIRMAN STETKAR: Okay.

10 MR. GIITTER: And since that time, we have

11 had some licensees that have made the decision to

12 transition. For example, Hatch made that decision.

13 And we would probably -- my understanding

14 is we are going to have more as well but that will remain

15 to be seen, I guess.

16 CHAIRMAN STETKAR: Job security. I know

17 all of you guys want to do this for the rest of your

18 careers.

19 MR. GIITTER: No comment on that one.

20 (Laughter.)

21 MR. GIITTER: Okay, to date, most of the

22 initial non-pilot reviews, we have exceeded the two-year

23 metric that we set out for ourselves. In some cases,

24 this was due to circumstances beyond our control. One

25 example is we were just about to issue the license

amendment for D.C. Cook and I was talking to the regulatory affairs manager in the morning. And in the afternoon I got a phone call and they were informed by Westinghouse of the failure of the Gen II Seal Shield design. So, they changed their plans.

(Laughter.)

CHAIRMAN STETKAR: It's just a number.

MR. GIITTER: Right. A number that went from 0.05 to 1.0.

CHAIRMAN STETKAR: What's a factor of 20 among friends?

MR. GIITTER: But I think the biggest challenge, in all honesty, is the use of deviation from accepted methods by the licensees. That has been the number one cause for the delays. But we have also looked at some process improvements and I will talk a little bit about those, to gain efficiency.

So if you go to the next slide, in the fall of 2013 we conducted an internal lessons learned to review what we could do better with respect to the technical reviews from a process perspective. And aside from the circumstances beyond our control that I just mentioned, we learned that the request for additional information had a significant impact on the review schedule. More precisely, we identified the

1 second set of RAIs had the greatest impact on the
2 schedule.
3 So, to address this, we revised our
4 technical review process to conduct the on-site audits
5 later in the time line to allow the early development
6 of the draft safety evaluation with a more focused first
7 set of questions meant to support the completion of the
8 evaluation.
9 In other words, if you go back to our LIC-101
10 procedures, you develop the safety evaluation based on
11 the application. And where you have holes in the safety
12 evaluation, you use that as a basis for the RAIs. So,
13 the RAIs are more focused. That requires us to take a
14 little more time to review the application before we do
15 the audit. But in the past with the audits what we were
16 doing is were sending teams out, maybe they didn't have
17 as much time to look the application over and they were
18 using the audit to develop requests for additional
19 information. This way, we are using the audit to close
20 any of the open questions we have so we can actually
21 eliminate those and really reduce the number of RAIs in
22 the first round and, hopefully, avoid RAIs completely
23 on the second round.
24 So, what we are seeing so far with the
25 initial set of reviews under this new process is an

1 overall downward trend in the number of second round
2 RAIs. And you can see that in the graph on the left.
3 And there is another reason for that as
4 well. And if you look at the graph on the right, it
5 explains it. And that is, the quality of the
6 applications has improved. And that is evidenced by the
7 fact that yes, we do acceptance review. We have a
8 licensing procedure that has us do an acceptance review
9 to make sure the application is complete before we start
10 the review.
11 And as you can see on the graph on the right,
12 initially in 2011, all of the applications we received
13 required a supplement and then we had one in 2012. And
14 you can see the upward trend of five in 2013 required
15 no supplement.
16 MEMBER BLEY: Is this the completion year?
17 MR. GIITTER: That is the year that we
18 received the application for review.
19 MEMBER BLEY: You received it. Okay.
20 MR. GIITTER: So, that is part of the story,
21 too. It is not just efforts on the staff but I give some
22 credit to industry for improving the quality of the
23 applications.
24 CHAIRMAN STETKAR: This is reminiscent of
25 the license renewal experience also. I think that as

1 both the staff and the industry gained experience in what
2 is expected and what is possible efficiency improves.
3 The overall quality of the submittals improve and the
4 process should improve.
5 There is always plant to plant differences,
6 as it is in license renewal. But at least some of the
7 major bugs get worked out of the system early on.
8 MEMBER SCHULTZ: Joe, not to go after data
9 but have you looked at the first round RAIs? Have they
10 been relatively constant in terms of their number or have
11 they been declining as well as a result of the quality
12 of submittals?
13 MR. GIITTER: Yes, I believe they have been
14 going down but I will turn to my staff to answer that
15 question.
16 MR. DINSMORE: Yes, this is Steve Dinsmore.
17 The PRA ones have been declining as well.
18 MR. HYSLOP: The new process that Joe
19 referred to look at the LAR and establish RAIs from that
20 made a real difference in the first run PRA RAIs for Point
21 Beach. Point Beach was the first plant where we applied
22 this new procedure.
23 MR. BARRETT: And from a fire protection
24 standpoint, both fire protection and shutdown have been
25 significantly less number of RAIs.

1 MEMBER SCHULTZ: Thank you.

2 MR. GIITTER: Okay, this slide shows what
3 we call the NFPA 805 War Room. And another conclusion
4 from our lessons learned a year ago was that we needed
5 to practice more discipline in the reviews and this
6 included developing more focused RAIs, holding people
7 accountable to meeting deadlines. And we found that in
8 some cases some of the reviewers were asking questions
9 based on the information provided on the portal. The
10 portal was originally an idea to facilitate efficiencies
11 but it was actually working against us because, in some
12 cases, people were digging down into the details of
13 information on the portal. So, we have reemphasized our
14 expectations for conducting the review which were
15 embodied in the licensing review procedures and we
16 started instituting mandatory team meetings once a week,
17 held the staff accountable for meeting intermediate
18 milestones to ensure overall project completion.

19 And if you ever had a chance to step in, we
20 have the meetings on Tuesday mornings at 9:00, very
21 interesting.

22 While the staff has made considerable
23 strides in improving our internal review process, for
24 NFPA 805, we have also looked for ways of systematically
25 addressing the deviations from accepted methods. As I

1 mentioned earlier, the key technical issues that mostly
2 have been associated with the use of methods and
3 approaches in the NFPA 805 Fire PRA data have not
4 previously been reviewed and accepted by the staff.
5 The NRC and the industry, through EPRI, have
6 jointly developed NUREG/CR-6850 to provide acceptable
7 Fire PRA methods in support of NFPA 805 LARs. This
8 report was published in September 2005 and a Supplement
9 1 was published in September 2010.
10 Supplement 1 provides Fire PRA method
11 enhancements based on the lessons learned from the NFPA
12 805 pilot plants and the questions raised during the
13 development of their Fire PRA. The results of the
14 NUREG/CR-6850 implementation by the pilot plants were
15 also presented to the ACRS and a conclusion was made that
16 the methods and guidance in the NUREG/CR-6850
17 supplemented by the clarifications and enhancements in
18 Supplement 1 provide a sound technical basis for the
19 development of Fire PRA models and analyses to support
20 the transition to a risk-informed licensing framework
21 in accordance with NFPA 805.
22 However, the reality is that licensees and
23 their contractors have employed Fire PRA methods and
24 approaches that are, in some cases, significantly
25 different from those described in NUREG/CR-6850. The

1 review of these deviations from approved methods has
2 resulted in additional NRC resources needed to complete
3 the safety evaluations of LARs. In fact, we have moved
4 some of the review effort to contractors, in order to
5 have our staff focus on resolution of these method
6 deviations.
7 MEMBER BLEY: Joe?
8 MR. GIITTER: Yes.
9 MEMBER BLEY: Unless you are going to do it
10 later, can you give us any feel for the range of different
11 kinds of methods that have been submitted?
12 MR. GIITTER: I'm going to let my staff do
13 that later and they go into more detail.
14 MEMBER BLEY: Okay, that's fine.
15 MR. GIITTER: But there is a range. In some
16 cases, -- I will let them do it. But in some cases, I
17 would call it more of a tweak and, in other cases, it
18 is a dramatically different method --
19 MEMBER BLEY: That's what I was getting at.
20 MR. GIITTER: -- that doesn't have, in our
21 opinion, a strong technical justification in some cases.
22 MEMBER SCHULTZ: Joe, this difference, I
23 will call it, that is well known at the time you do the
24 LAR acceptance review.
25 MR. GIITTER: Not necessarily because when

1 you are doing an acceptance review, you are not looking
2 at the technical detail. You are looking at format,
3 content, whether you have enough information to start
4 your review. You are not necessarily getting down into
5 looking at methods.
6 MR. HYSLOP: The RAIs phase often exposes
7 some of these. And I will be talking about, in my
8 presentation, the various ways these deviations from
9 accepted methods have come to light. So, that will be
10 discussed later.
11 MEMBER SCHULTZ: Okay. I'll look forward
12 to that. Thank you.
13 CHAIRMAN STETKAR: One thing before you get
14 off this slide. You've had it too easy, so far.
15 You mentioned the two pilot plants that ran
16 through this study. I wasn't on the committee back when
17 the committee reviewed the original NUREG/CR-6850 back
18 in the early 2000s. But I know at that time if I look
19 back through the record that ACRS strongly advocated
20 piloting the full process. And I know, I think they are
21 all aware that that never happened.
22 And on the way of what the two pilot plants
23 did finally committed to in terms of hardware
24 modifications and such to get their license amendments,
25 I have heard and what I would like to probe a bit is that

1 subsequent submittals have relied perhaps more on
2 analysis methods, rather than hardware modifications.
3 In other words, substituting, perhaps, capital analysis
4 expenditures, rather than capital expenditures to
5 invest in a problem. The reason I want to get to this,
6 is you mentioned differences in methodology being a
7 strong factor in terms of differences of opinion between
8 the staff and the industry and also delays, time, if not
9 delays but time expended on everyone's part to reach some
10 sort of consensus.
11 Is my characterization correct or not in
12 terms of the fact that the later submittals after the
13 two pilots tend to be more analysis oriented than perhaps
14 hardware?
15 MR. GIITTER: I would say that some plants
16 chose to do more fire modeling.
17 CHAIRMAN STETKAR: Okay.
18 MR. GIITTER: I'm not sure about analysis.
19 But I know one plant I am thinking of in particular that
20 we looked at had done a lot more fire modeling than we
21 had seen in the pilot applications. And because of that
22 fire modeling, they did not have to make as many mods.
23 So, there was an exchange, if you will, resources to do
24 the fire modeling for the resources it would take do to
25 the models.

1 CHAIRMAN STETKAR: In a sense, the more
2 modeling you do, the more you challenge sort of the
3 nuances in 6850. You suddenly run up against the places
4 where the recommendations in different chapters of 6850
5 don't necessarily mesh all that well. And you don't
6 necessarily run into that until you drill down kind of
7 in the modeling and analysis direction.
8 MR. DINSMORE: Yes, I guess I would like to
9 comment. The first two pilots, yes, they had a bunch
10 of modifications. I'm not quite sure why they decided
11 to make them but they had them. So, they were included.
12 In the final plants there are a subset of them that also
13 have a large set of modifications. And then there are
14 a subset who didn't really come up with a lot of
15 modifications and mainly tried to transition with as
16 much as they had and what they needed.
17 And so yes, when you get to those
18 situations, they tend to come up towards the risk
19 acceptance guidelines and then we tend to look more into
20 the PRA. And when we look more into the PRA, we find
21 more stuff. So, yes, it is kind of a -- it gets a lot
22 more complicated when they are right up near the
23 acceptance guidelines.
24 CHAIRMAN STETKAR: Okay. Okay, thanks.
25 MR. GIITTER: Another concern that we

1 identified is the consistency in addressing the method
2 deviations. Because you have new methods that were
3 developed contractors supporting multiple
4 applications, we couldn't really effectively and
5 efficiently resolve the methods, previously un-reviewed
6 methods during the individual license amendment
7 reviews. So, for that reason, what we decided to do is
8 to work resolution of those new methods in parallel with
9 the license amendment applications reviews, primarily
10 through an FAQ process and you will hear more about that
11 later from J.S. and Steve how we are using that process
12 to address these methods in greater detail.
13 MEMBER BLEY: J.S., when you come up, I
14 would appreciate if when you talk about these, you can
15 give your thoughts on which things which really fit
16 within the framework of 6850 but are more detailed kinds
17 of analysis on which things are really something
18 deviating from the framework of 6850. From your point
19 of view and then we will hear from somebody else.
20 MR. GIITTER: Okay. The way we handled
21 these deviations initially for the first set of reviews,
22 for the non-pilots reviews is we asked licensees to
23 perform a sensitivity analysis on each deviation from
24 an accepted method to evaluate the risk impact of using
25 the unapproved method, instead of the staff-accepted

1 value in NUREG/CR-6850.

2 The feedback we were getting from licensees

3 was that this approach was burdensome and undermined the

4 stability of the review process. And it essentially

5 required them, every time we asked an RAI saying do a

6 sensitivity study on this deviation, the would have to

7 go back to their contractor.

8 Anyway, to address this concern, what we did

9 was we implemented a freeze-point approach. And this

10 is kind of borrowed from the new reactor world. And that

11 allowed licensees to conduct a single aggregated risk

12 analysis at the end of the review that would address the

13 use of deviations from the accepted methods, along with

14 other changes to the PRA input parameters. So, they

15 weren't continuously being cycled on what the impact on

16 the delta CDF was.

17 The aggregated risk analysis, of course,

18 would have to demonstrate that the change in core damage

19 frequency associated with transition to NFPA 805 was no

20 greater than 1e to the minus 5, relative to a completely

21 compliant Appendix R plant.

22 This approach is consistent with our

23 integrated decisionmaking process outlined in Reg Guide

24 1174 in that defense in-depth and safety margin are also

25 considered in making the decision to allow a plant to

1 transition to a risk-informed performance-based
2 approach allowed by NFPA 805.
3 The staff has been working with industry to
4 develop new methods and guidance when the current
5 methods and technical basis need improvement. The NRC
6 Office of Nuclear Regulatory Research has conducted a
7 number of fire tests in support of Fire PRA method
8 enhancements. Some recent examples are Electrical
9 Cabinet Heat Release Rate testing and Incipient
10 Detection System testing. I will remark that so far the
11 NRC has led the Fire testing activities on its own.
12 CHAIRMAN STETKAR: Are we going to hear
13 more about those test programs today?
14 MR. HYSLOP: Yes, you are going to hear
15 about both of them, in terms of the process that is being
16 followed. The result hasn't been published so we are
17 not going to talk about the results but sort of the
18 process.
19 MR. GIITTER: The NRC Office of Research
20 and the Electric Power Research Institute are also
21 working under a Memorandum of Understanding on a number
22 of Fire PRA research activities and they include
23 updating the industry fire events database and
24 evaluation of the electrical enclosure fire test data.
25 This next slide shows -- I talked about the

1 FAQs process. And this shows a list of the deviations
2 from accepted methods and approaches, some of which are
3 being addressed at the FAQ process. It itemizes
4 approximately 20 deviations from accepted methods that
5 have arisen primarily due to implementation of NFPA 805.
6 Many of these methods have been resolved, as I said, by
7 the FAQ process but some required larger research or,
8 in some cases, simply referencing accepted methods in
9 NUREG/CR-6850. As you can see from the list, many of
10 these are resolved. However, there is a number that are
11 still active. Steve and J.S. are going to talk more
12 about these deviations and how they were resolved or how
13 they are being pursued.
14 I'll jump ahead to slide number 11. This
15 is just a list of testing that has been done to support
16 NFPA 805. The table shows that there have been a number
17 of tests, recent tests to support NFPA 805. And again
18 I will note that NRC really has carried the burden for
19 conducting this testing. In all fairness, though, EPRI
20 has given us some equipment to use in the testing.
21 MEMBER BLEY: Are there any reports out yet
22 on those last three or is that still to come? K know
23 they are 2014 to 2015.
24 MR. GIITTER: Yes, I am just looking at them
25 real quick. I don't think we have -- we are close on

1 the Electrical Cabinet Heat Release Rate testing work.
2 MEMBER BLEY: Okay.
3 MR. GIITTER: The next slide, I just wanted
4 to point out from the graph, as you can see, getting the
5 testing data can be really important and I think this
6 graph really illustrates it. You can see here that fires
7 in electrical cabinets are the single largest driver of
8 core damage frequency. This study was done by EPRI.
9 So, as we get test results, such as
10 Electrical Cabinet Heat Release Rate testing, I think
11 it will have a profound effect on our understanding of
12 the fire risk.
13 CHAIRMAN STETKAR: Just because you threw
14 this one up here, for the benefit of the members who may
15 not have been following some of the details of this, it
16 is not really electrical cabinet fires in the sense of
17 burning up the equipment inside the electrical cabinet.
18 It is electrical cabinet fires that ignite nearby
19 cables. Is that the case?
20 MR. GIITTER: Yes.
21 CHAIRMAN STETKAR: And it just happens to
22 be that the plants have a lot of cables run to your
23 electrical cabinets. They had a lot of cables. When
24 you have a lot of pumps, you would see pump fires showing
25 up here.

1 MR. HYSLOP: Yes, the real contribution is
2 the damage --
3 CHAIRMAN STETKAR: It is not the damage
4 necessarily internal to the cabinet.
5 MR. HYSLOP: Right. That is right.
6 CHAIRMAN STETKAR: It is the propagation to
7 the nearby --
8 MEMBER RAY: Yes, because the cabinets are
9 separated.
10 CHAIRMAN STETKAR: Yes, I just wanted to
11 make sure because people look at this and say we have
12 a real problem with cabinets. It is we --
13 MR. HYSLOP: It is the propagation beyond
14 the cabinet.
15 CHAIRMAN STETKAR: -- are having a problem
16 with cables located very near cabinets, rather than
17 located near, like I said, pumps.
18 MR. GIITTER: Okay. So, to conclude, we
19 believe the NFPA 805 has resulted in improved plant
20 safety, not only fire safety but for mitigation of
21 station blackout and other events.
22 A year ago the staff identified and
23 implemented a number of process improvements. We
24 believe those have resulted in a more efficient and
25 effective review process. However, deviations from

1 accepted methods still cause considerable schedule
2 delays and have required additional staff and licensee
3 resources to resolve.
4 If continued progress is to be made, it
5 would require sustained industry senior management
6 engagement on solving problems. I believe that good
7 progress has been made over the last year. Before that,
8 I think the focus was more on articulating problems than
9 solving them.
10 Finally, it is imperative that we learn from
11 the NFPA 805 experience and apply those lessons learned
12 to future risk-informed performance-based initiatives.
13 NRC has established a risk-informed
14 steering committee that is focused on ensuring that
15 future risk-informed initiatives can be pursued in a
16 manner consistent with our principles of good
17 regulation.
18 It is important to remember that NFPA 805,
19 despite the implementation issues, provides an example
20 of a risk-informed performance-based alternative to a
21 very prescriptive deterministic rule. The net effect
22 of this effort is improved plant safety and a clearer
23 licensing basis.
24 I will now to turn to -- Steve and J.S.
25 MEMBER BLEY: Is there some point at which

1 you expect to issue a report about technical lessons
2 learned through this process? I would think at some
3 point if we are really advancing safety from some of the
4 things we have found, that there would be some spillover
5 of the lessons we learned here to plants that have not
6 adopted the proper approach to 805.
7 MR. HYSLOP: Well, the facts are made
8 publicly available. As we resolve a problem, they are
9 addressed in the public and made publicly available. In
10 the past, the Fire PRA facts in Supplement 1 were rolled
11 up into a revision of NUREG/CR-6850. It is certainly
12 possible that this new effort and these new completed
13 tasks may see the same thing.
14 MR. GIITTER: Yes, I would agree with what
15 J.S. said. I think that when we develop an FAQ, the
16 understanding is that that is interim and the intent is
17 to roll that into some sort of durable guidance like
18 NUREG/CR-6850.
19 CHAIRMAN STETKAR: But I think Dennis is
20 asking that question at a much different level. If I
21 am a utility executive reading a resolution to a FAQ
22 pretty much doesn't mean anything.
23 MR. GIITTER: Right. Right. No, I got
24 that. The answer is we haven't -- I don't think we have
25 put together -- we are trying to get through the process

1 right now. But you raise a really good point and that
2 is we do need to capture the lessons learned and we need
3 to communicate what those lessons learned are.
4 But my feeling is that the proof is in the
5 pudding and if I am a utility executive, I am going to
6 see how the last set of NFPA 805 reviews went and have
7 we figured out some of the process issues. Have we
8 addressed these deviations from accepted methods?
9 So, that is really what I am going to be
10 looking at, is have the industry and the NRC jointly
11 figure out how to do these reviews in a much more
12 efficient and effective way.
13 MEMBER BLEY: That is probably where I
14 would be focusing if I were I your spot now but I think
15 from the progress you have made and if you really believe
16 the first bullet up there, it is approaching time to sit
17 back and think about getting the word down in some other
18 forms that might get people's attention who weren't
19 really focused on 805.
20 MEMBER SCHULTZ: It would be interesting to
21 hear from NEI and EPRI this afternoon about their
22 thoughts regarding that, about how the plants that are
23 not just getting through the regulatory process here but
24 improving plant safety of those lessons learned are
25 being communicated through the industry.

1 MR. GIITTER: And I think to me one of the
2 big lessons learned from NFPA 805 and this is off script
3 but yes, we did learn from some of the reviews that we
4 did is there were some plants that had significant risk,
5 I don't want to say outliers, but significant
6 contributors to core damage frequency from fire much
7 more than we would have anticipated. And in fact, those
8 plants were compliant with Appendix R.
9 So, you have to ask yourself the question
10 are there gaps in the regulatory framework that assumes
11 that, you know especially with regard to Appendix R, you
12 are applying with Appendix R. Is that good enough or
13 are there gaps out there that we wouldn't see unless we
14 did a PRA, unless we took a really close look at it?
15 So, I think that is even a more fundamental
16 question that I think some of the reviews we have done
17 raised.
18 MEMBER SCHULTZ: Well, you have also
19 pointed out earlier in general terms the connection
20 between the elements of fire risk and the programmatic
21 changes that are happening as a result of Fukushima or
22 treatment of severe external events and so forth. And
23 so, it is really an opportunity to pull those examples
24 together and have an understanding of how one
25 modification clearly can affect different types of

1 events that an upset a plant and its opportunity to
2 respond.
3 MR. GIITTER: And I have, personally, taken
4 the opportunity to talk about the benefits of NFPA 805
5 from a safety perspective and in a number of different
6 forums. And I will be talking about that again next week
7 at the NEI Fire Forum. And I have spoken on this several
8 times.
9 We are trying to get the word out. But as
10 I said, the decision that the CNOs make is going to be
11 based on their confidence that the process works and that
12 they are going to come out on the end with a safety plant
13 and one that is going to result in a more stable licensing
14 basis.
15 So, with that, I am going to turn to J.S.
16 and Steve and have them delve in more detail into some
17 of the Fire PRA challenges.
18 MR. HYSLOP: My name is J.S. Hyslop. Steve
19 Dinsmore and I will be presenting. We are both
20 reliability and risk engineers in the PRA Licensing
21 group.
22 We have also asked Harry Barrett to come to
23 the table because we realize that Fire PRAs are really
24 a nexus between PRA and Fire protection and we felt like
25 we could better answer questions by having both

1 technical fields up here in front of you. The next
2 slide.
3 So, as Joe indicated, there are a large
4 number of deviations from accepted methods in the NFPA
5 805 License Amendment Requests. There are about 20 of
6 them. And what I am going to talk about in this
7 presentation are really the deviations. I will explain
8 what that means. There are different categories in that
9 table that Joe showed you earlier. In some cases, they
10 are just clarifications needed to resolve these
11 deviations, rather than a lot of work. And so, in some
12 cases you just reference 6850. In other cases, you
13 actually have to solve these problems through facts and
14 research and I will go on talking about that.
15 These deviations are from a comparison from
16 joint NRC/EPRI reports NUREG-6850 which was EPRI 1011989
17 Supplement 1 and NUREG-1921, which is on Fire HRA.
18 These deviations have been identified in
19 many ways. Some have been identified by licensees in
20 the LARs. Some are identified by the peer review teams
21 in facts and observations. Some are identified during
22 the site audits. They have one site audit per applicant
23 to discuss RAIs. And then in some cases by generic RAIs.
24 And these are based on deviations identified in previous
25 law reviews. If we see deviations arising, we often

1 establish, with some trend, we will establish a generic
2 RAI that will probe other licensees and we will ask that
3 question.
4 One example of a generic RAI was related to
5 transient combustibles and the placement in the room.
6 We discovered that all licensees weren't placing them
7 at pinch points or locations of high CCDP. So, after
8 we discovered that, of course we asked in an RAI and
9 didn't accept that position but then we ended up having
10 a generic RAI that asked licensees that question whether
11 or not we identified it or not, we just followed up for
12 due diligence. Next slide.
13 The key challenges that I am going to talk
14 about today are derived from deviations from accepting
15 methods. In these cases, we needed a resolution before
16 completing the law review. So, it is important that we
17 do resolve these. Of course, as has been stated,
18 sometimes we don't find out about these until the RAI
19 is issued. So, we are doing this in parallel with the
20 law review.
21 These key challenges have been resolved by
22 FAQ solution or additional research and testing,
23 primarily. I am going to talk about each one of these
24 items later but we resolved the issue of sensitive
25 electronics by FAQ. We resolved the issue of

1 self-ignited cable fires and hot work induced cable tray
2 fires by FAQ.
3 The transient fires, in fact that was
4 resolved primarily by an EPRI Fire PRA panel that
5 preceded this FAQ process and NRC went in and made some
6 slight modifications and endorsed it. Spurious
7 operations, there we relied on research, research
8 programs that were going on actually started before we
9 got into writing RAIs.
10 MEMBER BLEY: Let me make a comment just
11 because something about this hits me a little funny. I
12 kind of regret that we used the word deviation from
13 accepted methods. I don't think anybody who was
14 involved in developing the method expected that it was
15 set in concrete and would never change. In fact, that
16 was the idea of doing a limited set of complete pilots
17 so that it would actually evolve a methodology that was
18 improved because that always happens.
19 Many of these, I think from the ones I have
20 looked at, some are deviations but some are more
21 clarifications or enhancements as well. And I think we
22 almost set up a battlefield here where we don't need to.
23 But that is in place. So, I guess, go ahead.
24 But a lot of these are things that had to
25 get resolved by doing the real work with these PRAs

1 because they were things that --

2 MR. DINSMORE: I think sensitive

3 electronics, when we go through that in detail, that

4 probably will illustrate a little better what we are kind

5 of talking about. But yes, deviations is a very

6 unpopular word.

7 MR. HYSLOP: Really, what this term, it is

8 a label. And it is a label that said the staff needs

9 to do more review and to address this issue. And so that

10 is how it is going to fly.

11 CHAIRMAN STETKAR: Go ahead.

12 MR. HYSLOP: Yes. Developing more

13 realistic, generic fire PRA approaches is a complex

14 process. We will have to scope out the process, which

15 will require RAIs. We often carry these over to a FAQ

16 program. And if it doesn't require lots of research,

17 we have several iterations to resolve the fact. And that

18 is for the simple ones. Of course, when you have to do

19 research, it is even more complicated. Next.

20 Important issues are being worked by

21 research. These topics which will be talked about later

22 are Fire Ignition Frequency and Suppression, Very Early

23 Warning Fire Detection System, Electrical Cabinet Heat

24 Release Rate, and Main Control Room Abandonment.

25 The staff must make decisions from review

1 of specific LAR and accompanying RAIs prior to the
2 development of the generic solution, if that is a
3 circumstance. And for example, you can see as I discuss
4 these issues that we have interim positions but yet we
5 feel like more work is needed to be done either on a
6 confirmatory basis or just enhancing the state of the
7 art.
8 CHAIRMAN STETKAR: Guys, be careful when
9 you shuffle paper, there. It makes a lot of noise in
10 our recorder's headset over there.
11 MR. HYSLOP: Okay, I will try to leave
12 everything the away from it.
13 The first topic -- next slide. You got it
14 there. The first topic will talk about sensitive
15 electronics and I am going to give a background. CR-6850
16 specified that solid state components are sensitive
17 electronics and specified a failure threshold of 65
18 degrees Celsius or 3 kilowatts per meter squared.
19 It is worth nothing that this failure
20 threshold is much lower than your key fire PRA targets,
21 cables, which are 205 degrees Celsius for thermoplastic
22 or 330 for thermoset. So, this distinction is
23 important. You will see damage at sensitive
24 electronics at much lower temperatures.
25 Steve is going to talk about the examples

of early LAR treatment.

MR. DINSMORE: Yes, hi. This is Steve Dinsmore. I guess what I am going to try to do with each of these things is give a little perspective of how the different issues were identified and reviewed and dispositioned, pending on our reviews of the LAR.

Generally, as J.S. said, the candidate is reviewed and dispositioned through RAIs and internal NRC staff discussions. And I think this is a good one because as you see, in the NUREG, it tells you to do this. It doesn't really tell you how to do it.

So, what we noticed was early on in the pilots that people weren't really doing it. I mean, they would develop zone of influences, which is where they would figure out what was going to fail but they developed those based on the thermoplastic or thermoset cables and then they would just continue.

And so we started asking them well, how do sensitive electronics with these lower failure rates fit into this what you are doing. And they actually got some F&Os on it. So, when we pursued it we started getting answers. Well, the hot gas layer will be above the panels or the heat is isolated from the sensitive electronics by the steel structure and the volume of air in the panel, which all seemed fairly reasonable. But

1 again, there was no real accepted method to say well,
2 in this situation you don't have to worry about that.
3 At this time, we are also asking for
4 sensitivity studies. So, we asked for sensitivity
5 studies and it turned out that it wasn't that important.
6 And people were kind of agreeing this isn't really a
7 problem but we do need to kind of deal with it because
8 they do exist in the plant and they are sensitive to
9 fires. And so, we developed a FAQ and I think J.S. will
10 tell you what the eventual FAQ concluded.
11 So, is it a deviation? Well, you could call
12 it extension improvement but it was something like J.S.
13 said earlier that we had to look at specifically in
14 disposition.
15 So, this was solved in Fire PRA FAQ 13-0004;
16 13 indicates the year in which the FAQ was developed,
17 was initiated. This solution provides a further
18 definition --
19 MEMBER BLEY: In a sense, this set of FAQs,
20 which is a little different than we have done elsewhere,
21 I think, is like Appendix 1 to the methodology document.
22 It is extensions of the methodology.
23 MR. HYSLOP: It would be another supplement
24 is how you can look at it.
25 So, the solution provides a further

1 definition of sensitive electronics and determines
2 surrogate criteria for a failure threshold for those
3 located within the cabinet. The definition includes
4 some integrated circuits, excludes electro-mechanical
5 devices. The deciding was that since the electronic
6 located within the cabinet were not damaged unless the
7 thermoset cable fire failure criteria were applied to
8 the exterior of the cabinet. And the basis of this
9 surrogate is Fire Dynamics Simulator computer runs
10 translate the conditions outside the cabinet to within.
11 It is worth noting that if the sensitive
12 electronic is mounted on a cabinet wall, then it does
13 fail with the normal threshold of 65 degrees Celsius.
14 MR. DINSMORE: And just as a closing, to
15 deal with this issue, we probably went through 20 RAIs.
16 So, it takes a long time to get even a simple issue kind
17 of cleared up and put on a shelf.
18 MEMBER BLEY: And I assume that was across
19 a number of plants.
20 MR. DINSMORE: Across a number of plants,
21 yes.
22 MEMBER BLEY: But the NUREG was a joint
23 EPRI/NRC document. Are the FAQs a joint EPRI/NRC
24 document or something not quite that?
25 MR. HYSLOP: They are joint NRC/industry

1 solutions.

2 MEMBER BLEY: I don't know what that means.

3 We had a big fight in here a couple of days ago about

4 the word industry.

5 MR. HYSLOP: Well, when you say EPRI, you

6 know EPRI/NRC, in my mind, that connotates an MOU

7 process.

8 MEMBER BLEY: Okay.

9 MR. HYSLOP: This FAQ process is -- MOU.

10 MEMBER BLEY: The NUREG was via an MOU

11 process.

12 MR. HYSLOP: Yes. The FAQ process, it is

13 a public process. It involves discussions between NRR,

14 Research and all of industry. It is a public process

15 where we allow public comments. So, it is different.

16 MR. GIITTER: Yes, we are having public

17 Fire PRA FAQ meetings every week. And I think we do it

18 every two weeks now.

19 MR. HYSLOP: Yes, two or three.

20 MR. GIITTER: Every two or three, yes. But

21 we were having them about every week.

22 MR. BARRETT: And on the industry side,

23 that is done through an NEI task force.

24 MEMBER BLEY: Okay.

25 MR. BARRETT: There is a PRA Task Force and

1 there is a just a regular 805 Task Force. Those two task
2 forces work in concert with the FAQ process.
3 MEMBER BLEY: Okay. And sometimes it is
4 better to say that explicitly than to refer to the
5 industry as if there is some monolithic group out there
6 all speaking with one voice. If you are talking about
7 NEI or the Task Force, that is perfectly fine.
8 Is there a plan in the future to, at some
9 point, take all of the facts and maybe any other research
10 that has been going on and come out with a new methodology
11 document?
12 MR. GIITTER: Yes, a supplement to
13 NUREG/CR-6850.
14 MEMBER BLEY: Where does that sit on the
15 schedule or is on the schedule anywhere yet?
16 MR. GIITTER: I don't think --
17 (Simultaneous speaking.)
18 MR. GIITTER: So right now, like I said, our
19 focus is on getting through these reviews.
20 MEMBER BLEY: Okay, so it is something you
21 envision but it is not something that is planned yet.
22 MR. GIITTER: It is something we planned.
23 It is not something that is a high priority.
24 CHAIRMAN STETKAR: I think last I checked,
25 RES has it somewhere in their plan but they are too busy

burning cabinets these days.

MR. DINSMORE: In the safety evaluations, we can refer to FAQs. So, we can use them before they become --

CHAIRMAN STETKAR: Yes, I understand.

MR. DINSMORE: -- the next stages.

MEMBER BLEY: And in fact, you have been doing that.

MR. DINSMORE: Yes.

CHAIRMAN STETKAR: And now with this new staff guidance.

MEMBER BLEY: Yes.

MR. HYSLOP: Next slide. The next topic that we worked on is self-ignited cable fires and hot work induced cable tray fires. This particular issue required some clarification. The state of knowledge for fire propagation was basically based on 6850. There was some discussion about a burning area to be specified to initiate the scenario in one place. In another place, it talked about damaging all the cables within the initiating tray.

And furthermore, the Appendix that was most relevant that was referenced for this provides guidance for modeling propagation of cable fires due to hot work. And this particular Appendix R talks about propagation

1 between cables trays.

2 So, we kind of had a combination of

3 information that could lead us in various directions,

4 depending on what we did. And so that is what was

5 troubling. So, the staff initiated this FAQ because it

6 had the potential, at least the guidance if you interpret

7 it one way, had a potential for large propagating fires.

8 And that was contrary to our expectations or operating

9 experience. It basically doesn't have these

10 propagating in any events we see and Steve will talk

11 about the examples of the early LAR treatment.

12 MR. DINSMORE: That was a quick handover.

13 There is two things in the title here, self-ignited cable

14 fires and hot work induced cable fires. The

15 self-ignited ones actually were fairly simple to deal

16 with. Most of them simply said that there is no

17 self-ignited fires if there is no unqualified cables,

18 which was consistent with the piece of the NUREG. And

19 then we just had to clean up that that was consistent.

20 I am still a little confused about how that went.

21 But we eventually and fairly quickly, I

22 think, said that is okay. So, the self-ignited cable

23 fires was not much of a problem.

24 MEMBER BLEY: Are there plants that have

25 submitted that have cables that might not make that

criteria?

MR. DINSMORE: Oh, yes.

MEMBER BLEY: What have they done and what have you done with respect to those?

MR. DINSMORE: Well, we did ask -- I crossed this point out. So, let's see. We did ask somebody about it and they did say that we suspect that it had unqualified cables and they did respond back. But yes, we did have some. We do have some. And then we asked them to do a sensitivity study and they came back with a total CDF and LERF increased by two percent. But most of them don't have a large number of unqualified cables. There might be a couple of the cables that are unqualified and most of them are qualified.

MEMBER BLEY: So, the sensitivity study just assumed it would --

MR. DINSMORE: They were all unqualified.

MR. HYSLOP: Well, the sensitivity, in this case, there were a very small percentage of fires that -- of unqualified cable. So, the sensitivity study Steve is talking about is there. So, that is how we accepted it. It is a very small percentage.

MR. BARRETT: Some of your older plants have all unqualified cable. And I think they ended up following the guidance and actually did calculations for

1 self-ignited cable fires. It is the plants that had
2 majority of qualified cable where we asked them, well,
3 let's say you got 10 percent of unqualified cable. Is
4 that important? And so they did a sensitivity and we
5 found out no, it is not really all that important.
6 MR. DINSMORE: Even if they were all
7 unqualified, and some of them are qualified, so there
8 is even less incidence. So, that is how we kind of deal
9 with these sensitivity studies.
10 So, then the hot work of these cable fires
11 is a little more interesting because this is one of the
12 times where we decided that what industry was proposing
13 we didn't accept. Some of them were assuming that there
14 was no hot work fire damage because they had a continuous
15 fire watch. And I think NUREG-6850 says that you need
16 to assume that it does occur, just how often may be a
17 bit of a question.
18 Sometimes other plants were applying
19 something called a procedural compliance factor, where
20 they said well, because we do have a continuous fire
21 watch, we are going to credit that as 0.01 to the hot
22 work fire frequency, which would otherwise be developed
23 using NUREG-6850.
24 CHAIRMAN STETKAR: Steve, does that mean
25 because everybody has procedures, only one percent of

1 the fires that we have seen have actually occurred?
2 MR. HYSLOP: What they were doing is they
3 were modifying the fire frequency by the 0.01 and saying
4 --
5 CHAIRMAN STETKAR: Oh, I understand.
6 MR. HYSLOP: -- they were saying there were
7 additional features that could be credited. But the
8 staff said basically --
9 CHAIRMAN STETKAR: I understand. Every
10 plant has the best procedures in the world and the best
11 trained operators and they always follow them. I am
12 looking for that one plant somewhere in the world that
13 makes the industry look so bad because I want to get rid
14 of that plant.
15 No, honestly, people were actually claiming
16 -- okay. They are reducing the fire frequencies.
17 MR. DINSMORE: Yes. Well, that is actually
18 kind of a standard PRA technique. If you get a number
19 that you believe is too high, you go in and look and see
20 what you can --
21 CHAIRMAN STETKAR: I understand how one can
22 wash up numbers. I am just trying to understand what
23 people are doing.
24 MR. HYSLOP: Yes, well, they were using
25 0.01 for a while.

1 MR. DINSMORE: But in the end we, again,
2 through a lot of RAIs and back and forth. And when we
3 discuss these internally, we meet like six or seven --
4 three or four staff members and a bunch of contractors
5 on the phone, we talk about these things in great detail.
6 And it could be two or three weeks.
7 CHAIRMAN STETKAR: My point is facetious.
8 Now I mean you are talking about a lot of effort put into
9 this.
10 MR. DINSMORE: Yes, every one of them.
11 CHAIRMAN STETKAR: And people are
12 concerned about all of the efforts that has been
13 expended. And everyone who has done risk assessment and
14 has talked to plants knows that each plant knows that
15 they have procedures and training and follow them better
16 than everyone else --
17 MR. DINSMORE: Yes.
18 CHAIRMAN STETKAR: -- which is clearly not
19 true. On average, everybody is average. They do a
20 really good job. On average, everybody does a really
21 good job but we still have fires.
22 So, people with experience ought not to be
23 trying this sort of thing, for example. That is my whole
24 point. We ought not to be expending tremendous
25 resources both on the industry side and the regulator's

1 side for this way of making numbers get small.

2 MR. DINSMORE: Right. Well, they tried it

3 and we dealt with it. And we came back and effectively

4 said no, you have to do hot work fires according to 6850.

5 So, now everybody is. And this is one of the things in

6 the aggregate analysis Joe was talking about at the end.

7 If they have used hot work, they did one of these credit

8 things, then we don't ask them during the review -- well,

9 we ask them if they did it. And if they said yes, we

10 don't ask them to fix it then. We wait until the end

11 and we say well, when you finish your numbers, make sure

12 you don't use this.

13 There was a few FNRs on it. Some people

14 noticed that they weren't -- the FNRs are mandatory for

15 the people who said it wouldn't occur because there was

16 procedure controls. So, that issue we have actually

17 closed out, I guess.

18 CHAIRMAN STETKAR: But this issue, I mean

19 is closed out in the sense that there is no chance that

20 either a self-ignited fire or the hot work involving

21 cutting fire can damage cables in any more than one tray.

22 Right? That is the ultimate solution.

23 MR. HYSLOP: You will see in the next slide

24 that that is the functional line --

25 CHAIRMAN STETKAR: I'm sorry. I'm kind of

1 confused about the handoffs here. I'm sorry.

2 MR. HYSLOP: The only other large rate you

3 might want to mention is that from my experience, the

4 licensees have pretty much been assuming that the fire

5 damage was limited to the single tray for self-ignited

6 cable fires and cable tray fires due to welding and

7 cutting.

8 CHAIRMAN STETKAR: So, actually supported

9 by operating experience.

10 MR. HYSLOP: We are going to talk about that

11 in the next slide.

12 CHAIRMAN STETKAR: Okay, good.

13 MEMBER SCHULTZ: But that is a different

14 portion of the solution. I was surprised you said that

15 the compliance factor would be considered in some

16 fashion in the sensitivity evaluation versus just saying

17 you can't use that and you will go back and use the

18 appropriate guidance. I think that is what -- I heard

19 both.

20 MR. HYSLOP: Well, that is what we did. We

21 rejected it because the 0.01 is sort of included in the

22 frequency of fire already. So, we rejected it. And

23 what we would have them do is remove that factor from

24 their study and provide us a result without that credit.

25 MR. GIITTER: In other words, they still

1 have to show that they meet the Reg Guide 1174 criteria
2 without crediting that.
3 MEMBER SCHULTZ: Well, I still want to
4 sneak back in because it is not appropriate.
5 MR. HYSLOP: Agreed. Okay, so next slide
6 on the resolution.
7 So, basically, FAQ 3-0005 solved this
8 problem and have brought operating experience to bear
9 on such risk evaluations. However, operating
10 experience wasn't the only basis. There was testing
11 that was done that supported this conclusion and
12 Research did a review of some testing that was available,
13 not new testing. And so, we were able to support the
14 conclusion that fires are confined to the cable tray of
15 origin in this model. The model is graduated to address
16 the needs in the analysis, where initially, the
17 frequency of the entire physical analysis unit, which
18 is sort of the compartment which confines the effects
19 of the fire, is applied to the worst cable tray as defined
20 by a CCDP. And if that is good, then that is the
21 solution.
22 However, if that is too big, then you can
23 do a more refined approach where you actually look at
24 the frequency of that worst cable tray, assign the CCDP
25 and assign the remainder of the frequency to the second

worst cable tray. And you can kind of do that in an iterative fashion, until you are satisfied with your solution.

MEMBER BLEY: So people typically have to do that?

MR. HYSLOP: In the ones I have seen, I have seen it done. I have seen the refinement done.

MR. BARRETT: In some areas, like the cable spreading room --

MR. HYSLOP: Okay.

MR. BARRETT: -- or very high risk areas.

MR. HYSLOP: Yes, I have only seen the analysis for the high risk areas.

Suppression cannot be credited prior to the damage of the entire cable tray. You basically don't know what cable catches fire in this. So, it would be speculating which one is damaged and which one isn't, so you damage the whole cable tray but that is all you damage.

And as I said, the basis for constraint is operating experience in tests. And also for cable tray fires caused by welding and cutting, you have got a fire watch there. So, that is --

MEMBER BLEY: And as John said, as far as I know, everybody does that.

1 MR. HYSLOP: So, the fire watch won't stop
2 the damage to the tray but there is some confidence that
3 it would stop damage, further propagation.
4 MEMBER BLEY: If they put it out.
5 MR. HYSLOP: But as I say, we have testing
6 that supports the conclusion as well. And that is not
7 based on the fire watch.
8 The constraint on the fire propagation is
9 also applied to another initiator, junction box fires.
10 And that was resolved in FAQ 13-0006. And there we only
11 failed the cables that are in the junction box. Next
12 slide.
13 Transient --
14 CHAIRMAN STETKAR: J.S., before you leave
15 that one, I'm not going to let you off the hook. I was
16 going to ask you -- I mentioned operating experience.
17 Does our operating experience support this notion that
18 no self-induced cable fires or hot work related cable
19 fires can damage cables in more than one tray? And the
20 resolution of the FAQ cites operating experience of more
21 than 50 self-ignited and hot work initiated cable fires.
22 Well, that is 50 even if none of them have reasonable
23 confidence that it is probably two percent of the fires
24 and maybe have some confidence that it is not one percent
25 of the fires but zero is a really small number.

1 I am curious how the operating experience
2 would support zero.
3 MR. HYSLOP: Well, first of all, as I said,
4 the operating experience wasn't alone. There were
5 tests that were reviewed and cited in that FAQ.
6 CHAIRMAN STETKAR: Did you look at the H.B.
7 Robinson fire? I am looking at a photograph in front
8 of me here, for example, and it is not at all clear to
9 me. And that was a cable initiated fire. Just, I will
10 point you to that operating experience and what you
11 reconsider the numbers in there.
12 MR. HYSLOP: Oh, yes, that was a high energy
13 arcing fault.
14 CHAIRMAN STETKAR: But it was a cable.
15 MR. HYSLOP: It was a cable but it was a high
16 energy arcing fault. So, from a categorization
17 standpoint that would end up being covered by a high
18 energy arcing fault.
19 CHAIRMAN STETKAR: Oh, I see. Okay, so
20 that is the subtlety.
21 MR. HYSLOP: And the high arcing --
22 CHAIRMAN STETKAR: No, honestly, I want to
23 make sure that we are covered. There was a high energy
24 arcing fault but I don't know if people are evaluating
25 high energy arcing faults in power cables that are run

in cable trays. They tend to look at high energy arcing faults originating in switch gears.

So, if I have a cable spreading room where the cable for my reactor coolant pumps that is run in a cable tray, I have seen these things that could arc, are people looking at that type of high energy arcing fault in a cable tray configuration?

MR. BARRETT: I don't believe anybody is looking at cable trays.

CHAIRMAN STETKAR: Okay, thank you.

MR. HYSLOP: Next slide. Okay, you are on it.

The next topic that we addressed was transient fires. And the focus in this was the heat release rate distribution for transient fire. The state of knowledge is at 6850 establishes a 98 percent fire peak heat release rate of 317 kilowatts, which is generally applied as a portion of the applicable distribution. And the licensees have claimed that for some plant areas, this overestimates the combustible loading.

Steve will talk about the LAR treatment.

MR. DINSMORE: Yes, this is kind of similar to the sensitive electronics. We started looking around and realized some people weren't using 317 all

over the place. They were using lower heat release rates. And we started asking questions about well why did you use the lower one. And we were getting back answers along the lines of well, it is very difficult to access. We haven't had any violations in over a five-year period. We really don't store combustible materials in there. There is no hot work we do during power operations. So, they had a variety of reasons for doing it.

Then we also go another procedural compliance factor, which I think we were a little briefer on this one. So, we decided that was not applicable. But the other reasons we kind of took and looked at and I believe Joe Giitter signed the letter that came out and said well, all right, we agree that 317 might not be applicable all over the place. If you want to use something less, then you can go through these series of steps, which I think J.S. will tell you about right now.

MEMBER BLEY: So, did you find many people who, rather than just calculating from a peak heat release rate, used the distribution heat release rate? I know a few people did but I don't think many did.

MR. HYSLOP: I think there are distributions for all types of fires. I was more aware of them using the full distribution for the electrical

1 cabinets.

2 MEMBER BLEY: For the cabinets?

3 MR. HYSLOP: For the cabinet. I am not

4 aware of any distributions that were applied for

5 transient. I know they often use a multipoint method,

6 which is allowed by the standard which would have a 98

7 percent and a low one as well. But that is different

8 from --

9 MEMBER BLEY: But that is just a two-point

10 test. Right?

11 MR. HYSLOP: That is different from

12 discretizing the whole distribution. I don't think

13 anybody uses whole distributions. They have for much

14 of the cabinets. I have reviewed it in some of the site

15 audits.

16 So anyhow, we have accepted some of these

17 reduced heat rates in some cases.

18 MR. DINSMORE: When we accept them and all,

19 everybody uses them now. Once one of these things is

20 accepted that lowers the risk, people tend to pick it

21 up pretty quick.

22 MR. HYSLOP: But they need to meet the

23 criteria.

24 MR. DINSMORE: Yes.

25 MR. HYSLOP: Okay, the next slide talks

about how it was resolved.

So this was a part of the discussions that were initiated in the EPRI Fire PRA Panel. And they provided guidelines for adjusting the transient fire heat release rate from established values in 6850. NRC adopted this with few clarifications.

MEMBER BLEY: Did you have any representatives on that panel?

MR. HYSLOP: We had one representative and a couple observers.

MEMBER BLEY: Okay.

MR. HYSLOP: So the maximum peak heat release rate solution said that it can be reduced upon considering the potential presence of transient combustibles due to the need to bring them into the room. Potential for traffic and congestion might combine and just put something in. And any violations of transient combustibles, that was also reviewed.

MEMBER BLEY: What does that last one mean?

MR. HYSLOP: Basically, we were to ask them for the area or similar area whether or not they had violations within the past five years.

MEMBER BLEY: Okay.

MR. HYSLOP: And for the cases that I was involved where we accepted it, the answer was no.

1 MEMBER BLEY: Okay.

2 MR. HYSLOP: It also said that the heat
3 release rate maximum could be increased, if that was the
4 case but I don't recall that actually happening in any
5 of the LARs.

6 This discussion confirmed that a particular
7 ignition source need not be identified to postulate a
8 transient fire. The transient fire frequencies are
9 that we use in the PRA all frequencies of transient
10 fliers. They all exist. So, the challenge is what type
11 of combustible do you need to postulate with that
12 transient fire.

13 And although we didn't discuss it in this
14 resolution, transient fires may be excluded only if they
15 are physically impossible as opposed to just unlikely.
16 And the Fire PRA still under support says you must
17 postulate these transient fires regardless of
18 administrative controls. They may be low frequency but
19 you can't ignore them.

20 MEMBER BLEY: In the cases where they
21 argued for a lower maximum heat release rate, was there
22 any finding of -- I think there were experiments done
23 on generating heat release rates for these fires but with
24 maybe hydrocarbon sources, rather than passé kind of
25 stuff.

1 Was it challenged on that basis at all?

2 MR. BARRETT: Well, in many cases, it is an

3 argument that you have an area like a cable spreading

4 room where you really don't need to do any maintenance,

5 there is really no need to bring anything in there. So,

6 you have to postulate a transient fire but a smaller heat

7 release rate is probably reasonable because there is no

8 need to bring anything in there. That is basically the

9 argument that they used.

10 MR. DINSMORE: But you could bring in a

11 plastic chair and some small amount of stuff for some

12 reason or another. So, that is why we don't want to make

13 it zero.

14 MEMBER BLEY: We have seen that in some of

15 our audits, seen a plastic chair in a cable spreading

16 room.

17 CHAIRMAN STETKAR: We have a story we might

18 share at the break.

19 MEMBER BLEY: We don't want to share it on

20 the records.

21 MR. HYSLOP: So, the basis for the

22 relaxation of the maximum peak heat release rate is the

23 collective judgment of the staff and industry.

24 Next slide, spurious operations. Now the

25 spurious operations is a pretty broad topic. I am going

1 to talk about a state of knowledge and then tell you how
2 we got into this specifically in the LAR reviews.
3 State of knowledge, 6850 credited control
4 power transformers, CPTs, to decrease the spurious
5 operation likelihood by a factor of a half.
6 There are other aspects of spurious
7 operations. In fact, 08-0051, which is a part of
8 NUREG/CR Supplement 1 specified a probability of the AC
9 duration. That is, what is the probability of it lasting
10 a certain length of time.
11 However, at that point in time, there was
12 no credit for the DC duration only lasting a certain
13 period of time with the probability. We didn't have any
14 test data and we didn't feel like we could extrapolate
15 the AC to the DC.
16 This whole issue was brought to light in the
17 reviews because industry first mentioned it at NEI Fire
18 Protection Information Forum some years ago that they
19 felt certain industry members responsible for some of
20 the position and the testing indicated that a half credit
21 for the CPT was unwarranted.
22 And it turned out the CAROLFIRE and DESIREE
23 two NRC tests confirmed that. And so, Steve is going
24 to talk about how we handled in the LAR and then I am
25 going to talk about the resolution of this issue later.

1 MR. DINSMORE: Yes, this was an interesting
2 one because everybody used that credit because it was
3 a NUREG and so it was an accepted method. And when it
4 first came out that maybe the credit wasn't applicable,
5 we immediately asked everybody to give us a sensitivity
6 study without the credit. And it actually was pretty
7 important. A lot of numbers went up.
8 So, we were sitting there with a method that
9 was being used that we had accepted but we felt no longer
10 was correct, which made a big difference on the result.
11 MEMBER BLEY: I never understood the
12 argument that bothered us in the first place. Does
13 anybody?
14 MR. BARRETT: Yes, I can give you a little
15 bit of an insight on that. When EPRI did the testing
16 back in 2000, 1999-2000 time frame, they did see somewhat
17 of a correlation on the circuits that had a control power
18 transformer in them. And the theory was that you would
19 add enough of a burden on the transformer that the
20 voltage dropped such that you wouldn't have enough
21 voltage to actually pull in the contactor.
22 MEMBER BLEY: So they actually had a
23 rationale there?
24 MR. BARRETT: Yes, they had a rationale and
25 they actually saw it in their results.

1 MEMBER BLEY: Okay.

2 MR. BARRETT: They actually saw a factor of
3 two reduction in this spurious actuation probability
4 from the testing that they did the way they had their
5 test rates set up.

6 When we did CAROLFIRE and when we did
7 DESIREE-FIRE, we specifically tried to replicate that.
8 We used a variety of different sizes of control power
9 transformers and we specifically set it up to try to
10 replicate it and we couldn't.

11 CHAIRMAN STETKAR: If you look at the
12 circuit stuff, it is counterintuitive that it would
13 happen --

14 MEMBER BLEY: Well, that is what I always
15 thought but I wasn't aware of the earlier EPRI test.

16 MR. BARRETT: Yes, there was a reason why
17 they did it. And when you looked at the data, that made
18 sense. But when we tried to replicate it, we just
19 couldn't get it to do the same thing. So you know, after
20 that, we said well really we can't leave this in there
21 because we can't make it happen again.

22 MEMBER BLEY: I'm sorry.

23 MR. DINSMORE: No, that's fine.

24 So, in the end, we discussed it with
25 management and everybody and we just thought we had to

1 pull that methodology back. And so we, again, put it
2 in the RAIs to please provide us in the aggregate
3 analysis without this factor of two.
4 Now, there is a new report that has come out
5 that gives them an alternative method, which I am not
6 particularly sure about. So, the people in the pipeline
7 are now being able to switch over to that one.
8 CHAIRMAN STETKAR: What new report that
9 came out that gives somebody an alternate methods? And
10 who was it published and where is it?
11 MR. BARRETT: Yes, it is in another
12 JACQUE-FIRE Volume 2.
13 CHAIRMAN STETKAR: Oh, JACQUE-FIRE.
14 Okay.
15 MR. BARRETT: Okay? The Expert
16 Elicitation Panel took all the data on all the electrical
17 testing that was available so far and the PRA experts
18 parsed the data and do their thing on that. And they
19 came up with new probabilities for solenoid operated
20 valves, motor operated valves, circuit breaker
21 controls, whether it is double break design, I mean all
22 kinds of grounded/ungrounded. You have basically got
23 all kinds of different choices.
24 CHAIRMAN STETKAR: If you had said
25 JACQUE-FIRE, I would know what you were talking about.

1 In this business, I get really confused by people saying
2 there is another new report out with another method.
3 What is the status of our -- you know
4 JACQUE-FIRE has been published.
5 MR. BARRETT: And we have also put out an
6 interim letter before that was published that basically
7 had the technical information for licensees to use. So,
8 they have had that information now for a considerable
9 period of time.
10 CHAIRMAN STETKAR: And are people using it?
11 MR. BARRETT: Yes, sir, they are starting
12 to use it.
13 CHAIRMAN STETKAR: Okay.
14 MR. BARRETT: You know I heard from some
15 industry people yesterday that they are very happy with
16 that information. It is working fine.
17 CHAIRMAN STETKAR: Okay.
18 MR. BARRETT: It is working well.
19 MR. HYSLOP: We have almost eliminated the
20 need for the next slide. The next slide talks about
21 JACQUE-FIRE. And it was published in May of 2014 and
22 it is an expert elicitation of many sets of existing
23 data.
24 And Harry just told you about the SOV and
25 the MOV, new spurious actuation probabilities. And the

1 approach no linger distinguishes them according to
2 control power transformer.
3 In addition to what Harry told you, there
4 was a probability of DC duration that was published as
5 a result of the testing. So, we now have that to support
6 the AC duration probabilities.
7 There was another implication and that is
8 that the JACQUE-FIRE document in the new guidance
9 identified that option 2, which was a fairly
10 sophisticated way for evaluating spurious actuations in
11 6850 was flawed. So, it identified it. So, the staff
12 is going at it and that has been communicated to
13 industry.
14 The basis for this expert elicitation,
15 these decisions is test data from DESIREE-FIRE and
16 CAROL-FIRE, as was stated as well as some other testing
17 that has been done.
18 Next slide.
19 CHAIRMAN STETKAR: Actually, what I would
20 like to do here, because we are kind of transitioning,
21 I think, from facts that have been resolved to things
22 that are ongoing.
23 MR. HYSLOP: Yes.
24 CHAIRMAN STETKAR: And because we are close
25 to a break time, and way ahead of schedule, I am going

1 to call for a break.

2 So, let's recess until 10:15.

3 (Whereupon, the above-entitled matter

4 went off the record at 9:53 a.m. and resumed at 10:15

5 a.m.)

6 CHAIRMAN STETKAR: Great, we are back in

7 session. Let's hear about things that are in progress.

8 MR. HYSLOP: Okay, the first topic I am

9 going to talk about that is in progress is fire ignition

10 and frequency and suppression probabilities.

11 State of knowledge was 6850 at first, where

12 fire ignition frequencies and suppression values were

13 developed based on a large set of data from 1968 to 2000.

14 Next came an EPRI report which developed

15 frequencies relying heavily on the 1990 through the 1999

16 data. NRC endorsed that part of that document and there

17 were some consequences. The fire ignition frequencies

18 decreased overall from the 6850 values. However, the

19 FAQ solution specified a need for the sensitivity study

20 from the frequencies which have large uncertainties.

21 So, for the frequencies in the EPRI report where there

22 was a large uncertainty, they had to use the

23 NUREG/CR-6850 bin frequency values.

24 CHAIRMAN STETKAR: J.S., why would you do

25 that if you had data and an uncertainty distribution

1 already? If I have an uncertainty distribution for a
2 pump failure rate and it varies between, I don't know,
3 pick a number, ten to the minus two on demand and ten
4 to the minus three on demand, why would I do a sensitivity
5 study saying it is 0.1 on demand?
6 MR. HYSLOP: I can give you my opinion. I
7 don't know if it is --
8 CHAIRMAN STETKAR: Well, that is what I am
9 asking.
10 MR. HYSLOP: Basically, the frequencies
11 decrease and there were some concern about, at least from
12 some of the staff, about the decrease. And so one way
13 to mitigate it was to say for those cases where you have
14 a large uncertainty, you should do a sensitivity study.
15 However, I want to make it clear that we didn't evaluate
16 the results of the analysis versus the Reg Guide 1.174
17 guidelines for that.
18 CHAIRMAN STETKAR: But you required
19 somebody to do work and spend money and do things.
20 MR. HYSLOP: Yes.
21 MEMBER BLEY: I guess I am with John. Was
22 it that you didn't believe the uncertainty valuations?
23 I mean if you did, and we are going to use the
24 uncertainties, I don't see why that wouldn't be --
25 MR. HYSLOP: Well, they weren't using the

uncertainties. They were just going to use a mean value.

MEMBER BLEY: Oh. Of that uncertainty, I'm sure.

MR. DINSMORE: Well, the impact, when you say use the uncertainties, if you mean this propagation of uncertainties instead of knowledge and all that stuff, that doesn't have that much of an impact on the number. I'm sorry.

So, the thing here was they wanted them to use the old numbers to see what would happen to their estimates. Why? I don't know. I actually am not involved in this. But we did get the guidance. The guidance comes quite clearly and says you do it like this. And so that is the say we moved forward.

MR. HYSLOP: So, basically how we used this is if they exceed the guidelines of 1.174, then we asked them whether there is some defense-in-depth that could be credited that would mitigate those increases. And so far, everybody has come back and said yes, there is.

So, in essence, we have evaluated the risk values from the FAQ 48 EPRI report versus the Reg Guide 1.174.

CHAIRMAN STETKAR: J.S., let me try this again.

We all like internal event PRA and we were

1 all very, very happy with internal event PRA and we are
2 all confident in internal event PRA and we all really
3 like the numbers in internal event PRA. In internal
4 event PRA we have failure rate for things that are called
5 diesel generators, let's say. And they have an
6 uncertainty distribution. And if somebody has a
7 licensing submittal for I don't know, tech spec
8 improvement and they use the number that everybody likes
9 for diesel generator with uncertainty and they quantify
10 the uncertainty and they look at the uncertainty, the
11 staff doesn't have them go back and say well, suppose
12 your diesel generator failure rate was 0.5 and do a
13 sensitivity study. And then if that pushes you over the
14 limit, put in additional defense-in-depth, do they?
15 MR. HYSLOP: No.
16 CHAIRMAN STETKAR: No, they don't. So, why
17 are we doing that in the fire assessment? Why are we
18 forcing people to jump through hoops?
19 MR. BARRETT: I think there is some logic
20 to it. At least one of the staff members felt that the
21 change in the frequency number was partly due to under
22 reporting.
23 CHAIRMAN STETKAR: Okay, at least one of
24 the staff members. On the other hand, this is not an
25 agency that is driven by individuals. It is driven by

1 folks that sit at these tables and reach consensus
2 opinions, in many cases. Does that one individual drive
3 the entire vote?
4 MR. BARRETT: I think the consensus opinion
5 that there was enough of a doubt that they wanted the
6 sensitivity just to see how important it was.
7 MR. HYSLOP: And it is clear that there was
8 under reporting in this database because you will see
9 with the new database, they have collected a lot more
10 data. The data is more comprehensive, it is better
11 described.
12 CHAIRMAN STETKAR: Under reporting in
13 which? In the 1990 through 1999 data?
14 MR. HYSLOP: Yes.
15 CHAIRMAN STETKAR: Okay.
16 MR. HYSLOP: And the data preceding the new
17 database.
18 CHAIRMAN STETKAR: Having collected data
19 for a good portion of my boring technical career, I found
20 that as you go on in time, sometimes you find more events.
21 Sometimes you find fewer events. There is a legacy of
22 this. EPRI used to publish loss of offsite power
23 frequencies and would probably show that the loss of
24 offsite power frequency had decreased for three years
25 until it increased dramatically in one year. Things

1 vary. That is the nature of our business. It isn't
2 necessarily under reporting, it is a fact that some years
3 you get bad years. And that is part of the uncertainty.
4 I mean that is actually part of the uncertainty analysis.
5 MR. HYSLOP: But you know there were
6 certain areas where data is collected and how it is
7 collected in the early database and for the new database.
8 And some people were very clear that many of the plants
9 were reporting to the early database. So, it was less
10 complete than the new database effort which is going out,
11 going to all the plants, collected from most all the
12 plants. And not only is the data more complete, it is
13 better. They are better descriptions.
14 CHAIRMAN STETKAR: No doubt about it. I am
15 not arguing that.
16 MR. HYSLOP: And this was an interim study.
17 In the FAQ, it said that we need a better database to
18 move forward. So, there is an interim position. They
19 recognized the need for a better database and this was
20 an interim position that the staff settled on.
21 MEMBER REMPE: Did I hear Steve say it
22 didn't matter when they did the sensitivity numbers or
23 it did?
24 MR. DINSMORE: It depends on which plant.
25 So, I will get into that.

1 MR. HYSLOP: Yes, there were some cases
2 where it did drive plants above the acceptance criteria
3 that the sensitivity study. And as a result, they came
4 back and said well, there are some fire protection
5 defense-in-depth. It is not credited in our PRA. And
6 that is all the FAQ requires is to look for additional
7 fire protection measures or features that might offset
8 that.
9 And in those cases where it exceeded the
10 guidelines, the staff accepted the position and we ended
11 up measuring them against the Reg Guide 1.174 guidelines
12 with the EPRI frequencies without adjustments from the
13 sensitivity study for that reason.
14 MR. DINSMORE: Yes, so pretty much
15 everybody picked up immediately and used the values.
16 Quite a few of them did not do the sensitivity study and
17 they should have. And as soon as we started asking
18 questions, they did.
19 And as J.S. said, some of them moved up over
20 the guidelines because they were pretty close to start
21 with. Those that were far away from the acceptance
22 guidelines, we accepted qualitative discussions, saying
23 we are --
24 CHAIRMAN STETKAR: Steve, they were pretty
25 close to the guidelines because you are measuring point

1 estimate values to force significant figures of
2 precision. Had they done an uncertainty analysis, you
3 would have seen the uncertainty, the probability that
4 they exceeded the guideline. Wouldn't that serve the
5 same purpose?
6 MR. DINSMORE: We use -- we compare the mean
7 value to the guideline or the result.
8 CHAIRMAN STETKAR: I recognize that. My
9 question was, had they done the uncertainty analysis,
10 wouldn't you have seen the same effect that there is some
11 probability that they would have exceeded the guideline?
12 There is some probability.
13 MR. DINSMORE: You mean do the uncertainty
14 analysis, you mean propagate everything through and get
15 a distribution?
16 CHAIRMAN STETKAR: That is what I generally
17 think about doing an uncertainty analysis, yes.
18 MR. DINSMORE: Yes, well you would always
19 get that. I mean but again, we are not quite sure what
20 to do with that.
21 CHAIRMAN STETKAR: But you are sure what to
22 do with an arbitrary sensitivity study that has another
23 single failure with three significant figures that you
24 can then compare to a black and white criterion.
25 MR. DINSMORE: It doesn't have to be three.

1 Some of them went from like nine times ten to the minus
2 six to two times ten to the minus five.
3 CHAIRMAN STETKAR: My point is you are just
4 comparing arbitrary single numbers. And you say you can
5 draw conclusions from that sensitivity study, comparing
6 arbitrary single numbers. I'm saying that if the
7 person, if an applicant did a real uncertainty analysis,
8 given the data or the information they had, you would
9 have, you as a regulator would have the probability that
10 they exceed that arbitrary line in the sand, that number.
11 MEMBER BLEY: Even if you like the means,
12 if the mean is lower than the number, it could be as much
13 as a 50-50 chance.
14 CHAIRMAN STETKAR: That's right. There
15 could be a 30 or 40 percent probability that you are above
16 the number.
17 MEMBER BLEY: So, that is kind of a false
18 sense of security, I think, that you get just using the
19 point estimate -- the means, not point estimate. Even
20 using the means.
21 MR. DINSMORE: I agree with everything you
22 are saying. It is just that the only one thing I would
23 say is it is not really arbitrary guidelines. They are
24 guidelines that have been selected and everybody has
25 kind of agreed. So, they are arbitrary in that there

1 is no physical derivation of them.

2 So, we do have guideline values and we have

3 a methodology we apply.

4 CHAIRMAN STETKAR: You have rules of the

5 game.

6 MR. DINSMORE: We have rules of the game and

7 we, just because it makes it more consistent and fair

8 to everybody to follow the rules of the game, which we

9 try to do that. And what you are talking about, I

10 believe, now, is kind of changing some of the basic ways

11 we do things, which might be a very good idea but which

12 we probably are not going to try to -- well, I'm sure

13 we are not going to try to do it in this NFPA 805 process.

14 CHAIRMAN STETKAR: Well, a similar point is

15 that perhaps if it had been more a focus of doing that

16 both in terms of whether we are talking about fire

17 initiation event frequencies, whether we are talking

18 about uncertainty distributions and caveated heat

19 release rates, a variety of parameters that are

20 quantified in the models in developing an uncertainty

21 distribution for the results that was presented to --

22 I mean this is for the benefit of the folks sitting behind

23 me, as well as you folks sitting in front.

24 Because we have an uncertainty distribution

25 and then say on a mean value basis we are here, you know

1 some margin below a numerical acceptance criteria and
2 there is a 17 percent probability that our core damage
3 frequency is above that. And that is basically an
4 expression of our current situation. You know that
5 makes life a little more difficult for you because it
6 is not black and white anymore. And I keep telling
7 people if somebody had told me back in 2006 that there
8 was a one percent chance that I would lose 30 percent
9 of my net worth, it is a little more difficult decision
10 but it is much more active than just somebody saying
11 don't worry, the market is going to keep going.
12 And that is really the difficulty of
13 decisionmaking. It requires discipline on both parts.
14 MR. DINSMORE: But if we got the
15 information that there is a 17 percent chance that I
16 exceed the guidelines, without also guidance on what is
17 acceptable, then at least to me it seems it would become
18 arbitrary.
19 (Simultaneous speaking.)
20 CHAIRMAN STETKAR: But 1174 is an
21 integrated decisionmaking process.
22 MR. DINSMORE: Yes sir.
23 CHAIRMAN STETKAR: It doesn't say you must
24 meet a particular number. It says you take all of the
25 evidence in total.

1 So, you take that 17 percent and you say
2 well, what sort of difference in depth do you have to
3 counter this 17 percent? Things that you haven't
4 considered. The same kind of questions you are asking
5 on these sensitivity studies. But in the context of
6 understanding what either -- what the margin is. If
7 there is a 99 percent chance that you are below the
8 acceptance criterion or a 17 percent chance that you are
9 above.
10 That's enough. I made my point.
11 MR. DINSMORE: I don't disagree with you
12 but it just is kind of not the way we are doing things
13 right now.
14 CHAIRMAN STETKAR: Okay.
15 MR. HYSLOP: Okay, so moving on to the
16 suppression values, these have been reevaluated from
17 6850 in the FAQ 08-0050 to create suppression prior to
18 fire brigade arrival. So, this is valuable in that an
19 early response, suppression response is credited.
20 And each of these items we talked about was
21 a state of knowledge moving into the post pilot phase.
22 Steve will talk about LAR treatment.
23 MR. DINSMORE: I guess we did. Again, they
24 all used the new frequencies. They eventually did the
25 sensitivity studies when requested. A few of them

1 bumped up over the risk acceptance guidelines and didn't
2 seem to have a hard time identifying the scenarios that
3 bumped over and how they could do some qualitative
4 defense-in-depth improvement of those scenarios. And
5 so we have been kind of just generally applying this and
6 it hasn't been a problem, once we got the FAQ out that
7 they had to do the sensitivity study. Next slide.
8 MEMBER BLEY: Is there one of these that is
9 going to deal with incipient detection?
10 MR. DINSMORE: Yes.
11 MEMBER BLEY: Okay. I was looking and I
12 didn't see it. So, go ahead.
13 MR. DINSMORE: FDS. We call it something
14 else.
15 CHAIRMAN STETKAR: Same thing.
16 MR. HYSLOP: So, we have an active program
17 of fire ignition frequency and suppression. This is a
18 joint Research/EPRI program, which is in progress. And
19 as I said, this is a very comprehensive fire event data
20 collection effort to collect data from 2000 to 2009 done
21 by EPRI. Many interactions with the licensees. So,
22 this is a better database.
23 CHAIRMAN STETKAR: J.S., are we going to
24 hear more about this from EPRI, do you know?
25 MR. HYSLOP: I don't know.

1 CHAIRMAN STETKAR: Okay.

2 (Simultaneous speaking.)

3 CHAIRMAN STETKAR: Okay. Because again,

4 it is ten years but only ten years.

5 MR. HYSLOP: Okay. The fire ignition

6 frequencies rely heavily upon the new data, with the 1968

7 to 1999 data supplementing very sparse bins for 2000 to

8 2009.

9 They have codified criteria for classifying

10 the events, enabling the reproduction of the basis for

11 events that count towards fire frequency. That was one

12 of the criticisms of 6850 and this is very specific.

13 It also recalculated the suppression

14 failure probabilities based upon this new dataset. And

15 in particular, they captured the control of fire. One

16 of the complaints of industry was that the fires are

17 controlled prior to their being extinguished. And fair

18 criticism. Some cases it is but early on, with the

19 earlier database, the data wasn't there. The

20 clarification wasn't there to say it. They are making

21 that decision now.

22 CHAIRMAN STETKAR: That is an important

23 distinction. The difference between suppression and

24 extinguishment is very different.

25 MR. HYSLOP: So the current approach is

1 that staff is applying FAQ 48 for 805 applications for
2 frequency and FAQ 50 for suppression because that is what
3 we have published and that is what is out there right
4 now.
5 Next slide.
6 MEMBER SCHULTZ: But --
7 MR. HYSLOP: Yes?
8 MEMBER SCHULTZ: So, that is the current
9 approach. But then all this other work that is being
10 done, it sounds as if you are in agreement with the
11 approach that is being taken.
12 MR. HYSLOP: Yes, this work will --
13 MEMBER SCHULTZ: Should be applied.
14 MR. HYSLOP: This work will supersede the
15 approach that we are following now.
16 MEMBER SCHULTZ: When it is completed.
17 MR. HYSLOP: Yes.
18 Now, the next topic is incipient detection
19 or VEWFDS Very Early Warning Fire Detection System. The
20 state of knowledge was that there was a FAQ 46 in
21 NUREG/CR-6850 Supplement 1 for VEWFDS installed to
22 monitor the conditions inside the cabinet. So, that is
23 what we had.
24 Industry recognized that there were other
25 applications that had been proposed to draft FAQ. And

1 not only did it look at cabinet again but it looks
2 area-wide, where instead of having the detectors only
3 in the cabinet they are dispersed throughout the area,
4 and then the main control room application.
5 The staff realized that it needed new
6 testing to actually make better decisions here. So, we
7 recommended that industry withdraw the FAQ due to the
8 ongoing testing program. That is what happened.
9 So you know within cabinet we have an
10 existing technique that is going to be confirmed.
11 MEMBER BLEY: Can you remind me what that
12 is?
13 MR. HYSLOP: What it is?
14 MEMBER BLEY: Yes.
15 MR. HYSLOP: Yes, basically it is based on
16 an event tree where there fires are ignited. Then it
17 talks about the availability and reliability of these
18 systems. Then it asks the question how reliable is the
19 operator response to the fire to detecting the fire. And
20 then there is a suppression aspect, where the VEWFDS may
21 be helpful for suppression but under conditions where
22 it is unavailable, unreliability it isn't, and then it
23 relies on the typical suppression from Appendix B of
24 6850.
25 MEMBER BLEY: But it helps identify the

1 need for suppression.

2 MR. HYSLOP: Yes. Although, you asked me

3 a different question than I answered.

4 Yes, the VEWFDS identifies the fire in the

5 incipient phase. That is the purpose.

6 MEMBER BLEY: And what kind of credit did

7 the FAQ allow people to take?

8 MR. HYSLOP: About a reduction of 50 and I

9 think in one case 100 for the --

10 MEMBER BLEY: A factor?

11 MR. HYSLOP: A factor. For this case, for

12 those cabinets where incipient detection is

13 appropriate.

14 MEMBER BLEY: I see now. Okay.

15 MR. HYSLOP: But it is 50 and it may be more.

16 MEMBER BLEY: Okay.

17 MR. HYSLOP: But it is 50 for sure.

18 MEMBER BLEY: But those cases are limited

19 right now.

20 CHAIRMAN STETKAR: First of all, because I

21 have followed all of this and it has been evolving, right

22 now today, is the resolution -- if I am launching in to

23 do a new analysis today, the guidance that is applicable

24 for the treatment of VEWFDS is the resolution of FAQ

25 08-0046. Is that --

1 MR. BARRETT: Yes.
2 CHAIRMAN STETKAR: Okay.
3 MR. BARRETT: That is the only resolution
4 we have on the table.
5 CHAIRMAN STETKAR: Okay, I thought I
6 understood that but there is a lot of things.
7 MR. BARRETT: There is a lot of limitations
8 to go with that.
9 CHAIRMAN STETKAR: Well, yes. And that is
10 what I wanted to understand because this is a topic that
11 I have heard a lot of and you will probably hear this
12 afternoon more. It is limited to only cabinets that have
13 circuits of less than 250 volts. Is that right?
14 MR. BARRETT: That's right.
15 CHAIRMAN STETKAR: Okay. Why?
16 MR. BARRETT: Because above 250 volts you
17 can get an arcing fault, which would not necessarily end
18 up having an incipient phase.
19 CHAIRMAN STETKAR: But isn't that treated
20 -- I will bring you back around to my cable example.
21 Isn't that treated under arcing faults?
22 MR. BARRETT: Yes and no. There are arcing
23 faults that are not categorized as high-energy arcing
24 faults that would still end up not exhibiting an
25 incipient phase.

1 CHAIRMAN STETKAR: All right. I have seen
2 some arcing faults in the 120 volts wiring in my outlets
3 that look like an arcing fault also that we can talk about
4 later.
5 It also says you can't apply it to things
6 that are called circuits with fast acting components,
7 such as electrical electronic circuit boards that
8 contain electrolytic capacitors, chart-recorded
9 drives, cooling hand motors, mechanical drivers driven
10 by electric motors and so forth. Why don't those types
11 of circuits exhibit the same type of behavior that would
12 trigger these incipient detectors like charring?
13 MR. BARRETT: Okay, at the time we ended up
14 doing FAQ 46, we looked at the types of components that
15 could be in a cabinet and we tried to categorize those
16 ones where we had a pretty good handle on what that
17 failure rate was, whether it would end up exhibiting,
18 let's say a smoking behavior or smoldering or get hot.
19 And there was a certain quantity of mechanical
20 components where we couldn't necessarily predict are you
21 going to get, let's say a stalled rotor on a motor that
22 is going to end up failing more rapidly.
23 That is not to say that it couldn't end up
24 having an incipient stage, we just don't have the data
25 to be able to predict whether or not it would or not.

1 So, we excluded, we asked that licensees look in their
2 cabinets to see whether or not they had those and not
3 credit this directly. If they had other data that they
4 could use, then we would look at that. But right out
5 of the box, we tried to like electrolytic capacitors are
6 the type of thing that it is almost like rolling the dice
7 when it decides to guide. Just poof, it goes. That's
8 it.
9 CHAIRMAN STETKAR: Yes.
10 MR. BARRETT: There is no predictor and
11 when it goes, it goes. Okay? You said if you have those,
12 then you can't look for an incipient stage because they
13 don't happen always.
14 The chart recorders and mechanical drives,
15 again, if you end up having a mechanical component and
16 it seizes, that may not be something you get a lot of
17 warning on. So, we try to exclude those, not because
18 there isn't a possibility but you could certainly end
19 up having a chart drive that had a high resistance or
20 had a friction in it that caused the motor to get warm.
21 And it may end up having an incipient phase.
22 Unfortunately, we don't have data to be able to tell what
23 is the frequency of that and how predictable would that
24 be.
25 MEMBER BLEY: And these are things that

1 could fail before we get the indication.

2 MR. BARRETT: Yes, that would not

3 necessarily have an incipient phase.

4 CHAIRMAN STETKAR: Well, in some cases, I

5 mean you say you didn't have data but there really aren't

6 all that much data. Did you look at -- these systems

7 have been used for a long time in other industries.

8 MR. BARRETT: Right.

9 CHAIRMAN STETKAR: And I don't know what

10 other industries have in their things that they call

11 cabinets. Have you looked at the experience from the

12 other industry?

13 MR. BARRETT: We tried to get as much data

14 as we could from the telecom industry, which uses very

15 early warning detectors extensively. And we were not

16 able to get any data as far as failure rates or something

17 we could use from a PRA perspective from them. We got

18 qualitative data but not --

19 CHAIRMAN STETKAR: Not necessarily in

20 terms of failure rates but at least anecdotal experience

21 that says yes, I did have a problem with one of these

22 things you call a fast-acting component. And indeed, the

23 system detected it. Not the flipside of the coin but

24 evidence to support the notion that it indeed would work

25 for those things.

1 MR. BARRETT: We didn't get any data that
2 I remember that talked about stuff that wasn't
3 effective. Basically, electronic components are the
4 types of things that start having an incipient phase.
5 CHAIRMAN STETKAR: Right.
6 MR. BARRETT: And so they are very
7 effective at looking at those, which is why we headed
8 down the road of trying to come up with a method to --
9 CHAIRMAN STETKAR: Well, my whole question
10 is, as I read through the guidance and I think about doing
11 an analysis, it says now in order -- okay. I want to
12 spend the money to put this system in my cabinets in my
13 plant. I want to get credit for it in my PRA. And I
14 have a cabinet now that is full of electronics, except
15 for it has got a couple of these other things in it. And
16 now I have to go look at every single cabinet and count
17 up the couple of those other things and do now some more
18 math and some more modeling and some analysis, and get
19 less credit numerically for the stuff that I am spending
20 money to put in my closet -- in my cabinet not my closet,
21 without necessarily any evidence to support that it
22 wouldn't work for that equipment.
23 MR. BARRETT: Right.
24 CHAIRMAN STETKAR: And that is what bothers
25 -- in terms of the effort required to do the analysis

1 and the amount of credit that I can get for something
2 that I think everybody admits is much better than A) no
3 detection at all, or B) a traditional smoke detector.
4 That is why I am trying to probe kind of the technical
5 bases here.
6 MEMBER BALLINGER: Your point is well taken
7 and I think when we talk about some of the research that
8 is going on now, we are trying to quantify that based
9 on data on failure, how many failures it had that were,
10 let's say, not incipient in electrical cabinets where
11 we are looking at doing that.
12 But at the time that we did this, we had some
13 staff members that voiced concerns that well not
14 everything in the cabinet is going to have an incipient
15 stage. So, we tried to come up with a way of quantifying
16 what types of things might not.
17 CHAIRMAN STETKAR: Okay.
18 MR. BARRETT: Okay, and these are the
19 examples of things that we weren't sure. And so we just
20 put them in there. It is probably conservative but that
21 is kind of where we ended up.
22 CHAIRMAN STETKAR: Okay.
23 MEMBER BLEY: How is this work progressing,
24 then? Do you have an idea when we might have some
25 replacement of this FAQ?

1 MR. HYSLOP: I will let Research answer the
2 question of when the report is scheduled for testing.
3 I don't have that. In my next slide, I talk about the
4 things that are being done to resolve it.
5 MEMBER BLEY: Okay. We will let --
6 MR. HYSLOP: But Mark is coming to the
7 microphone.
8 MR. SALLEY: Sure, Mark Salley. I am
9 Branch Chief Office of Research. We have done an amount
10 of testing with NIST. Quite a bit, actually. We have
11 done small scale, medium scale, and full scale testing.
12 We have done in-cabinet and we have done room testing,
13 vent return.
14 The report is complete. It is drafted. We
15 have got it over to NRR. NRR, the code for this one is
16 going to be DELORES-VEWSFIRE. But NRR is reviewing it
17 and then we have got some comments. We are trying to
18 work through those comments.
19 After we get agreement with NRR, the next
20 step will be to put it out for public comment. So, right
21 now it is complete but it is with NRR.
22 CHAIRMAN STETKAR: One last thing. I think
23 you guys have to go over something. You have got an hour
24 and a quarter to suffer through here.
25 There is a paragraph that caused me real

1 difficulty. And I have led into it with my mining about
2 15 minutes ago. In the FAQ resolution, it says licensees
3 are cautioned that while the installation of VEWFDS to
4 monitor critical control cabinets may significantly
5 decrease fire risk and positively impact several of the
6 fire protection defense-in-depth attributes,
7 parenthesis, preventing fires from occurring and
8 rapidly detecting and suppressing those fires that do
9 occur, closed parenthesis. Consideration of
10 defense-in-depth is a requirement of NFPA 805.
11 Licensees are still required to demonstrate the ability
12 to achieve the nuclear safety performance criteria,
13 assuming that a challenging fire impacts safe shutdown
14 equipment, depending on the other defense-in-depth
15 attributes for a given fire area, recovery actions,
16 and/or physical plant modifications may still be
17 required to demonstrate the ability to meet the nuclear
18 safety performance criteria.
19 That to me says that I have to go back and
20 do an Appendix R analysis. Despite all of this stuff
21 that I am doing, I still need to go create a fire that
22 burns up everything related to safe shutdown and
23 demonstrate some sort of defense-in-depth. Or am I
24 reading that wrong?
25 MR. DINSMORE: But they are the much less

1 frequent. It is a much less frequent fire.

2 In the applications that we have been

3 getting, I guess I don't read -- I haven't read that well.

4 (Laughter.)

5 CHAIRMAN STETKAR: Well, I am obviously

6 looking for words that you might --

7 MR. DINSMORE: Yes, I understand. But in

8 the applications we have been getting, the incipient

9 detection is very popular. People use it a lot.

10 CHAIRMAN STETKAR: Yes.

11 MR. DINSMORE: And they seem to be happy

12 with the credit they are getting. We haven't gotten any

13 complaints that I am aware of. When I credit it, I have

14 to do all this other extra work as well. I'm not sure,

15 I haven't seen those, it could well be that they can just

16 assume that if they get a 50 percent reduction in the

17 fire ignition frequency for this area, then whatever is

18 left, one-50th of the original risk is far enough down

19 that they don't have to worry about it.

20 What we did notice, though, in the beginning

21 was they would come in and they would credit it in the

22 main control room. And they would credit it for

23 area-wide, which I know is drifting off.

24 CHAIRMAN STETKAR: You are drifting off. I

25 am going to keep you back on this thing that says are

1 still required to demonstrate the ability to achieve the
2 nuclear safety performance criteria assuming that a
3 challenging fire impacts safe shutdown equipment and
4 that recovery actions and/or physical plant
5 modifications may still be required to demonstrate the
6 ability to meet the nuclear safety performance criteria.
7 That to me sounds like reversion to a traditional
8 deterministic safe shutdown equipment assumption fire
9 assessment, which is not what this risk-informed,
10 performance-based program is supposed to be doing.
11 MR. DINSMORE: I have not seen that as a
12 difficulty expressed by licensees in their RAI
13 responses. I don't know --
14 CHAIRMAN STETKAR: You have not. Okay.
15 MR. DINSMORE: I don't know about the fire
16 protection side.
17 CHAIRMAN STETKAR: I mean in practice if it
18 is something that doesn't seem to be a problem, it is
19 just before when you were talking about defense-in-depth
20 and we talked about the notion of sensitivity studies
21 with values that might push you over a limit and what
22 is the benefit of doing that, this is another area where
23 I said well why, once I have done all of these analyses,
24 once I have made a commitment to install the stuff and
25 taking credit, you can argue about what numerical credit

1 you want to take about for it and what uncertainties
2 there might be, once I have done all of that, if the staff
3 is then telling people that well, despite all you have
4 done, go and light a fire that burns up everything --
5 MR. DINSMORE: No, I don't think that is
6 what it means.
7 CHAIRMAN STETKAR: -- and give me
8 defense-in-depth against that.
9 MEMBER SCHULTZ: But that sounds exactly
10 what that means. I mean if it is not being interpreted
11 that way, then it is not being read or it seems like
12 something that needs to be cleaned up.
13 CHAIRMAN STETKAR: I mean in practice if
14 you haven't seen it, it means that everybody agrees that
15 it doesn't mean what I thought it meant, which is fine.
16 MEMBER SCHULTZ: But it means what it says.
17 CHAIRMAN STETKAR: But it doesn't mean what
18 I thought it meant.
19 MR. BARRETT: Well, having been part of the
20 team that addressed that, I believe what that is saying
21 is that you wouldn't want to have an area where the only
22 thing that you have going for you is an incipient
23 detection system. And if that thing fails, you
24 basically have no way of demonstrating safe shutdown.
25 You have got to have enough

1 defense-in-depth in there so that that is not the only
2 thing. Defense-in-depth ends up meaning you are not
3 supposed to rely on just administrative controls. You
4 are not supposed to just rely on whether an operator
5 fails to take an action.
6 So, what this is saying is this one thing
7 may have this huge risk reduction. Let's say the risk
8 reduction isn't that high, it really isn't that
9 effective or let's say for some reason it is out of
10 service, you still have to be able to show that you can
11 end up meeting the defense-in-depth criteria in that you
12 have some assurance that you can still safely shut down
13 beyond just what this one detection system gives you.
14 So, that was the philosophy that went into
15 this. It is kind of like not relying on administrative
16 controls as being your only way of being compliant
17 because obviously, they fail at times. This detection
18 system is the same way.
19 We had a situation that Harris, when we
20 reviewed their application, they had one room that they
21 put incipient detection in that had one cabinet in it.
22 It was extremely high risk. They put this incipient
23 detection system in and that particular room no longer
24 even met any of the criteria as being one of the higher
25 risk rooms. It reduced so much that it was in the weeds

1 as far as the risk numbers.

2 Well, that is fine but if that incipient

3 detection system doesn't work, that room is critical.

4 So, what we are saying is you have to look at the other

5 defense-in-depth to make sure that that is not the only

6 thing you are relying on.

7 CHAIRMAN STETKAR: But the risk assessment

8 accounts for the fact that it might not work. It's in

9 there. That is why the number is what it is. That is

10 why it is not zero. If it were guaranteed to be a

11 success, it would be zero.

12 MEMBER SCHULTZ: Perhaps it is being given

13 too much credit.

14 CHAIRMAN STETKAR: Well, --

15 MR. BARRETT: I guess that is our way of

16 saying this is risk-informed. So, yes, the PRA can end

17 up giving you things that make things look pretty rosy.

18 We still think that you ought to be able to do that to

19 demonstrate that you can reliably get safe shutdown,

20 even if that fails.

21 Now, that is not to say that we are totally

22 discrediting the incipient detection system. We all

23 agree it is a very effective system and it reduces risk.

24 But what that sentence right there is saying is hey, you

25 still ought to end up having some defense-in-depth

1 beyond that. That shouldn't be the only thing you are
2 relying on.
3 MR. HYSLOP: Okay, next slide. Now I am
4 going to talk about the active RES research program
5 underway. First of all, the research is going to be
6 confirmatory related to FAQ 46, what we just talked
7 about, the in-cabinet. The other focus of the research
8 is to address the area-wide installations for which
9 there is really no guidance at this point.
10 The purpose of the test, the tests are
11 measuring how much advance notification they get over
12 more traditional detections. There were a wide variety
13 of detectors tested. I guess cloud chamber, lasers are
14 incipient, right? Laser and there are others.
15 The FAQ 46 event tree approach is continuing
16 to be applied. We talked about that. There is one
17 addition beyond what FAQ 46 had and there is a data review
18 to examine the events in the new fire events database
19 to determine which experience an incipient stage. So,
20 there is a factor that didn't exist in the previous --
21 MR. BARRETT: Well, it existed but it was
22 qualitative.
23 MR. HYSLOP: It was qualitative, okay.
24 Thank you, Harry, for correcting me.
25 So, it was qualitative. It wasn't

1 quantitatively folded into the event trees.
2 We are not pursuing main control room
3 installation at this point. So, I understand that that
4 is a lack of interest. And the current approach, as I
5 said, is FAQ 46. We haven't seen any cases where we have
6 credited area-wide installation. And 6850 allows a
7 five-minute advance notification for an installation in
8 our main control board.
9 CHAIRMAN STETKAR: J.S., you mentioned --
10 I was scribbling notes here. I wasn't listening as
11 carefully as I should have.
12 You said that the main control room
13 installation, there doesn't seem much interest in it --
14 MR. HYSLOP: That is my understanding.
15 CHAIRMAN STETKAR: -- from the industry's
16 perspective. The only reason I was asking is there is
17 an FAQ out there, 13-0001, that discusses -- it has not
18 been resolved yet. It is in the pipeline.
19 MR. HYSLOP: Well, 13-0001 applies to all
20 the different applications.
21 CHAIRMAN STETKAR: It does but it discusses
22 the most part of it, at least the version that I saw and
23 it is redlined strikeout, so it is obviously in flux,
24 discusses quite a bit about main control room.
25 MR. HYSLOP: Right.

1 CHAIRMAN STETKAR: And then sort of at the
2 end, it says oh, by the way, if you have control boards
3 in the main control room but not out front, you can use
4 this. And it talks about other applications, other
5 cabinets outside the main control room. But it is
6 focused mainly on the main control room.
7 And is that FAQ still active?
8 MR. HYSLOP: The FAQ we have sort of
9 suspended work on the FAQ so that we can see the test
10 results.
11 CHAIRMAN STETKAR: Then I am not going to
12 ask anything about it. Thanks.
13 That is all I was trying to get.
14 MR. HYSLOP: Okay, next slide. Now we are
15 going to talk about the electrical cabinet heat release
16 rate. We have distributions in 6850. I'm sure
17 everybody knows about them. There are five different
18 cases where you have a full peak heat release rate
19 distribution. And this was based on a NUREG/CR-6850
20 team, expert judgment relying on available testing.
21 Factors that produce these different cases are cable
22 type, internal cable configuration in the cabinet,
23 cabinet type.
24 One of the complaints that we have heard is
25 that industry claims that these peak heat release rates

1 do not comport with the data in the fire events database,
2 which frequencies are developed. You are going to see
3 in the next set of slides that we have a program underway
4 to reevaluate these heat release rates and I am going
5 to talk about that.
6 Steve, before I get there, is going to talk
7 about the LAR treatment.
8 MR. DINSMORE: Yes, in these ones, this
9 treatment is kind of in the cusp between PRA and fire
10 modeling because we haven't had much interaction or
11 discussion that they are changing the heat release rate,
12 that they were proposing to change the heat release rate
13 for the transients.
14 So, they seem to be using the heat release
15 rates that came out of NUREG-6850. But the problem, I
16 believe, comes is when they are trying to figure out what
17 is damaged beyond the cabinet and when you get fire
18 propagation. And so that is actually not in our PRA
19 purview. And I am sure that you will hear about that
20 fire propagation later.
21 So, effectively for us, we haven't been
22 having much of a problem with heat release rates in
23 cabinets. It is everything in the cabinet is destroyed
24 and then they come up with a zone of influence. And how
25 they come up with that zone of influence depends on the

1 fire modeling, either generic or specific.

2 MR. HYSLOP: But having said that, we

3 talked about it earlier about how the distribution is

4 treated. We see some cases where the distribution is

5 discretized, some cases where it is a two-point method

6 where they just assume a couple of values. So, we have

7 seen that in the LAR treatment.

8 Next slide. So, Research and EPRI have a

9 working group underway to resolve this. The first

10 purpose was to perform the testing. That was conducted

11 by Research. And then they are going to reevaluate the

12 cabinet peak release rates.

13 One of the aspects of the testing is these

14 aren't the worst case fires that you can develop in a

15 cabinet. The factors in the heat release rate testing

16 matrix include some of the same issues before but they

17 are going about it in a lot more detailed fashion,

18 cabinet type, internal cabinet configuration, cable

19 type, and ventilation. So, the issues are being

20 addressed, although they may be addressed in different

21 ways.

22 There were a range of ignition sources

23 tested to produce ignition. In fact, minimal energy

24 ignition sources were used in this testing to encourage

25 realism.

1 And the results, EPRI is going to
2 participate in the evaluation of the data for the
3 production of the probabilities of the peak heat release
4 rates. So, the data crunching, they are going to be a
5 part of that.
6 The current approach is to apply the
7 NUREG-6850 release rates. That is what we are seeing.
8 However, we have told industry that they can always look
9 in the cabinet and evaluate the heat load and establish
10 their own but I haven't seen that done.
11 MEMBER BLEY: Nobody's done that?
12 MR. HYSLOP: I haven't seen that done.
13 CHAIRMAN STETKAR: That is the current --
14 Mark Salley will probably have to stand up.
15 I know that the testing is being done. I
16 thought that the expert panel elicitations for heat
17 release rates are in progress. Do we know what the
18 schedule for actually having something in reasonably
19 complete draft formulas?
20 MR. HYSLOP: Go ahead, Mark.
21 MR. SALLEY: Yes, Mark Salley, Office of
22 Research. The expert panels have been convened. The
23 work of Ashley in EPRI. It is balanced panels. They
24 have four meetings there. In fact, we just had a meeting
25 yesterday with those but hopefully it is going to be the

1 last one.

2 The project will be broken up on phases.

3 The first phase to come out, we are trying to target for

4 the end of the year. Actually, we are trying to target

5 before Thanksgiving. And that is going to be the

6 reduction in heat release rate. And the second part of

7 the first panel would be, if you will recall, the

8 instructive plume. And that is how the fire is modeled

9 on top of the cabinet for the exposed trays.

10 So, those seem to be the two big pieces.

11 Ashley, I think you would agree that those are the two

12 big pieces that industry is looking for and we hope to

13 have the draft, if all goes well, before the end of the

14 year.

15 CHAIRMAN STETKAR: Thank you.

16 MR. HYSLOP: Next slide, main control room.

17 This is the last topic that I intend to discuss, although

18 it is not the last slide, with respect to things moving

19 ahead and being enhanced.

20 First of all, the state of knowledge is that

21 he HEP is associated with shutdown after main control

22 room abandonment can be estimated with existing methods

23 but the actions are complex. We do have methods that

24 we can go on through to get answers.

25 The timing of abandonment is reasonably

1 straightforward for abandonment driven by loss of
2 habitability. It is a smoke visibility thing. It is
3 evaluated by the fire models.
4 The identification of which equipment is
5 failed by the fire and which survives the fire is very
6 complex.
7 CHAIRMAN STETKAR: It is obvious in the
8 fire log. You have got the obvious in the control room.
9 MR. HYSLOP: Well, the criteria in 6850 for
10 when evacuation occurs, it has to do with some type of
11 optical --
12 MEMBER BLEY: Optical and temperature,
13 isn't it?
14 MR. HYSLOP: Optical and temperature.
15 MEMBER BLEY: How many operators who have
16 been in a fire were involved in the development of that
17 part of 6850?
18 MR. HYSLOP: I can't answer that. I don't
19 know.
20 MEMBER BLEY: I think you can.
21 MR. HYSLOP: No, I really don't know the
22 answer. I can speculate.
23 CHAIRMAN STETKAR: No, the answer is zero.
24 Because Dennis asked how many operators who have been
25 involved in main control room fires were involved in

1 that.

2 MR. HYSLOP: Oh, okay.

3 CHAIRMAN STETKAR: And that answer is zero.

4 MR. HYSLOP: I didn't understand the

5 question.

6 MEMBER BLEY: Keep going. I will have some

7 more questions.

8 Just a quick question. This interim staff

9 guidance, what is the status of that?

10 MR. HYSLOP: I'm not sure. If you are

11 talking about --

12 MEMBER BLEY: Supplemental interim staff

13 guidance on main control room abandonment analysis for

14 loss of habitability.

15 MR. HYSLOP: Less than 0.1. That has been

16 issued.

17 MEMBER BLEY: That is real.

18 MR. HYSLOP: That is real.

19 MEMBER BLEY: Okay.

20 CHAIRMAN STETKAR: People are using that.

21 MEMBER BLEY: Go ahead.

22 MR. HYSLOP: We are not sure how often it

23 is being used. It has been issued. We can talk about

24 that.

25 MEMBER BLEY: But if somebody follows that,

1 you are onboard.

2 MR. HYSLOP: We are onboard. The

3 conditions specified in the document must be met but,

4 yes.

5 MEMBER BLEY: Okay.

6 MR. HYSLOP: So, basically, the licensees

7 don't evaluate every fire in the main control room. They

8 have to identify a representative site or something.

9 And however when they do their evaluations, they take,

10 Steve will talk about, many different types of

11 evaluations that have been done and they have various

12 levels of accuracy.

13 Steve, why don't you talk about the early

14 LAR treatment?

15 MR. DINSMORE: Okay, so the main control

16 room stuff is a real difficulty. We are struggling with

17 it a lot.

18 CHAIRMAN STETKAR: Steve?

19 MR. DINSMORE: Yes, sir.

20 CHAIRMAN STETKAR: Let me as you first,

21 before we get into things that I know are going to lead

22 off in different directions.

23 You say it is a real difficulty and you are

24 struggling with it. Is it a significant contribution

25 to the results that you have seen so far in the

applications?

MR. DINSMORE: In some plants, it can be the driving force.

CHAIRMAN STETKAR: Okay, thanks. I was just trying to get a benchmark because I had heard that.

MEMBER BLEY: We should say we haven't had a chance to look at any of these analyses. We just heard bits and pieces from you and from others.

MR. DINSMORE: Okay. So, the major difficulty we are having is once you know it has failed and once you know that the operator has got to go somewhere, then you can use all these different methods to figure out what the condition of core damage probability of that is. The problem seems to be inside the control room they don't want to put a fire in every foot and try to calculate everything that happens. And so there is a very, the first step is where you get a lot of the simplification. We can't burn this cabinet and figure out that these fire things failed, and we have got this spurious action, and the cabinet gets other fire things and spurious actions, and operators will run out, one for each -- well, depending on which cabinet fails or burns to have the specific set of and the other. And so, they tend to group things in larger and larger groups.

1 CHAIRMAN STETKAR: Steve, let me there ask
2 you also. But they do that throughout the rest of the
3 plant when they are looking at cable trays running around
4 rooms. Right?
5 MR. DINSMORE: Well, they take an ignition
6 source and they will figure out which cables were failed.
7 CHAIRMAN STETKAR: Yes, but they need to
8 know what cables are in that zone of influence throughout
9 the rest of the plant, which is logically equivalent to
10 something like the last control rooms I have been in,
11 you could actually look at the control board and see
12 things. And it was pretty clear. They had labels on
13 them. So, I sort of knew what controls they are and I
14 could look in the back and see where the cables were
15 routed. I mean it strikes me as doing what you said
16 people are not doing is a lot easier in the control room
17 than it is out in the areas where they have rats' nests
18 of cables where they are arguing it.
19 MR. DINSMORE: Well, some of the control
20 rooms are bigger than this. If you go behind this room,
21 if you go behind the back panels, there is dozens and
22 dozens of cabinets back there. So, it is not just in
23 the horseshoe area. It is the whole control room because
24 fires in the back can cause smoke which sends you out
25 the front.

1 And so I haven't tried to do any of these.
2 I do know that the most popular assumption is just to
3 assume that whatever fire goes on in a control room, I
4 am going to have my protective train of equipment
5 available, which is my safe shutdown train, and I am
6 going to run out there and I am going to do a complicated
7 or detailed human reliability analysis, shutting down
8 the plant from that protected train.
9 CHAIRMAN STETKAR: But everybody strives
10 for realism. And is that real? That is not real. What
11 you are doing is you are challenging this 0.1 number at
12 an artificial frequency because people don't want to do
13 a realistic fire analysis.
14 MR. DINSMORE: Yes, sir. We wrote a lot of
15 RAIs because --
16 CHAIRMAN STETKAR: Okay.
17 MR. DINSMORE: And we also answered --
18 MEMBER BLEY: Everything you have talked
19 about so far is this system's analysis during a
20 nightmare. The operators are people and you have got
21 stuff in here about complexity. The problem of
22 complexity is a good one. It is identified. Just pick
23 a handful of real fires that have happened that haven't
24 driven anybody from the control room, haven't even
25 caused habitability problems in the control room but

1 they have led to some confusion and the interactions
2 between the fire procedures and the EOPs and sometimes
3 the APs. And if you go from the one at SONGS to the one
4 at Robinson to the one that even longer ago at Millstone,
5 I think, interpretations of what is going on in the fire,
6 the fires, the real ones seem to never be a simple thing
7 we might be modeling, which there is only one thing
8 involved. There is other stuff going on.
9 So, if one turns the question around and
10 says what is the likelihood of there being complexity
11 and complications, in general, if you have an initiating
12 event is pretty small.
13 What about given that you have got a fire
14 somewhere? It is a little more likely to be complicated.
15 What if you have a fire that is such that it could drive
16 you out of the control room on a habitability basis,
17 which you are talking about now? Well, it is a lot
18 higher. And the arguments that sit in here about why
19 it might not be complex just seem to me they ignore what
20 happens in real fires.
21 MR. DINSMORE: Did we say not complex?
22 MEMBER BLEY: I don't think you lit a fire
23 that could drive out of there that doesn't lead to
24 substantial complexity both cognitive and in operator.
25 Just a few more things. Through the list

1 of things that you don't say mitigate, I forget what
2 words you used, reduce, the things that make it better,
3 relaxations, not one of those deals with the operators
4 having had experience in fires. Like having been to
5 firefighting school where you are going in to really put
6 out fires and you live with the heat and the smoke. You
7 get used to it.
8 I don't know what the status is right now.
9 Some years ago when I was working for people out in
10 various places, most plants didn't have any requirement
11 to send their folks to firefighting school, even the fire
12 brigade. I have been a couple places where in fact
13 everybody on the fire brigade goes but probably nobody
14 else. So, we are going to have people who are trying
15 to do these very clear things about when you leave, maybe
16 with a breathing apparatus on and they are in an
17 environment they are not used to, that creates lots of
18 problems for people.
19 So, I am just uncomfortable with the idea
20 that the thing that could drive you out of there might
21 in fact not be a complex situation. And the things that
22 might help them a lot from the person point of view, from
23 the poor guys in the control room, aren't all on that
24 list of things that could make life better for them. So,
25 that is just a series of comments.

1 I do have one question. You did this for
2 loss of habitability but at least from fire protection
3 guys I have talked to and some operators, the other side,
4 the guidance that gets you out of there on loss of control
5 are even more perplexing. The decision to say I don't
6 have good control here anymore and I am going to give
7 up all this wonderful stuff and go somewhere else is a
8 pretty tough one and nobody has had to do that yet.
9 You didn't do any guidance for that. Do you
10 have any or is there some coming?
11 MR. BARRETT: It's coming.
12 MR. HYSLOP: Yes, the next slide talks
13 about a research program.
14 MEMBER BLEY: Okay.
15 MR. HYSLOP: And loss of control, we are not
16 as far along as we are with loss of habitability.
17 MEMBER BLEY: I guess the underlying point
18 here that is troubling me is I don't see an
19 acknowledgment of what has happened in control rooms in
20 real fires that have had some significance but didn't
21 actual challenge the control room. And I don't see a
22 strong influence from people who have lived in that
23 world, maybe never been -- we don't have a real fire for
24 them to have been in in the control room but I know you
25 have got people on staff and I know industry has lots

of people who have been through firefighting stuff and have been operators. And I think some of their input in this is pretty condescential.

So, I don't find it convincing right now. And that's that.

MR. BARRETT: Well, to help in that area, we are planning on doing research and there will be people from NRR that have had firefighting training and are fire people that have been operators that are going to be --

MEMBER BLEY: I know you have got them. I would really like to see their thumbs in this.

MR. BARRETT: I am going to end up participating to a certain extent in that and then research. So, I will put my two cents in when I can.

MR. DINSMORE: Well, I think J.S., when he said we have methods to grind through that, that was a specific choice of words. It doesn't mean that we know how to do it right. We do have methods that allow you to step through. And some of the licensees are stepping through them. They figure out all the steps and where the guys have got to go and they have feedback and independence between the steps. We also have to have, I believe there is a requirement out there that you have to have at least one instrument tray that is not affected

1 by the fire which is being relied upon by the fire. So,
2 there is no instrument tray. It is gone.
3 So, there is kind of a process. It is
4 certainly not the best process and I guess we are still
5 --
6 MEMBER BLEY: But it is heavily focused on
7 systems, rather than people and procedure.
8 MR. DINSMORE: Probably but this is what we
9 are trying to deal with in the LARs that are flowing
10 through and we are trying to, we generally kind of come
11 to the conclusion well, they have used reasonable
12 methods and they have evaluated what should be evaluated
13 and the results that they have appear reasonable and,
14 therefore, we are going to let them move ahead. And when
15 the other methods are finished, then they are supposed
16 to start using them. But we can't wait now, unless you
17 want to --
18 CHAIRMAN STETKAR: What happens, Steve, if
19 those other more refined methods conclude that a better
20 treatment of human performance from the human
21 perspective concludes that it is not very likely that
22 the operators would decide to abandon the control room
23 with enough time left to save the plant, considering all
24 the things that they need to do, so that the 0.1 number
25 becomes a 0.95 or 0.97, especially in particular cases?

1 That can create heartaches for people who
2 now have had their license amendment accepted and if,
3 indeed, you said some of the applicants in the main
4 control room fires are even currently an important
5 contribution.
6 MR. DINSMORE: Well, we have tended to have
7 some fraction of those fires go to 1.0. The question
8 is, how do you figure out that fraction.
9 MR. HYSLOP: We are seeing, in the
10 responses we are seeing that 0.1 isn't all that is
11 presented. They are giving us a range of conditional
12 programs, probabilities from questioning. And like
13 Steve says, there are cases where they don't feel like
14 they can for certain scenarios, cases where they are
15 likely and in cases where they are less likely. And that
16 is what we are seeing.
17 CHAIRMAN STETKAR: So, you are at least
18 getting that.
19 MR. HYSLOP: We are getting that.
20 (Simultaneous speaking.)
21 MR. HYSLOP: We've pushed that from the
22 very beginning but I will say that the complexity has
23 gotten greater since the early treatments. In the early
24 treatments, there might have been several numbers
25 demonstrating that, where now they are getting many,

1 many scenarios that are contributing to that range of
2 CCDP.
3 MS. COOPER: Susan Cooper, Office of
4 Research. I just wanted to comment a little bit about
5 the issue of complexity. The real intent of the interim
6 guidance was to try to make people aware of the fact that
7 it is going to be a complex process. And in fact, we
8 were just simply looking for operational conditions in
9 which the complexity can be reduced. Now, that might
10 not have come off the way that it read. But the point
11 was we understood that it was a complex process and, as
12 a matter of fact, as Office of Research was working with
13 NRR staff, we talked through a lot of different things
14 and identified some additional performance shaping
15 factors, if you will, that aren't traditionally
16 addressed in HRAs that seem to be important when you are
17 outside the control room and trying to shut down the
18 plant.
19 Now, this is just the beginning. I think
20 NRR staff can talk about the fact that we started off,
21 this is a fact. We tried to see if we could resolve it
22 through that process and we ended up coming to the
23 realization that we were going to need to do more
24 research to get this issue addressed.
25 And again, there are other parts of the HRA

1 and the PRA that would address the operator staying in
2 the control room. We do recognize that we don't have
3 events and that is also part of the issue of complexity
4 and trying to evaluate exactly what operator performance
5 is going to be, in the sense that they haven't done this.
6 There is limited training, probably not training
7 integrated with field operators doing things. So, it
8 is just a very different sort of thing.
9 MEMBER BLEY: I appreciate that. My
10 reading the flavor hit me as here is how you can -- despite
11 the fact somebody might think this is complex, here is
12 the sort of things you might say oh, if we do all this,
13 it is not complex and I tis easy to get out of. That
14 is the flavor I got.
15 CHAIRMAN STETKAR: And I excerpted, just
16 for the record, I stumbled over this. If things that
17 say on the base definition for the 0.1 case for safe
18 shutdown following MCR abandonment matches the
19 NUREG-1921 definition for quote simple unquote
20 parenthesis rather than complex closed quote -- closed
21 parenthesis. That was cited in Section 4.1 of this
22 document plus other characteristics discussed above.
23 Overall, however, the intent is that the 0.1 case
24 represents a reasonable screening value for a simple,
25 straightforward and unambiguous case with adequate time

1 for both cognition and execution.

2 So, despite all of the warnings about the

3 fact that this can be very complex and that this 0.1 value

4 is a screening value that is appropriate, it is all, all

5 the words you need is that it is simple.

6 And then the cases in the back say well, even

7 if you don't meet the things that we are calling simple,

8 you can still use the 0.91 number because these other

9 conditions are simple enough.

10 MR. DINSMORE: Well, our example of the

11 simple one was a trash can that caught on fire in the

12 control room and the atmosphere caused the operator to

13 leave. So, there is really nothing failed. It is

14 simply they can't shut down. That is what we were --

15 MR. HYSLOP: Basically, there are

16 different levels of complexity associated with this, if

17 all your actions at the remote shutdown panel, that is

18 what we call simple for this 0.1. It doesn't happen very

19 often. Industry said we really can't use that but we

20 still recognize that there are various degrees.

21 So, that was our base case. Now, I'm sure

22 there are many remote shutdown panels that don't enable

23 such a clean shutdown, where complexity is more of an

24 issue. As Susan said, the research program that is going

25 to be an issue and this be identified many things that

1 has benefited research. That would be coordination,
2 communication, number of locations, the environment of
3 the command and control. So, this document talks about
4 these things as needing to be considered. And if you
5 get into complicated situations like that, you don't
6 make the 0.1.
7 And so, part of this research is to, like
8 Susan said, was to understand the plant conditions from
9 a gradated fashion and that is it. And so, obviously
10 the more complicated issues for loss of habitability are
11 going to have been addressed for this research program.
12 Loss of control is even a bigger bag of bones. The
13 decision, like you said, we are shortly going to identify
14 that as an issue because it is more complicated. The
15 procedures are vague. I think it is more of a judgment
16 on when to evacuate in the loss control than when you
17 are in an environment that is unpalatable.
18 So, that is sort of the thinking.
19 MEMBER SCHULTZ: J.S., you have identified
20 very quickly, I couldn't count them all, but on the order
21 of ten different features and factors that can be
22 incorporated into the overall program of research. It
23 really seems that this is an area where the clear
24 definition of what is going to be done and how it is going
25 to be done needs to be established up front. Otherwise,

1 we won't really accomplish much with the research. We
2 will be about in the same place with the 0.1 number, --
3 MR. HYSLOP: I agree and the program isn't
4 sorted.
5 MEMBER SCHULTZ: -- which we are not very
6 confident with. So, it is important that you really
7 identify how research is going to be conducted to clarify
8 the understanding associated with this and really parse
9 those elements and determine where the focus should be.
10 MR. HYSLOP: I agree.
11 MEMBER SCHULTZ: What can be accomplished
12 with which part of our research program? Research
13 program is the right characteristic but I am afraid if
14 we try to accomplish it all, we will accomplish nothing
15 of use.
16 MR. HYSLOP: So, we will certainly have to
17 talk about the scope and think about those questions and
18 have conversations with research about those questions.
19 Okay, next slide. So, we talked a lot about
20 this. Let's see. I am going to add things that we
21 haven't talked about. This started out with a draft FAQ
22 13-0002 issued by industry. And the FAQ was sort of a
23 framework on how you might do venting, what
24 considerations are important. But we realized we
25 needed some more fundamental work before we can move

1 ahead. So, we provided comments and history on the FAQ
2 and then we moved towards this document that you just
3 referenced, Dennis, as a starting point. So, that is
4 what we have done.
5 And so we issued this guidance. And the
6 guidance arose from industry examples that they
7 presented as a method to do the evaluation. The staff
8 felt like an overall method was a little arbitrary at
9 this point, so we didn't buy into it. And still, we moved
10 in the direction to understand the plant factors that
11 drive this abandonment and drive the complexity. We
12 felt like that needed to be investigated before we were
13 ready to move forward with the quantitative method.
14 That is why we went where we went.
15 And we did identify some relaxations
16 because I don't think anybody has the base case. I'm
17 not sure if anyone has the base case where everything
18 is done at the remote shutdown panel. Everything is
19 quiet for command and control. There is no coordination
20 to speak of if everything is done. So, we identified
21 some relaxations where we felt were reasonable with what
22 we knew.
23 Now, we have talked to Research about a
24 program, the letter from Joe Giitter to Mike Tschiltz
25 supports the research program. In fact, it says we agree

1 with industry because they knew the documents that
2 industry gave us. They said that these areas of
3 complexity that I mentioned, which were coordination,
4 communication, number of locations would be a benefit
5 for research. So, we agreed with that.
6 So, the letter is out there. We are going
7 to have a research program. They need to start talking
8 about research, about what that means, and get their
9 input in terms of what direction. But you know, we will
10 certainly be talking to them and we will be providing
11 some guidance as well.
12 And I guess the last part of this, we are
13 making decisions right now on this. We are moving ahead.
14 We have enough that can be going forward. We have
15 discussions with industry about what we are doing. And
16 so, we have a level of familiarity.
17 And as I said when we first started out, we
18 just had a few CCDPs that range from 1.0 to 0.1 and now
19 the licensees are understanding that more is needed and
20 they are doing more with these later ones and we are
21 getting it.
22 And so, I think we are evolving to this more
23 sophisticated stage but we do need a research program
24 to address the issues like you talked about, Dennis. And
25 so, we are going to commence with that.

1 MR. DINSMORE: Yes, unfortunately, they
2 are all doing more but they are all kind of doing
3 different things. Again, when you are trying to review
4 all of these submittals and get them through and you have
5 got -- so you end up with --
6 MEMBER BLEY: Are you doing it in a
7 catalogue of what looks best?
8 MR. DINSMORE: Well, you end up with four
9 or five, six different things.
10 MR. HYSLOP: It is the actual evolving
11 which looks best because they start out with a few and
12 now we are getting more sophisticated analyses.
13 And like Steve said, once you get a program
14 out there that says what to do, then that does encourage
15 some sort of standardization in terms of what level of
16 detail, what the issues are. So, that is going to be
17 helpful also.
18 Next slide. Next slide is on concluding
19 observations. So, Joe put a slide up of 20 deviations
20 from accepted methods. We talked about a set of them
21 that we feel are more important than the remaining set.
22 You know, the work that was done, Harris and Oconee, they
23 were the first ones to use these methods in an integrated
24 fashion. We can see that they truly didn't test the
25 readiness, there was more work to be done.

1 We talked about this final risk estimate
2 which is an aggregate change. This is an aggregate
3 change versus Reg Guide 1.17 for guidelines using
4 accepted methods. The point that you talked about,
5 Professor Schultz, is gone. That is not there. That
6 is not in the aggregate change. So, we are using only
7 accepted methods.
8 Finally, these approaches have improved.
9 There have been a couple stages of improvement. We are
10 in another stage. And they are continuing to evolve at
11 the same time.
12 So, that is all I have got to say.
13 MEMBER BLEY: Are there some more to be
14 submitted or have they all been submitted?
15 CHAIRMAN STETKAR: Joe's pie chart had two,
16 if I recall.
17 MR. HYSLOP: Oh, you mean plants?
18 MEMBER BLEY: Yes.
19 MR. HYSLOP: Oh, Davis-Besse and Hatch are
20 yet to --
21 MEMBER BLEY: Still in progress. Okay.
22 CHAIRMAN STETKAR: Well, they are still in
23 the -- they haven't submitted yet.
24 Anything more for the staff?
25 MEMBER BLEY: Well, it's early and I don't

1 know if all of these guys will be here all day. Despite
2 some of the things I have said, I really appreciate you
3 coming and bringing us up to speed. We push kind of hard
4 because there is a lot of things we haven't seen and we
5 are trying to figure out. So, thanks a lot for your
6 presentations.
7 CHAIRMAN STETKAR: I will echo that. What
8 I would like to do is, because we are in the rare condition
9 here that we are early, first ask can we get the bridge
10 line open if there is anybody out there. I don't know
11 if there is but we have to check.
12 I will ask if anybody has any members of the
13 public or anyone else in the room has any comments
14 regarding this morning's presentation by the staff.
15 Let me see if we can get the bridge line open, just in
16 case there is anyone out there. And then we will figure
17 out what to do in the next few minutes.
18 It is open. I hear pops and crackles. If
19 there is anyone out there on the bridge line, just do
20 me a favor and say something so we have confirmation that
21 it is open and that we can hear you. It sounds silly
22 but it is the only way that we can confirm this.
23 So, if there is anyone out there, could
24 someone just please say something? Hello. That is
25 always troublesome. I assume -- I hear popping and

1 crackling, so I assume it is open and there is no one
2 out there.
3 With that, again, thanks a lot. You guys
4 went through a lot of material. And again, if we sounded
5 very critical, A) it is the way I am; and B) it is because
6 we have not actually seen any of the real applications.
7 So, we don't know what people are doing in practice. We
8 have heard snippets here and there but to see the real
9 details, you know, for example, what J.S. was just
10 talking about in terms of current applicants coming in
11 and having a broader range of assessments of the main
12 control room, the abandonment, rather than just taking
13 a frequency of main control room fires and putting a 0.1
14 on it and saying okay, I am below the acceptance
15 criteria. That is all I need to do. That is really good.
16 We have no -- that is why we are having this briefing.
17 We are limited to what we could read.
18 So, we really appreciate the effort that you
19 guys put into this. I think it was really, really
20 useful.
21 Now, I think rather than having the industry
22 start and having to cut them off just as we are revving
23 up to speed with them, if it is okay with everyone, I
24 am going to split the difference and we will break for
25 lunch. And we will reconvene at 12:45. I will give you

1 an hour and a quarter for lunch, instead of an hour and
2 a half. But let's reconvene at 12:45. We are recessed
3 until then.
4 (Whereupon, the above-entitled matter
5 went off the record at 11:29 a.m. and resumed at
6 12:45 p.m.)
7 CHAIRMAN STETKAR: We are back in session.
8 And this afternoon, we will get to make the folks up front
9 feel uncomfortable.
10 MR. FLICK: We're on the hot seat.
11 CHAIRMAN STETKAR: Who is going to start
12 off, Elliott?
13 MR. FLICK: Yes, I am.
14 CHAIRMAN STETKAR: Okay.
15 MR. FLICK: You all ready?
16 CHAIRMAN STETKAR: We are ready.
17 MR. FLICK: Okay, great. I'm Elliott
18 Flick. I am the Senior Director of Operations for the
19 Corporate Engineering Group at Exelon Nuclear
20 Corporation. And in the fall of 2012, NSIAC asked for
21 me to take an executive sponsorship role for industry
22 efforts to work with NRR to improve working
23 relationships relative to NFPA 805. And I thank you all
24 for the opportunity to listen. We are going to present
25 some information to you that talks about the experiences

1 that we have had with NFPA 805 over the last couple of
2 years.
3 I would tell you that at a high level, safety
4 improvements are taking place at the power plants as a
5 result of the NFPA 805 process but it hasn't been without
6 significant challenges and at the expense of executive
7 disillusionment with the promise of risk-informed
8 processes.
9 I am not going to spend a lot of time on this
10 particular slide. I know that you all are quite aware
11 of the history with NFPA 805. But you know just these
12 four bullets here kind of sums up some of the experiences
13 that we have had in the last years, unpredictability of
14 expectations, cost and schedule challenges, resource
15 challenges, both on industry side and NRC's side and
16 challenges in planning the work. And all of these
17 challenges have resulted in significant increases in
18 costs, high levels of rework in the processes, both at
19 the station and at NRC. And it has reduced the amount
20 of resources that are available for working on other
21 important initiatives that we have at our stations.
22 So, all that being said, there are things
23 that are going well in this process. As I mentioned,
24 safety improvements are being implemented. We are
25 making modifications at the facilities and operator

burdens are being reduced as a result of the application of the NFPA 805. We have seen a significant improvement in understanding between industry and NRC over the last year and a half as a result of the work that the executive teams of both NRC and industry have been doing in order to make the process work better. So, I commend all the work that has been done in that area.

CHAIRMAN STETKAR: Elliott?

MR. FLICK: Yes.

CHAIRMAN STETKAR: On that issue, if I can interrupt you, do you see, are you reaching sort of an asymptote of stability? In other words, I know over the last couple of years there has been a sharp learning curve, let's say.

MR. FLICK: Sure.

CHAIRMAN STETKAR: Do you see things finally starting to stabilize? Again, I will use the license renewal processes as a good example.

MR. FLICK: What I would tell you is there is still significant room for improvement. However, we have gotten most of the low-hanging fruit. And the low-hanging fruit is primarily in the processes area. And the areas where there is significant room for improvement is in the area of conservatism within the PRA models. And how that is both directed from

1 NUREG-6850 in some regards but also in how it is being
2 applied in the review process.
3 And so, the folks today are going to get into
4 discussing that more in-depth. But I think from the
5 process perspective, we have gotten a lot of very good
6 proof in the last 18 months.
7 CHAIRMAN STETKAR: Thank you.
8 MR. FLICK: Yes, so just some of the things
9 that I would highlight that have been beneficial. Last
10 October we had a lessons learned meeting where industry
11 and NRC got together here in White Flint and we spent
12 an entire day going through things soup to nuts. And
13 frankly, I couldn't believe that Joe's group was able
14 to pull off with as many people and interested parties
15 as there were getting us to a focus point where we had
16 a couple of top priorities that both industry and NRC
17 were going to go after. And I think we have made a lot
18 of progress on those top priority items.
19 The working relationship between the Office
20 of Research and EPRI has gotten better, since the early
21 part of this year. And I think that the priorities are
22 set appropriately for the things that can be done with
23 research in order to help improve over-conservatism that
24 exists within the PRA models. My biggest issue in this
25 area is the timeliness of that and I am going to get into

1 that in a little bit more detail shortly.

2 The audit schedule changes have taken place

3 with the process, which so far we have had a couple of

4 plants that have gone through this new process. And that

5 appears to be beneficial in reducing the overall number

6 of RAIs and improving the understanding of the NRC

7 reviewers prior to coming to the site for the audit.

8 That has been very beneficial and also use of a freeze

9 point concept that was one of the items that was brain

10 stormed out of last fall's lessons learned meeting has

11 recently been verbally endorsed by NRR. And I think that

12 that is very positive.

13 But overall, what I would tell you is that

14 in order to make these changes, it has involved a very

15 significant level of high level leadership engagement

16 that has been required in order to make those changes.

17 And so you know, just kind of my big picture

18 summary, when you have big change that you are trying

19 to implement, it requires big involvement of folks in

20 order to make it happen. And if you back off on

21 engagement of leadership in processes, you can end up

22 with results that you don't necessarily want to see.

23 MEMBER SCHULTZ: Elliott, have you seen

24 that? Are you speaking of that in terms of leadership

25 with regard to the utility industry as well as the NRC?

1 MR. FLICK: I am, as a matter of fact.
2 MEMBER SCHULTZ: On both sides?
3 MR. FLICK: Yes, on both sides. And I think
4 that we had a fairly high-level of industry leadership
5 in place during the time up to when the pilots took place.
6 And then this thing Fukushima happened. A lot of
7 management attention got distracted from this process
8 but it was at a time when the other plants were just
9 starting to go through the process. And we didn't really
10 recognize what the pitfalls were going to be when the
11 post pilot plants started going through the process
12 until sometime down the road when the first round of RAIs
13 starting coming through for those plants. And that is
14 when we really recognized as an industry that we needed
15 to step it up again.
16 MEMBER SCHULTZ: Now, are you talking about
17 that between October and now or before October, in order
18 to make October happen, October 2013?
19 MR. FLICK: We actually started getting a
20 higher level of engagement of industry leadership in
21 the fall of 2012 and so before last October. And like
22 I said, I was put into a lead position. I assembled an
23 executive oversight committee.
24 So, basically, my counterparts, the vice
25 presidents of engineering at the key plants that are

1 going through NFPA 805, we got together. We formed a
2 group that gets together. We meet monthly. We talk
3 about issues that we have, how things are going. And
4 it helps us to pinpoint focus areas when we have monthly
5 management calls with NRR to discuss the process, so that
6 we can target our concerns or messages.
7 So, that is basically part of the process
8 that we have put in place. And we do periodic update
9 reports to NSIAC on overall progress.
10 MEMBER SCHULTZ: Thank you for that detail.
11 MR. FLICK: Sure.
12 MEMBER SCHULTZ: I appreciate it.
13 MEMBER BLEY: I have one question.
14 MR. FLICK: Yes, sir.
15 MEMBER BLEY: Were you and the folks you
16 deal with usually surprised or would you even agree that
17 in the end it turned out the pilots were kind of unique
18 applications and they aren't at all like full-on
19 analyses in the details of how the analyses are done and
20 what they are trying to do?
21 MR. FLICK: Yes, we were surprised. There
22 were areas, for instance, where pilot plants were able
23 to credit things in their PRA models that was essentially
24 not allowed in the post-pilot applications. And I think
25 that industry went into -- or we came out of the pilots

1 understanding that there was a much higher level of
2 conservatism in the Fire PRA models than we certainly
3 would want to see that would cause us to potentially make
4 investment decisions in modifications that maybe
5 weren't exactly the right ones but we accepted that. I
6 mean, as industry said to the ACRS that we were okay with
7 moving forward at that point.
8 And I, personally, think in retrospect that
9 we have more work to do at that point. Some of it wasn't
10 necessarily recognized because of how the pilot plants
11 were approved. And I think that we just didn't really
12 get a good enough shake out through the pilot process
13 in this particular case.
14 Okay, so some of the current industry
15 concerns. We are going to have a number of folks from
16 the industry talk about PRA risks being overstated and
17 over-conservatism. So, I am not going to get into a
18 significant amount of that now, other than to say that
19 when you compare the operating experience in the
20 industry to a post-implemented NFPA 805 fire model on
21 order of a three times factor over prediction of Fire
22 PRA risk in an NFPA 805 model than what the operating
23 experience would actually comport. So, and you will see
24 more of that as the folks go through the discussion.
25 The costs have been significantly higher to

1 go through this process, partially because of rework but
2 it wasn't, I think, fully recognized what it would
3 actually take between putting a PRA model together and
4 going through all of the RAIs and different rounds of
5 experience that it turned out to be.
6 So, I would tell you that for the
7 constellation plants, Nine Mile Point, Ginna, and
8 Calvert Cliffs, converting five plants to NFPA 805 at
9 an expense of about $80 million for those facilities when
10 our initial expectation was on order of maybe $15
11 million.
12 So, I mean we are orders of magnitude
13 outside of the cost and a number of companies have looked
14 at this in terms of boy, it would have really been a lot
15 less expensive for us just to stick with MSO and go
16 through and implement the MSO modifications versus going
17 with NFPA 805 as an application. You get different
18 things between the processes, obviously. But that is
19 a perspective that is out there.
20 CHAIRMAN STETKAR: Have you -- and I have
21 heard varying things, cost, obviously, resource
22 requirements is foremost in people's minds.
23 You mentioned costs of responding to RAIs
24 and kind of going through the process. Do you have any
25 estimate, I don't need precise numbers, but the amount

of cost that has been required to do things like confirm cable routing and the fundamental information base that you need and then the development of the models, the performance of the study to get to a point where you have something to submit, basically? Is that --

MR. FLICK: Yes, there is a piece of that that plants have had to go through. Some plants have had to go through that. One of the plants in my fleet we had to go through doing a significant additional amount of revalidation, whereas the other plants didn't necessarily have to do that.

So, there was a piece of that I do not personally today have --

CHAIRMAN STETKAR: I was just curious.

MR. FLICK: Yes, but I would just tell you that looking across the industry from the discussions that I have had with my peers, costs are averaging on a per reactor basis somewhere in the order of $15 to $20 million to go to an NFPA 805 application.

MEMBER BLEY: That is currently.

MR. FLICK: Correct, the current costs. Right.

So, you know that is going to -- exceeded our expectations, obviously. And once we made commitments to go forward with it, we followed through

1 with it. But this is part of what causes this executive
2 disillusionment in overall PRA processes in the
3 opportunities that are provided.
4 CHAIRMAN STETKAR: Do you think, and this
5 is a leading question and tell me you don't know. Do
6 you think part of the disillusionment was that the
7 initial cost estimates were made low by people who sold
8 services without the realization of what was actually
9 needed?
10 MR. FLICK: I wasn't engaged with it at that
11 time, so I really couldn't tell you the basis for that.
12 Although you know I can tell you that there was --
13 CHAIRMAN STETKAR: I am still a consultant.
14 I know how it works.
15 MR. FLICK: And there may have been a piece
16 of that.
17 CHAIRMAN STETKAR: But honestly, people
18 get disillusioned. In some cases, the real cost -- there
19 may be a middle ground. Parts of the numbers that you
20 have been siting may, indeed, be inflated because of
21 honest lack of expectation, whether it is the review
22 process or the actual analysis process, the cost
23 involved.
24 MR. FLICK: Yes.
25 CHAIRMAN STETKAR: Part of it may be simply

1 that going into a very, very complex analytical process
2 that honestly nobody in the industry has any real
3 experience with today.
4 MR. FLICK: That's right.
5 CHAIRMAN STETKAR: You know in the 21st
6 century, people tend to be optimistic. You sell me a
7 cup of coffee, you think it is going to be a nickel because
8 you remember it used to be a nickel and I am kind of
9 surprised that I paid $2.18.
10 MR. RISHEL: So, I had -- I now own both
11 pilots. So, I know when I did Harris, we took the
12 estimates and tripled them. And we were off by a factor
13 of ten.
14 (Laughter.)
15 MR. RISHEL: And a lot of that, I think,
16 looking back, we did not really understand the level of
17 complexity in detail that this effort requires. You
18 know, everybody said well we did the IPEEEs. And this
19 will be kind of like that. Well, it is nowhere near like
20 that.
21 It is not an order but orders of magnitude
22 more complex. So, I think we did not appreciate the
23 complexity we were going to have to go to and that, of
24 course, drives costs.
25 CHAIRMAN STETKAR: Yes, thanks.

1 MR. FLICK: So, we are in a situation now
2 where we are kind of at the peak of the number of
3 applications that are in for 805. And there are still
4 more to come through the middle of next year and a little
5 bit further out than that, even.
6 But the ability to take advantage of the
7 research that is going on right now is a challenge for
8 us. And NRR is working with us to help expedite the
9 ability for us to use new research that is being done
10 on heat release rates, okay, and fire frequencies,
11 incipient detection, the things that are listed here on
12 this slide. The concern is that the timing of it, plants
13 are going to want to take advantage of it. It will cause,
14 potentially, changes to LARs having to be submitted.
15 And it is going to cause rework not only on industry side
16 but also with the resources within NRR to address those
17 changes.
18 But I think that the changes are very
19 worthwhile. They are important changes. So, it is a
20 concern for industry right now.
21 MEMBER REMPE: On your discussions with NRR
22 on the process that you are discussing for changing LAR
23 commitments, have had some good ideas that everyone
24 seems to --
25 MR. FLICK: Okay, so on changing LAR

1 commitments, I mean on industry side, I think we have
2 a couple of ideas of things that could be done. For
3 instance, the language within the license condition for
4 the plants could be changed, such that when the SE is
5 approved, it could provide a limited ability of plants
6 as new research comes in to allow us to make changes.
7 All right? So, that is one idea on our perspective.
8 NRR is currently in discussions with OGC,
9 I believe, on this issue, in order to figure out what
10 might be the best approach for how to go after doing
11 something like this. That is our understanding.
12 Okay, I am just going to point out here this
13 is just some side-by-side comparisons of what an IPEEE
14 Fire PRA would suggest, compared to a post-NFPA 805 Fire
15 PRA for two different unnamed plants. But just
16 basically showing the very significant increase in PRA
17 risk that would be suggested by going between the two
18 processes. And as I have already mentioned here, we are
19 going to talk today about how this doesn't necessarily
20 comport with the industry operating experience.
21 And you know the perspective here, from
22 industry would be wow, if our fire risk really is this
23 great after NFPA 805, we just need to pile all of our
24 resources, time and attention into everything that is
25 fire at the expense of time and attention that could

1 potentially be getting spent on other things. Right?
2 CHAIRMAN STETKAR: One of the things I used
3 to tell my clients, was until you have evaluate d all
4 your sources of risk, all of the money you plunged into
5 making all of those internal event contributions so
6 small might have been money misspent. And this just
7 might be a snapshot in time of that because the industry
8 has spent a lot of money --
9 MR. FLICK: We have.
10 CHAIRMAN STETKAR: -- in the last three
11 decades, --
12 MR. FLICK: Right.
13 CHAIRMAN STETKAR: -- since we have risk
14 assessment capabilities, training people, putting in
15 hardware and everything that has reduced the internal
16 event contribution in an absolute sense quite a bit.
17 MR. FLICK: Right.
18 MR. FINE: If I could, this is Ray Fine for
19 Sandia. I would argue that a little bit. If we haven't
20 made the internal events corrections you would have seen
21 a much larger amplification in fire because it is an
22 exponential jump. Internal flooding and fire see a lot
23 of the same things.
24 So, if I have fixed something in flooding,
25 I have also fixed it in fire. Seeing if other internal

1 events, things that we looked at, if we see sequences
2 that don't look like we could benefit by improving the
3 plant, typically that is going to directly relate into
4 the fire and it will be a much larger slice of the pie
5 than what you got in internal events.
6 CHAIRMAN STETKAR: There is some of that.
7 The only difference on the fire is that it cuts through
8 geometrically in the plant in a way that the other things
9 don't. But you are ultimately limited to the same pumps
10 and pipes and valves that have to mitigate this stuff.
11 MR. FLICK: So, you know the things that I
12 would like to just highlight on this slide, we have
13 already touched on the number of them. The
14 opportunities that we see for process improvements, we
15 have already reached agreement on establishing a freeze
16 point for PRA, very positive from our perspective. That
17 will help provide additional regulatory stability from
18 our perspective as we move forward with Fire PRAs.
19 And then the last piece here, PRA peer
20 review process must work and be trusted. And so what
21 I would tell you here is that our PRA review process
22 involves getting industry experts together, reviewing
23 and challenging PRAs, and making sure that they really
24 are accurate. And we did give NRC a couple of examples
25 where those processes did not necessarily validate that

1 what was in 6850 was being met within the PRA because
2 there was an alternate approach being used.
3 So that, I think, brought a level of
4 somewhat distrust of is the peer review process really
5 working or not. Now, industry, over the last year and
6 a half has made some very significant efforts to make
7 sure that as we go through these reviews that we are
8 reviewing to 6850 and that we aren't in that type of a
9 situation. But our perspective is that in Reg Guide
10 1.200, the process that is laid out there works and
11 should be trusted. And we need to make sure that we are
12 meeting our end of the commitment with regard to that.
13 MEMBER BLEY: There is another side to that
14 and I wish you would comment on it. Early on we mentioned
15 that I think you mentioned something like that the
16 pilots, if the test would have gone the way one would
17 have expected, they would have led to big hard looks and
18 maybe 6850 would have been revised. We would have a
19 methodology that was fixed.
20 It seems like, and we only get little looks
21 here and there, it seems to me like a lot of this bypassing
22 with the peer review process and evolution of the facts
23 and all of that have a lot to do with the methodology
24 document being completed and then being read by
25 everybody and carried through. Do you see that as part

1 of what the problem was and do you envision -- and we
2 have asked staff about this today -- some point at which
3 the staff becomes more comfortable with the peer review
4 process because it is being run against a commonly
5 narrowly agreed upon after experience instead of
6 procedures.
7 MR. FLICK: Yes, I think -- do you want to
8 take that, Anil?
9 MR. JULKA: I think that is part of it. I
10 think we are not comfortable. We have learned a lot
11 about the peer review process and now NEI has a task force
12 looking at what the peer review process is going to be.
13 But I think when we initially started the pilots, maybe
14 Bob can comment more on that, but what we know now we
15 did not know at that time. We know a lot more about fire
16 than I did.
17 I came here in 2010 when we have ACRS
18 subcommittee and we had only Duane Arnold. We talked
19 about that. And now we have gone through six other
20 plants. And you know the level of information on it this
21 time is very tremendously more.
22 And the peer review process has to go
23 through the same thing. They did not know at that time.
24 We were debating at one time whether they should be
25 looking at the methods or not. Initially peer review

1 was saying well, we are not looking at methods we are
2 just looking at how you did the PRA. But now it is
3 starting to be defined what they need to look at. So,
4 peer review process has evolved.
5 MR. RISHEL: This is Bob Rishel from Duke
6 Energy. I would just add a little bit.
7 So, in the pilots you remember the NRC staff
8 was originally going to be the peer reviewer. And they
9 did review both pilots. And at the time, 6850 was, I
10 believe, and I think the NRC believed was a guidance
11 document. You follow it but deviations were acceptable
12 if they were reasonably prudent and had some basis upon
13 why that was a reasonable thing to do. And I will say
14 that the pilots did deviate from 6850 and the staff had
15 looked at those things and agreed to me. And in some
16 cases like incipient detection, that kicked off an FAQ
17 which later became a license condition to have to go back
18 and implement that.
19 And so as we have evolved into the peer
20 review processes, I think similarly peer review process
21 still were thinking 6850 is a guide, not thou shall do.
22 So, there has been an evolution in our thinking both in
23 the peer review process and in how 6850 applies. And
24 pretty much now we are into 6850 and FAQs and you stick
25 within those boundaries. You are okay, you are out, so

1 those boundaries, that is a potential problem.

2 So, that is about the peer reviews also in

3 the way they approach the reviews.

4 MR. JULKA: I was initially retired for the

5 guidance as opposed to a focus-type report. So, that

6 is big delta.

7 MR. FINE: Yes, this is Ray Fine again. If

8 you look at internal flooding, seismic, all these models

9 that we are building, those are guidance documents.

10 Every plant is unique. Every plant is going to have

11 something a little different. As long as you fit within

12 the requirement of the standard, the standard dictates

13 what technical adequacy is.

14 So, not being able to work within the

15 standard and having to be stuck with a methodology that

16 all of us know is flawed is troublesome.

17 CHAIRMAN STETKAR: How is the methodology

18 flawed, Ray? You raised the term, so I will ask you.

19 MR. FINE: I will get into some of the things

20 a bit later.

21 CHAIRMAN STETKAR: Okay, if you are going

22 to address it later. But I won't let that one lie for

23 a while.

24 MEMBER SCHULTZ: I really want to, by the

25 end of the afternoon, understand better why the more --

1 we have studied this fire a lot in the last decade and
2 yet we continue to say that the more we learn about it
3 the more we understand but we can't get over the
4 conservatism that has been applied. That is different
5 than an ordinary technical investigation where the more
6 you study, the better you understand it, you can shrink
7 the conservatism.
8 So, when I look at the pie charts, I presume
9 from the quick evaluation of what that is trying to tell
10 me is that I didn't understand fire very well when I did
11 the IPEEE. And so now when I did the 6850, perhaps what
12 I knew then is there is a lot more uncertainty associated
13 with it than I thought for IPEEE. So, I needed to apply
14 more conservatism. And that doesn't bother me.
15 What bothers me is that we are really
16 studying this. As Anil said, we are learning more and
17 more but we can't get over this hurdle of we still apply
18 the conservatism.
19 MR. FINE: I'm going to go into that a little
20 bit.
21 MEMBER SCHULTZ: There is a high hurdle
22 there that we ought be able to figure out how we parse
23 it out so we can jump over them.
24 MR. FINE: Right. I'm going to go over that
25 a little bit but it is a feeling of 6850 was developed,

1 the methodology and fire modeling was developed in
2 little silos and nobody looked at the cumulative effect
3 of those silos. And even though right now we are still
4 in the silos, patching the holes in the silos, we still
5 haven't addressed the cumulative effect or the
6 propagation of not only the uncertainty but by doing a
7 bounding effect here, and then this one is also bounding
8 and this one is also bounding, just compounds. And we
9 have not addressed that at all yet.
10 MR. FLICK: So, for the slide I have up here,
11 future concerns, just the experience that we have had
12 with 805 causes significant concern within the technical
13 community and the executives in the industry relative
14 to how is this going to play out in terms of other much
15 less well-defined PRA processes that are to come
16 shortly, such as seismic and flooding PRA and whether
17 or not we are going to have the same type of issues there.
18 You know in those cases, we are not using the pilot
19 approach. We do have some lead plants but by the time
20 the lead plants are done, the other plants are going to
21 be moving forward.
22 So, we are not in a mode right now where we
23 are going to take a breather after the lead plants go
24 through and figure out what worked, what didn't work,
25 and how we need to move forward with the other ones. So,

1 it is a risk area right now but that is a concern.
2 So, the conclusions here I think would be
3 that unpredictability in process and overstatement of
4 the risk is having an effect where we are potentially
5 not investing in the right safety improvements at the
6 facility. And so, we need to continue to work on both
7 the long-term and short-term solutions to this.
8 And risk informed approaches, they need to
9 be an alternative, not layering determinism within a
10 risk-informed approach; where in this case, we believe
11 that that is part of the silos that Ray was just talking
12 about and how that can overall stack up in over
13 conservatism throughout a PRA like this.
14 So, with that, I am going to go ahead and
15 I will turn it over to Mike Saunders from ERIN
16 Engineering and he is going to provide us some discussion
17 about the conservatisms.
18 CHAIRMAN STETKAR: Thank you.
19 MR. HYSLOP: May I ask a question and make
20 a comment?
21 MR. FLICK: Yes.
22 MR. HYSLOP: Is that allowed?
23 CHAIRMAN STETKAR: It absolutely is
24 allowed. Just identify yourself, please.
25 MR. HYSLOP: My name is J.S. Hyslop. The

one thing that kind of strikes me when comparing 805 and 6850 was that hot shorts really weren't an issue at the time the IPEEEs were done. They were not evaluated or just evaluated on a very limited basis. So, it is not necessarily that the methodology evolved. There were some things that weren't even addressed in those IPEEEs that could play an important role for some plants, maybe, maybe not. I don't know. So, that is certainly a contributing factor.

MR. FINE: If I could counter that real quick. All my IPEEE models, my CDF has gone down as I have improved them because they were bounding in fire that didn't happen. It went exactly in the opposite direction.

CHAIRMAN STETKAR: Yes, I don't think we want to get into a discussion of IPEEE versus NFPA 805. Everybody has their own opinions. Let's stick to where we are on that NFPA 805. Okay?

MR. SAUNDERS: Okay, good afternoon. I am Mike Saunders from ERIN Engineering. Thank you for the opportunity to come and present the work that was done and presented in the paper "Characterizing Fire PRA Quantitative Models: An Evaluation of the Implications of Fire PRA Conservatisms."

The paper was written in an effort to

1 identify what the potential range of results may be and
2 how the inputs may influence decisionmaking.
3 Most of us understand the background of Fire
4 PRA development. As general, the development of
5 external hazard PRAs has generally lagged behind the
6 development of internal events PRAs. This has been
7 exacerbated in the Fire PRA because of a lack of adequate
8 data, methods to allow a reasonably accurate
9 quantification, one that provides a quantification that
10 is not subject to very large uncertainty bounds.
11 CHAIRMAN STETKAR: Let me push you there.
12 There is a lot of uncertainty in fire. There is a lot
13 of uncertainty in flooding. There is a lot of
14 uncertainty in seismic. That is a part of risk.
15 So, part of doing risk assessment is to
16 acknowledge those uncertainties and quantify them, not
17 to say that we can't do it because there is a lot of
18 uncertainty. The opposite is true. So, saying that we
19 can't -- I am really troubled by this notion that we can't
20 do fire risk assessment because there is a lot of
21 uncertainty. Yes, there is.
22 I go back to my if I had known in 2006 that
23 there was a one percent chance of losing 30 percent of
24 my net worth I might have made a different decision.
25 That uncertainty is important. It is not something we

1 can't do it because there is large uncertainty. We must
2 do it because there is large uncertainty.
3 So, this notion, it really bothers me that
4 I keep hearing well, because of all of these large
5 uncertainties, we can't do it. We must have a precise
6 realistic number. The realistic number is driven by the
7 uncertainty. There was a one percent. In fact, there
8 was a higher than one percent chance that I would lose
9 30 percent of my net worth. Nobody would tell me that.
10 So, I don't know how you react to that but
11 it is actually contrary to the notion of a risk-informed
12 process. We hear it from industry, quite honestly,
13 sitting here, and we hear it from the staff, the same
14 thing. The uncertainties are too large, so we can't do
15 it.
16 MEMBER SCHULTZ: Unless you determine that
17 because you have large uncertainties that you must take
18 a bounding approach. And then that begins to sound a
19 lot like deterministic.
20 CHAIRMAN STETKAR: That's right.
21 MR. FINE: And that is, effectively what we
22 think is happening.
23 MR. RISHEL: I think one is to acknowledge
24 that you have the uncertainty and acknowledge what
25 direction it likely goes, whether you think you are

1 underestimating or you think you are overestimating.
2 So, you have to do that in business and anything else
3 and make decisions.
4 But first, everybody has got to fess up that
5 there are uncertainties. We don't really know exactly
6 but we are going to proceed in the face of those
7 uncertainties with maybe compensatory measures or what
8 defense-in-depth or safety margins is what we call it.
9 MEMBER BLEY: You just hit on the key, I
10 think, at least for me. And that is, to do any of this
11 sort of thing, trying to understand and characterize the
12 uncertainties is a first step. And until you do that,
13 they are just something that you can't deal with. But
14 once you do that, then you might have to bound it. There
15 are lots of things you can do once you have identified
16 them and thought about them an organized it.
17 CHAIRMAN STETKAR: And it might be the
18 discussion I had this morning, it might be okay that
19 there is a 17 percent probability you would exceed some
20 nominal line in the sand because there is an 83 percent
21 probability that you won't. And your best at, your
22 medium estimate might give you substantial margin and
23 you understand where that 17 percent came from. And you
24 make a decision. Like you said, you make a decision.
25 But without doing that, without doing the

analysis to, as Dennis said, characterize the uncertainty and recognize the fact that that 17 percent is real, or in my case the one percent is real, you really can't make that informed decision.

MR. FINE: Right. And I am a big fan of sensitivity studies to find out what is driving you. You know assume all your cables, assume none of your cables, assume you know certain things. You can run all that in your model, once you have it put together. But you have to build the model first before you can do it. That is the trick.

CHAIRMAN STETKAR: It costs a little bit and takes some time to build those models.

Anyway, I'm sorry, Mike. Go on.

MR. SAUNDERS: The NRC PRA policy statements states the PRA evaluation in support of regulatory decisions should be as realistic as practicable. However, the current methods accepted for use are often agreed upon to be bounding.

Part of this is because the guidance in NUREG-6850 was not fully piloted. And this has resulted in numbers that are potentially conservative or bounding biases being incorporated in data, rules, and methods. The industry and the NRC continue to make progress in developing the Fire PRA methods through the processes

as discussed earlier NFPA 805 FAQ process and industry review panels. However, this work is generally not reflected in most current Fire PRAs that are being used for risk-informed decisionmaking.

The primary inputs to risk-informed decisions are the insights from gleaned from the PRA, not a bottom line number. Undue conservative bias Fire PRA could confound a decisionmaking and improper insights may result.

Fire PRA insights are used for plant or procedural changes which influence the fire risk profile. The risk of these may dramatically change, based on the degree of conservative biases that are imposed on the Fire PRA. The risk reduction because of plant changes may be overstated and there may be risk beneficial plant changes being masked.

Inappropriate allocation of resources. The possibility of misprioritizing plant modifications is critical for the industry that is under severe economic pressure. The need to perform those safety enhancements that are most beneficial is critical to public safety. And risk metrics may approach or exceed safety goals, which restrict proactive use of risk insights to apply resources to areas of highest safety significance.

1 The purpose of the analysis was to try to
2 characterize Fire PRA Models by identifying the
3 potential range of results in how they influence
4 decisionmaking.
5 Areas of potential biases were identified,
6 based on my experience developing Fire PRAs. The degree
7 of conservative bias was quantified and the dominant
8 contributors were identified. And this was done to
9 determine the potential prioritization for contributors
10 to change.
11 CHAIRMAN STETKAR: Do you have any examples
12 where you said you have gone through the exercise --
13 unless you are going to tell us.
14 MR. SAUNDERS: Yes.
15 CHAIRMAN STETKAR: You are?
16 MR. SAUNDERS: Example of changes, yes.
17 CHAIRMAN STETKAR: Okay.
18 MR. SAUNDERS: All right, the analysis was
19 performed by identifying select areas with potential
20 conservative biases. I chose ten areas that I believe
21 would influence the results, based on my experience. I
22 categorized these areas into three types.
23 Type 1 areas, I categorized as matured
24 because there has been additional guidance. Type 2
25 areas, I categorized as not matured because there is

1 either research or review in process. Type 3 areas I
2 categorized as lacking knowledge because the modeling
3 is generally based on limited data or industry
4 experience.
5 I chose three Fire PRAs for three plants of
6 differing designs so we could see if the potential biases
7 influence all Fire PRAs or just a subset. I quantified
8 each of the sensitivity studies separately so we can look
9 at those. And developed three point estimates: an upper
10 bound used the NUREG-6850 guidance; nominal
11 incorporates the Type 1 areas for those that are matured;
12 and the lower bound incorporates all the sensitivities.
13 So, for each area of interest, an alternate
14 guidance to 6850 was chosen or an assumption was made
15 and was inserted into the three PRAs and quantified for
16 each sensitivity.
17 Then the bounds of the three plants was
18 generated by including the sensitivities. Again, the
19 upper bounds were using the 6850 guidance; the nominal,
20 the Type 1 areas for those that had matured; and the lower
21 bound, all of them.
22 Type 1 areas or the mature ones, I have four
23 examples of those. Fire ignition frequencies, as
24 discussed earlier instead of the 6850 frequencies, I
25 applied the EPRI 101-6735 frequencies. In this

1 sensitivity we saw a consistent reduction across the
2 Fire PRAs.
3 Transient fires, updated guidance using FAQ
4 12-0064 was used. And also I applied additional
5 guidance to changing influence factors within an APAU.
6 There was a draft FAQ on this that has been tabled right
7 now but there has also been papers written that this
8 method would be reasonable.
9 The largest reduction in the Fire PRAs are
10 those that can apply to very low and extremely low
11 categories in FAQ 12-0064.
12 Spurious operation and duration, for this
13 sensitivity, I applied the NUREG-7150, Volume 2
14 probabilities and durations. Here we see it a
15 significant decrease across the Fire PRAs.
16 And lastly, I used for electrical cabinets,
17 I used the cabinet factor method. The cabinet factor
18 method distinguishes cabinets by type and a factor is
19 derived based on fire being reviewed. The method went
20 through the NEI review panel consensus process, however
21 it is not endorsed by the NRC for use in applications.
22 MEMBER BLEY: Let me ask you a question. It
23 has been a while since I have read the NUREG but I thought
24 the NUREG if you go look in your cabinets, it may be
25 reasonable to use a different heat release rate, based

1 on what is in the cabinets. There is not much stuff in
2 there. There is not much fuel. You can knock it way
3 down. That sort of thing, I guess, is what you are doing
4 but that is, as far as I can tell, consistent with 6850.
5 Is it not or did you do something very different? What
6 did you do?
7 MR. SAUNDERS: This is factors based on a
8 data review, a review of the fire events.
9 MEMBER BLEY: This is just a data review.
10 MR. SAUNDERS: Yes, sir.
11 CHAIRMAN STETKAR: You mean separating
12 fire frequencies by I&C cabinets?
13 MR. SAUNDERS: Right.
14 CHAIRMAN STETKAR: Yes, which is something
15 that has been discussed for about oh, five years and the
16 industry has said no, we are going to keep that same
17 generic electrical cabinet. Any electrical cabinet is
18 an electrical cabinet.
19 We raised this issue in a meeting that we
20 had about four years. And they said no, that is the way
21 we are going to do it and EPRI isn't going to reparse
22 their data. So, fine. If the industry wants to keep
23 one generic category of electrical cabinets, live with
24 it.
25 Quite honestly, that is what you did here.

1 MEMBER BLEY: That is not an unreasonable
2 thing to do.
3 CHAIRMAN STETKAR: It is not an
4 unreasonable thing to do.
5 MR. SAUNDERS: Right and like I said, it was
6 reviewed by the methods panel and they presented a
7 position on that.
8 MEMBER BLEY: Help me out. The methods
9 panel is who?
10 MR. SAUNDERS: I think there is --
11 MR. RISHEL: It is an industry task force
12 that was put together.
13 MEMBER BLEY: NEI?
14 MR. RISHEL: NEI, EPRI, and industry folks.
15 And I think there is off and on NRC individuals on the
16 panel.
17 CHAIRMAN STETKAR: Okay. On ignition
18 frequencies, because everybody points at ignition
19 frequencies, has anyone, and I don't care what the
20 category is, whether it is electrical cabinet ignition
21 frequencies which tend to be the big driver, has anyone
22 done anything like using plant-specific data in a
23 two-stage Bayesian update? And if I get blank stares
24 up there, I will know that no, you don't even know what
25 we are talking about.

1 MR. FINE: I would say we know what you are
2 talking about. It is not a very cheap thing to do.
3 CHAIRMAN STETKAR: Oh, come now! I can do
4 it in five minutes on my computer here.
5 (Simultaneous speaking.)
6 CHAIRMAN STETKAR: It is cheap. I can give
7 you a 100 billion Excel uncertainty distribution of each
8 parameter.
9 MR. RISHEL: Oconee did do that and some of
10 the other Duke plants.
11 CHAIRMAN STETKAR: Did they?
12 MR. RISHEL: We have a split between some
13 that did and some that didn't.
14 CHAIRMAN STETKAR: Some of the experience
15 that we have seen, especially in the fire area is, and
16 when I say two-stage, I mean two-stage. Not just because
17 -- the example I always use, take ten plants, ten years'
18 of operation each, 100 reactor trips. What is the
19 average reactor trip rate? It is once a year.
20 If you look at the plant-specific data and
21 then find out that one plant had all 100 trips, it is
22 very easy to show that your plant is not a member of that
23 population. And it can have a substantive effect on your
24 estimated frequency. That is not prohibited by the
25 methodology. It is standard risk-assessment

1 methodology.

2 MR. FINE: Right. And we do that in the

3 basic data. What I am getting at is I was thinking of

4 another sensitivity study that the owners' group wants

5 to get into and that is take all of the conservative,

6 you know 98 percentile, all these other things, and say

7 what if we just use the means throughout the process with

8 a known distribution and recalculate an entire fire

9 model using that. That is something the owners' group

10 is looking at trying to do but that is not a cheap

11 evolution.

12 MR. DINSMORE: May I comment?

13 CHAIRMAN STETKAR: You may. Just identify

14 yourself.

15 MR. DINSMORE: Yes, this Steve Dinsmore

16 with the NRC staff. I guess for some time we have been

17 looking at these things and for the designers to do more

18 realistic analyses is the way it is stated. But really,

19 the more realistic analysis like you were indicating

20 earlier, you go out and you look in the cabinets. You

21 split up the ignition frequencies by small events. But

22 most of the sensitivity studies, and most of the methods

23 that are being proposed are simply the generic analysis

24 and instead of using the 98 percent heat release rate

25 for every cabinet, we used the mean heat release rate

1 for every cabinet.

2 That certainly doesn't increase the

3 resolution of the analysis. It mainly just lowers the

4 numbers. If you are going to go out and say I am only

5 going to use a 70 kilowatt heat release rate in all my

6 cabinets now, there are some still out there that might

7 have a 300 kilowatt. So, those will be reduced below

8 what they should be.

9 So, if you say realism, it implies to us that

10 you are going to do a more high resolution analysis as

11 opposed to simply modifying the generic values that are

12 being used. So, it gets a little confusing.

13 MR. FINE: I will agree with that comment

14 in that I do think we need to have more refined methods.

15 The current methodology we are using is not accurate.

16 CHAIRMAN STETKAR: See, that is what I was

17 going to challenge the words methods before. And I think

18 Dennis was trying to get at it earlier.

19 I don't think we need more refined methods

20 because I think that the methods that are there point

21 you in that direction. It is that people are not

22 actually reading what is there and having the experience

23 to use the methods. Methods in NUREG-6850/ CR-6850 do

24 not say thou shalt always use the 98 percentile of the

25 heat release rate for every calculation that you ever

1 performed in the analysis. It says use it as a first
2 cut screening and they provide uncertainty
3 distributions. I have used the whole uncertainty
4 distribution which has a mean value, which might be lower
5 than what the staff would like to see for a conservative
6 bounding 98 percentile but they have to realize that
7 that, in fact, is the uncertainty distribution. And
8 that is what it is.
9 So, the method is there. I haven't seen --
10 I actually haven't heard anybody present anything that
11 isn't covered by the methodology. I am still looking
12 for that thing that there is a fundamental lack of a
13 methodology for doing it.
14 MR. RISHEL: So, this is Bob Rishel, Duke
15 Energy. So, I will say that when folks come to me and
16 say I have this problem with this cabinet, I go, well,
17 we will look into it. So you look in the cabinet and
18 see what is in there. If you are using a 702, is it really
19 a 702? Okay? Step one.
20 Step two is what is the distance to the
21 nearest targets? What does your fire model tell you?
22 What is your pressure probably, et cetera? If you
23 haven't done that, go do that. Put it in.
24 So, those things are being done but I will
25 say my view is that we talk about the heat release rates.

1 We are probably getting off base here a little bit.
2 CHAIRMAN STETKAR: It's okay.
3 MR. RISHEL: But we are using fire growth
4 curves that are not right. Right? They came out of a
5 testing regime that was designed to burn the whole
6 cabinet up. So, for that fire, that is correct. But
7 for the 75th percentile or 50th percentile, that is not
8 the fire growth rate. But we are applying that same fire
9 growth rate. We are just changing the heat release rate.
10 So, generally speaking, so I used the 50th
11 percentile or 75th percentile, or even the 30th and the
12 zone of influence, the damage and the time really is not
13 affected measurably. So, it doesn't matter, because of
14 the fire growth, how quickly the heat gets to the tables
15 in our assumed model is unchanged. I can lower the heat
16 release rate and it doesn't really matter. It doesn't
17 change the answer.
18 So, in that respect, that is -- I think our
19 fire growth models are, frankly, wrong. And I think our
20 assumed distribution of the 702 and so 50 percent or the
21 75th 702 is I think 211 is what we are using. I think
22 that is probably wrong. I think it is probably 76 or
23 79. And I think the 50th is probably like 40. But we
24 don't have data to support that. So, we are using, in
25 my view, these are some of the artificialities that we

are living with and it all comes down to what are we assuming as far as how hot the fires are. What is our average for fire.

And because the cable trays are one foot or two foot away, I said it doesn't matter, unless you are getting down in the 40s, 50 kWs, it won't matter.

So, we are opening the trays up. We are adjusting them. I would just say just anecdotally, Brunswick has got 60 cabinets in the back. We opened very one of them up. Some of them had nothing in it. Those went away. All right? So, originally the bounding was really, really bad.

(Laughter.)

MEMBER BLEY: Well, and that is the way to get there. Take the easiest route first.

MR. RISHEL: So, that is what I believe is where we are talking about heat release rate, it is the distribution and how quickly it gets to those peak fire temperatures.

MEMBER BLEY: Mike, I have a --

CHAIRMAN STETKAR: Wait a minute, J.S. had one.

MR. HYSLOP: This is J.S. Hyslop. The only thing I wanted to say is it is the methods and that is how they are implemented. I have been on I guess seven

1 or eight audits. And on one or two of those, I have seen
2 the cabinet heat release rate 98th percentile applied
3 exclusively. And I told them, that is awfully
4 conservative, don't you realize that? And they said
5 yes, we do. And but we are sticking with it and it is
6 not our position to tell someone they have to change.
7 But sometimes that happens as well.
8 MR. RISHEL: And so I would agree. And
9 sometimes we go we are go we are sticking with it because
10 if I use the 50th or 75th, it doesn't change the answer.
11 So, all that is is more work.
12 MEMBER BLEY: Can we go back a slide?
13 I know some of you folks were here four years
14 ago. It has been a long time. Mike, I don't remember
15 if you were here. There were several guys in the
16 audience who also talked a lot who were old hands at this
17 stuff. And they and EPRI were telling us back then that
18 about two-thirds of the thing you got on your list, they
19 were going back and they knew all about this stuff and
20 they were going to go talk to people in the plants
21 applying the data that wasn't in the computer files and
22 really address the ignition frequency plus specific put
23 that one to rest. And maybe the transient fires,
24 definitely the electrical cabinets and a couple others.
25 And I don't know if the right person is here

1 to say what happened to all of that but maybe it was too
2 big to bite off. Maybe you tried it and it didn't help
3 you. You know I heard a little bit about how you tweaked
4 this to get your variations but it would have seemed that
5 work would have given this a real pedigree.
6 MR. JULKA: Yes, Dennis, I think that work
7 we did collect all the data after that. And EPRI was
8 do the collection. So, maybe Stuart can --
9 MR. LEWIS: Yes, I think I --
10 MEMBER BLEY: Stuart, you have got to --
11 CHAIRMAN STETKAR: You have to say who you
12 are and where you are from.
13 MR. LEWIS: This is Stuart Lewis from EPRI.
14 I wasn't at the meeting four years ago but I am aware
15 of some of what has happened since then. Ashley is going
16 to address much of that in her discussion.
17 MEMBER BLEY: Does that mean that has moved
18 along?
19 MR. LEWIS: It has, not as quickly as we
20 would have liked.
21 MEMBER BLEY: Well, it never does.
22 MR. LEWIS: But it certainly has been, the
23 fire events database, for example, as maybe you heard
24 about this morning from the staff, has been a significant
25 event. It is not just in developing a database but in

1 collecting the extensive qualitative information about
2 the nature of the fires helping form a lot of these other
3 aspects of the PRA models.
4 So, we will report on that. Again, it has
5 certainly been a difficult time-consuming process but
6 we are making progress.
7 MEMBER BLEY: And I guess the other thing
8 I would say, I enjoyed Bob's dissertation on heat rates.
9 It makes a lot of sense.
10 Two things could have already addressed
11 that. One is there could have been some additional
12 experiments. But number two, some of these panels that
13 have the experts looking at all of the available data
14 in the engineering basis could have addressed that. And
15 I don't know which parts have been addressed. And maybe
16 there is just too much work to have gotten to all of it.
17 But it seems to me what we used over the last five years
18 maybe we could have made progress right in the direction
19 you are talking about. It makes sense or it doesn't make
20 sense.
21 MR. FLICK: Dennis, I agree with you. We
22 could have made better progress and I think that when
23 I talked about leadership engagement, this is one of
24 those areas that there was a vacuum for a significant
25 time.

1 MEMBER BLEY: And I would have to say there
2 was. I agree with you. That has certainly got in the
3 way of a lot of stuff.
4 MR. FLICK: Yes.
5 MEMBER BLEY: A lot of stuff here and I am
6 sure everywhere else.
7 MR. FLICK: Yes.
8 MEMBER BLEY: Yes, I was pretty excited
9 after the last meeting. I was like I might see something
10 pretty interesting.
11 CHAIRMAN STETKAR: Go ahead, Mike.
12 MEMBER BLEY: Take advantage of the silence
13 whenever you can.
14 (Laughter.)
15 MR. SAUNDERS: All right. For the Type 2
16 areas, those that I classified as not matured, fire
17 control and suppression. This one I assumed that the
18 conditions in the rooms wouldn't get to the point where
19 there is high gas layer and deterministic conditions of
20 full room burnout. But this, you see the range of
21 decrease is dependent on the design of the plant and
22 spatial separation and compartment size. And heat
23 release rates, you say there is more research going on
24 that. And hopefully, we will see a significant decrease
25 in the heat release rates. For this sensitivity, I

1 assumed that just the ignition source itself was
2 damaged. And, obviously, you see a large decrease
3 across all the Fire PRAs and that.
4 The Type 3 areas, I classified as lack of
5 knowledge. Fire HRA, there is new guidance in NUREG 1921
6 and 6850. However, there is the resources for the inputs
7 for the HRA can be lacking, such as cable data for cues
8 or other conservatisms. The heat release rates may
9 affect the timing and the performance shaping factors.
10 Fire induced trip, 6850 gives the guidance
11 that you may have to assume a bounding initiator based
12 on lack of knowledge. The lack of knowing where the
13 cable data is for all systems, this sensitivity, I assume
14 that if you didn't have a larger fire-induced initiator
15 then there was no initiator.
16 Main control room abandonment, again, we
17 have the guidance at 6850. I think the lack of industry
18 experience results in conservative assumptions here.
19 Fire models are used to predict the conditions.
20 However, we give no credit to operators to combat the
21 fire prior to the conditions occur.
22 And offsite power recovery --
23 MEMBER BLEY: Before you leave that, as we
24 said this morning, we haven't had the opportunity to look
25 to any of these 805 PRAs. So, I didn't see what was in

there. But to tell you the truth, I haven't read the PRA, I haven't done a PRA in which when I went through looking at things like this, in addition to finding places I could have fine-tuned the analysis and improve things, I found places where really maybe my assumptions were a little optimistic and go the other way. You didn't find anything that could go the other way. How come?

MR. SAUNDERS: Well, the purpose was to provide an upper bound.

MEMBER BLEY: I mean it gives us a lot of confidence if it is really all one-sided.

MR. SAUNDERS: No, the purpose was to identify the potential range of results, using an upper bound of what we believe are bounding and a lower bound. And these were just ten areas that from my experience could influence the results.

MEMBER SCHULTZ: You made an assumption that the considerations and assumptions within the NUREG would be the upper bound.

MR. SAUNDERS: Yes, sir.

MEMBER SCHULTZ: Then, you looked at deltas in each of these areas, as you would see it. In each case, you have identified this range of conservatism and then applied that --

1 MR. SAUNDERS: Yes, sir.

2 MEMBER SCHULTZ: -- to get a feel as to where

3 things were.

4 MEMBER REMPE: Okay I am going to ask

5 Dennis's question a little more bluntly. You didn't see

6 any places where you thought some things maybe were a

7 little optimistic?

8 MEMBER SCHULTZ: As compared to the NUREG.

9 MR. SAUNDERS: Well, I mean there are

10 assumptions in each of these Fire PRAs like control room

11 abandonment. On two of these Fire PRAs, we used the 1.0

12 probability because they have a more complex remote

13 shutdown procedures. So, there are things inside the

14 Fire PRAs already that we took, we made them probably

15 bounding.

16 These were just, like I said, areas that we

17 were just trying to identify what the range was, could

18 be, and how prioritization of things can change.

19 MR. FINE: If I could, this is Ray Fine

20 FirstEnergy. Even in my sensitivity studies, I am

21 showing something similar. What if we could make this

22 better? What would be the change? And we all noticed

23 that at some plants, that silo doesn't change anything.

24 But in another plant, it is rather significant. But

25 fixing that one silo isn't the answer. It is, I have

1 to fix all of them.

2 MR. JULKA: This is Anil Julka from

3 NextEra. I think another thing to note is that the whole

4 objective when we started doing this Fire PRA was that

5 we needed to get our numbers down to a certain point.

6 So, as soon as we got there, we stopped doing any more

7 refinements. So, I think that is one of the keys and if

8 I kept them going, we could have found areas where we

9 could reduce that risk also.

10 So example for Duane Arnold is that we did

11 not route the -- even look at the routing for the high

12 pressure systems before we can need to take credit for

13 it to get down to the number we wanted to get down to

14 in order to meet the requirements for the LAR. So that

15 is a big factor.

16 And in every Fire PRA we have done, we have

17 stopped at a certain point, say stop looking anymore

18 because of the cost involved. So, there was like a

19 freeze point kind of thing. Let's not look anymore.

20 MEMBER SCHULTZ: That is a very interesting

21 comment or perspective. Because if one takes that

22 approach and draws the line and say well, what my

23 intention is here is just to continue to whittle away

24 until I am successfully meeting the margin to limit and

25 then I am going to stop. Would a PRA analyst then say

1 okay, I can use my model to make decisions about plant
2 modifications that I should do?
3 Should I use that model to do that? If my
4 management asks me to do that, will I feel confident that
5 I can prioritize modifications with what I now have?
6 MR. FINE: That is the position we are in.
7 MR. JULKA: Yes, I think that is true for
8 all our sites. I can tell you that much.
9 MEMBER SCHULTZ: But at some point we, all
10 of us in this room, may have mischaracterized what I can
11 use my tool for based upon the way in which I have
12 approached the analysis. And it also sounds like, in
13 spite of what Bob said, there may be a large difference
14 in approaches across the industry in how this has been
15 done. And so some utilities may be saying I am in a good
16 position to make these decisions about resource
17 allocation and other utilities may be taking from that
18 with their model they can do the same. And I am not sure
19 that ought to be translated that way.
20 MR. JULKA: That is a very good point
21 because I am not sure we have communicated that
22 appropriately to our management but this is what we did
23 and we developed. We are just saying that it is
24 conservative and that was one of the reasons it is
25 conservative, that it, you know --

1 MR. FINE: That is not to say that we didn't
2 think about this as we were going through because in one
3 of my plants, we were getting a number even after we had
4 gone quite a ways through, we were getting a number that
5 was just not acceptable. Okay?
6 So, we then did a tremendous number of
7 sensitivity studies to see what was the weak link and
8 we put in a major modification to close that weak link.
9 Okay?
10 Doing that, dropped me two and a half orders
11 of magnitude. So, clearly, it helped me in internal
12 events. It helped me everywhere, throughout the model,
13 that mod fixed a lot of things. And it was always a
14 dominant system in the normal PRA. But putting in that
15 mod was clearly a safety benefit across the board. But
16 even after I did that, I still see issues, challenges
17 and conservatisms in the model.
18 Now, can I more easily implement this model
19 now that I have dropped CDF that much and LERF that much?
20 Yes, I can stop. I don't have to go any further now.
21 But that is the kind of decisions you make because
22 management is looking at total cost. Your $25+ million
23 is still going and sooner or later, you have just got
24 to say stop.
25 MR. RISHEL: This is Bob Rishel at Duke

1 Energy again. I think one is we stopped when we thought
2 we hit the point of diminishing returns. And so go back
3 to decisionmaking. So, if you are going to make a
4 decision about a mod and you know you didn't credit high
5 pressure injection, let's just say, you had better
6 recognize that, that you neglected that and that
7 whatever mod you decide to put in, doesn't become
8 invaluable if you decide to go put that in your analysis.
9 So, I think it gets back to decisionmaking
10 and uncertainties and understanding what you did and
11 what you didn't do.
12 Like I said, frankly, we went down to where
13 we thought we were at the case of diminishing returns
14 and we were sort of stuck at that point. That has been
15 our approach.
16 MR. SAUNDERS: All right.
17 MR. RISHEL: But I do think even mod-wise
18 or decisionmaking-wise you had better recognize that you
19 made those decisions and incorporate that understanding
20 in your decisionmaking or you are fooling yourself.
21 MR. SAUNDERS: Okay, this chart provides a
22 comparison of the bounds, the CDS for the three plants.
23 The blue is the upper bound, the red is the nominal, and
24 the green is the lower bound.
25 The next chart shows for one plant how the

1 prioritization of plant location can change, based on
2 our inputs. This is a prioritization of fire scenario
3 importance, based on the inputs.
4 And another key point is the masking effect.
5 The upper bound model tends to have basic event
6 importances as expected. What I mean by that is your
7 important events and actions tend to be related to your
8 diesel safety related switch gears and other safety
9 related components.
10 Using this lower bound model, new important
11 basic events come up, some non-safety related systems
12 like CRD or alternate DC equipment and other operator
13 actions.
14 So, conservatisms could result in high CDFs
15 that prevent proactive use of Fire PRAs, which leaves
16 about a 50 percent reduction; using the Type 1 areas,
17 implementing all the sensitivities up to an 80 percent
18 reduction; reductions in LERF are expected as well; and
19 the dominant contributors may be incorrect or may be
20 masked and could extend to other hazards.
21 CHAIRMAN STETKAR: The 80 percent
22 reduction being slightly less than a factor of two? If
23 there is a 100 percent reduction, it would be a factor
24 of two?
25 MR. SAUNDERS: A little less than an order

1 of magnitude is what I was meaning.

2 CHAIRMAN STETKAR: Okay. I guess I don't

3 know how 80 percent is being helped but it is an order

4 of magnitude, not a factor of two.

5 MR. SAUNDERS: Yes.

6 CHAIRMAN STETKAR: Okay.

7 MR. SAUNDERS: And again, PRA is most

8 useful when it presents realistic risk assessment and

9 removal of conservative biases will likely see changes

10 in the prioritization, which could result in mods or

11 procedural changes.

12 The conservative bias for Fire PRAs could

13 also be problematic for other applications.

14 So, in conclusion, it is critical that the

15 limited available resources be applied to the most

16 beneficial areas to public safety.

17 CHAIRMAN STETKAR: Mike, a lot of this, you

18 know we talk about risk-informed decisionmaking And I

19 guess in my experience, there is a responsibility of the

20 people who build and understand the PRA models and

21 quantify them that if the manager comes to me as the owner

22 of the PRA and says what do I do, you mentioned

23 conservative bias may be problematic for other

24 applications.

25 Well, if I understand the PRA, you say well,

1 you have to be careful in this application because you
2 know the model is kind of dicey over in here. So, if
3 we are going to apply it for this, that doesn't mean that
4 the model is bad or the conservatism is bad. It just
5 means that I am saying you have to be careful. You don't
6 want use your Yugo and take it out to Indianapolis and
7 expect to win the race. You know you have a Yugo.
8 MR. SAUNDERS: That is what Bob is getting
9 to next.
10 CHAIRMAN STETKAR: But a lot of the sort of
11 high level things saying oh, it is so conservative and
12 is masking things and I can't make realistic decisions
13 just says that the people who run the model are the people
14 who really understand where all of the daemons are, if
15 you will. We are stepping up and saying we can make
16 decisions, we just have to be careful in these areas.
17 (Simultaneous speaking.)
18 MR. RISHEL: So, I am Bob Rishel from Duke
19 Energy and I am going to talk about where we are in 6850
20 and Fire PRA issues where the Duke Plants are at, without
21 names.
22 And some of the changes we have seen, I have
23 seen, you know, Dennis, I was here four years ago.
24 MEMBER BLEY: Yes, I know you were.
25 (Laughter.)

1 MR. RISHEL: Probably whining about the
2 same thing I am going to whine about today and going
3 forward.
4 So, all of our plants have a Fire PRA,
5 actually including Crystal River. And all have been
6 submitted, all the active plants have been submitted
7 under 805. And Harris is completed. Oconee has
8 completed the transition. Brunswick we are expecting
9 the SE sometime next quarter, I believe. And McGuire's
10 start of their RAIs and Robinson, Catawba will start this
11 year.
12 So, fire is the most risk contributor on
13 each site. And you will see that on a slide here in a
14 minute. And I get a lot of questions from the site
15 management and other folks about the same point earlier.
16 So, you are telling me that I ought to put
17 all of my resources in the fire. Why not fire watch every
18 room in the plant? Are you kidding me? Is this true?
19 And so you get both. And it does raise credibility of
20 the PRA in general and disillusions the execs with PRA
21 in general. And I was like, so nobody is pressing you,
22 I believe, on is it that big of a slice of the pie.
23 MEMBER BLEY: Let me ask you a question
24 about that. And this is your opinion I am interested
25 in. It is kind of a do you believe question.

1 I can kind of make a rationalization why
2 that might be a reasonable thing, especially depending
3 on what in each plant you are. There is a tremendous
4 amount of effort on the design making systems good and
5 reliable in preventing core damage. So, a lot of effort
6 on seismic. But at some points in time, there wasn't
7 a whole lot of effort on fire. And it has gradually
8 increased and increased.
9 So, the plants ought to be better protected
10 against those other things than fire. Maybe not floods
11 and winds but then the hazard isn't as great at most
12 places there.
13 MR. RISHEL: So, multi-facet answer here is
14 fire is a dominant risk. The question is how big is it.
15 Is it three-quarters of it? Is it a third? Is it a levy?
16 My view is it is somewhere between -- it is not what the
17 IPEEE said it was because I think most people recognize
18 that the IPEEE fires were flawed. We didn't look at
19 everything we are looking at now. But I don't think the
20 6850 results are right either. So, we are in the middle.
21 CHAIRMAN STETKAR: Yes, I mean it is a
22 little bit, the problem is the pie charts. And I think
23 you have one coming up here.
24 MR. RISHEL: The pie charts are the
25 problem.

1 CHAIRMAN STETKAR: But they can be
2 misleading because a small piece of a big pie, which is
3 what you say well, it ought to be a small piece is a lot
4 different than a big piece of a small pie, because that
5 big piece of a small pie on an absolute sense may be the
6 same as the small piece of the big pie.
7 MR. RISHEL: Right. So you will see kind
8 of what you are talking about here.
9 CHAIRMAN STETKAR: And I like the way you
10 have presented your pie charts. In some sense, that
11 historically, this notion that everyone that knows fire
12 ought to be a smaller part of the overall risk is perhaps
13 skewed by not having appreciation of how big that
14 absolute value is.
15 MR. RISHEL: Right. You are absolutely
16 correct. And part of it is we think there is room for
17 6850 to be improved in some dramatic ways. And we think
18 that will change the results. Now, will it change the
19 risk insights? Probably not. I don't believe it will
20 but of course, I don't believe the numbers. But I
21 believe the important areas that we say are important
22 will be important no matter what the fire frequency is,
23 no matter what the heat release rate is, no matter what
24 the fire growth is. Those are important places and bad
25 places to have a fire.

1 MR. FINE: Can I interject something?
2 MR. RISHEL: Sure.
3 MR. FINE: This is Ray Fine, FirstEnergy.
4 The issue that I am seeing is the cart is already in front
5 of the horse, so to speak. We are already, because of
6 the models that we have built, we have already made the
7 commitment, you know we have to make these commitments,
8 we are going to put in these mods and then we are going
9 to go fix the methods and get to another place. And we
10 are going to get to take advantage of those mods, whether
11 they were the right ones or not. We are going to take
12 advantage of those mods. So, the model CDF will go down.
13 But it is the fact that we area the cart in
14 front of the horse. That is the thing. We are in this
15 really strange place here, compared to any other way we
16 have done it.
17 CHAIRMAN STETKAR: I'll give you -- and
18 here is -- I get accused of telling the stories. But
19 a quick story. I had a client. I have been doing risk
20 assessment for a long time. The client had a problem
21 for internal event risk and they installed another
22 supplemental emergency feedwater train. It helped
23 their internal risk a lot. They couldn't have run the
24 cables through a worse part in the plant for fires
25 because they hadn't done a fire analysis. We did the

1 fire analysis and said you know you could have run the
2 cable pretty much anywhere else, except where you ran
3 it. It didn't buy them anything for fires. And that
4 is at least the perspective of having everything in
5 place. When you say the cart before the horse and where
6 is the numbers going to flesh out, a little bit of what
7 Bob said in terms of the perspective of is this location
8 going to be different as I refine the methods? Probably
9 not. The absolute value of this location might be
10 different but this location, relative to another one
11 probably isn't going to change much.
12 MR. FINE: Yes, we had to be very, very
13 specific in our mod at one of our plants as to where it
14 was going, how it was going, and everything.
15 CHAIRMAN STETKAR: So, anyway.
16 MR. RISHEL: Yes, so the CDF results, when
17 we are looking at Reg Guide 177174 with some of these
18 Fire CDFs, it is squeezing us out of other risk-informed
19 improvements we would like to make. And so that is where
20 the number part is coming in.
21 So, we are looking at additional
22 modifications facility instead of trying to offset risk
23 other ways. So, the costs are high. And the initial
24 cost is about 50 percent. And you asked about how much
25 was fire versus cable routing and reconstitution. So,

1 our view is the Fire PRA is about 50 percent of the total
2 805 LAR. And that varies from plant to plant, depending
3 upon cable databases and a lot of other things.
4 The cost going forward is high. So, in our
5 fleet, I have three full-time PRA guys looking at mods,
6 engineering mods, as they come through the engineering
7 pipeline. Is that going to be a problem with fire? Do
8 I need to put that pump maybe someplace else because I
9 don't like how much oil you put in it. And if I use my
10 oil thing, that is a bad place. So, we are putting a
11 lot of effort into that. A lot of it is it could be
12 reduced if we had better zones of influences and things
13 like that. It could be a little reminder.
14 So, I just did an update of one plant and
15 total updating it was three-quarters of a million
16 dollars to do an update. So even going forward, once
17 they are built, these are expensive things to maintain.
18 MR. FINE: And I want to add that he is not
19 importing new fire frequencies or new -- because once
20 you turn something --
21 MR. RISHEL: I didn't go back and get some
22 FAQs.
23 MR. FINE: Right. But when you start
24 taking on some of the ones that we are going to be getting
25 new information on there, that is like start over kind

1 of.

2 MR. RISHEL: Yes, if we get better --

3 CHAIRMAN STETKAR: That is what I was going

4 to ask.

5 MR. RISHEL: Usually distributions, that

6 will be a bigger cost, perhaps.

7 And so the other, my last bullet here is so

8 I am the only fleet that has had three triennials under

9 805. And I have an FAQ submitted and my issue is that

10 under the fire source scenario, I had better have the

11 scenarios right or I can get a finding. And I find that

12 a bit expensive to deal with.

13 CHAIRMAN STETKAR: Wait a minute. You are

14 going to have to help me. What? What is that last

15 bullet.

16 MR. RISHEL: If I have a fire source in a

17 risk significant area, I had better have the zone of

18 influence, all of the targets, all of the spurious --

19 but I have all that right under a triennial inspection

20 process.

21 CHAIRMAN STETKAR: Okay.

22 MR. RISHEL: So no errors. I can't have

23 missed a target, missed a cable that -- and so I am into

24 what is good enough for your PRA. And so under

25 triennial, what is good enough is bulletproof.

1 MEMBER BLEY: That is the first time I have
2 heard --
3 MR. FINE: And when you are talking 603,000
4 scenarios, that is a lot of work.
5 MEMBER BLEY: You have got a PRA. You have
6 had it reviewed by staff --
7 MR. RISHEL: Or not.
8 MEMBER BLEY: -- in an SER. And now every
9 inspector who comes in can say I have got a finding
10 because you didn't pick up X to switch it. It should
11 have been in your zone of influence.
12 MR. RISHEL: Right.
13 MEMBER BLEY: And what does that mean to
14 you? They have to do an analysis to see what color this
15 finding is?
16 MR. RISHEL: Exactly.
17 MEMBER BLEY: And with any luck, it is not
18 a bad one.
19 MR. RISHEL: With any luck it is green.
20 MEMBER BLEY: If it is a really bad one, then
21 we will probably have to fix it.
22 MR. RISHEL: Well I'm not just going to go
23 get it and fix it. But my impression is is kicking into
24 another hole.
25 (Simultaneous speaking.)

1 MR. JULKA: It takes resources.
2 MEMBER BLEY: It does take resources.
3 MEMBER BALLINGER: But wouldn't you want to
4 know that?
5 MR. RISHEL: I'm not saying I wouldn't want
6 to know it. I'm not saying that. I'm not saying I
7 wouldn't want to --
8 MEMBER BLEY: But you are saying it has to
9 be perfect. And perfect means something maybe
10 different. An inspector might not be coming with the
11 viewpoint of risk assessment. It might just be some --
12 (Simultaneous speaking.)
13 CHAIRMAN STETKAR: You included 99 out of
14 the 100 things you missed one.
15 MR. RISHEL: I got 99 out of 100 but I missed
16 one. And that calculates into a number greater than zero
17 and, hence one.
18 MR. FINE: I think what his main point of
19 this, though, is you get one of those. And then the next
20 try you get another. And you have 3,000 scenarios. It
21 is a pretty easy guide. You are going to get one.
22 So, then you have three. Now, you have to
23 grade a cornerstone, let's say. And is it really?
24 MR. RISHEL: So, there is more to come on
25 the safe process. I guess that is part of my message

1 there. I don't know, J.S. --

2 CHAIRMAN STETKAR: Let me just ask. I know

3 J.S. is up here. But have you had -- has any of the Duke

4 Plants done any other risk-informed license amendments,

5 other than NFPA 805?

6 MR. RISHEL: Yes.

7 CHAIRMAN STETKAR: You have. Do you get

8 the same, I mean you are using PRA models for that. They

9 just happen to have that wonderful internal events stuff

10 associated. But in principle, somebody could do the

11 same thing. Right? You don't get --

12 MR. RISHEL: Yes, I guess so. Yes, I mean

13 your PRA is always subject to audit whenever you

14 submitted a license amendment for the --

15 MEMBER BLEY: What is your FAQ suggesting

16 on this one?

17 MR. RISHEL: That there be sort of a

18 threshold that is below this value.

19 MEMBER BLEY: In risk space?

20 MR. RISHEL: In risk space. It goes away.

21 Yes, you fix it. So, I don't degrade cornerstones for

22 E minus 8, 9, and 10 CDF increases.

23 MEMBER BLEY: Yes, I haven't seen that FAQ.

24 MR. FINE: This is Ray Fine, FENOC. But

25 another aspect of that is when you are doing these --

1 my thought is leaving my head.

2 MEMBER BLEY: Come back to it. You will get

3 it.

4 CHAIRMAN STETKAR: Let me let J.S. add

5 something.

6 MR. HYSLOP: J.S. Hyslop. What is

7 interesting about that fire source scenario, we have

8 seen peer review FAQs and observations which it said

9 targets were missed and the licensees had a disposition

10 through going back and making sure that their process

11 was complete and those sorts of things.

12 So, industry itself has even raised that

13 issue besides NRC.

14 MR. RISHEL: You know as you go through the

15 process, as you know, this is hard, hard work. And if

16 it weren't hard, we wouldn't be here talking about it.

17 CHAIRMAN STETKAR: And as Ray said, 600 to

18 3,000 scenarios. Did you miss anything? The answer is

19 yes, you did.

20 MR. RISHEL: I know it. I get questioned

21 about it. That's all. I don't need to go in the field

22 to tell you I missed one.

23 MR. FINE: This is Ray Fine again. On that

24 point, we had done a tremendous amount of uncertainty

25 analysis of what if I knew the cables in that tray versus

didn't? Or what if? A lot of what if questions.

So, we really did a lot of work to bound what if I was perfect; what if I wasn't? And so, if I get that triennial, I am hoping that those sensitivity studies I ran said I postulated assuming this and it didn't matter.

I don't know how that is going to fly. I know they did similar sensitivity studies and they are saying it didn't fly. So, that is what has got me bothered.

MR. RISHEL: So, here is my fleet chart. And you can see that most of the plants are half, half of it is fire. And the size of the bubble is the size of their total CEF. So, A and F are quite a bit apart.

MEMBER BLEY: I like doing that. At least it puts John's comment in perspective.

MR. RISHEL: Right.

MEMBER BLEY: When I saw yours, I was thinking I wish there was an indication.

MR. RISHEL: Yes, there are different ways.

CHAIRMAN STETKAR: And this is an easy way to do it.

MR. RISHEL: Yes, it is.

MR. FLICK: We call this the planetary chart.

1 MEMBER BLEY: I mean you are probably doing
2 it based on area and RAIs might not integrate as well
3 as they could either.
4 MR. FLICK: I mean at least you get a sense
5 that it is a smaller end.
6 MR. RISHEL: So, fire CDF's range, quite a
7 range there on the plants.
8 MEMBER BLEY: And these plants were
9 designed over --
10 MR. RISHEL: We like to say like from the
11 1965 Ford Mustang to the --
12 CHAIRMAN STETKAR: The 1972 Edsel or
13 something.
14 (Laughter.)
15 MR. RISHEL: We are up to the Cutlass or
16 something, Oldsmobile Cutlass 442 or something.
17 So, changes in requirements. So, you know,
18 I listened to staff earlier this morning and they hit
19 most of what it talked about, fire frequencies, but you
20 still had to do some sensitivities. And so my kind of
21 point was why bother to use the new numbers, if I still
22 have to use the sensitivities>
23 Circuit spurious probabilities we talked
24 about this morning. There were 68 -- Harris and Oconee
25 used the original 6850 values. Later submittals we

1 doubled them as requests to RAI.

2 And 7150 comes out and it is pretty much

3 going pretty close to the original values. It is a

4 little higher but not -- in other numbers --

5 MEMBER BLEY: Which one is 7150?

6 MR. RISHEL: That is the new JACQUE-FIRE --

7 MEMBER BLEY: JACQUE-FIRE okay.

8 MR. RISHEL: -- results. And so there is

9 some good stuff in 7150, some bad stuff, too, but we are

10 moving on with it.

11 MR. FINE: I'm going to inject one more

12 thing because I really like his presentation.

13 That first or second bullet there, when you

14 are talking about the sensitivity studies, you are

15 talking about maintaining multiple models, at this

16 point. Okay? And one model is a beast. Now, I am

17 maintaining 20, 30 models, --

18 MR. RISHEL: In order to build it in.

19 MR. FINE: -- in order to maintain the

20 capability to do that sensitivity studies because these

21 are complex sensitivity studies. They are not simple.

22 MEMBER BLEY: Do we have an indication of

23 whether that is going to be going away?

24 MR. RISHEL: I would hope.

25 MR. HYSLOP: This is J.S. Hyslop. I think

1 the staff has reverted to asking one sensitivity study
2 in aggregate. Early on in the process, when we didn't
3 like something, we asked what is the importance. What
4 is the sensitivity? And we sort of revised our approach
5 now where we only have one. But it is the grand roll-up
6 of all the issues. And so that is how we have been
7 perceiving lately.
8 MR. RISHEL: And I will confirm that my last
9 RAIs went that way, a good roll-up.
10 MEMBER BLEY: I was waiting for somebody on
11 this panel to mention something about that.
12 MEMBER SCHULTZ: It seems to give you the
13 result that Mike was presenting as the 6850 result.
14 MR. RISHEL: So, recently, fire zones of
15 influence, we had a 35 degree from the source to the
16 ceiling and burned everything up. And recent inquiries
17 we may need to go beyond that. So, I guess that is a
18 question for us to engage with the staff is that as
19 plant-specific armored cable issue or is that a new
20 generic industry position? It is too early to tell for
21 me but that has kicked off another set of plant lock downs
22 in changing the zone of influence, which is, again
23 another level of complexity that I had not originally
24 planned on doing.
25 And frankly, we think it is pretty much

1 going back to Appendix R where I just do a whole room
2 burnup. And if I live with that, okay but probably
3 can't. Next slide.
4 Human reliability is another area where we
5 have seen a change with now a dependency of a floor, i.e.,
6 no matter how many operator actions you have, you can't
7 get more than this amount of credit. So, we are working
8 through that.
9 And then the other is a few years' back, the
10 staff put out NUREG-1921, which is an HRA for fire. And
11 so now please compare yourself to 1921. And that is
12 another bit of work to do.
13 Closed cabinets, we talked about that a
14 little bit. So, this is where I would say Harris and
15 the pilots got a little bit of understanding from the
16 staff. We had assumed that if a lower control center
17 was closed, not vented, that the fire would not propagate
18 out. And after some negotiation, we negotiated a ten
19 percent negotiation out.
20 So, recently the question has been well, you
21 can't. It is supposed to less than 440. Most MCCs are
22 480 or above. I have some 600s. There are very few MCCs
23 that are less than 440. And so this seemed to us was
24 a match of Section 11 and Section 6 being mashed together
25 in 6850 and they don't reference each other to say by

1 the way, when you are looking at Section 11, also go look
2 at restrictions in Section 6.
3 So, there is an FAQ on this and it is being,
4 I think, worked out. But again, it is an increased cost
5 and CDF increase, where really, again, the industry data
6 shows that MCC fires generally are not getting out of
7 the cabinets and going into the cable trays and damaging
8 the cable trays.
9 So, changes of overall risk. We have put
10 in modifications. We have used incipient detection.
11 We have reduced our reliance on operator actions. And
12 we have a significant increase in the plant staff on fire
13 risk. I mean there has been a tremendous recognition
14 by the operators and the rest of the staff on transient
15 combustibles. They now look overhead before they park
16 something and go, now this probably isn't a good spot
17 and brought more awareness about asking before they just
18 assume. The same thing for modifications. Like where
19 should we route these cables? What room should we avoid?
20 So, there is a lot of benefits coming out of 805 and it
21 has, through either directly through mods or indirectly
22 not really quantifiable but behaviors have improved.
23 So, I understand the NRC staff has got a
24 really difficult task, reviewing all these 805 LARs. And
25 the pilots did have because there was one-on-one

1 interaction with everybody and it was multiple, and I
2 will get into this a little bit. And there are some
3 changes coming, well, we hope they come through. They
4 need to get priority.
5 So, a lot of discussion on the pilots. So,
6 I want to go -- there was a lot of interaction with the
7 staff on the pilot process. There was 6850 was, when
8 the pilots got it, was by no means perfect. There are
9 lots and lots of technical gaps and a lot of early FAQs
10 closed those gaps. Just cabinet counting was an early
11 one. We couldn't even figure out how to do that early
12 on.
13 The staff was reasonable and flexible, I
14 think in that 6850 wasn't treated as a compliance
15 document and it was allowed to be some reasonable
16 deviations were allowed.
17 And like I said, some areas, bus duct fires
18 was a late add FAQ actually after Harris had submitted.
19 Closed motor control, operator actions, control room
20 evacuation, all of those things were not ironed out early
21 on and now are coming on.
22 And I don't think the results were terribly
23 out of line. So, Harris, you know we put in the incipient
24 detection system and we talked about that FAQ. And the
25 FAQ has sort of been characterized as well, unless you

1 name is Shearon Harris and you happen to have a plant
2 in New Hill, North Carolina, the FAQ doesn't apply to
3 you.
4 And I actually believe that incipient
5 detection is worth its weight, way, way worth the
6 modification as far as plant safety.
7 I'm just going to say you probably heard it
8 but Harris had a transformer fire in a switch gear room.
9 Now, there was incipient detection in another cabinet
10 installed, in-cabinet installation two or three
11 cabinets over in the same room and it detected something
12 going wrong with that transformer two hours before the
13 fire.
14 So, you know it is sensitive and it does
15 work. Now, you have to maintain it. And the FAQ, as
16 I remember says if it is not in service, you have got
17 to put a continuous fire watch in the area. So, there
18 is a lot of incentive to keep the things available and
19 working correctly. And actually Harris staff will tell
20 you it is too darn sensitive.
21 MEMBER BLEY: You are getting a lot of
22 nuisance alarms?
23 MR. RISHEL: Well, they are getting some
24 stuff and they are calling craft in and going, yup, that
25 fuse or whatever is a little hot. Check it, yes. But

it is okay or we just turned the thing on, this thing on over here and it had been sitting a while and heated up, and set it off.

So, those kind of things are happening and we are working through it.

MEMBER BLEY: But we have heard -- you don't have to go back. Two slides ago, you noted this business of depth fires. Now, that is bus duct fires. The 6850 originally didn't have bus duct fires in it.

MEMBER BLEY: There was a fire quite a few years ago that occurred not in a nuclear plant but onboard a ship. And it was actually a ventilation duct that caught on fire because of dust in the duct and the big fire at one end of it.

The point that bothered me and I don't know what we are doing about it if we are doing anything was the smoke that came out of the duct got into the propulsion control panel, which was all of this new kind of electronic equipment that we are now getting in the plant. And the smoke got into that in a way it completely failed the whole unit. And they went dead in the water. And they couldn't -- just cooling it off didn't do it. I mean it was a serious problem.

Are we including the effects of smoke on electronics at all?

1 MR. RISHEL: We are, there is actually an
2 FAQ. I didn't list that. That was another one that was
3 not in early 6850. And the sensitive electronics was
4 another one that there is an FAQ now on how to deal with.
5 MEMBER BLEY: And that includes smoke?
6 MR. RISHEL: Yes.
7 MEMBER BLEY: Good, I hadn't seen any
8 analyses that had done that but it was a pretty troubling
9 event when you saw what happened.
10 MR. RISHEL: And heat affects, local heat
11 affects is another area that has come up.
12 MEMBER BLEY: Yes, I knew there was another
13 one.
14 MR. RISHEL: So, Oconee is also in line and
15 a number of significant mods protected service water,
16 a lot of fire mods there. And we are, Oconee is actually
17 in the process of another revision based upon some recent
18 FAQs.
19 So, going forward I think we talked about
20 fire frequency by component instead of a site, fire
21 frequency and dividing it up by component and that is
22 coming. Heat release rate, fire growth modeling. We
23 talked about that a lot.
24 Fire distribution, I still think the fire
25 heat release rate distribution curve we are using is

1 wrong. And maybe that will get something there.
2 And we talked earlier today about the
3 Robinson. So, I have known Robinson, too. And I was
4 heavily involved in their fire, fires, and we actually
5 sent the cables that were affected to the national labs.
6 And I will just say that their high energy arc fault
7 cables three inches away did not catch fire in fault.
8 You could tell that they had been in a fire but they were
9 not failed by -- our 6850 fire model would say that those
10 would be failed.
11 So, I think the high energy arc fault is
12 another area that I would put forward as an area with
13 a little bit of conservatism. And I am going to say that
14 no high energy arc faults could ever cause that. I
15 think, again, maybe there is a 98th percentile and a 50th
16 and some distribution of high energy arc faults that we
17 should be applying, instead of saying high energy arc
18 fault here is the cone of death.
19 So, any other questions, I am available to
20 answer them.
21 MEMBER SCHULTZ: So, Bob, I heard a lot of
22 benefits that you feel you have gained from
23 participating in the process and moving forward with it.
24 In terms of not only improvements that you have
25 implemented in quantifiable ways, if you will, but a lot

1 of unquantifiable opportunities for participation in
2 terms of even walking through different plant
3 improvements, having a PRA team evaluate the design
4 changes. Each of the design changes, all of this sounds
5 very beneficial, in terms of improving plant safety.
6 But it is difficult, perhaps, to quantify that to
7 management.
8 MR. RISHEL: It is difficult to quantify to
9 management.
10 MEMBER SCHULTZ: Unless you just keep
11 talking.
12 (Laughter.)
13 MR. RISHEL: You know it is a step forward
14 in industry and nuclear safety. It is. It is painful
15 and it is getting a lot of attention because of the
16 numbers. And because, frankly, as we talked about it,
17 6850 was a starting point. But and I think everybody
18 will agree that was never meant to be a freeze point but
19 a starting point.
20 And the movement has been very slow. And
21 so when I talked to the plants about they want a diesel
22 AOT, I go well, that is probably not going to happen under
23 the current Fire PRA numbers. We are going to have to
24 do something about that, unless the staff will go well,
25 that Reg Guide 177, they will grade that because of the

1 fire numbers. That is probably not going to happen.
2 MEMBER SCHULTZ: But that is a very
3 interesting point. Very interesting point that one
4 particular risk-informed evaluation is influencing
5 other opportunities that you feel should be there.
6 MR. RISHEL: And that is what I think got
7 the execs. That and the cost got most of the execs a
8 little up in arms.
9 MR. FLICK: And I think that there are
10 examples where companies have gone, like I have
11 mentioned at the beginning, and they stuck with MSO
12 modifications and they are done. They have been done
13 for several years, where you can look at 805 process
14 plants are still working their way through making those
15 modifications, based on the duration of time and
16 investment that is required in order to go through it
17 in this alternate approach.
18 MR. FINE: I am going to steal a little
19 thunder on this. But if you look at one of my plants,
20 Perry. It is not an 805 plant but I am not allowed to
21 build an 805 model on that plant, even though it is a
22 very well designed plant. It would probably do quite
23 well in an 805 space.
24 But because of these challenges, management
25 is not going to give me the money to go build that model.

1 That is the only thing holding me up from 4B, 5069,
2 everything is that one model.
3 CHAIRMAN STETKAR: Anil, before you start,
4 because I don't want to talk you off in mid-sentence.
5 I need to take a break. We started early. Let's take
6 a break until ten minutes of three.
7 (Whereupon, the above-entitled matter
8 went off the record at 2:34 p.m. and resumed at 2:48
9 p.m.)
10 CHAIRMAN STETKAR: We're back in session.
11 Sorry, Anil.
12 MR. JULKA: That's fine.
13 CHAIRMAN STETKAR: I wanted to make sure we
14 were fresh for you.
15 MR. JULKA: Okay. Thank you. Again, my
16 name is Anil Julka and I am the Manager of Risk and
17 Reliability for NextEra. We have eight plants and five
18 sites going on as the single site BWRs, MRPs. So, next
19 slide.
20 And I do appreciate the opportunity to come
21 here and talk. I was here four years ago and I think
22 we know much more than we did four years ago, especially
23 for Duane Arnold.
24 I just want to go over this. I think some
25 of the things have been covered already in the objective,

1 background, discussion of points, expected benefits of
2 Fire PRA, what they have been, what lessons we have
3 learned and then concluding. And I will still go over
4 some of the things which we have already talked about.
5 There are some objectives and you know somebody has
6 talked about the heat release and you know they are
7 pretty much applicable to all of us.
8 And I think we are going to talk about what
9 are the lessons learned. I think there have been good
10 things which come out Fire PRAs and NFPA 805 and there
11 are some things we still need to work on. And I am going
12 to go through some of the benefits we see coming out of
13 it.
14 So, seven out of eight NextEra plants are
15 transitioning to NFPA 805. We have all the LARs
16 submitted, approved, at least one of nine approved.
17 We have the first SER post-pilots for Duane
18 Arnold which we have implemented only in March of this
19 year. So, you know Duane Arnold has transitioned to an
20 805.
21 Seabrook, we decided not to transition. We
22 did the multiple spurious operation inputs. It is a
23 little vintage plant, fairly decent robust plant. So,
24 we didn't feel like we needed to transition. So, we did
25 not.

1 DAEC did transition, as I said. But
2 looking back, could we have done it without
3 transitioning? I think maybe we could have. Like
4 Exelon is not transitioning most of these. These have
5 less of a problem than these do for some reason. But
6 we could have.
7 DAEC, again, was the first site. Turkey
8 Point and Saint Lucie plants, four plants there. We are
9 already close to obtaining SER on Turkey Point, which
10 is expected later this year and Saint Lucie will follow
11 that. Point Beach was our most difficult plant or is
12 our most difficult plant. If there is a part of the new
13 NRC process, I think Joe Giitter mentioned that this
14 morning they are coming out with an audit. You know and
15 RAIs are submitted after the audit, finally. But we got
16 them before and then we discuss it during the audit.
17 In this regard, I told our executives that
18 is just how this new process is. I told them it was very
19 good. And then after that they asked me is everything
20 okay. How many RAIs? I say hundreds. They say oh, that
21 is a good process. I wonder what a bad one looks like.
22 (Laughter.)
23 MR. JULKA: But I still think it is a good
24 process, as far as the interaction. We will see what
25 remains to be see, you know, how it works out in the

long-run.

So, I think some of the things may have been brought up here before. I think when we started all this we did not have in-house resources. So, everybody was starting the X number of plants starting Fire PRAs. So, this whole effort had to be contracted out. You know, we did not increase the PRA staff at the fights. We just almost gave it like a turnover projects to the industry contracts.

So, there is a limited industry technical resources. I remember we were looking at peer review requirements. There were not enough people the first time we wrote the peer review requirement, there was only one or two people qualified to perform a peer review. I said that didn't make sense.

So, now it is the industry which has come a long way since then. Regulatory requirements, we have already talked about it. EPRI is still working on the finding and NEI is working with them. Next slide.

And now here we are. We have talked enough about conservatism that people are talking about. And as Bob Rishel has said, I think we do have the models. Like I said, you know we did not even work on refining after a certain point in time. So, I think those insights have to be filtered into the decisionmaking

1 later on. But I think as we transition to a newer
2 generation, I think a lot of that information is going
3 to be lost. We looked at the internal events. We looked
4 at the cut sets and people make decisions based on the
5 cut sets. Then people don't go through everything they
6 have to read.
7 So we little bit the objective here, at
8 least for our seven plants, was get to a point that gives
9 me enough margin for internal events, external, you
10 know, floods, and high winds, seismic, add up everything
11 that is stay under the one equals a five minus four
12 criteria. So, that was really the objective.
13 Now, we are still struggling with
14 technology transfer, based on the new issues. As you
15 know, based on Fukushima, now we are finding out there
16 are enough challenges for external flooding at the
17 plants. And that is where I think Professor Schultz said
18 now they are going to be looking at fire and I am sure
19 they will find things which me missed. But you know we
20 are finding out things we have missed and that is also
21 taking a lot of resources away from the PRA group,
22 especially dealing with the SDP space. So we are doing
23 that like for three of our plants right now and people
24 are involved in looking at SDP's significance. And that
25 makes me aware because this was my time for doing a lot

1 of the technology transfer for Fire PRA for all of the
2 sites.
3 Our cost for each I said we are now the
4 simplest plant, you are talking about $10 million there.
5 And the biggest, Point Beach, has a one cable spreading
6 room with both units in it and both ACs power supplies
7 for both units in the same room, both divisions. So,
8 that is how we get challenged. So, that is where we have
9 to do the most amount of fire modeling. We are making
10 modifications of this area putting in and then you seal
11 it as well. And that is about 35 major, major mods, where
12 we even knew op speed were aligned, having you know
13 extending battery life, even netting another source of
14 outside power. We do have gas turbines there, which
15 helps us. So, we are getting that. That has never
16 worked in the past. So, we, as part of this, and said
17 okay, let's get that working so, I can take some credit
18 for it in the fire space.
19 CHAIRMAN STETKAR: You didn't have to take
20 credit for it in your internal events?
21 MR. JULKA: We did.
22 CHAIRMAN STETKAR: Oh, you did? Okay.
23 MR. JULKA: See, but I think we did not want
24 to take credit in internal events before because it
25 really never really worked properly.

1 CHAIRMAN STETKAR: Okay.

2 MR. JULKA: So, I think that is one of the

3 expected benefits is now we made people do it. You know,

4 before people may not have listened to us before.

5 (Laughter.)

6 MR. JULKA: And then part of them, the 805

7 people who understand saying okay, we need that.

8 Another example is -- that is one of the good things I

9 call it. There is things we wanted to do all the time

10 but it is always --

11 (Simultaneous speaking.)

12 MR. JULKA: It is not a regulatory

13 requirement, so people don't want to do it. Our

14 batteries are good for one hour and I have never seen

15 that at any other plants. You know, one hour, that is

16 it.

17 CHAIRMAN STETKAR: One hour?

18 MR. JULKA: One hour. That is the design

19 basis but we know that it will last longer. It just needs

20 to be looked at and justified. And if we need to have

21 load shedding procedures, then we could implement those

22 as people did for station blackout.

23 So, as part of this exercise, I said we need

24 that. That thing has to be done that is going to avoid

25 another mark. So, that is one of the good things which

1 happened.

2 CHAIRMAN STETKAR: Actually, I never

3 thought of that before but that is a really interesting

4 perspective. Because what I am hearing you say is you

5 had internal events risk assessment. From that risk

6 assessment, you identified things that might benefit

7 plant risk. But because you didn't have that regulatory

8 footprint --

9 MEMBER SCHULTZ: The risk was low,

10 comparatively.

11 MR. FINE: Well, and remember that piece of

12 pie I was talking about earlier, how the internal events

13 was a small piece, maybe 10, 15 percent but now you throw

14 fire at it, that got compounded to 50 percent.

15 CHAIRMAN STETKAR: Well but plus it also

16 has now the regulatory part of it because it is a

17 risk-informed license. I mean it affects your

18 licensing pieces.

19 MR. JULKA: And it is an older plant. The

20 valves had a one-hour air supply, you know, nitrogen

21 supply. We said wait a minute. I need 24-hour supply.

22 So, we changed those out together and this met air

23 approval.

24 So, that was done, too, which again, is

25 certain operator action. If otherwise operator had no

1 action and that gives us minimal credit and you know HRA
2 people have to rotate manual action in the field.
3 MR. FINE: If I could interject one thing.
4 This is Ray Fine FirstEnergy. Fukushima is also going
5 to have an impact on these fine models. A lot of plants
6 haven't put it in a lot of the Fukushima mods. I have
7 started to, not so much in the Fire PRA, some pieces are
8 part of the Fire PRA, but others I have still got to put
9 in. And even though I will use that Fukushima equipment
10 slightly different than the Fukushima response plan, and
11 then my timing and so forth be different, I can still
12 credit, a Godwin pump or a diesel generator or whatever.
13 MEMBER SCHULTZ: Hopefully, we will check
14 all of the external events.
15 MR. FINE: Yes, it is just that you know my
16 internal events said I kind of needed something. Fire
17 said well you really kind of do need something now. When
18 Fukushima came along, I said no, you are getting it.
19 (Laughter.)
20 MR. FINE: You know and so I get to take
21 credit for it now.
22 MEMBER SCHULTZ: You're right, John, this
23 is a very interesting perspective.
24 CHAIRMAN STETKAR: I hadn't thought about
25 that, actually, I think before. But it is --

1 MR. JULKA: That is our opportunity to get
2 things done what we wanted to get done.
3 CHAIRMAN STETKAR: That is interesting.
4 MR. JULKA: And it does include plants risk.
5 It does include internals events risk.
6 CHAIRMAN STETKAR: Sure.
7 MR. JULKA: And I think as a follow-up,
8 there has bene more focus on detection and suppression.
9 We used to have some plants, I won't name them, but
10 suppression and detection may have been out for six
11 months, nobody ever looked at it. But I think we have
12 for the name, please focus on that. Combustibles
13 another area, we have signs outside. You know, no
14 combustibles in this area, especially like the cable
15 spreading room.
16 And also the fire maintenance rule came in
17 last year April. So, we did separate from NFPA 805 but
18 we did use the insights for and then in other areas, we
19 don't have an SCR implemented. We did take the insights
20 from NFPA 805 to see what risk management actions need
21 to be taken and certain things like if the printer is
22 out of service for filing the maintenance rule last year.
23 Either we used I-53 information or we used the
24 information NFPA 805 to write those insights.
25 We have an example for your previous PRAs

prior to NFPA 805. I think we have already discussed that. We would not have known everything at that time. We have made modifications. We could talk about that. And I think a plant like Point Beach, I think it may have had a lot more modifications if we didn't use risk as a basis, made a risk-informed decision, we were still going to spend a lot of money but it is still --

CHAIRMAN STETKAR: But you still think that in the long-run you are --

MR. JULKA: Yes, because I think in the --

CHAIRMAN STETKAR: -- maybe not ahead of the curve but at least comparable.

MR. JULKA: Right. Because just think about it. If we are talking in one room, one problem priority that they got both origins both units, you know it just -- I was looking at internal flooding. You know we got three pipes going through this, four or five, I don't know. If one of the pipes break, that represents an internal flooding area, although our risk is low but 98 percent of the risk comes from that one pipe.

I was talking to the vice president last week and he said Anil, who knows that in my plant. I said go ask. We have it in the procedure that they have to expect this pipe. I still haven't heard back from him about it.

1 But you know 98 percent of the risk comes
2 from that because that room is so important. That is
3 the main thing. It is important. Did everybody need
4 a Fire PRA to say that? I mean everything we look at,
5 if you take anything other than in a normal in that room,
6 it is at high risk, it is high and it is going to show
7 up high.
8 I think we have beaten this enough,
9 conservative. So, I think we need to be careful. As
10 Professor Schultz has said, you know we need to be
11 careful on the insights we get from it.
12 We don't want to mask other hazards. You
13 know I still, personally, the industry doesn't believe
14 fire risk is that much of a -- either a small fire or
15 a big fire, but that we are going to take all the resources
16 and put it on fire. I still think people need to worry
17 about the internal events. That is something that is
18 based on the industry and the national or international
19 events which have happened. If people were able to
20 manage their internal events risk, they would have
21 managed the risk.
22 So, we need to make sure that the people have
23 appropriate procedures in place, appropriate training
24 to be able to handle those risks.
25 We talked about 6850. I was involved in

1 6850 when initially they were writing it as a part of
2 one of the plants. We never really finished all the way,
3 validating it when it was traded on pilots. Before the
4 pilots, they were writing 6850, we were working on track
5 to the newer work. But we never had enough time early
6 to do a good job on it.
7 So, there are other hazards we need to be
8 careful and look at. We talked about the uncertainties.
9 So, I think in the industry there is a big effort right
10 now on how you aggregate risk. And I think that is where
11 the real issue is. And we are trying to represent the
12 plant risk. We need to make sure that we aggregate. We
13 talked about internal events. John you said that this
14 morning we have really internal events 25 years ago were
15 not as perfect as -- you know probably in the same state
16 fire is now. But we, over the years, we have improved
17 that. Internal events, we have made changes to the plant
18 to make risk as low as achievable. And now that the
19 uncertainty in that internal limits is very low. And
20 fire risk is maybe 300 to 400 percent or wherever that
21 number will lie. So, I think how we aggregate the risk
22 is going to be probably most important on how we
23 communicate that through the rest of the plant to make
24 sure we are paying attention to the risk significant
25 items at the plant. And I think that is our challenge

1 at this point in time.

2 And EPRI is working on an NEI. I don't know,

3 are we going to talk about that? So, Victoria will talk

4 about that.

5 CHAIRMAN STETKAR: I have to ask you, Anil,

6 have you formally quantified uncertainty through your

7 fire risk models, in other words, develop uncertainty

8 distributions or area parameters anyway?

9 MR. JULKA: We have not done that for all

10 the plants.

11 CHAIRMAN STETKAR: You have?

12 MR. JULKA: No.

13 CHAIRMAN STETKAR: You have not?

14 MR. JULKA: No, we have done some of them,

15 not all of them.

16 CHAIRMAN STETKAR: Okay. You have not,

17 Ray?

18 MR. FINE: No, not to the full extent, no.

19 MR. JULKA: Yes, that needs to be done, I

20 think.

21 CHAIRMAN STETKAR: It is on the -- and I

22 don't want to dwell on it too long. I have my own

23 opinions and this is a subcommittee meeting, so we can

24 pontificate as individuals. But I have my own opinions

25 about this notion of aggregating risk and you said how

do you make decisions about things. But I feel anyway that the explicit display quantification and display of the uncertainties, rather than focusing on a number for internal events and a number for fires is an important piece of that puzzle. Because if you can -- for a decision-maker, if you can show the fact that the thing that you are characterizing as a number is way out on the tail of the uncertainty distribution compared to something that a number for internal events is in the middle of a fairly narrow uncertainty. That is useful information because you can explain to the manager and the decision-maker the fact that it is very, very likely that this A number for fires is much smaller. You can't quantify it at the moment but it does affect decisionmaking and whether it is in regulatory space or whether it is internal in the plant in terms of organizing your priorities for modifications, I think that is very important.

MEMBER BLEY: And if it is something you might want to fix or something you just need to understand better.

MR. FINE: That's right.

MEMBER BLEY: But let me ask you guys a question. I want to know what the tools are. I didn't ask this while everybody was still here, we are just

1 talking about it now. Does the computer model you have
2 got for your 805 PRA easily capable of propagating
3 uncertainty distributions or is that something you have
4 to do offline or with some other tool?
5 MR. FINE: I would say my risk bin model is
6 but my capped model is very, very difficult because I
7 have to break it up into so many pieces to quantify it.
8 MR. LEWIS: Could I comment on that?
9 CHAIRMAN STETKAR: Please do.
10 MR. LEWIS: This is Stuart Lewis from EPRI.
11 One problem or issue with Fire PRA is that a lot of the
12 parameters that have significant uncertainties or that
13 are treated with bounding values that enter into the
14 model are not explicitly part of the PRA model. So, it
15 is difficult.
16 Things like cabinet and heat release rates,
17 there is not a distribution in your carrying model that
18 reflects that it is an input to the deterministic
19 calculation of what the fire does that then determines
20 what your PRA reflects.
21 So, we have a project and Ashley will touch
22 on it in her presentation to try to develop an approach
23 that does account for it fully for uncertain
24 propagation.
25 MEMBER BLEY: But you could build that into

a model rather than --

MR. LEWIS: Presumably it is in the model but it is not at all a trivial exercise to account for them. And no matter what tool you use right now, that is not accounted for.

MEMBER BLEY: Right.

MR. FINE: Yes, and I am thinking one of the parameters that I, my final parameter that I get I can do the uncertainty analysis on. But the hidden stuff that went into that parameter, I can't. Unless I do a tremendous number of sensitivity studies, I can't really guess.

MR. LEWIS: So, there are people who propagate all the uncertainties for the basic events in their models but those basic events aren't necessarily reflective of all the sources of uncertainty.

MR. STREMPLE: Rick Stremple with FENOC. At my plant, we tried to do full propagation of uncertainty through our model for our top maybe ten scenarios. I forget. And it was kind of a mixed approach. We ended up applying distributions to a lot of the fire modeling inputs, heat release rates, things like that in a third party software to do Monte Carlo.

And then we developed distributions for basically the scenario ignition frequencies for each of

1 those top scenarios. We then input those into our PRA
2 model software as those distributions and propagated
3 through our full model. And it did come out a fairly
4 wide distribution then and right there, the CDF numbers
5 that we are reporting are on the higher end of that
6 distribution quite a bit.
7 But the other thing was even for those top
8 ten scenarios or whatever, our PRA software one time was
9 ten days. Do you want to clarify that?
10 (Simultaneous speaking.)
11 MR. STREMPLE: We have made improvements to
12 speed up them all since then but it takes a long time.
13 CHAIRMAN STETKAR: That is useful. I don't
14 want to trivialize that because it is obviously
15 something that is real. On the other hand, it is not
16 something that you necessarily do on a day -- you know,
17 people talk about the risk monitors where you would like
18 information immediately. Quantifying the uncertainty
19 for a baseline fire analysis maybe you can afford to have
20 somebody start running and pray that you don't lose
21 power.
22 MR. FINE: Like he said, the ten days he is
23 talking about, that is with the fastest PC you can buy
24 today with every bit of bells and whistles you can put
25 on it.

1 CHAIRMAN STETKAR: Okay.

2 MR. JULKA: So, Bob touched on this. You
3 know we talked about a lot of the inherent issues with
4 the fire release rates and everything else. I think in
5 addition to that, I think another thing that just source
6 of conservatism are not directly related to fires. But
7 it comes into play when we are doing an NFPA 805. Which
8 is a combination radius. NUREG-1921 mandates a floor
9 value of 1E to the power of minus five for some HFE
10 dependency floor value, which historically we have not
11 done that for anything because we just use the HRA
12 calculator and it does inherently ask the right
13 questions. To put that value on, we saw that some of
14 our plants are risking from 5 percent to 40 percent.

15 And then you have to make a decision on there
16 was a mod which was not really anybody wanted this mod
17 but they are saying okay, do we need to do this mod or
18 not? We are trying to make a decision like for a charging
19 pump trip, whether it needed to trip the charging pump
20 on low pressure, which is not really a risk benefit but
21 it is not one of our top risk reduction modifications.

22 So, talking about conservatisms there were
23 places at some point you have to make a decision on
24 whether you do a certain model or not. It does play a
25 part on who much conservatism you have in there.

1 So, this was an issue which came up during
2 our process at our sites. Some of the sites we did looked
3 like they were making insignificant difference. We
4 said okay, we will use the value either power minus five
5 or it didn't make a lot of difference. We are still
6 challenging that. EPRI has a new task force which is
7 looking at this issue and they are supposed to have a
8 decision at the end of this year.
9 I don't think there is going to be an
10 agreement with the Commission or it is going to be just
11 industry position. So, we are still waiting to see what
12 that is going to do just moving forward.
13 So, there are significant differences. We
14 have talked about, I guess, you know IPEEE, we didn't
15 know more. Now, I am going to fill you two charts you
16 are trying to put together to get insights for people.
17 This is for Seabrook. This again, fire is
18 done in accordance with fire methodology. MSOs, there
19 is no forced IPEEE.
20 MR. FINE: Yes, if I could interject
21 something here because comments were sort of about these
22 particular models. The fire model that was built here
23 is the same methodology and level of detail that you will
24 see at Beaver Valley, Diablo Canyon, and South Texas.
25 And that model at South Texas was good enough to get 4b,

5b, and 50.69 at the time. Today, that model would not be good enough. So, it is just perspective.

So, these are actually very good models.

MR. JULKA: Seabrook is the only, probably one of the few two or three sites who ever compete model. We have all events in there, you know shutdown included.

So, people, you know executives have been asking us okay, how do we get insights to people. So, this is really a trial right now to see how we can get PRA insights to rest of the site folks. So, we just are showing all events, internal, external, high winds, and external flood.

Now, if you have done past that to the next one, it is Saint Lucie. Look at the fire risk. It almost overwhelms the rest of them. But the insights we get from it, I am going to have the similar insights what I am getting from the other PRAs.

So, like I said, we have to be careful, like I said, as far as giving insights to people. And what Victoria is going to talk about aggregated risk, that is very important going forward.

So, at least we understand what the risks are, what the answer to the needs are associated with it and make sure we really communicating the right information.

1 MEMBER BLEY: Just to make sure you are
2 communicating to me, the heights of these colored bars
3 on the left are proportional to the percentage
4 contribution to core damage frequency?
5 MR. JULKA: That is correct.
6 MEMBER BLEY: Is that right? Okay.
7 MR. JULKA: But I did take the numbers out.
8 People don't look at the numbers and focus on numbers
9 but proportionately, that is what it shows.
10 CHAIRMAN STETKAR: In the sense of what we
11 were looking at before without getting into the numbers,
12 if you compare the Seabrook stack with the Saint Lucie
13 stack, are they equal in height or is the Saint Lucie
14 stack much smaller? In other words, the absolute value.
15 MR. JULKA: They are about the same.
16 CHAIRMAN STETKAR: About the same, okay.
17 MR. JULKA: Yes, because Seabrook has a
18 higher seismic risk. So, the overall risk is about the
19 same. Yes, they are alike.
20 MEMBER BLEY: Yes, this one is remarkably
21 balanced among everything else. I'm not sure I have seen
22 this.
23 MR. JULKA: So, again, aggregation of risk,
24 I think communication of risk is very important how we
25 communicate risk.

1 Not for all plants but I think at least for
2 one plant or one site, we know it has provided a financial
3 benefit to redoing the plant or even to determine whether
4 the plant is feasible to operate.
5 I guess NRC is looking at improving the
6 efficiency of the RAI process. That is very important.
7 In the past I think on the first few plants, we may have
8 spent about a million dollars for RAI responses because
9 of like what J.S. had talked about you know we were doing
10 uncertainty analysis with every one of the issues. And
11 now we have combined it all to do it one time, rather
12 than all the time.
13 Then, we used these the Fire PRAs now. We
14 also have to be careful that these, when we use it for
15 the existing plant decisions, these include the
16 modifications, which are not yet been done. So, it is
17 not a true representation of the current plant. So, that
18 has to be taken into account. So, we have been deciding
19 whether we need to maintain two models, which we don't
20 want to do. But these models are only effective after
21 the last modification is done, which is two refueling
22 outages after the SER. So, any decisions we are making
23 for any other risk-informed applications right now are
24 snapshots today. We have either, at one of the sites
25 we have put flags in there so we can take them in and

1 out. Other sites, it is kind of hard to do if they have
2 not gone to the latest software. So, that is trouble.
3 It is causing units to go off.
4 And overall, I think that we are getting
5 there. So, thank you. That was it.
6 CHAIRMAN STETKAR: Thanks, Anil. We are
7 just hoping somebody just says one more word. You can
8 say now I don't have anything to say at all.
9 (Simultaneous speaking.)
10 MR. FINE: I'm Ray Fine of FirstEnergy.
11 And I have three plants that are transitioning to 805.
12 We have just made their submittal at Beaver Valley and
13 we are still in the enforcement of discretion at
14 Davis-Besse.
15 As discussed in the ERIN presentations,
16 modeling of NUREG-6850 was developed, and the way I see
17 it, is they were developed somewhat in silos, where you
18 have ignition frequencies, spurious operation, fire
19 growth, heat release rates and so forth. Each one of
20 those things was developed in a document, so to speak.
21 And they didn't really look at the compounding effect
22 of the conservatisms from one thing to the next because
23 you go through each step along the way before you get
24 at the final answer.
25 Now, some guys did look at some of them

1 crossing over but the entire process wasn't really
2 understood until after the pilots had gone through it.
3 And so the problem with what we are doing
4 right now, not that it is a problem. I mean what we are
5 doing is good but we are still working within the silos.
6 We are still trying to patch up and make the silos make
7 sense. And then we still have to deal with the
8 compounding effect and what does that mean? It is not
9 a simple thing to solve when you have multiple things
10 broke. You have to fix at least one thing before you
11 can fix the next.
12 So, what that means to someone like me who
13 is, you know we started building our models about the
14 same time the pilots started, you know seven or eight
15 years ago. And every time these FAQs come out, something
16 else comes out. Okay, start over. Do that section over
17 again.
18 So, some of these guys were done earlier
19 than me and they were done at $15 million. I am at $25
20 million per site and counting because it never stopped.
21 Now, we have a new process in place where we get to freeze.
22 Well, I wish that had happened a couple of years ago.
23 MEMBER BLEY: Every time there is a new RAI.
24 That is not an efficient way to do it. Is it?
25 MR. FINE: No, it is not very efficient at

1 all. And so that is one of the reasons why a lot of plants
2 haven't moved forward and have frozen and why I can't
3 move forward with Perry.
4 And so one of my arguments I am going to make
5 here is I am going to have to see a critical mass of
6 improvements, not just oh, they gave me new cabinet
7 frequencies, they gave me new this, new that. I am going
8 to have to see a critical mass of changes before I can
9 justify to my management, oh, let's go spend another $10
10 million fixing it. They are just not going to go there.
11 They are putting in the mods that they were
12 required to put in and stuff. And then I will have to
13 fix it wherever I can, when I can. So, that is one of
14 the problems that I see going forward.
15 So, this presentation is going to give you
16 some idea of how I am perceiving these silos and how I
17 see little sensitivity studies within the silo.
18 MEMBER BLEY: Let me ask you a question. It
19 doesn't help you but for somebody who now decides to go
20 ahead and do this, people mentioned freezing but I don't
21 know how that is being implemented. If I started one
22 today, I could take, the way I am interpreting it, I could
23 take the NUREG as it is, the supplement, and the current
24 list of facts and that is my methodology.
25 MR. FINE: Right. And I would get to

1 choose, if I want to improve my model in process with
2 a new FAQ.
3 (Simultaneously speaking.)
4 MEMBER BLEY: And then if you need to add
5 some things, add them later.
6 MR. FINE: Which is the way we do all other
7 PRAs. Right? We will freeze our data collection. Like
8 in a seismic model, I freeze my data collection with
9 CEUS. Everything I froze in a certain way and I moved
10 forward in a static environment. And I built it and I
11 am done. Anything that happens between here and there,
12 I get the next model update. I don't try to morph.
13 And that is one of the things that has made
14 this cost so much and been such a mess was that iteration.
15 MEMBER BLEY: How many have you had going
16 on concurrently?
17 MR. FINE: Three.
18 MEMBER BLEY: Three.
19 MR. FINE: And I have lost project
20 managers. I have lost everything else in the interim
21 because up and down, stop, start, money, no money. I
22 mean it has just been a nightmare because of management
23 disillusionment and so forth.
24 So, next slide.
25 So, when I talk about silos, I am going to

1 talk about a specific silo, which is the very first silo,
2 really. If you consider a plant with two emergency
3 diesel generators, the ignition frequency per source was
4 2.52E to the minus 3, if you assume a CCDP of one. And
5 then if that plant goes and installs a third emergency
6 diesel generator, that factor now goes down. That
7 doesn't make any sense.
8 So, if I am four train plant, I have a lower
9 ignition frequency per component than a two train plant?
10 That doesn't make any sense at all. So, on first
11 principles we are starting wrong.
12 So, go ahead, J.S.
13 MR. HYSLOP: I'm still waiting for EPRI to
14 come in and give us that information.
15 CHAIRMAN STETKAR: J.S. identify yourself.
16 Just to make sure.
17 MR. HYSLOP: This is J.S. Hyslop. I guess
18 this is a project that is ongoing with industry and
19 industry really has the ability to collect that and not
20 NRC. You know we recognize the situation.
21 MR. FINE: Yes, but I am saying is it is the
22 process we have and we are starting already with a flawed
23 assumption. And a lot of us recognized this years ago
24 but by then it was already a NUREG. So, --
25 CHAIRMAN STETKAR: In some sense, some of

1 that two-stage Bayesian stuff that I was talking about,
2 though, would help you in that area.
3 MR. FINE: Oh, yes.
4 CHAIRMAN STETKAR: Because despite the
5 plant-level stuff, if you have got a plant over here with
6 three times the amount of equipment, you would
7 construct, theoretically, the fire frequency would be
8 three times as high.
9 That isn't always the case, unfortunately,
10 because obviously it depends on housekeeping and
11 maintenance practices and all that kind of stuff. But
12 that tends to help a little bit, given this constraint,
13 which is obviously --
14 MR. FINE: Yes, the point I am trying to make
15 is not specifically this point but then let's go to the
16 next thing and the next thing.
17 CHAIRMAN STETKAR: I understand.
18 MR. FINE: And that is the point I am trying
19 to make.
20 So, another point of ignition frequencies
21 is the control of transient combustibles. The NRC has
22 made a big push for the utilities to control the
23 transients. But because it is an administrative
24 control and can be violated, we get limited credit. At
25 my plants, we knew this was a potentially challenging

1 issue. So, as part of 6850, we developed these really
2 nice databases and actually filed permits, transient
3 combustible permits. And fire impairments are all
4 controlled through this database. It is all currently
5 programmed for Appendix R rules but when 805 goes into
6 effect, it will be programmed for the 805 rules.
7 You cannot get a permit on a protected
8 train. You know all the rooms that are combustible
9 exclusionaries, you cannot get a permit to go into those
10 areas.
11 So for us, it is almost an act of commission
12 now to violate these things because there are signs on
13 the doors, you have got a permit. And to the extent when
14 805 goes into effect, it is actually going to have, this
15 is where you can walk and where you can put your stuff
16 map, just like an HP map would have for radiation areas.
17 And so it is going to be very controlled and
18 it is not going to be like they are not informed. So,
19 why can't I take credit for that? If it is zero because
20 I have made it zero, it should be zero.
21 (Simultaneous speaking.)
22 MEMBER BLEY: If it is not zero, then
23 violations of tech specs are not zero everywhere else.
24 MR. FINE: Well, right but it would be dealt
25 with in that way. It will be dealt with in the

1 significance determination process or whatever. But if
2 that violation would be treated like it should be instead
3 of I am going to label it into this model early the
4 conservatism. So, let's regulate the output not the
5 input.
6 So, we say we can justify reduced
7 frequencies but that is hard to do because if I go into
8 like a cabinet, like you mentioned, I can go look in that
9 cabinet, I can see what is in there and I can calculate
10 exactly what I think that release frequency would be.
11 But once I do that, now I have got to control to that
12 level. Okay?
13 So, from a station perspective, that is a
14 lot of work for design change or anything. It is easier
15 if I were to say no, it is bounded by a certain value.
16 Okay? And then I can allow things to happen a lot easier.
17 I don't have so much maintenance and care and feeding
18 that I have to do to this thing to make sure that there
19 is no impact.
20 So when you say the industry doesn't want
21 to go do it, well, there is a reason. The amount of work
22 that goes into controlling that level of detail of every
23 cabinet in the plant is daunting.
24 MEMBER BLEY: I want to roll you back a
25 couple of slides but don't go back on the slides.

1 You probably can't tell me this. You said
2 you are up to $25 million on that.
3 MR. FINE: Right.
4 MEMBER BLEY: If in fact you were starting
5 now and the freeze were in place, instead of $25 million,
6 what do you think it would have been? Do you have any
7 idea?
8 MR. FINE: Probably more into the tens, I
9 am guessing. One of my --
10 MEMBER BLEY: Up to a two to three kind of
11 thing?
12 MR. FINE: Yes, at my Beaver Valley units,
13 I would say probably in the ten ballpark, given it is
14 a RISKMAN and it is difficult to model fire in RISKMAN.
15 In the Davis-Besse plant, knowing what we
16 know now with methods and so forth and FRANKS, all this
17 cool software and tools we have, you could do it quite
18 a bit better, probably somewhere in the five to seven
19 range. But you have to also understand at Davis-Besse,
20 we would have stopped at the same place, knowing the mode
21 that we had to do there. So, we could have just gotten
22 a fast train cleaner.
23 So, it is still expensive. But a plant like
24 Perry, I would say minimum five, even though I know that
25 is a really well-separated plant and really well

1 designed. It is the process itself.

2 And I would still stop it 3 to 5E minus 5

3 and then my money would stop because they are not going

4 to let me sharpen my pencil anymore after that, even

5 though I clearly would have margin in that plant to do

6 that.

7 We are guessing here, so it is not an

8 official --

9 MEMBER BLEY: No. Understood.

10 MR. FINE: But we still see large

11 contributions from cable spreading rooms and so forth

12 that don't make sense in our model because of transient

13 combustibles. And so that is some of the -- and then

14 like I said, it keeps compounding.

15 So, here is a sensitivity study that shows

16 one of the improvements that we have made. We have seen

17 one of our iterations updating to the new EPRI fire

18 frequencies, ignition frequencies, we have dropped CDF

19 at these three plants by this much. Well, that's good.

20 That is real and we can use it. Okay?

21 And so, I don't want to say what we are doing

22 isn't benefitting us, it is. It is just from this point

23 forward, I am not going to be able to do this iteration

24 game anymore. Next slide.

25 Here is an example. And again, it is a

1 sensitivity study, and I understand it is an extreme
2 sensitivity study, but what if I could reduce that
3 another ten percent? If you notice across the bins, it
4 is not linear. And based on the number of plant you know,
5 the component count, which is the CDF change, again,
6 nonlinear. Okay?
7 But if I were to increase it by ten percent,
8 it would be the opposite direction. So, for other
9 sensitivity studies I am showing you and you say well,
10 I am really trying to make it better. But if I made it
11 worse, it would just be the opposite because at that
12 point it is linear.
13 So, where I am going here is the point is
14 the change in the bins in the component count. And it
15 is complex. And you can see one changes doesn't affect
16 all bins proportionately. So, no one singular fix fixes
17 everything that I have a problem with. Fixing one silo
18 or two silos doesn't fix my problem because I may have
19 had a different type of conservatism at a different step
20 along the way for pumps that I had for valves. Okay?
21 So, it is not simple by any stretch.
22 Likelihood analysis. The utility
23 appreciates the efforts in the continued testing the
24 unpreached spurious event probabilities but we feel more
25 needs to be done. By making the utility use a starting

1 spurious event probability of 0.2, means to us that there
2 has been 377 spurious operations in the 1,885 fires
3 reported to date. And that number seems overly
4 conservative and to indicative of current OE, which says
5 that number is somewhere in the ballpark of 1E minus 4.
6 And this is an estimation. EPRI is actually doing the
7 math and they will actually report what the real number
8 is going to be. But this is our quick back of the
9 envelope calculation.
10 So, in the run, the updated circuit analysis
11 guidance can help our units reduce CDF in order to take
12 credit for things like duration factor. Thermal
13 hydraulic analysis now has to be done to find out what
14 the actual timing is. And then just more complexity
15 keeps being added to the list. And, therefore, you look
16 at the typical staff of PRA guys because we do a lot of
17 the work in-house but we also have vendors helping us
18 but all my guys are capable of doing what the vendors
19 did.
20 This is very time consuming and very
21 involved. And training guys to be able to do all this
22 takes years. And it is incredibly expensive and
23 difficult. And that leads to other things I am going
24 to be talking about.
25 So, I have an example on the next slide. So,

1 when you look at likelihood analysis, you go after
2 significant spurious operation. The spurious events of
3 a PROV can reduce CDF. By estimating the PORV can
4 withstand the spurious opening for a limited amount of
5 time, say three to five minutes, I can get a reduction
6 factor say 0.1. Then, I can reduce CDF by between 6 and
7 25 percent.
8 Again, though, it depends on the plant what
9 thing benefitted me the most. So, even though at Plant
10 C, it gave me nothing, Plant A it was huge. Again, we
11 have to be careful of the silos and how they compound
12 and where we are going.
13 So, we think 7150 will be helpful in this
14 area but it is not so helpful with Unit C and we need
15 a more holistic approach.
16 MEMBER BLEY: Back up to that one for a
17 second.
18 MR. FINE: Sure.
19 MEMBER BLEY: My take on it is it is helpful
20 everywhere because it is giving us a better
21 characterization.
22 MR. FINE: Yes.
23 MEMBER BLEY: It bought you a lot more than
24 another plant because of characteristics of that plant.
25 MR. FINE: Right. But if I am going to put

1 this in and say I am only Plant C and 7150 when I put
2 it throughout my model only buys me six percent, am I
3 going to go update my model with that? Am I going to
4 go spend the money to do that versus Plant A, where it
5 clearly is going to help me? That is why I am saying
6 it is a game that you have to play.
7 MEMBER SCHULTZ: Well, in order to use your
8 model appropriately, you would say yes, you would do it
9 for all three.
10 MR. FINE: Well yes, in a perfect world, I
11 would say I want it all, I want to improve everything.
12 MEMBER SCHULTZ: Well it depends what your
13 goal is. If you goal is to use it to make decisions,
14 then you would have to implement it in each case.
15 MEMBER BLEY: But if you were going to put
16 in a $20 million piece of equipment or a $200, it would
17 be worthwhile in all three cases.
18 MEMBER SCHULTZ: That's right.
19 MR. FINE: It helps to know. And I would
20 do a sensitivity study if this was, in particular, a
21 PORV mod, say they are going to do a PORV mod, then I
22 am going to say well, I need to do this before I am going
23 to give you answer on your PORV mod because it matters.
24 And like I say, in this case it would matter
25 but, again, the point is not all fixes fix all things

1 equally. And that is why I am saying you need to fix
2 more than just the few things we need to fix the overall
3 because we still haven't addressed the cumulative issue
4 yet.
5 MEMBER BLEY: Now, I don't want you to
6 answer this but the question I would put before that
7 amorphous industry we have talked about, Harold, and
8 before, say they are going to amorphous NRC because it
9 has got various pieces and groups in it --
10 MEMBER RAY: Do you mean amorphous or
11 diverse?
12 MEMBER BLEY: Yes, diverse is better. How
13 did we get in this spot? And I think all of us see a
14 lot of pieces. Well, one reason was it went too fast.
15 One of the reasons it went too fast was it didn't start
16 early enough. So, there is plenty of this, that, and
17 the other thing.
18 But if this is going to come up again, which
19 it is, how do we, as a whole group, deal with this in
20 a way that we don't get ourselves in the same box again?
21 Because we would have saved a whole lot of money, we would
22 have done better work and we would have done better mods,
23 I guess, if we had done it in a more orderly fashion and
24 gone this way.
25 I don't want you guys to answer that. I just

1 putting that out as something all sides need to work at.
2 MS. ANDERSON: I can justify the answer.
3 We have, the industry and NRC have a cooperative
4 risk-informed steering committee. It has a very high
5 level of management engagement. And one of the major
6 objectives when we chartered that group was to make sure
7 that we take the lessons learned from NFPA to apply them
8 moving forward with risk-informed regulation.
9 And so I think a lot of the things that you
10 have heard about today, like the freeze point concept
11 can be applied to other risk-informed applications and
12 other initiators.
13 MEMBER BLEY: But it wouldn't have made
14 sense to freeze this one, back when it would have helped
15 Ray so much because the methodology wasn't worked out.
16 CHAIRMAN STETKAR: What Dennis is saying is
17 who is taking the lead on doing the first full scope
18 seismic PRA. And it better be started a year ago.
19 MR. FINE: I'm practically done.
20 CHAIRMAN STETKAR: I mean honestly, --
21 MR. FINE: Yes, I am done with --
22 CHAIRMAN STETKAR: -- that industry should
23 have learned.
24 MR. FINE: Yes, I am done with Davis-Besse.
25 I am going to be peer reviewing Perry next month. And

1 I will be peer reviewing Beaver 1 and 2 in December.
2 CHAIRMAN STETKAR: Okay.
3 MR. FINE: And it is moving quite well. And
4 I think they are doing everything, the number of findings
5 I have got have been quite minimal, which means it is
6 a good industry template because we have been very robust
7 in how we have done everything and we have done a lot
8 of interfacing with EPRI and our peers like Vogtle and
9 Southern and so forth. And we are doing it right but
10 we are also, even though we have EPRI guidance, we also
11 know that EPRI guidance needs to be updated. And so we
12 are improving methods and so forth as we go with EPRI
13 capturing as they go. And we don't have interference
14 in that development.
15 So, and I think we are ending up with a good
16 product that has the right insights and the right
17 answers.
18 CHAIRMAN STETKAR: That's good to hear.
19 MR. LEWIS: John, this is Stuart Lewis at
20 EPRI. Ray was also very active in labor of doing this.
21 We have what we call our first movers effort underway
22 where the PRAs and his are very much in the lead that
23 are already underway, are sharing their insights,
24 sharing their trouble spots, so that we can resolve those
25 before the next batch of PRAs can start.

1 In lieu of having a full-blown pilot all the
2 way through the process where we can make sure everything
3 is firmly in place to start the next batch, which is not
4 consistent with the NRC's schedule for Interim Task
5 Force recommendation 2.1. This is the next best thing
6 that we came up. What we haven't piloted is the
7 interaction with the NRC back to see what they will find
8 adequate or lacking in those PRAs.
9 CHAIRMAN STETKAR: And two things you just
10 said gave me pause because I was happy to hear what Ray
11 was saying but maybe not so much now but at risk of going
12 too far afield but it is important. One is what did you
13 say about lack of doing a full-blown pilot because of
14 the schedule pressures?
15 Because that is one of the lessons learned
16 here.
17 MR. FINE: Right. Again, we had commitment
18 requirements that we had to move forward, regardless of
19 the fact that we didn't have pilots.
20 CHAIRMAN STETKAR: Which is why we are
21 where we are with 6850. We haven't learned that lesson.
22 MR. FINE: Well, I learned it quite good at
23 FirstEnergy. So, I have been doing a lot in seismic to
24 make sure the best I can, I mean I have no control over
25 the staff, but I have done the best I can to make sure

1 we don't have another system failure.

2 CHAIRMAN STETKAR: And that second part,

3 that is the second thing Stuart mentioned and you just

4 mentioned is the common knowledge and expectation

5 between industry and the staff of what it is that ought

6 to be done, which clearly was missing and we are still

7 sort of working it out here. But that has yet to happen

8 in the seismic area.

9 MR. FINE: Right. And I think once we get

10 a little bit further down the road, I mean I am pretty

11 sure the way we are doing our plants, I think the NRC

12 would appreciate. I think they would like what we have

13 done.

14 CHAIRMAN STETKAR: Boy, will you be shocked

15 if there is a surprise.

16 MR. FINE: I would be shocked --

17 CHAIRMAN STETKAR: But honestly, that is

18 the concern.

19 MEMBER SCHULTZ: I know that Oconee would

20 have made the same comment many years ago.

21 CHAIRMAN STETKAR: Right.

22 MR. FINE: Right. Like one of the things,

23 you know the ground measure response factor that EPRI

24 developed, which is what we developed for our seismic

25 PRA, our seismic GMRS matched what the NRC did for the

1 most part.

2 So, you are in a lot of agreement in a lot

3 of the inputs. And the methods like the structural

4 stuff, I know we are getting way off the topic here --

5 CHAIRMAN STETKAR: Yes, I was going to say

6 we ought to get back on fire.

7 MEMBER BLEY: That is part of why I didn't

8 want you guys to respond. I am glad to have heard this.

9 I wish you could close that other part of

10 it.

11 MR. LEWIS: I think everybody would feel

12 better if we did.

13 CHAIRMAN STETKAR: Victoria, when you come

14 up, were you going to address some of the risk-informed?

15 MS. ANDERSON: The Risk-informed Steering

16 Committee Activities? Yes.

17 CHAIRMAN STETKAR: Okay, good. Thank you.

18 MR. FINE: All right, let me get back to what

19 we were talking about.

20 So, if you took the ignition frequency and

21 the circuit failure mode likelihood analysis and you

22 were to put them together, you can see how it compounds

23 on the improvement that you can get, which is pretty much

24 normal in here. It is an effect which reflects how the

25 same affect goes on with the deterministic

1 conservatisms.

2 So, I think we have a comment.

3 MR. DINSMORE: Yes, hi. This is Steve

4 Dinsmore from the staff. Is this on?

5 CHAIRMAN STETKAR: Yes, it is.

6 MR. DINSMORE: I guess I am just a little

7 curious. You had up there the spurious circuit

8 probability. But that probability is when you get a big

9 fire. So, maybe the problem isn't with the spurious

10 circuit probabilities, it is with the heat release

11 rates.

12 So, I guess you can't forward each one and

13 then say we are happy. You have to figure out which one

14 is driving it. So, when you just put them all together

15 and multiply them, you get a big number.

16 MR. FINE: But see you just said the issue

17 that I say is a problem. We have put everything in these

18 little silos and we are fixing them like that and we

19 haven't addressed the integration of those.

20 MR. DINSMORE: But the condition of the

21 probability of a spurious operation depends on the size

22 of the fire.

23 MR. FINE: Right.

24 MR. DINSMORE: So, maybe it is not that, it

25 is the size of the fire that is causing the problem. So,

1 I am not sure that --

2 MR. FINE: Well, I can have my guys who

3 actually ran the sensitivity tell you the answer, if you

4 don't mind.

5 MR. DINSMORE: Well, I know the numbers the

6 come out. I believe your numbers. It is just that the

7 way you are multiplying them, I am not sure is correct.

8 MR. RUSHER: This is Nick Rusher from

9 FENOC. But it is not just a multiplication of the

10 ignition frequency change times the spurious event

11 change. They were two kind of separate sensitivities.

12 So, what we ran first was taking the EPRI

13 frequencies off of the 68 frequencies, in addition to

14 also modifying the spurious event probability and EPRI

15 gives you the 50 percent reduction.

16 Now your point of the fire size is what

17 determines what has failed and what causes that spurious

18 event. I agree with you. And so when we look at the

19 heat release rates and we find that this damaging fire

20 did cause a spurious event and was a single break MOV

21 type of failure, then you can use your duration

22 probabilities and look at okay, after five minutes or

23 so, this spurious event clears, the PORV resets and so

24 that is how we got the 0.1 factor.

25 So, we took into account the circuit

1 parameters.

2 CHAIRMAN STETKAR: Okay, we are getting a

3 little bit into the detail compared to what we in the

4 ACRS subcommittee can help -- understand or help.

5 MR. FINE: Yes, so the next one is heat

6 release rates. And the new heat release rate, and some

7 of this we have already discussed about whether or not

8 it is 75th percentile, the 98th percentile burn. You

9 can actually go and look at the detail of the cabinet.

10 You know we have gone back and forth. And I think this

11 particular issue we have talked about.

12 But one of my issues is that when you use

13 a 98th percentile conservatism and then you compound it

14 with other conservatisms, it ends up looking like the

15 candle that burns twice as bright burns twice as long.

16 And that just defies physics.

17 So, I have a hard time when my guys showed

18 me some of these scenarios and I was like how is that

19 even possible. And then they explain to me and I shake

20 my head.

21 So another good example of an unbalanced

22 methodology pertains to the cabinet heat release rates

23 and we are working on that. The test measures heat

24 release rates could not manage to get a cabinet fully

25 engulfed without putting a source in that cabinet to get

it engulf. So, are we modeling realism or are we modeling some false positive? And so that has me a little bit worried, even though it didn't have energy to the fire, the fact remains that the cabinet fire would not have gotten to the size that was postulated without it.

And so this is where I am going to say we have spent over $50 million in eight years developing 20,000 pages of documentation and an absolute monster of a model to maintain or three models to maintain. And just to go back and review heat release rates will be significant. It is almost a start over because your cone of influence and everything changes.

So, again, we are talking critical mass and it is not a simple thing to just fix one or two things.

So, second to the last slide or so. We have got the CDF contributions. Now, the Plant A pie size is not the same as Plant B and C pie size. However, B and C are equal. Okay? And B and C are a plant that has all external events model, though not all of them meet Reg Guide 1.200. But I can say that when we updated internal flooding, seismic, and other external hazards, all the CDFs went down. Okay? And LERFs went down. Fire did not.

So, but I would expect it to go up because

1 it is a more detailed analysis by far, I didn't expect
2 this.
3 So, where we are going with this is, this
4 is the model I will have to use in a significance
5 determination. This is the model I will have to use in
6 4b, 5b, 50.69. Is this model telling me the right thing?
7 Am I giving management the right performance indicator,
8 so to speak, of their plant? Because they will work to
9 this indicator. Okay? And that is what has me a little
10 bothered is I am telling them fire is, by far, the most
11 important thing with regard to nuclear safety, period.
12 And I have a hard time believing that message myself.
13 I know it is important but is it that important?
14 And so when we talk to management and these
15 things and we have already kind of talked about the VPs
16 and they say yes, these mods have been a safety benefit.
17 Well, they have seen a reduction in this chart, due to
18 those modifications. Are they seeing a safety benefit
19 with a false positive? And that also has me a little
20 worried because we are saying here is this information.
21 I have seen it in A4 and other risk-informed applications
22 where we have used deterministic methods in a sense, you
23 know multiplier methods to accept thresholds -- 30 days,
24 even though it is only out for one hour, just because
25 I want to bound it and I don't want to have any issues.

1 So, I am going to make it simple and I am going to put
2 this bounding value out there.
3 Well, now they are looking to a false
4 positive, much like here. I don't know how big this
5 false positive is but I know it is a false positive. So,
6 I am going to manage my indicators. So, I get the yellow
7 risk and what we were indicating is your plant for
8 managing A4, you are going to take associated
9 compensatory action. Well then, they are going to focus
10 their compensatory action here.
11 Then, I go and look at something like the
12 significance determination process. I know I have a lot
13 of conservatism here. Now, if I am in a fire SDP, I am
14 kind of locked in. This is the model I am going to have
15 to use.
16 But if I am not in a fire SDP but this is
17 dominating the SDP, does it make sense that this is going
18 to throw me into a finding when I know that is overly
19 conservative?
20 Those are things that bother me, as an
21 analyst looking at this stuff. Because I am an
22 applications guy. I have done 4b, 5b, 50.69 and all
23 those in my previous positions. And I look at this and
24 I am like this is troublesome. And then I am going to
25 go and do all these changes to my plant. And then later

I am going to back off. The same thing happened to us at South Texas when we had some issues with the plant. CDF shifted by 30 percent in the middle of the 50.69 process. The pie just turned on its head. A whole bunch of components came in. A whole bunch of components came out. Everybody went nuts. And then the next model update because we fixed it, that data disappears and boom, we are right back where we were again.

And so, it is liken to that. And that is where I see these false positive information hitting or indicated as telling me and telling my station to do a thing that I have a hard time justifying.

And so the VPs understand that. And they understand that the issue lies in the methods. Initially, they thought it was all PRA's fault. Now they understand where the issue is and they are not really blaming me. I am just the messenger. But that is the issue I have now is they are kind of losing faith. I am gaining back a little bit of faith, hopefully with seismic but we will find out if I actually gained it back or not.

But it is a problem. Okay? Let's see if anything else -- yes, that is it for that one.

So, this goes back to one of the very first slides you saw. We were asking are the pie sizes the

1 same. And the answer is yes, the pie sizes are the same.
2 These are my two plants.
3 And so I know like from IPEEE to today, you
4 will note these proportions don't show that. I know the
5 model answers now because I have got the answers now
6 versus a few weeks ago. Seismic went down, all these
7 others went down, but fire grew. And so that is the point
8 of that story.
9 MEMBER SCHULTZ: So by that statement, you
10 are saying that from the unit the IPEEE to the Unit the
11 6850, the size of the pie is the same.
12 MR. FINE: No.
13 MEMBER SCHULTZ: No?
14 MR. FINE: No, the IPEEE pies between the
15 two units are the same and the 6850 pies are the same.
16 But I have made a lot of improvements in the plants, total
17 CDFs so that they are actually lower than they were back
18 in IPEEE.
19 MEMBER SCHULTZ: Total CDFs? Total.
20 MR. FINE: Yes.
21 MEMBER BLEY: Even with the fire?
22 MR. FINE: No, if I looked at internal
23 events only then I went down.
24 MEMBER SCHULTZ: Right, I understand that.
25 MR. FINE: From IPEEE down, I have

1 improved. But fire blew that out of the water.
2 MEMBER SCHULTZ: Okay.
3 MEMBER BLEY: Overall, your core damage
4 frequency was up.
5 MR. FINE: Went way up, yes.
6 MEMBER SCHULTZ: Because of rate of fire
7 event.
8 MR. FINE: Right. So, all the improvements
9 I have made, PRA technically had been washed away,
10 basically, with this model.
11 The summary is the same one you have heard
12 from everybody else. We believe the methodology is
13 conservative and deterministic and strays away from PRA
14 regulatory framework to be as realistic as possible best
15 estimate, in accordance with 1.174.
16 And these conservatisms provide extra work
17 and to become as realistic as possible. But even then,
18 the risk is overstated and the big value mode we show
19 is an example of that. And more information provided
20 in 6850, we don't believe, in all cases, matches OE. And
21 I know we are working towards that but it is what is
22 driving a lot of this uncertainty. I should say
23 uncertainty is driving this result that we don't like
24 too much, we don't think is right.
25 So, we appreciate the effort NRR and EPRI

1 and everyone is doing. We think there is more work to
2 be done and we think that a more holistic approach needs
3 to be developed, instead of trying to patchwork and fix
4 and cajole what the current method is, we need to think
5 outside that box a little bit and look at is there a better
6 way to approach this, still capturing what we have
7 learned in a more clean way.
8 And so that is my challenge not only to the
9 NRC but also to the industry. We have got to find a
10 better way to do this.
11 So, I would like us to take a second look
12 at the method of building fire scenarios and come up with
13 a better method.
14 That's it.
15 MR. GIITTER: This is Joe Giitter. I just
16 wanted to make a couple of observations. One of the
17 senior VPs at FENOC had approached Dan Dorman and myself
18 concerning the cost of implementing NFPA 805 at Beaver
19 Valley and we took that to heart. And Dan and I went
20 up to the site. We met with the staff. And I think this
21 is relevant and that is why I am interfering here but
22 I think it is important.
23 One of the things that we noted was that a
24 substantial fraction of the total cost was actually in
25 reconstituting the Appendix R licensing basis for both

1 units.

2 And another point was that because the

3 Beaver Valley units are so different, even though they

4 were supposed to be identical they were built in such

5 a different time period, that they actually had to do

6 two fire PRAs for Beaver Valley. So, I think it is

7 important when you look at the total cost of NFPA 805,

8 that you do it relative to what the Appendix R compliance

9 cost would be. That is the true cost. And I think

10 sometimes it is easy to lose that perspective.

11 The other thing I will point out is we took

12 a tour of the plant. And one of the things that kind

13 of jumped out at us was there was an area of the plant

14 where there was a significant risk contributor as a

15 result of fire. And I won't go into detail now but when

16 the staff was doing the review, they also noticed that

17 and we sent staff up there to take a look at it. But

18 it was a situation where you have a transformer and right

19 above that, a cable tray, and not more than maybe 20 feet

20 away they were going to check out a panel. And what was

21 interesting about that was even though this was a highly

22 risk-significant area of the plant, they were still

23 Appendix R compliant because it didn't affect the other

24 train.

25 So, that was one of the big insights we have

1 seen, and I mentioned this before, from the NFPA 805
2 reviews is that I think that one of the real values in
3 doing the Fire PRA is it gives you insights that you
4 wouldn't have otherwise, taking a strictly
5 deterministic approach.
6 MEMBER RAY: Well, tell me why, then, if it
7 is a large part of the cost is reconstituting Appendix
8 R licensing basis, why that isn't something that is
9 enforced so that it becomes a cost deterministic
10 approach? Why are we in a situation in which people
11 don't know, neither we nor the licensee, what is the
12 Appendix R requirement? Do you have any idea?
13 MR. GIITTER: That is a very good question
14 and I don't have a good answer for it.
15 CHAIRMAN STETKAR: I think, Harold, and I
16 am speaking only from stuff that I have sort of heard,
17 is I have heard from some of the plants who have decided
18 to not go the NFPA 805 route. They tend to be newer
19 plants and they have much better documentation in their
20 Appendix R requirement. They know where the cables are.
21 MEMBER RAY: Well, sure.
22 CHAIRMAN STETKAR: They are better
23 compartmentalized, that sort of thing.
24 MEMBER RAY: That is, naturally, the case
25 but I am just uncomfortable with the observation that

1 well, the only way we can get people to understand what
2 the licensing basis is, is to update in NFPA 805. But
3 otherwise, there isn't anything we can do. That
4 shouldn't be the case.
5 CHAIRMAN STETKAR: Well, in some sense,
6 though, I think that is what prompted the time schedule
7 for why we are here, is that the Commission finally said
8 we are going to do away with the exemptions on fire
9 analysis. Either comply to your deterministic
10 licensing basis and do whatever needs to be done or go
11 the risk-informed route and we are going to give up on
12 the 20 years of exceptions.
13 MEMBER RAY: That's fine. If in fact that
14 is what is happening.
15 CHAIRMAN STETKAR: I mean honestly, I think
16 -- Joe, you can correct me.
17 MR. GIITTER: That is exactly right.
18 CHAIRMAN STETKAR: That is what started the
19 time clocks.
20 MR. FINE: And I think what made this doubly
21 difficult, it is not like other processes where we said
22 oh, let's risk-inform Appendix R. That would have been
23 a lot more straightforward than let's go to a whole new
24 fire code and let's confirm that. It is a whole other
25 animal.

1 So, I don't think people were ready for the
2 big fundamental leap that we just took.
3 MEMBER RAY: So, the point is, a part of this
4 expenditure that we have been talking about, presumably,
5 would have to be made if you took the other path back.
6 CHAIRMAN STETKAR: You need to know where
7 your cables are, you know for example.
8 MEMBER RAY: But you do have to take one of
9 the paths is my point.
10 CHAIRMAN STETKAR: Yes, you are not allowed
11 to say I am going to have a fire watch in my cable
12 spreading room because I don't comply anymore, despite
13 the fact that I don't know what cables are in there.
14 MR. FINE: Right but I do have this delta
15 that I have got to maintain now and that is part of
16 reconstituting everything.
17 MEMBER BLEY: So, you guys have put in a lot
18 of pain that might help new plants coming along.
19 MR. FINE: Well, new plants are built so
20 that this isn't really an issue for them. They are
21 designed like the newer plants like Perry and South Texas
22 and they are heavily separated, well-designed plants.
23 There was a fire code in place when they built them;
24 whereas, these old plants, there was no fire code when
25 the built them.

1 CHAIRMAN STETKAR: Anything more for Ray?
2 See, you didn't think you would have much to say.
3 MR. FINE: Oh, I always have something to
4 say. That's my problem.
5 (Laughter.)
6 CHAIRMAN STETKAR: Victoria?
7 MS. ANDERSON: Victoria Anderson with the
8 Nuclear Energy Institute. Ashely and I are
9 collectively going to be answering the question on what
10 on earth have you been up to in the past four years since
11 we came and talked about this.
12 So, I am going to start out with just a
13 little bit of background on how we got to our current
14 situation. I think we have established already today
15 that NFPA 805 and the modern-vintage Fire PRAs kind of
16 emerged hand-in-hand and that has created some problems.
17 They were kind of co-piloted. During that pilot
18 process, we noticed issues with both 805 and Fire PRA.
19 Even with the staggered transition schedule
20 that we started pursuing a couple of years ago, NFPA 805
21 has pushed for some accelerated application of the
22 modern-vintage Fire PRAs. So, rather than having some
23 time to step back from the pilots and do some of the major
24 rework that Ray referenced maybe we need to undertake,
25 instead of doing that, we have had to go piecemeal

1 because people have been too busy developing their
2 plant-specific Fire PRAs.
3 The degree of conservatism in the Fire PRAs
4 became even more apparent as we moved through the 805
5 transition effort, as we applied it to a more diverse
6 set of plants and had to use the CCA-15 methodology more
7 broadly.
8 Another key difference here is that the
9 pilots were able to use CCA-15 as a framework, which I
10 think is kind of how it was intended to be used. So,
11 it was a framework and they could integrate some plant
12 specific improvements to realism because the follow-on
13 plants haven't been able to do that.
14 Unfortunately, the staff got inundated with
15 several applications, even with the staggered approach.
16 And we don't have the luxury of supporting the intricate
17 reviews of all the methods and supporting the schedules
18 that we are all looking at.
19 MEMBER SCHULTZ: So the pilot plants, what
20 we are hearing is the pilot plants had the opportunity
21 to take the guidance and implement models that were felt
22 to be --
23 MS. ANDERSON: More realistic.
24 MEMBER SCHULTZ: More realistic, yes.
25 MS. ANDERSON: And more representative of

1 the plants.

2 MEMBER SCHULTZ: Yes, and they passed.

3 MS. ANDERSON: Right.

4 MEMBER SCHULTZ: And then I presume that

5 rather than industry following along and saying well,

6 those models worked; I am going to use the same models,

7 it became more broadly implemented. So, each applicant

8 wanted to --

9 MS. ANDERSON: They wanted to be

10 innovative.

11 MEMBER SCHULTZ: -- be more innovative than

12 the pilot plants.

13 MS. ANDERSON: Right.

14 MEMBER SCHULTZ: And that is when the staff

15 said we are going to have to clamp down here and do

16 something different.

17 MS. ANDERSON: I think, yes.

18 MEMBER SCHULTZ: And it was perhaps an

19 overreaction but it resulted in a very difficult

20 situation in terms of PRA implementation.

21 MEMBER BLEY: Well, correct me if I am wrong

22 but the first ones also kind of took the philosophy of

23 fixing everything that might be a potential problem.

24 So, they made an awful lot of mods, so that they had less

25 to analyze.

1 MS. ANDERSON: Right.

2 MEMBER BLEY: Which was a really different

3 approach than those since then.

4 MS. ANDERSON: Right and a lot of follow-on

5 plants are also looking at constructing Fire PRA models

6 that they want to use for other applications. So, it is

7 not just a matter of well, we will make mods and that

8 will fix the Fire PRA. They want to have something that

9 is relatively representative from the beginning.

10 CHAIRMAN STETKAR: Steve?

11 MR. DINSMORE: Yes, hi. This is Steve

12 Dinsmore from the staff. I would just like to say one

13 thing, that the pilots did take a lot of flexibilities.

14 Now while Harris was eventually approved but Oconee was

15 only approved because they had a large risk reduction

16 that we didn't approve all the methods. And maybe those

17 methods actually kind of continue to be used, which is

18 somewhat of a problem.

19 So anyway, yes, the pilots did a lot of

20 different things but it wasn't completely successful for

21 the pilot.

22 MS. ANDERSON: Right.

23 CHAIRMAN STETKAR: But again, I think

24 Dennis' point is you mentioned Oconee, they had a large

25 risk reduction. They got that, though by putting in

1 substantial capital-intensive hardware modifications.
2 And, therefore, they didn't face the need to challenge
3 a lot of the let's say more creative or more involved
4 modeling issues that the current plants are struggling
5 with.
6 It's just the way it is.
7 MS. ANDERSON: So, I think when we looked
8 at the current situation with NFPA 805, and Elliott
9 mentioned this earlier, there are two areas we need to
10 be looking at. The first is the 805 process, the
11 application process, getting the LAR through and getting
12 the SE issued. And the second is Fire PRA realism.
13 I think we have made a lot of improvements
14 with the 805 processes and some of those have been
15 discussed today the new LAR that processors seeing, many
16 fewer RAIs and the ones that we do see are better focused,
17 in general.
18 So, we have seen a lot of process
19 improvements for 805 and we are still struggling with
20 Fire PRA realism.
21 As far as the 805 process improvements, I
22 think we have discussed almost all of these already, so
23 I will go through these pretty quickly.
24 The NRC initiated a few that I think we
25 really appreciate. As we mentioned, the new LAR audit

1 process, which has resulted in more focused reviews,
2 more focused RAIs which are more site-specific and that
3 makes a much better use of NRC and industry resources.
4 And there is also the NFPA 805 FAQ process
5 that has allowed for generic resolution of 805-related
6 issues, both application related and more recently some
7 implementation related items that I think are going to
8 pay dividends to a lot of plants really soon.
9 Some industry-initiated ones, we have an
10 NFPA 805 task force that meets regularly to address
11 emerging issues so that we can try to address them
12 proactively. We have continually revised the LAR
13 template to support incorporation of lessons learned.
14 And I think as the NRC staff noted this morning, they
15 have seen an improvement in the quality of the LARs
16 because we have taken lessons learned from the leading
17 plants.
18 And we have been hosting internal
19 transition workshops to support consistent
20 implementation throughout the fleet.
21 For Fire PRA realism improvement efforts,
22 we talked about the review panels before and what was
23 mentioned was the review panels for the transient fires
24 and for the electrical heat release rates, the
25 electrical cabinet heat release rates. And the

1 question arose what exactly was this panel.

2 These were some EPRI-led review panels that

3 consisted of several industry efforts with relevant

4 expertise in the method being reviewed. There was some

5 NRC participation in some of the panels and they endorsed

6 several methods.

7 We found that this had an insufficient

8 regulatory footprint. So, the panel said these methods

9 are available for all of you to use with such and such

10 boundary conditions. Utilities started integrating

11 them and the NRC came in and said hold on, we don't accept

12 those for use in regulatory applications.

13 So, despite that, we did get a couple

14 through that the NRC accepted, pump oil fires and

15 transient fires. So, we did get some improvements

16 there. So, that sort of died out because we realized

17 we weren't going to have very much success there.

18 Early last year, we started a Fire PRA FAQ

19 process. This process has been successful in

20 clarifying some issues, which helped reduce the number

21 of RAIs that plants had to respond to and help give plants

22 some better regulatory certainty associated with their

23 Fire PRAs.

24 And the staff went over the specific FAQs

25 that have been wrapped up already this morning, so, I

1 am not going to repeat that.

2 CHAIRMAN STETKAR: Victoria, could you

3 help me on that? The FAQ process has been around since

4 2008.

5 MS. ANDERSON: That is the 805 FAQ process.

6 This is the Fire PRA FAQ process. Because presumably

7 Fire PRAs are going to be used for other applications.

8 So, we started a new process that deals with the Fire

9 PRA related documents. Procedurally, the 805 FAQ

10 process is supposed to be, it is supposed to involve

11 questions related to the regulatory guidance for 805.

12 So, Reg Guide 1.205 and the NEI documents that it

13 endorses.

14 If we are talking about a question related

15 to NUREG-6850, that doesn't really follow from the scope

16 of that. So, that is why we started to do Fire PRA FAQ

17 process.

18 MEMBER SCHULTZ: Is there some --

19 CHAIRMAN STETKAR: That subtlety is lost on

20 me but go on.

21 MEMBER SCHULTZ: Is the Fire PRA that we are

22 talking about here different from what was used in the

23 805 process? There are a number of licensees who are

24 doing Fire PRAs that aren't transitioning to NFPA 805.

25 MS. ANDERSON: Right.

1 MEMBER BLEY: Okay. And is that --
2 MEMBER SCHULTZ: So then there are
3 licensees then that have used Fire PRA to do the 805 and
4 they don't have a Fire PRA or they have two?
5 MR. GIITTER: No, there are fleets that are
6 doing Fire PRAs and they made decision not to transition
7 to NFPA 805. They are doing Fire PRAs to take advantage
8 of Risk-Informed Tech Spec 4b, 50.69, those type of
9 voluntary licensing initiatives.
10 But because they are not planning the
11 transition to NFPA 805, this Fire PRA FAQ process would
12 be one that would apply to their Fire PRAs. That is
13 realizing that there will be Fire PRAs.
14 MEMBER BLEY: So, this applies to both.
15 MS. ANDERSON: It applies to all Fire PRAs,
16 regardless of what application they are being used for.
17 MEMBER SCHULTZ: I'm still struggling with
18 the licensee that has done the 805 Fire PRA.
19 MS. ANDERSON: Well, don't think of it as
20 -- I think the problem is when we start thinking about
21 it as an 805 Fire PRA. It should just be a Fire PRA that
22 is used for 805 and that same licensee could also use
23 that Fire PRA for Risk-informed Tech Spec 4b.
24 MEMBER SCHULTZ: It would save five hours
25 of problems associated with the 805 Fire PRA. It is very

1 conservative. You can't use it for decisionmaking.
2 MS. ANDERSON: Right.
3 MEMBER SCHULTZ: So, it seem like there are
4 two different PRA approaches and that the licensee that
5 has utilized, gone through the 805 approach with a PRA
6 that they have implemented has got to start all over to
7 do a Fire PRA associated with other applications.
8 MS. ANDERSON: Right, I don't think anybody
9 is looking, and anybody can correct me if I am wrong.
10 I don't think anybody is looking at putting together two
11 Fire PRA models right now, although I think some people
12 have said in the past that if they had to be so
13 conservative for 805, they were contemplating putting
14 together a new model. But I don't think anybody is
15 actually going through with that.
16 MEMBER BLEY: Well, I'm confused,
17 Victoria. There was something in one that had FAQs in
18 it. There is another set of FAQs that people are using
19 who are doing PRAs because they have moved to 805. Most
20 of those FAQs that I have looked at have to do with PRA.
21 MS. ANDERSON: Right.
22 MEMBER BLEY: This that you are talking
23 about is also PRA --
24 MS. ANDERSON: Right.
25 MEMBER BLEY: -- but it is a separate list.

1 MS. ANDERSON: This is a separate -- this
2 is going forward because we didn't want it to be limited
3 to 805 plants.
4 MEMBER BLEY: Is this the FAQs that belongs
5 to NEI or to EPRI? Is NRC involved in this?
6 MS. ANDERSON: NRC is involved. So, it is
7 a newer process.
8 MEMBER BLEY: It is a joint list again.
9 MS. ANDERSON: Right, it is a joint
10 process.
11 MEMBER BLEY: But it is a third list now of
12 FAQs that are associated with PRA for fire.
13 MS. ANDERSON: I prefer to not think of it
14 as a third list because all the old 805 PRA-related FAQs
15 are now part of the supplement. So, now that is just
16 sort of part of 6850. So, this is just the process that
17 we are using going forward.
18 MEMBER BLEY: Go ahead.
19 MS. ANDERSON: Because that supplement
20 would apply to non-805 plants because it is part of
21 NUREG-6850.
22 MEMBER BLEY: Okay.
23 MS. ANDERSON: And Bob wants to make a
24 comment.
25 MR. RISHEL: Yes, this is Bob Rishel with

1 Duke Energy. Is this on?

2 MEMBER BLEY: Yes.

3 MR. RISHEL: Okay, so our understanding

4 with the staff is there is one way to meet the standard,

5 no matter what you are doing. And that is essentially

6 to follow 6850. But we did start this new Fire FAQ

7 process to sort of get the technical efforts restarted,

8 where it had fallen apart. And so it was felt, we talked

9 earlier, the regulatory footprint was insufficient.

10 So, we started this effort to reinforce that regulatory

11 footprint so that everybody is in agreement about what

12 is an acceptable method and is not, so we don't put things

13 in front of the staff that they are not going to reject

14 -- that they are going to reject and cause us to go back

15 and pull it out or withdraw the submittal or whatever.

16 MEMBER BLEY: Well, that makes sense. I am

17 going to ask one more question and then I hope we move

18 on.

19 There are FAQs associated with Supplement

20 1. There are FAQs since Supplement 1 was published. Is

21 there one list of FAQs since Supplement 1 was published

22 or is there more than one list?

23 MR. BARRETT: This Harry Barrett from the

24 staff. There is actually two FAQ processes. There is

25 one that was created for the 805 process that works with

1 the 805 Task Force with the NEI and there is a Fire PRA
2 FAQ process that works with the NEI PRA Task Force. Two
3 different groups of technical expertise that
4 participate in the FAQ process. They are somewhat
5 independent but they both use a similar process.
6 MEMBER BLEY: Are there any conflicts
7 between the two lists?
8 MR. BARRETT: No, there is no conflicts
9 between the two lists because you are dealing with
10 different topics.
11 CHAIRMAN STETKAR: Different topics?
12 MR. BARRETT: Yes. Primarily the fire
13 protection and safe shutdown aspects of 805. The other
14 one deals with the PRA aspects related to doing the Fire
15 PRA.
16 (Simultaneous speaking.)
17 MEMBER BLEY: John, would you make sure we
18 know what these are?
19 MR. HYSLOP: Basically, the whole list of
20 FAQs that have been built for Fire PRA are in Supplement
21 1 and in the table that Joe gave you early on about your
22 deviations from accepted methods. Those are all the
23 Fire PRA work that has been done in the FAQ process,
24 whether it is the new process, the old process, or
25 whatever, since the development of the original 6850 in

2005. So, you have your lists with those two documents or sheets.

MS. ANDERSON: Ashley suggested that I give an example of one of each so, just with open FAQs we have right now.

CHAIRMAN STETKAR: That would be good.

MS. ANDERSON: Okay. So, there is an 805 FAQ that we have on a post-transition change control. So, how you manage that.

CHAIRMAN STETKAR: That is great. I understand it.

MS. ANDERSON: That is on how you implemented 805.

CHAIRMAN STETKAR: I understand.

MS. ANDERSON: But that is 805. It doesn't really have to do with your Fire PRAs specifically. It is not in interpreting 6850.

On the other hand, we have an open Fire PRA FAQ on how you treat propagation of fires from well-sealed MCCs.

CHAIRMAN STETKAR: Okay.

MS. ANDERSON: And that has to do with Fire PRA. That is something that could affect you whether you are an 805 plant or not an 805 plant. And that deals with an interpretation of NUREG-6850, rather than an

1 interpretation of the NFPA 805 standard.

2 CHAIRMAN STETKAR: Okay.

3 MS. ANDERSON: Does that clarify it

4 slightly?

5 CHAIRMAN STETKAR: As long as the things

6 that you are calling NFPA 805 FAQs are programmatic in

7 nature and the other stuff that is technical in nature

8 is in the other box, I understand it.

9 MS. ANDERSON: Right.

10 CHAIRMAN STETKAR: If there are technical

11 issues in your NFPA 805 box, then I am confused but that

12 is okay.

13 MS. ANDERSON: Right. I mean that is

14 essentially how it breaks down but really the delineator

15 is what document are you asking a question about. Are

16 you asking a question about NUREG-6850? Because

17 NUREG-6850 is not part of NFPA 805 specifically. Or are

18 you asking a question about NFPA 805 and the associated

19 regulatory guide? So, that is the question.

20 Anyhow, we established this because we

21 wanted to be able to get the NRC Fire PRA technical

22 experts together with the industry technical experts in

23 a public forum. We are slightly limited because we can

24 only address interpretation of existing methods and not

25 really new methods. But this has helped us make some

1 advances and the staff noted those this morning.
2 CHAIRMAN STETKAR: Let me stop you there
3 because here is another source of -- you said we are
4 slightly limited, to make sure I understood what you
5 said, because we cannot look at new methods.
6 MS. ANDERSON: Right.
7 CHAIRMAN STETKAR: On the other hand,
8 somebody somewhere, I thought, was looking at new
9 methods.
10 MS. ANDERSON: Yes.
11 CHAIRMAN STETKAR: Who is doing that?
12 MS. ANDERSON: Oh, right. Next slide.
13 MEMBER SCHULTZ: We haven't caught up with
14 you on your last slide.
15 MS. ANDERSON: Okay, well, I can go back.
16 (Laughter.)
17 CHAIRMAN STETKAR: You know I'm not sure
18 whether they are playing baseball or football, much less
19 who the team -- who is pitching yet.
20 MS. ANDERSON: Right. The constraints on
21 the Fire PRA FAQ process are just that you can only deal
22 with interpretations of NUREG-6850. So, that is just
23 the bounds of it.
24 EPRI and NRC Research are working on a new
25 method work. So, we haven't left it for nobody to do.

1 CHAIRMAN STETKAR: And now we have three
2 players. We have the NFPA 805. So, if I have a question
3 about Reg Guide 1.205, I go talk to those people. If
4 I have got a question about heat release rates from
5 cabinets in terms of some table in NUREG/CR-6850, I go
6 talk to these other people. But if I have a new method
7 to figure out how to get those heat release rates, I
8 go talk to the third set of people. Right?
9 MS. ANDERSON: Right.
10 MS. LINDEMAN: That is correct.
11 CHAIRMAN STETKAR: Okay, I got it.
12 MS. ANDERSON: And this is the third set of
13 people.
14 CHAIRMAN STETKAR: It is on the record now.
15 Others in the public can listen to this.
16 I mean, honestly, does this make any sense?
17 MS. ANDERSON: Well, there is an extent to
18 which we are a little bit constrained because with the
19 new methods where we can't have a public process because
20 some of that data isn't publicly available. So, the
21 experts sort of have to meet in a non-public venue. So,
22 that is why that has to be separate.
23 And similarly in the 805 FAQ process, you
24 can't say I want to change NFPA 805. You have to go back
25 to the standards, you have to set out a new reg guide.

1 You can't say I want something new.

2 If you want an interpretation, then you can

3 go through the 805 FAQ process. So, this is analogous

4 to that. If you want an interpretation, the existing

5 guidance, you go through the Fire PRA FAQ process. If

6 you want something new, you have to go somewhere else.

7 So, the somewhere else is the EPRI-NRC

8 Research Methods Development Panel. And this allows

9 for development of new methods and does help make new

10 data available for use. We have a higher confidence in

11 the regulatory footprint because the NRC and the

12 industry are working together more closely and early on.

13 MEMBER BLEY: And this one has a memo of

14 understanding, that has got it all tied together?

15 MS. ANDERSON: Yes.

16 MS. LINDEMAN: This is Ashley Lindeman.

17 Also, the previous panel maybe had an unequal

18 representation between the staff and the industry. And

19 under this panel, the membership is equal. So, if the

20 NRC objects, more than one person would need to object.

21 CHAIRMAN STETKAR: Okay.

22 MS. ANDERSON: So, in addition to those

23 realism improvement efforts, we have some continuous

24 improvement methods. We have talked about the freeze

25 point concept several times already. This allows

1 licensees to freeze their PRA information supporting the
2 licensing application, so they can address the changes
3 in bulk, rather than individually. And as Ray noted,
4 that could really save licensees quite a bit of hassle
5 and money. It is a better use of everybody's resources.
6 And we are also looking into
7 post-transition integration of improved methods and
8 data.
9 So, moving forward, I think we have
10 established it is important to keep improving Fire PRA
11 realism. The more timely they are, the better they
12 support 805 transition but we need to keep an eye for
13 other applications on the horizon as well.
14 We should be leveraging the processes that
15 are already in place to help licensees incorporate
16 improvements. And it is important that we achieve
17 results that comport with operating experience.
18 And as I noted earlier, I was going to talk
19 a little bit about the Joint NRC-Industry Risk-Informed
20 Steering Committee. They have established an effort on
21 improving the approach we take to establishing PRA
22 technical adequacies. So, we are working on
23 streamlining the process of making methods for fire and
24 other initiators available for use in regulatory
25 applications and they are also very tuned in to just any

1 potential pitfalls to the viability future of
2 risk-informed regulation.
3 MEMBER SCHULTZ: Victoria, could you go
4 back to your first bullet on this slide? The timely
5 improvement better supports NFPA 805 transition.
6 Earlier you mentioned that it would seem that moving
7 forward and trying to gain improvements related to 6850
8 seems all but intractable. And so I am trying to
9 understand what improvements associated with PRA
10 realism, how that is going to help.
11 MS. ANDERSON: Well I mean there are still
12 several licensees that haven't finished their SEs yet
13 who would be able to incorporate some of this new
14 information. And while the Fire PRA FAQ process is a
15 little constrained, the work that Ashley is doing in
16 cooperation with her colleagues at NRC Research does not
17 have that constraint and they do have some pretty good
18 work that is going to be coming out shortly. So, and
19 she will be talking about that.
20 MEMBER SCHULTZ: So, it is more near term
21 than what you talked about with regard to the other model
22 improvement.
23 MS. ANDERSON: Well, the modeling
24 improvements that Ashely has been working on, I mean they
25 have been working for almost a year now.

1 MEMBER SCHULTZ: No, the ones that you had
2 discussed that there is a separate proprietary arena in
3 which NRC and the equal --
4 MS. ANDERSON: Well, that is the one that
5 Ashley is working with.
6 MEMBER SCHULTZ: Okay, I want to hear about
7 that.
8 MS. ANDERSON: All right. Well, we can
9 hear about that.
10 MEMBER SCHULTZ: I want to see how that is
11 going to fit into the NFPA 805 transition because I
12 haven't figured out how that is going to happen yet.
13 MS. ANDERSON: Okay. So, if there aren't
14 any other questions on this topic, we can move on to
15 Ashley.
16 MS. LINDEMAN: Okay. I am Ashley Lindeman
17 with EPRI. So today, we will just give a status on where
18 we have gone or where we have come since 2010, a little
19 bit of where we are now and then looking forward, what
20 value can we add to make Fire PRAs more realistic.
21 So, Fire PRA research is a major area focus
22 within EPRI. As you are well aware, EPRI is a co-author
23 of 6850. It has the EPRI number 1011989. I think as
24 demonstrated by the prior panelist, fire risk is an
25 important -- fire is an important contributor to risk.

1 And we are under the understanding that we still need
2 improvements to the methods, tools, and data to support
3 better decisionmaking and proper insights.
4 You know I think in the past four years we
5 have made slow incremental changes but we really haven't
6 made any transformational changes since the publication
7 of 6850. And what that means is we have had FAQs that
8 have helped a little bit. And we have gone and done a
9 lot of research in the area of HRA and circuit failure
10 but nothing to really transform how we do Fire PRAs.
11 And we believe improvements are needed so
12 that everyone believes the results and they are
13 meaningful and useful and lastly, make Fire PRAs more
14 manageable and efficient. I think as people mentioned,
15 they have anywhere between a 600 to 3,000 scenarios and
16 several databases and spreadsheets and it is difficult
17 to manage.
18 I am going to highlight three topics that
19 we have really, EPRI has been heavily involved with since
20 2010. And that is a --
21 CHAIRMAN STETKAR: I have to bring you back
22 to slide number three.
23 MS. LINDEMAN: Okay.
24 CHAIRMAN STETKAR: You skipped that one
25 pretty quickly.

1 MS. LINDEMAN: I did.

2 CHAIRMAN STETKAR: And we have heard all
3 day how conservative and how realistic these Fire PRAs
4 are and how the NRC staff is forcing the industry to use
5 the conservative and unrealistic and absurd numbers in
6 NUREG/CR-6850 and the methodologies. And yet here in
7 regulatory guidance, which is followed by the staff, as
8 industry is aware of it, it says you didn't have to do
9 that. You didn't have to use NUREG/CR-6850. It says
10 right here. This is a quote. I found it also. You
11 don't have to use NUREG/CR-6850. You, as an applicant,
12 can use more realistic better models and different data.
13 You don't have to justify it. I mean you just can't make
14 stuff up but you can use it. And you, the NRC staff have
15 to review those because it is a submittal and this is
16 your regulatory guidance. So, I don't get it.

17 MS. ANDERSON: Well, I think I can take a
18 shot at answering this. I think in a lot of cases
19 licensees found that they got RAIs that essentially
20 directed them to change their model and take out those
21 plant-specific analyses. I am looking at Bob in the
22 back. He is a licensee and he is nodding.

23 MR. DINSMORE: Yes, hi. This is --

24 CHAIRMAN STETKAR: Okay, this is
25 regulatory guidance. So, the staff is supposed to

1 accept those submittals and review them for technical
2 adequacy and get on with it.
3 MR. DINSMORE: Yes, this is Steve Dinsmore
4 from the staff. This is one of the reasons why the
5 reviews are taking so long because we do have to do that
6 and that is what we are doing. So, when they submit a
7 new method or a variation of an old method, we have to
8 go through it and we review it and as I was explaining
9 earlier, we discuss it with bunches of people inside the
10 NRC and we come to a decision as to whether they accept
11 it or not. Sometimes we accept them. Sometimes we
12 don't. But because of the time schedules of the LARs,
13 sometimes they will get an RAI response back or an RAI
14 saying we have reviewed what you did and we don't accept
15 it. So, either use acceptable guidance or try something
16 else.
17 MS. ANDERSON: And I think people observed
18 how often, how rare acceptance was and made the
19 calculated decision to not pursue individual --
20 CHAIRMAN STETKAR: You know and I
21 understand that but when you make that decision, you do
22 it at your own risk. So you ought not to complain about
23 the fact that your numbers are too conservative. You
24 could have done better. You could have decided to fight
25 the battle. You decided not to, period.

1 MS. ANDERSON: Well, I think a lot of
2 licensees did fight the battle, including one licensee
3 who wound up getting their LAR submittal rejected. And
4 people did continue to fight it. And what we heard from
5 the staff was we don't want to see new methods in your
6 LAR. We would rather try to resolve them generically,
7 which I think we agree is a more efficient use of
8 everybody's resources.
9 So, that is why we have moved to this, rather
10 than the individual licensees doing plant-specific
11 analyses.
12 MS. LINDEMAN: The purpose was to
13 potentially recognize the shortfalls in the development
14 of 6850 and recognize that more research is needed on
15 a generic basis for everyone.
16 Okay, you can go to the next slide.
17 So, I will start out talking about the EPRI
18 Fire events database. This was a multi-year project.
19 It started with our request to go and do a CR search for
20 fire, explosion, smoke and it resulted it about 300,000
21 entries. And those were screened by the owners' groups
22 and they were told to screen out non-fires. And then
23 those that remained went through another screening to
24 request the full CR so we can see if it was a probable
25 fire or not. And the sort of cascading approach went

until we had confidence that we had all the potential fires.

We didn't eliminate the database or the old events. So, the fire events database, the collection effort was to collect for 2000 to 2009, to enhance 1990 through 1999, and the data prior, which was 1968 to 1989 remains as an archived version within the current fire events database.

MEMBER BLEY: When was this -- is this database just recently finished or is --

MS. LINDEMAN: The database was published in July 2013.

MEMBER BLEY: In 2013.

MS. LINDEMAN: Yes.

MEMBER BLEY: And this is the one that went back to the plants and sought more detailed information?

MS. LINDEMAN: Yes.

MEMBER BLEY: And is that what the CRs are, plant reports?

MS. LINDEMAN: Yes.

MEMBER BLEY: I don't know what CR stands for.

MS. LINDEMAN: Oh, I'm sorry. A plant condition report.

MEMBER BLEY: Condition reports, yes,

1 okay. But those came straight from the plants.
2 MS. LINDEMAN: Yes.
3 MEMBER BLEY: So this is the one that went
4 back and tried to find as much data as you could find
5 over that time period.
6 MS. LINDEMAN: Yes, and we found the data
7 is much better. You know working with a prior database
8 entry may say there was a fire and an MCC. And now we
9 have a plant condition report and an algorithm that picks
10 out insights from the fire.
11 So, if you have a question --
12 MEMBER BLEY: Machines search CRs.
13 MS. LINDEMAN: Well, it went through a
14 screening. The algorithm was actually for fire
15 severity. But other insights were picked out. I'm not
16 sure if it was a person, I'm guessing it was, that picked
17 out insights. You know how far did collateral damage
18 occur.
19 MEMBER BLEY: Does anybody know?
20 MR. LEWIS: Yes, it was done by human
21 beings. First it was the owners' groups and then when
22 they whittled the number of interesting events down to
23 a certain number --
24 MEMBER BLEY: Not summer students or
25 something but by --

1 MR. LEWIS: No, no, by competent
2 individuals.
3 MS. LINDEMAN: So, I apologize. I came in
4 the middle of the project.
5 (Simultaneous speaking.)
6 CHAIRMAN STETKAR: In the past, things
7 suffered from that because people would do key words on
8 relay smoked replaced relay and that was a part. And
9 somebody who didn't understand what plants were about,
10 that got thrown into a switchgear because a relay must
11 be like a switchgear.
12 MR. LEWIS: But that is why it started with
13 such a large number of condition reports in the first
14 place was we wanted to make sure that we didn't ignore
15 something that might have been of at least peripheral
16 relevance to this process.
17 MEMBER BLEY: Now some event reports that
18 I go through, sometimes just say, as John said, relay
19 smoked replaced relay. Did these actually have more
20 stories so you could understand what happened?
21 MS. LINDEMAN: It does depend on the plant.
22 Some condition reports are very thorough and some are
23 just a few sentences. There is a category where if we
24 didn't have enough information, we call it undetermined.
25 And then we would either categorize it as we have

1 confidence -- we can't make a determination if it is not
2 challenging or potentially challenging. And that is one
3 area. And then we have enough information that it is
4 at least potentially challenging but we are not sure if
5 it is challenging. So, we are able to split the
6 undetermined category a little bit better than the prior
7 6850 database did.
8 MEMBER BALLINGER: But if it is a newer
9 plant, could you go back to the plant and get more
10 information?
11 MS. LINDEMAN: Yes, and along the way, we
12 have been requesting at different intervals based on how
13 big the bucket was to get the plant information in order
14 to properly code the events. Right now we are just
15 finishing up the fire ignition frequency project and we
16 went through it again. And in the process, we had to
17 go back to a few plants and request some additional
18 information in order to properly bin the fire for
19 frequency.
20 CHAIRMAN STETKAR: There were only a few
21 plants?
22 MS. LINDEMAN: You know so there is about
23 500 events in the frequencies and a couple that -- you
24 know if we couldn't tell --
25 CHAIRMAN STETKAR: I mean that is

1 interesting. Just based on my own experience, I have
2 always had to go back and talk to people, as many people
3 as I could to find out at a particular plant that I was
4 working on what the fires were. I couldn't just do it
5 by processing a piece of paper.
6 MS. LINDEMAN: Well usually we had pages of
7 documentation and that made it easier. And it was
8 definitely an improvement from the prior database.
9 That means we didn't have a reference or an easily
10 accessible reference but we have condition reports and
11 LERs and ENs and, in some pieces, root causes. So, we
12 are able to --
13 CHAIRMAN STETKAR: LERs?
14 (Simultaneous speaking.)
15 MEMBER BLEY: Number three up there to me
16 is the important thing. And if you could tell us a little
17 bit more about that one.
18 MS. LINDEMAN: Sure. And so as I
19 mentioned, the first bucket number one was really to get
20 data, as J.S. mentioned, from the last ten years of data.
21 But it also wanted to strengthen the data. As I
22 mentioned, the database to develop 6850 was through the
23 year 2000. So from 1990 to 1999, we went through those
24 events and requested additional information to
25 strengthen the information we had for those fire events.

1 MEMBER SCHULTZ: So, this is
2 representative of 20 years?
3 MS. LINDEMAN: Yes, so the last 20 years is
4 really comprehensive and the existing, the prior data
5 is used a little bit in the fire frequencies to inform
6 the distribution. But it is driven mostly by the last
7 10 or 20 years, depending on how many fire events
8 occurred in the last 10 years.
9 CHAIRMAN STETKAR: Say that again.
10 MS. LINDEMAN: So, if the bin was sparse,
11 so there was two and a half fire events or less, we looked
12 at the last 20 years of data.
13 CHAIRMAN STETKAR: Okay, how do I now have
14 a consistent estimate of fire frequencies?
15 MS. LINDEMAN: You know I think partly the
16 reason for that is there is a concern that the 1990s were
17 under reported.
18 CHAIRMAN STETKAR: No, no. Listen to what
19 I am asking first. If I now have different scopes of
20 my dataset because if you had sparsity, you said less
21 than two and a half or whatever that means, you went and
22 looked for more but you didn't when you had what you
23 thought was enough. How do I have any confidence in what
24 the real fire frequencies are? Because you thought you
25 had enough, so you had like 30. We can go back to find

1 out that there were like 60 more in the '90s because you
2 thought 30 was enough. You had two and you went back
3 and you found four more in the nineties.
4 So, I am curious about now my understanding
5 of what the experience base is and what the fire
6 frequencies really mean. If I am picking and choosing
7 from different buckets, depending on what you thought
8 was enough.
9 MS. LINDEMAN: I guess maybe I am
10 misunderstanding the question but once we had the fire
11 event counts, we didn't go back and look if there were
12 any more events.
13 CHAIRMAN STETKAR: How did you come up with
14 your fire event count? I thought you said if you didn't
15 have enough you went back and looked more.
16 MS. LINDEMAN: Sorry. That would be the
17 level of detailed information that we had.
18 CHAIRMAN STETKAR: Let me start simply.
19 You have a big triangle here. At the top, that box with
20 the little hexagonal thing that says 1. What was the
21 start date for 1 and what was the end date for 1 for every
22 single plant?
23 MS. LINDEMAN: So, I believe they looked
24 from the year 2000 to 2009 for this search.
25 CHAIRMAN STETKAR: Okay and that is it?

1 MS. LINDEMAN: Yes. And then --

2 CHAIRMAN STETKAR: So, nothing about the

3 1990s is relevant to this one.

4 MS. LINDEMAN: Until we get to the number

5 3, where the importing the existing FEDB.

6 CHAIRMAN STETKAR: No, no, no, no. You

7 can't go back and change -- you can't go to playing

8 basketball when we are already playing football.

9 The database set that you are dealing with

10 has to be constant.

11 MS. LINDEMAN: Yes, and the level of

12 consistency to get to we are number 1 until we are number

13 3 is where we felt the 1990s data was.

14 So, at number 1, they may not be fire events.

15 CHAIRMAN STETKAR: No, no, I understand

16 that they may not be fire events but if I sit down and

17 I tell computer to do a word search, I say start at 01/01,

18 fill in four digits for the year and end at 12/31, fill

19 in four digits for the year. I am asking what were those

20 four digits for the start and the end date for all of

21 those searches. And were they consistent throughout

22 the entire winnowing process to get down to the little

23 point at the bottom or did you change it?

24 MS. LINDEMAN: No, I believe it was from the

25 2000 to 2009, so 01/01/2000 to 12/31/2009.

1 CHAIRMAN STETKAR: Okay. So, I don't want
2 to hear about anything in the nineties because it was
3 that ten-year snapshot. Okay.
4 MS. LINDEMAN: Okay. I feel like I didn't
5 fully answer your question.
6 CHAIRMAN STETKAR: You know you did, unless
7 you are starting to talk about 1990s. So, I am just
8 trying to understand the whole process.
9 MS. LINDEMAN: Okay.
10 CHAIRMAN STETKAR: So, we get down -- go on.
11 MS. LINDEMAN: Well, eventually -- so, do
12 you want me to explain number 2?
13 CHAIRMAN STETKAR: Sure. Sure, yes.
14 Please.
15 MS. LINDEMAN: Okay. So number 1 resulted
16 in 300,000 entries. And this was anything that had those
17 key words. So, the owners' groups did a screening of
18 all those short paragraphs to eliminate things that
19 weren't actual fires. Maybe someone got fired and they
20 wrote a CR or there was a fire damper that was inoperable.
21 So, all those fires were removed from consideration to
22 the database because they weren't actual really fires.
23 MEMBER BALLINGER: So, there were some
24 rules, some censoring rules that they applied that was
25 applied uniformly? It wasn't one owners' group person

1 and another owners' group person sitting at a desk saying
2 Joe got fired or Joe smoked dope and something like that
3 and that is where the fire came from. I mean was it
4 uniform censoring?
5 MS. LINDEMAN: The owners' group screened
6 is it a fire or is it not a fire.
7 MEMBER BALLINGER: Okay.
8 MS. LINDEMAN: So, if it was any question
9 if it was a fire, it was left for additional screening.
10 MEMBER BLEY: So, Ron, I think, as I
11 understand what they are saying, they asked the plants
12 to do a key word search on their CRs and they probably
13 threw in fire, smoke, heat, stuff like that. And one
14 of them might have come back because there was a heat
15 exchanger.
16 MS. LINDEMAN: Yes. So, all those groups
17 did a high level screening for --
18 MEMBER BALLINGER: So, it is a very clear
19 distinction. There was nowhere that data got left out
20 that should have been put in.
21 MEMBER BLEY: No, and that is --
22 MS. LINDEMAN: And that was because there
23 were so many events.
24 And then once we got past that, it was more
25 manageable. As you can see, the first box had 2,000 to

1 4,000 per plant. And then once the owners' groups
2 performed their screening review, there was a much more
3 manageable set of 75 to 125 per unit.
4 And the NRC, the triangles indicate an audit
5 point where the NRC reviewed the data. And they were
6 involved all along to ensure that the process and the
7 methods were correct.
8 So, then now we have everything that could
9 be a potential fire. And then EPRI would screen for
10 potential significance. So, again, there is another
11 set of rules on how to determine the fire severity. So,
12 really they are classified as non-challenging, no matter
13 what the circumstances would happen following, there was
14 no way that the fire could ever be a potentially
15 challenging fire.
16 So like a single relay that burned up and
17 did not cause damage to any other components, those would
18 be determined to be non-challenging. And then I
19 mentioned we had the undetermineds and we had the two
20 classes. The class we had confidence to think that
21 wasn't a real fire. And then we had fires that we still
22 may not have a lot of detail. So, the details are vague
23 so we could say we know it was a fire. It is at least
24 potentially challenging and it could be challenging.
25 So, those also, obviously remained in the database and

1 then we screened potentially challenging fires and then
2 we had challenging fires. And those are the, they count
3 for the frequency, as well as the undetermined that are
4 at least classified as potentially challenging.
5 So, it was the fire severity. And if it is
6 okay, at this point, this is when the 1990s data comes
7 in because, at this point, EPRI requested additional
8 information for the existing fire events from the 1990s
9 to help strengthen the data.
10 So, then at the end, we are left with our
11 important fires. And these are the fires that we are
12 going to consider for fire ignition frequency and
13 non-suppression probability.
14 MEMBER BALLINGER: So are these so-called
15 non-challenging fires, they were extinguished or they
16 went out by themselves? I mean what made them
17 non-challenging.
18 MS. LINDEMAN: Self-extinguished, maybe in
19 the plant but not inside the plant area like a trash can
20 in the admin building.
21 MEMBER BALLINGER: Okay.
22 MS. LINDEMAN: And the NRC or the staff was
23 involved in this process and I think we agreed on all
24 events, with the exception of maybe one of 2,000 events
25 in the database.

1 Next slide.

2 So, as I mentioned, the fire events database

3 was published in 2013. And through the process that we

4 went through to collect the data for the 2000s and the

5 strengthening of the 1990s, we are pretty -- have

6 confidence in the data for the last 20 years.

7 MEMBER BLEY: So, just the process you went

8 through is essentially the same process, various of us

9 and others went through 30 years ago or more. But this

10 time, you actually got into all of the plants. What

11 fraction of plants responded and did they all respond

12 in a way that was meaningful?

13 MS. LINDEMAN: Sure, so to answer that, I

14 believe most, if not all, responded to one, as you can

15 see, 102. And 84 plants responded to the final request

16 for information.

17 MEMBER BLEY: Did you try to get back to more

18 than the 84 or were those the only ones you thought you

19 needed to go back to?

20 MS. LINDEMAN: This was prior to me

21 arriving at EPRI.

22 MEMBER BLEY: Okay.

23 MR. LEWIS: Yes, we made quite an effort,

24 including to their chief nuclear officers to try to get

25 these additional units to respond. And that is where

1 we ended up. I can't tell you exactly why some of those
2 units chose not to provide the information but
3 ultimately we had to wrap it up and move forward. We
4 couldn't wait forever.
5 MEMBER BLEY: So on item three, did folks
6 actually go visit the plants and talk through the ones
7 you were more clear about?
8 MR. LEWIS: Yes but those 16 units, we just
9 couldn't have any closure on them.
10 MS. LINDEMAN: And then --
11 MEMBER BLEY: That is pretty good,
12 actually.
13 MEMBER BALLINGER: Well, a major one, they
14 would have had -- they could have checked it with LERs.
15 Right?
16 MS. LINDEMAN: And we have the LERs for
17 some.
18 MEMBER BLEY: That tends not to be the best
19 place to get what you are after.
20 MS. LINDEMAN: And just a note. INPO is
21 collecting a fire event data going forward in their ICES
22 database. So, I think once EPRI went through this
23 process, that they realize how time-consuming it was and
24 --
25 CHAIRMAN STETKAR: Does INPO -- that is

1 interesting by the way. That is really useful. Because
2 it is always easier to collect the fire happened
3 yesterday and let's find out as much as we can. Are they
4 using -- have they established classification -- you
5 called this classification criteria but basically
6 information bins when they collect the information.
7 The fire happened last night. I need to
8 know X and Y and Z and W so that they can satisfy the
9 goals going forward.
10 MS. LINDEMAN: Yes, EPRI worked with INPO
11 to develop the types of information that are important.
12 So, INPO got collected from when the fire events database
13 collection left off. So, they retroactively collected
14 three years of data and now it is live and plants are
15 reporting fire events as they happen.
16 So, that is going forward to help manage
17 data in the future.
18 But going back to the data we have now, the
19 insights on a generic basis was that the majority of
20 fires were small and typically contained to the ignition
21 source and did not spread or cause collateral damage.
22 Obviously one of the outcomes of the fire
23 events database was to produce new ignition frequencies
24 and updated non-suppression probability estimates but
25 also to look at some of our inputs into Fire PRA. So,

1 some of the interesting insights is we saw many long
2 duration fires that actually didn't damage anything
3 outside of the component of origin, therefore,
4 questioning the use of a t-squared growth from the onset
5 of fire.
6 So, and you know we understand this might
7 not be right for all cases but we have seen a lot of long
8 duration fire events that have not caused damage outside
9 of the component of origin.
10 Are there any more questions on the
11 database?
12 CHAIRMAN STETKAR: I kind of really
13 actually have the database. I haven't read it yet
14 because I don't have the time. If I just look at plant
15 level fire frequencies, if I go back to your big triangle
16 there on slide five, and if I look at 10 to 15 per unit
17 or zero to 3 per unit, and I will pick a number like 5,
18 I don't know. Five fires per unit over 20 years, which
19 is the actual, I think, denominator, gives me 0.4 fires
20 per unit a year. That is kind of comparable to the
21 numbers that are in NUREG/CR-6850, if I add up the total
22 number of fires divided by -- you know fire frequency.
23 MS. LINDEMAN: I have a slide on that later.
24 CHAIRMAN STETKAR: Oh, you do?
25 MS. LINDEMAN: Yes.

1 CHAIRMAN STETKAR: Okay, I will let you get
2 there, then.
3 MS. LINDEMAN: Okay.
4 MEMBER SCHULTZ: Back up one slide. So
5 your comment about indicating the majority of fires were
6 small. I just wanted to be sure, you are talking about
7 the fires that were in the database itself.
8 MS. LINDEMAN: That is correct.
9 MEMBER SCHULTZ: You are not talking about
10 the other ones that were not included in the database.
11 MS. LINDEMAN: Yes, just the potentially
12 challenging and the challenging fires.
13 MEMBER SCHULTZ: All right, thank you.
14 MS. LINDEMAN: Yes. Then, I wanted to
15 recognize some of the progress the staff and EPRI has
16 made on the circuit failure issues. So, since 2010, both
17 JACQUE-FIRE I and II have been published. And the first
18 JACQUE-FIRE was a PIRT Panel and they were chartered to
19 look at and rank phenomenon common to circuit failure
20 issues. And what they did is look at all the available
21 test data to make informed decisions on what the data
22 was telling us as a whole, instead of looking at certain
23 tests in isolation. And this looked at both AC and DC
24 circuit types.
25 The conclusions of the panel served as a

1 primary input to the PRA expert panel, which looked at
2 the likelihood of spurious operation probability and
3 duration. I think that was covered also in this
4 morning's presentation.
5 MEMBER BLEY: Was JACQUE-FIRE performed
6 under the same memo of understanding we heard about a
7 little while ago?
8 MS. LINDEMAN: Yes, there is an MOU between
9 EPRI and NRC on fire risk. So, JACQUE-FIRE --
10 MEMBER BLEY: Covered this and from now on
11 the other studies that are being done.
12 MS. LINDEMAN: Yes. And then the PRA Panel
13 was a follow-on. And like I said, they developed, using
14 expert elicitation, the likelihood and conditional
15 probability of spurious operation duration. And I hate
16 to repeat but, as mentioned in the morning, Option 2 of
17 6850 was eliminated as a technical approach. So, Option
18 1 and the new tables are the now --
19 MEMBER BLEY: You said we now forget Option
20 2. What was that about?
21 MS. LINDEMAN: Option 2 was more of a
22 reverse engineering to get the spurious operations
23 probabilities.
24 MEMBER BLEY: Is there anything to rely on,
25 then?

1 MS. LINDEMAN: On the tables in JACQUE-FIRE
2 II are --
3 MEMBER BLEY: I have got JACQUE-FIRE but I
4 haven't read it yet. Did JACQUE-FIRE, did the group
5 actually find some areas where they recommended further
6 testing or research?
7 MS. LINDEMAN: Yes, they have,
8 particularly in instrumentation circuits and in panel
9 as well.
10 MEMBER BLEY: Okay.
11 MS. LINDEMAN: I think possibly some
12 upcoming tests to test the secondary fires and SETs.
13 They definitely identified some areas for further
14 research.
15 MEMBER BLEY: Great.
16 MS. LINDEMAN: The last item I wanted -- or
17 major research effort was the HRA methodology. This is
18 1921 and there is also an EPRI number. What was in 6850
19 was a framework and a screening approach. It is
20 difficult to get a realistic estimate using 6850. So,
21 another multi-year effort to provide guidance on how to
22 estimate ETPs and account for the different
23 performance-shaping factors during the fire.
24 So, I think that came out in 2010 and
25 provides three was, a screening, a scoping, and a

1 guidance on a detailed methodology.

2 MEMBER BLEY: Can you comment on if anybody

3 is using the screening approach?

4 MS. LINDEMAN: From my experience, I think

5 some people will start with a screening approach.

6 MEMBER BLEY: Yes, but actually what they

7 have been doing.

8 MS. LINDEMAN: I think most people revert

9 to the detailed methodology but maybe Bob or someone can

10 comment.

11 MR. RISHEL: This is Bob Rishel from Duke

12 Energy. So, we have done all of the above. We have tried

13 to do 1921 screening and, after four months, gave up on

14 it.

15 MEMBER BLEY: That is kind of what I have

16 heard. So far as I know, nobody is actually trying to

17 use it.

18 MR. RISHEL: So, we either go to default,

19 write the detailed or we just use multipliers. So, that

20 is where we ended up.

21 MEMBER BLEY: Thanks.

22 MS. LINDEMAN: So now, for sort of the

23 heart. What is EPRI doing now? And the answer is a lot.

24 We are working a lot with research to provide methods

25 and the first one I will talk about is an update to the

fire ignition frequency and non-suppression estimates with our fire experience through 2009. So, I have a slide on that in more detail.

But another area that we have heard a lot about is the heat release rates. So, we have a joint panel that is ongoing. Mark Salley said that the panel has met four times. And we take to hear what Ray Fine said as things are developed in silos. And when we started the project was the answer to just look at heat release rates or was it to look further?

So, we are taking -- we take a step back and one of the -- in addition to looking at the heat release rates, we are also looking at the effects of the plume. The fire in the electrical cabinet is basically in a box and there is a solid top on the cabinet. Right now, you calculate your plume calculation assuming that that top of the cabinet is not there. So, we ran a set of virtual experiments and fire dynamics in the simulator, which is a computational fluid dynamics program and we have gotten some good results from that and I have a slide on that.

MEMBER BLEY: Virtual experiments rather than calculations.

MS. LINDEMAN: Or instead of in lieu of testing.

1 MEMBER BLEY: Well, it sounds really
2 different to me.
3 CHAIRMAN STETKAR: It sounds like a virtual
4 experiment of something real, other than a computer
5 doing something.
6 MEMBER BALLINGER: When they went from
7 calculation to CFD, it went from calculation to virtual
8 experiment.
9 MEMBER BLEY: Yes, I know and that just
10 drives them nuts.
11 (Simultaneous speaking.)
12 MS. LINDEMAN: The above --
13 MEMBER BLEY: We heard something today
14 about fire code being questioned. Is that on your list
15 of things to examine?
16 MS. LINDEMAN: Yes, we are considering
17 that. The way the panel is working right now is the first
18 item on the table is the revised heat release rates and
19 the plume calculations because those all affect the zone
20 of influence. So, how big the fire can spread for a given
21 heat release rate. And if those change, and the licensee
22 or the plant decides to use them, or requires a
23 recalculation of their zone of influence, in addition
24 to potentially collecting a different set of targets.
25 So, the research right now is to get this

1 piece out that affects the zone of influence and then
2 look at other modeling refinements, like the fire growth
3 as a secondary effort to follow-on.
4 MEMBER BLEY: The way you phrased that
5 sounds as if the panels are standing panels. You have
6 a standing panel that does these one after another?
7 MS. LINDEMAN: No, the expertise in the
8 panel that we have that is looking at heat release rates,
9 it is a natural extension to have them follow-on and do
10 the second work as well.
11 MEMBER BLEY: Okay, it takes the same
12 experts. Okay. That's good.
13 MS. LINDEMAN: But the panel that is doing
14 heat release rates is obviously very different from the
15 panel that is looking at HRA or circuit failure issues.
16 So, the answer is yes. And then some other
17 work --
18 MEMBER BLEY: Do you have a panel now
19 looking at HRA?
20 MS. LINDEMAN: We will have another joint
21 EPRI/NRC project to look at main control room
22 abandonment, loss of habitability.
23 MEMBER BLEY: You have specifications for
24 what kind of expertise has to be on that panel?
25 Are you going to require that you have real

1 operators who have had some experience with fire
2 somewhere anywhere on that panel?
3 MS. LINDEMAN: That actually came up for
4 the loss of control issue. As was mentioned, it is a
5 very difficult issue. I think we need not only HRA
6 people but operations and PRA as well. But it could
7 definitely be a consideration.
8 MEMBER BLEY: And fire.
9 MS. LINDEMAN: Yes.
10 MEMBER BLEY: I sure hope that ends up being
11 your criterion because too often we see these things that
12 affect operations having maybe somebody who maybe
13 operated some time ago but not having the real relevance
14 to which we are looking for for the issue at hand.
15 MR. LEWIS: We haven't actually started
16 this project. We have a meeting on October 8th, is that
17 the right date --
18 MS. LINDEMAN: Yes.
19 MR. LEWIS: -- to kind of kick it off. And
20 we will certainly take that into consideration at that
21 time.
22 MEMBER BLEY: I hope so.
23 MS. LINDEMAN: So, getting back to the
24 research, we are also looking at the fire location
25 factor. And that is going through the EPRI/NRC panel.

1 It is also a set of virtual experiments to look at how
2 fires behave as they approach a wall or a corner.
3 It went through the panel and we are
4 responding to comments but that looks good.
5 We are also --
6 MEMBER BLEY: Who has got this big model
7 that you are going to do these virtual experiments on?
8 MS. LINDEMAN: You can run it on any
9 computer but FDS typically takes a long time to run. But
10 just a computer, a laptop, instead of running a real big
11 computer.
12 MEMBER BALLINGER: I guess what Dennis is
13 asking for is who do you write the check to to get the
14 code.
15 MS. LINDEMAN: Oh, FDS is free.
16 MEMBER BALLINGER: That is a NIST code.
17 MEMBER BLEY: Who are the experts running
18 it and know if it is giving them nonsense or meaningful
19 insights?
20 MS. LINDEMAN: Oh, that is a great
21 question. There is a NUREG-1824, also an EPRI number,
22 and it verifies and validates tools that you can use for
23 fire modeling. So one of them is FDS.
24 MEMBER BLEY: Some human being must set up
25 the model like those clever computer code ones and --

1 CHAIRMAN STETKAR: Take a look at the
2 results and say huh, that doesn't make sense. I have
3 got to go tweak something in the input.
4 MEMBER SCHULTZ: Or be able to do the other,
5 so this does make sense.
6 MEMBER BLEY: Is there one group who has
7 been running all these for you?
8 MS. LINDEMAN: The same --
9 MEMBER BLEY: It is somebody at EPRI?
10 MS. LINDEMAN: No.
11 MEMBER BALLINGER: Is this a secret?
12 MS. LINDEMAN: Can I say who it is? Okay,
13 Hughes has been running it. They do a lot of fire
14 protection work.
15 So, to go back to the V&V, it looked at all
16 the fire models that you can use and they have limits
17 of applicability. So, you can take your results and run
18 through some numbers and see if you are applying within
19 the known means. And all that has been completed for
20 these two virtual experiments.
21 MEMBER SCHULTZ: And the update of fire
22 modeling is an update of the NUREG-1824?
23 MS. LINDEMAN: Yes, in progress. I was
24 told that within two weeks it will be available for
25 public comment. So, it is a supplement to the fire

1 modeling V&V. The original V&V was published in 2007
2 and since then, there has been newer versions of FDS and
3 MAGIC and CFAST. So, those have all been folded in in
4 addition to, I believe, the prior V&V looked at maybe
5 36 experiments or 24 and now there is something like 300.
6 So, we have a lot more data to benchmark against. That
7 is also an enhancement.
8 Next slide.
9 MEMBER BLEY: Is there some -- I haven't
10 seen any of this stuff you have been doing. I am sort
11 of back on the CF2 stuff.
12 MS. LINDEMAN: Okay.
13 MEMBER BLEY: What kind of outside review
14 checking, you know confirmation of the modeling is done
15 to support these things?
16 MS. LINDEMAN: I would say there is a fair
17 amount in-house.
18 MEMBER BLEY: In-house at Hughes?
19 MS. LINDEMAN: Yes and then --
20 MEMBER BLEY: Or in-house at EPRI?
21 MS. LINDEMAN: Both. You know I have
22 reviewed staff at Hughes and I believe they work with
23 this FDS all the time. In addition, in the fire location
24 back there, we also brought it to a methods panel, so
25 staff and research have reviewed it. Kevin McGratten,

1 who is the developer at FDS has provided comments on this
2 and we have also --
3 MEMBER BLEY: On the models as run.
4 MS. LINDEMAN: Yes, so he has the input
5 files, the output files. In addition to other members
6 in the industry that are knowledgeable and running FDS.
7 So, since frequencies seem to be an area for
8 good comparison, if you add up all of the bins in 6850
9 you get a total frequency of 2.9E minus 1. And as
10 mentioned, the frequencies in the EPRI report were
11 essentially cut in half, 1.5.
12 The differences in approach were the EPRI
13 data relied heavily on the 1990s data, so that spoke for
14 most of the frequency. And as we work into the new data,
15 we see the updated fire events database is producing
16 frequencies that are you know somewhere in-between 10167
17 and 6850.
18 And overall in the results, some bins went
19 up, some bins went down. So, that is what we found when
20 we calculated all the numbers.
21 And specifically since Bin 15 can be a
22 driver, I just wanted to provide a comparison in
23 frequency. So, just to be clear on all of the data, 6850
24 looked at the time period 1968 to 2000.
25 MEMBER BLEY: What led you, EPRI, to decide

1 not to try to tear down Bin 15 further?

2 MS. LINDEMAN: Well, I think prior -- using

3 the old database it maybe wasn't possible.

4 MEMBER BLEY: On the new database, what led

5 you not to -- we have been hearing for years now that

6 this is a big deal and yet, you are not doing anything

7 to try to parse it into pieces that might let somebody

8 do a better job of modeling in their PRA.

9 MS. LINDEMAN: Right, and the answer to

10 that is it has been done. I have a slide. I broke out

11 Bin 15 by cabinet type. And here is my thinking. Right

12 now the plant frequencies are calculated -- so Bin 15

13 is a plant-wide frequency. So, you go around and you

14 count all your cabinets and then you divide it by -- your

15 frequency is your cabinet divided by the total number

16 in the plant.

17 So, if you were to break up Bin 15, it may

18 require some rework to count all your new different bins

19 out. So, my thinking is why don't we look at

20 component-based frequencies where it is less reliant on

21 counting. And as we evolve the fire frequencies, let's

22 break up Bin 15.

23 CHAIRMAN STETKAR: That would be great

24 except that you got 84 plants to give you feedback on

25 stuff. You need each of those 84 plants to give you

1 counts of every single thing that you call a pump and
2 a valve.
3 MS. LINDEMAN: Yes.
4 CHAIRMAN STETKAR: Or not valves because
5 they are screened out. But you are not going to get that
6 feedback in real-time. So, people right now are
7 struggling with this problem.
8 MS. LINDEMAN: Yes, and I think that is why
9 I haven't gone there yet. In 2010, the owners' groups
10 collected counts from their respective plants. So,
11 EPRI has both of those reports. One of them I just got
12 Monday so, it is brand new.
13 So, now we have the counts or rough counts.
14 And those were done a few years ago so I think we would
15 want to do some type of consistency check to see as they
16 went through a peer review are the counts still similar.
17 But at least we have an idea of the rough sample size
18 and variability.
19 CHAIRMAN STETKAR: Okay. Did anybody,
20 when they were asking people for counts of stuff, we have
21 now theoretically a numerator and a denominator, did
22 anybody make sure that the numerator and the denominator
23 covered the same population?
24 For example, if I am asked to count all of
25 my motor-operated valves in the plant, I wander all out

1 there is one in the turbine building and there is a heater
2 drain valve, and if I am counting fire events that don't
3 include those, I am not dividing correctly. So, was
4 there assurance done for that?
5 MS. LINDEMAN: I can't -- I was not involved
6 in the report but I think going forward, there needs to
7 be some type of check.
8 MEMBER BLEY: Just a comment, the last time
9 we heard about this before it was done, I thought one
10 of the goals of going to the plants to dig out this data
11 was really to break this one apart. I guess it didn't
12 happen when they went to the plants to talk to them.
13 MS. LINDEMAN: I think the premise of
14 updating the new frequencies was update the new
15 frequencies in the current frameworks.
16 CHAIRMAN STETKAR: You know the
17 interesting thing that I have found, I will cut to the
18 chase because it is getting late here, is that heat
19 release rates for things like switchgear and motor
20 control centers are pretty high because they have got
21 a lot of energy in them.
22 MS. LINDEMAN: Yes.
23 CHAIRMAN STETKAR: You also find that on a
24 per unit basis, the fire frequencies for those things
25 are pretty high because they have a lot of energy in them.

1 The fire frequencies on a per unit basis for I&C cabinets
2 are pretty low and they don't have very high heat release
3 rates. On the other hand, there is a hell of a lot of
4 them scattered through the plant.
5 So, if my fire risk is determined by an
6 artificially high per unit fire frequency for an I&C
7 cabinet that doesn't have a very high heat release rate,
8 despite the fact that it has got a cable tray located
9 a foot above it, that is the conservatism. And nobody
10 is addressing that. EPRI is not helping to address that.
11 Nobody is addressing that.
12 MS. LINDEMAN: I agree.
13 CHAIRMAN STETKAR: And that is the FAQ. I
14 mean, I have done this for plants. I have been doing
15 fire risk assessment for 30 years and that is what we
16 see when we break down these cabinet things by high
17 voltage switchgear, load centers, motor control
18 centers, I&C cabinets.
19 So, a lot of this so-called conservatism is
20 just laziness. And yet, we have been, for four years,
21 recommending that you break it down and nobody is
22 listening.
23 MS. LINDEMAN: I personally would like to
24 break it down.
25 CHAIRMAN STETKAR: So, why don't you?

1 MS. LINDEMAN: I plan to in the next
2 evolution. But --
3 CHAIRMAN STETKAR: I mean, honestly, who is
4 -- why won't anybody take the lead? The industry is
5 complaining that everything is conservative. From my
6 experience, I know one really strong source of
7 conservatism. The industry is represented by nuclear
8 power plant chief executive officers, by Nuclear Energy
9 Institute, and by the Electric Power Research Institute.
10 They won't take the lead on this except for complaining
11 that everything is too conservative. This is really
12 frustrating, obviously.
13 MS. LINDEMAN: Yes, I understand.
14 CHAIRMAN STETKAR: And it is just silly.
15 MS. LINDEMAN: I think what we are -- the
16 database took longer to publish, I think. So, it was
17 just published a little over a year ago and I think we
18 are just starting --
19 CHAIRMAN STETKAR: And you have been
20 working on it for how long?
21 MS. LINDEMAN: Many years.
22 CHAIRMAN STETKAR: Right.
23 CHAIRMAN STETKAR: Why at time zero didn't
24 you start doing it?
25 MS. LINDEMAN: I think we are just starting

1 to reap the benefits of the better data. Right now the
2 effort is to produce the update of data and then further
3 evolve where we can go with the data.
4 CHAIRMAN STETKAR: Okay.
5 MS. LINDEMAN: Next slide.
6 MR. LEWIS: Yes, I don't know why it evolved
7 in the way it did. I wasn't always part of that either
8 but I agree with you. This is a --
9 CHAIRMAN STETKAR: Honestly, you know the
10 ranting aside because I am obviously trying to provoke
11 people, but in my experience, looking at a lot of
12 plant-specific data that I have collected, I don't do
13 heat release rates but I look at per unit fire
14 frequencies for I&C cabinets which ought to have lower
15 heat release rates just because the combustible loading,
16 their per unit fire frequency tends to be low. Per unit
17 fire frequency is for things like motor control centers
18 and switchgears, medium to high-voltage switchgear
19 tends to be higher. And they have higher heat release
20 rates.
21 Now the good news is, in most plants, they
22 don't have a lot of cables running round in your
23 switchgear rooms, not to the extent that you have in a
24 lot of the rooms that have relay racks and cabinets and
25 stuff like that, which tend to be rats nests of cables.

1 Now, some plants may have a lot of cables in their
2 switchgear room but that tends to be more rare.
3 So, you know, looking from a list
4 perspective in terms of what is driving the frequency,
5 if indeed propagation of fires from something called an
6 electrical cabinet to nearby cables overhead is driving
7 the risk, one of the first things you do is look at where
8 is the frequency, where is the high energy. And if you
9 have a plant that has high energy with high frequency
10 and cables located close, then you might have a real
11 problem.
12 MS. LINDEMAN: I agree.
13 CHAIRMAN STETKAR: But until you do this
14 breakdown by cabinet type, the people doing the risk
15 assessment are really hamstrung because they are
16 applying heat release rates for switchgear to benign I&C
17 cabinets, which is what everybody is complaining about.
18 MS. LINDEMAN: To make you happy, I did
19 break it out. It is in a further slide, 20.
20 CHAIRMAN STETKAR: Good, I will let you get
21 done, then.
22 MS. LINDEMAN: Okay. I do understand the
23 problem.
24 So moving on, we will talk about electrical
25 cabinet fire modeling. And it is a complicated piece

1 for many reasons. The heat release rate is the driving
2 factor but also how we model the fire. We use a lot of
3 simplified assumptions about the growth rate and the
4 fire elevation within the cabinet. And a criticism of
5 the methodology is that the distributions are from test
6 data and the ignition frequency and the suppression
7 credit is from events. So, do those really comport?
8 And that has been a consideration in the working group.
9 We need to inform the distribution not only from testing
10 but also the types of fire events we have seen in the
11 database.
12 So, as primary inputs to the working group,
13 we are using the applicable old tests, the new test,
14 which are called HELEN-FIRE and also the fire events
15 database to glean any type of qualitative insights that
16 we can get. Next slide.
17 So, this is the Table G-1 of 6850. But the
18 current list of distributions you can use for cabinets
19 and the Fire PRA. So, as you can see, the distributions
20 are limited based on if your qualified cable or
21 unqualified cable, or if you have a fire limited to one
22 bundle or to multiple bundles. And there is some
23 appendix in 6850 that can help you determine what is a
24 one bundle or a multi-bundle.
25 So, as you can see, you don't really have

1 many options. So, what is proposed by the working group
2 is an additional few ways to categorize. So, we have
3 looked at energetic sources like our power cabinets, our
4 switchgears and our load centers will now have their own
5 distribution. Motor control centers will have their
6 own distribution. And we have binned our currently
7 binned battery chargers, upon looking at the loading and
8 energy in those type of components.
9 And then we have looked all the type of
10 control cabinets and small, so wall-mounted or --
11 MEMBER BLEY: When you speak of the working
12 group, is that the same as a panel or is this the EPRI
13 --
14 MS. LINDEMAN: So, this is an EPRI and
15 Research operating under MOU and we both have an equal
16 representation of industry and staff on them.
17 MEMBER BLEY: Okay, like the management
18 group of this MOU.
19 MS. LINDEMAN: So, out of this group will
20 be a NUREG EPRI report, if that clarifies it.
21 So, that is sort of what we are working with
22 now. And I think we found from the test is the
23 configuration matters, the loading of the fuel, how much
24 of it matters. So, what we have had is we have provided
25 distributions for that. But if you can open a cabinet

and look and see that you have a configuration that is not conducive to large growth, you would be able to knock down that heat release rate.

And I think to some degree you can do that now. So, if you open a cabinet that you call 702 and you see oh, I don't have much, I can knock it down to a 211. So, we have provided some more or we hope to provide some more guidance on what to look for, so you can classify or down-classify your cabinet.

But the first cut was made to be on visual inspection, recognizing that it is difficult to open cabinets. But we did think it was important to, if you had an important scenario to go and look if you needed to dial in your cabinets.

MEMBER BLEY: That's good, at the risk of setting off my colleague again.

CHAIRMAN STETKAR: No, no.

MEMBER BLEY: We have talked with a couple of organizations involved in doing the PRAs and asked them could you do this. And they said that is a lot of work to look in all those cabinets, no. But it is too conservative to use the stuff that is in the NUREG but we are not going to go look.

I like that you are doing something that helps people.

1 MS. LINDEMAN: Yes, we recognize on a large
2 scale basis, it is impractical to open the cabinet. But
3 if you need to, it is important to risk, it is probably
4 worth your while.
5 MEMBER BLEY: Yes, and I think utilities
6 doing their own PRA, they have got people who open
7 cabinets all the time.
8 MS. LINDEMAN: Right, and maybe on a Sunday
9 or whatever, but you are going to do it if you need to
10 do it.
11 CHAIRMAN STETKAR: It doesn't take long to
12 open a cabinet and take a photograph.
13 Just go back here. I saw this before and
14 I just have to ask. Why are inverters grouped with
15 control cabinets and battery charters grouped with motor
16 control centers? That is the only thing -- I mean I saw
17 this and I said okay, this makes a lot of sense except
18 for the inverters and the battery chargers. Somebody
19 must have made a decision.
20 MS. LINDEMAN: So, when we first, to start,
21 we looked at all the potential bins and then we reviewed
22 the inside of cabinets. And when we reviewed pictures,
23 recognizing that motor control centers are more
24 compartmentalized, we felt some of the ignition under
25 energy and the layout of combustibles was similar.

1 CHAIRMAN STETKAR: Right. I am not
2 challenging battery chargers. I am asking why an
3 inverter isn't up in that second line item there.
4 MS. LINDEMAN: Within the power
5 components?
6 CHAIRMAN STETKAR: Right, yes.
7 MS. LINDEMAN: Yes. Yes, to me it is sort
8 of a power component but , based on the review of
9 pictures, --
10 CHAIRMAN STETKAR: Pictures, okay.
11 MS. LINDEMAN: -- we felt that the cabling
12 was similar from a combustible loading perspective.
13 CHAIRMAN STETKAR: See, I don't look at
14 cables. I look at energy. An inverter that has power,
15 especially in newer plants where they then to use
16 inverters a lot, and I am talking large power inverters,
17 I am not talking about a little -- the only concern is
18 that if I -- see, I have seen plants that have larger
19 inverters that indeed had had fires in them. Some of
20 them call them battery chargers. Some of them call them
21 uninterruptible power supplies. And some of them call
22 them inverters. But they are the same thing.
23 MS. LINDEMAN: And obviously, --
24 CHAIRMAN STETKAR: And if I am doing my fire
25 analysis now and I say okay, I got this inverter that

is powering one division of my safety-related stuff, because that is the way I have designed my plant, I am going to now use the heat release rate for that inverter the same as I will use for whatever a medium control cabinet is. That is the only concern.

MS. LINDEMAN: Sure, and we will be sure to check that out before -- as you said, this panel is working.

Related to the heat release rates I talked about, we are looking at exploring the effects of how a fire in a box with a top can impact the vertical zone of influence. So, when we define a fire or when we have our heat release rate, we calculate how high is the flame. What is our horizontal radiation zone of influence, our ceiling jet, our hot gas layer. And the most critical is really the plume and this affects the vertical zone of influence and basically gives us the answer to the question does it damage cable trays.

So, we wanted to look how having a top on the cabinet would affect the plume because the plume gets, for lack of a better word, obstructed by the top of the cabinet and may diffuse the temperature.

So, we ran a series of virtual experiments in Fire Dynamic Simulator. You don't like the word virtual experiments.

1 CHAIRMAN STETKAR: No, because it sounds as
2 if you really did something, other than calculated
3 something according to a computer model.
4 MS. ANDERSON: Computational research.
5 MS. LINDEMAN: Well we ran a simulation
6 where we looked at various obstruction geometries. So,
7 we will call it a flat plate and that would maybe assume
8 you had vents on all four sides. We looked at an arch
9 configuration where two sides and the plume could go out
10 two ways. And then we looked at one side or three sided,
11 where the plume can escape one way. And we compared the
12 results to what you would get if you used Heskestad and
13 McCaffrey's plume correlation.
14 Next slide.
15 So, this is sort of a wrap-up of what the
16 results look like. The blue line is the unobstructed
17 for how you would normally calculate the plume and then
18 the lower line would be the unobstructed. So, it
19 essentially is about a 30 or a 35 percent decrease in
20 plume temperatures, which, at certain times, could be
21 significant. So, we will plan to wrap this into the
22 panel as an option for refinement.
23 Then going forward, as many people
24 mentioned, there is still a lot of research that needs
25 to be done. Notably, in fire frequency I think we like

1 to look at how feasible it is to do the component-based
2 fire frequencies. At least right now we have some rough
3 counts for each plant. So, that is a good starting point
4 in recognizing that there are several challenges.
5 MEMBER BLEY: On these counts you have been
6 getting from the owners' groups, I think you said.
7 MS. LINDEMAN: Yes.
8 MEMBER BLEY: How is the pedigree on that
9 compared to the pedigree on the report you just did for
10 the stuff over the last 20 years.
11 MS. LINDEMAN: You know I am not sure it is
12 fair to compare the two just because the owners' groups
13 reports are for 2010. So many of those plants maybe
14 didn't go through a peer review or the audit. So, I think
15 we actually have to take the information with a grain
16 of salt and do some more due diligence to understand.
17 CHAIRMAN STETKAR: This is just a thought,
18 Ashley. I think you said that INPO is now collecting,
19 yes, if I read the middle bullet here, I would know that,
20 is now collecting the numerator.
21 MS. LINDEMAN: Yes.
22 CHAIRMAN STETKAR: Fire events and --
23 MS. LINDEMAN: Yes.
24 CHAIRMAN STETKAR: -- characteristics of
25 each fire event. Is there any that INPO, since they are

1 collecting the numerator could collect one time only
2 now, the denominator, to make sure that, indeed, as
3 Dennis said, the pedigree is the same and that indeed
4 we have some confidence that we have information that
5 is from the same population of each plant?
6 MS. LINDEMAN: I'm not sure how easy or hard
7 that would be to do. But that would be another way to
8 ensure some type of consistency.
9 MEMBER BLEY: Now that the data is being
10 collected again and INPO is the collector, can you have
11 an idea of all the plants participating or do we still
12 have some hold outs in this process?
13 MS. LINDEMAN: I have last checked in with
14 them maybe six months ago. But from what I heard, there
15 is still one or two that don't fully report. But I think
16 it will be --
17 MEMBER SCHULTZ: It is almost shocking.
18 (Simultaneous speaking.)
19 MEMBER SCHULTZ: All the events are
20 supposed to be reported. I don't understand that.
21 MS. LINDEMAN: And how we took that into
22 account is if you did not complete the full request for
23 information, we didn't include those plants events at
24 all in the count or the reactor years. And the reason
25 why is there is no confidence in the data, even though

1 if you had some of the data you couldn't have confidence
2 that everything was accounted for. And that was a
3 decision made a few years ago.
4 MEMBER SCHULTZ: But when you described
5 what INPO had taken on, you mentioned also that there
6 was a three-year overlap. And I presume that was to make
7 sure that INPO understood how the database had been
8 developed and so that they would be comparing doing the
9 evaluation for 2007-2010.
10 MS. LINDEMAN: Yes, so they have seen the
11 fire events database and they know the attributes that
12 are collected. So, they worked to make sure --
13 MEMBER SCHULTZ: But it continued on. I
14 just can't believe that everyone isn't required by INPO
15 to fill in the blank and send it in.
16 MS. LINDEMAN: But I think overall there
17 are advantages to INPO collecting the data. Just for
18 what you said, if the fire happened yesterday, INPO was
19 able to follow up with them, if something is in conflict,
20 or something is missing to help ensure that we have good
21 data moving forward.
22 CHAIRMAN STETKAR: But as Steve said, in
23 theory, there is that level of trust and level of
24 interaction with INPO that you would expect 100 percent
25 participation.

1 MS. LINDEMAN: I mean I can't comment on
2 what that is today. And that may only be for the
3 retroactive collection. You know I can't really speak
4 to the current --
5 (Simultaneous speaking.)
6 MEMBER SCHULTZ: The licensee doesn't say
7 well, I guess I don't think I will turn this information
8 in. It is there. It is there on a daily basis in the
9 plant.
10 CHAIRMAN STETKAR: On the other hand,
11 retroactive stuff I understand. Some people have to go
12 -- that is an expenditure.
13 MEMBER SCHULTZ: The retroactive stuff,
14 that's different. We are talking about, I thought
15 real-time here.
16 CHAIRMAN STETKAR: Well but what Ashley
17 said is it might have been some of the retroactive stuff.
18 MS. LINDEMAN: Yes, there was two periods,
19 a small retroactive period --
20 MEMBER SCHULTZ: Right.
21 MS. LINDEMAN: -- and then live, real time.
22 MEMBER SCHULTZ: Different issue.
23 MS. LINDEMAN: So, EPRI, a number of years
24 ago had a Fire PRA action matrix. And to some degree,
25 there a lot of progress has been made but sort of just

1 in wrapping up, I highlighted some of the more important
2 things that would need to be done to achieve realism.
3 So, I think advancing where we are for fire
4 frequencies and I think recognizing Bin 15 as a outlier,
5 if you looked back a few slides, you notice that the spike
6 on the graph was Bin 15. So, and especially if it is
7 a current driver for plant risk, we should do what we
8 need to do to break that up. I don't believe we had the
9 capability to do it previously. But going forward, the
10 capability is certainly much better.
11 You know I think spearheading off of what
12 was done for transient fires, the panel said you can use
13 other heat release rates besides what is prescribed in
14 6850 but to do a little bit better job with documenting
15 what types of heat release rates would be appropriate.
16 I think that is a near term objective, once we get through
17 heat release rates for cabinets.
18 And then while we were talking about
19 cabinets, we mentioned the fire growth. There is other
20 options that we need to tackle with respect to how we
21 model these in Fire PRAs. So, one of them would be
22 looking at the fire growth. Right now we assume really
23 no incipient or pre-growth stage. We ramp up from zero
24 to peak heat release rate in 12 minutes. So, questioning
25 whether or not that is applicable, both the T squared

1 and the 12 minutes is probably warranted, especially
2 based on what we have seen from OE. We have many long
3 duration fires that really don't go anywhere.
4 And then finalizing the treatment for motor
5 control centers, I think we all recognize we have had
6 a lot of events in the database but not many have actually
7 caused damage. So, determining how we should treat them
8 in the Fire PRAs is probably another area we need to
9 tackle.
10 CHAIRMAN STETKAR: And there you still have
11 to be careful. I have been in a lot of switchgear rooms
12 and if I look up, I see the ceiling. So, when you say
13 that motor control centers haven't caused damage, I see
14 motor control center fires that the motor control
15 center, itself, looks pretty nasty but there wasn't any
16 cables to get involved.
17 MS. LINDEMAN: Sure.
18 CHAIRMAN STETKAR: I have been in
19 electronic cabinet rooms, where I have looked up and I
20 can't see the ceiling because it is just chock a block
21 full of cable trays. I haven't seen any damage from
22 those electronic cabinet fires because they don't happen
23 as frequently. And when they do, they are pretty well
24 self-extinguishing anyway.
25 MS. LINDEMAN: That is a pretty slow

burning source.

CHAIRMAN STETKAR: If you could ever get a big one there, you would probably see the damage. So, just saying that we haven't seen the damage is more, I think, a function of the way plants are built, rather than the fact that motor control center fires are inherently innocuous.

MS. LINDEMAN: There is some level of degree that they are typically unvented. So, I think there is room for improvement. Right now, we consider most of them to be propagating.

CHAIRMAN STETKAR: Okay.

MS. LINDEMAN: I listed the pump heat release rate. Currently in 6850, this is keyed to heat release rate distribution of a cabinet. So, I think there is enough said.

As mentioned, right now there is one zone of influence for bus ducts and high energy arcing faults. So, I know research is planning some testing. But looking if there is a difference in zone of influences especially between voltage types.

CHAIRMAN STETKAR: That again, too, I think that is an artifact because as was mentioned earlier, bus ducts was an afterthought.

MS. LINDEMAN: Right.

1 CHAIRMAN STETKAR: And I said well, if I
2 have got a high voltage bus duct, what else do I have?
3 I will use the zone of influence from further away --
4 MS. LINDEMAN: I believe --
5 CHAIRMAN STETKAR: -- the arcing fault.
6 That is just an afterthought.
7 MS. LINDEMAN: -- 6850 Appendix M, which
8 prescribes how you treat high energy arcing fault was
9 basically like that calculated from the SONGS event.
10 So, I think we have some additional experience that we
11 can draw upon.
12 MS. LINDEMAN: And the last bullet I had is
13 there anything that we can do to revisit some of our
14 critical assumptions? We are doing a project on Fire
15 PRA uncertainty and it is really looking at the fire
16 modeling portions of the PRA model, the severity factor
17 and the non-suppression probability. And it is able to
18 run a pretty sophisticated Monte Carlo simulation. And
19 the approach is similar to what the guy from Beaver
20 Valley said. And that one maybe glean insights on what
21 parameters are driving some of the scenarios and see if
22 there is further research that is needed.
23 And another important issue that has
24 already been brought up today is main control room --
25 well abandonment, the ATP due to loss of habitability

1 but also the issue of loss of control. I think we all
2 agree it is a difficult topic. And I think we want to
3 get our hands around loss of habitability before we
4 really start loss of control because it is a difficult
5 issue.
6 You asked if there was any follow-on
7 research from JACQUE-FIRE and so I had that. I thought
8 it was so important, I looked at it twice.
9 (Laughter.)
10 MEMBER SCHULTZ: Thank you for that.
11 MS. LINDEMAN: And then you know, as
12 necessary, we have can we advance where we are with the
13 treatment of the main control board or the assumption
14 that all fires cause a plant trip.
15 And then lastly, there is just some areas
16 of 6850 that needed a cleanup. One of them is structural
17 steel, which is in the standard but not in 6850 and the
18 multi-compartment analysis, which is commonly
19 misunderstood.
20 So, here is a list or a chart of the cabinets
21 by cabinet type. I did this just a few months ago. I
22 looked through all the Bin 15 fires for the last 20 years
23 and, as you can see, the motor control centers are really
24 high in the 90s and it seemed to have come down in the
25 2000s. But it seems like your feeling is correct that

the power do have the most fire events and, as you can see, the control cabinets with the relay racks and the inverters fill out the rest.

But I guess the answer is now with the fire events database, this type of evaluation really can be done.

MEMBER BLEY: So it looks like almost half, it would be 45 percent of the fires were in the -- well, even more, the switchgear -- half or a little more in the high power equipment.

MS. LINDEMAN: Yes.

CHAIRMAN STETKAR: Yes, the important thing is if you look at it on a per unit basis --

MEMBER BLEY: Yes.

CHAIRMAN STETKAR: -- when you think of the number of switchgear cubicles or motor control center cubicles in the plant as compared to the number of control cabinets, it is dramatically different. It is much more dramatically different from this. Because if you look at eight or nine control cabinet fires distributed over an inventory of 700 or 800 cabinets, say 400 or 500 cabinets per plant versus switchgear you might have, if it is 4 kV switchgear, you might have like four or six. It much more dramatic than even this shows you.

1 MS. LINDEMAN: There are still a few that
2 were unknown but, in general --
3 CHAIRMAN STETKAR: What I was saying
4 earlier is if you look at inverters, if you have two or
5 four -- let's say four per plant, the per unit fire
6 frequency of inverters is actually relatively high on
7 a per unit basis per complement basis, compared to
8 control cabinets.
9 MEMBER BLEY: See, we are able to assign
10 almost all of them.
11 MS. LINDEMAN: Yes, I mean there was about
12 70 events and, as you can see, maybe four or five are
13 -- well, one was the other and a few were unknown. But
14 I guess the answer is, it is possible.
15 I understand that it is late. I believe I
16 talked about the problem --
17 CHAIRMAN STETKAR: You will find we have no
18 lives.
19 MS. LINDEMAN: Okay.
20 CHAIRMAN STETKAR: I was speaking of the
21 royal we.
22 MS. LINDEMAN: Okay. So, I was going to
23 mention the 6850 transient fires is 317 kilowatts. And
24 if you assume a two by two by two package, it is roughly
25 a zone of influence of ten feet by ten feet by ten feet.

1 And really the experience in the fire events database
2 does not comport with this.
3 And we have seen transient fires and a lot
4 of them are very small, like a burnt extension cord, a
5 small temporary equipment and small transient. So, we
6 would be willing to work in advance, you know, the method
7 and potentially a range of heat release rates.
8 I just wanted to end with some of our
9 insights that we got from our review of the fire events
10 database. So, in the fire events database, we have
11 challenging and these are out fires that no question have
12 an observable affect where it would be smoke or equipment
13 damage and then potentially challenging fires.
14 So, when we looked at all the challenging
15 fires, we found that all of them, which was about 12 of
16 the 70 were over ten minutes in duration with a mean to
17 suppress 35 minutes, which is pretty long.
18 And then when we looked at the potentially
19 challenging fires, more than half of them were five
20 minutes or less in duration, with a mean time to suppress
21 of approximately eight minutes.
22 Another insight that we were able to get is
23 not a lot of fires are detected by fixed detection
24 systems and a large majority are detected by plant
25 personnel. And that is true whether it is challenging

1 or it is potentially challenging.

2 And then in regards to suppression, you know

3 the fire brigade they extinguish a third of the

4 challenging fires and 23 percent of potentially

5 challenging fires. But the plant staff, so anyone other

6 than the fire brigade also extinguishes a large number

7 of fires, most notably, the potentially challenging

8 fires.

9 CHAIRMAN STETKAR: Ashley, before you wrap

10 up here, and I hope this is quick, we have heard a lot

11 about modeling or plants installing incipient detection

12 systems and getting credit for those detection systems

13 in the fire models.

14 Because of the method that is applied for

15 determining potentially challenging and ultimately

16 challenging fires, is there a danger that we are

17 screening out events that would be detected -- that occur

18 would be detected by incipient detection and applying

19 an incorrect frequency for events that were taking

20 credit for incipient detection? That didn't come

21 through very well.

22 If I have 100 fire events and I screened it

23 down to 50, let's say, that I have determined I want in

24 my database, those other 50 events may have been real

25 fires but they weren't determined to be potentially

1 challenging. So, the real frequency of fires that could
2 be detected by incipient detection is 100. It is not
3 50.
4 MS. LINDEMAN: I see what you are saying.
5 CHAIRMAN STETKAR: But in my PRA model, I
6 am taking credit for that incipient detection as
7 detecting stuff that already was bigger than it -- you
8 know it was too big to meet the alert criteria, for
9 example.
10 And again, it is late, so I am not expressing
11 myself very well. But the concern is are we getting
12 disconnected between models for the credit that I can
13 take for incipient detection as a fraction of the
14 frequency of events that have already screened out the
15 stuff that I am taking credit for.
16 MS. LINDEMAN: I think the short answer or
17 my perspective is some smoking, light smoking events,
18 those are not yet a fire or determined --
19 CHAIRMAN STETKAR: But the incipient
20 detection is saying that I am going to detect --
21 MS. LINDEMAN: Right.
22 CHAIRMAN STETKAR: Let me put it this way.
23 You have a real fire. The incipient detection models
24 are saying I am going to detect that fire before it
25 becomes a real fire. But you have already thrown away

1 all of the events that would --

2 MS. LINDEMAN: Yes, I see what you are

3 getting at.

4 CHAIRMAN STETKAR: -- have been detected by

5 that.

6 MS. LINDEMAN: It probably will catch fires

7 that could never have grown.

8 MEMBER SCHULTZ: You just need to be

9 careful how you apply the information in bullet 4, the

10 15 percent of fires detected by fixed detection systems.

11 That information can be misused or misinterpreted.

12 MS. LINDEMAN: Sure.

13 MEMBER SCHULTZ: For example, not to

14 install the fixed detection systems and not to get full

15 credit for them.

16 MS. LINDEMAN: But the rest of this comes

17 if you do a calculation for time to detection using the

18 6850 heat release rate and the growth time, it happens

19 very quickly. And the point of this is these fires may

20 be slower developing than we are giving them credit for.

21 And that is why they were detected by the passer by and

22 not by a detection system.

23 So, in summary, we have made some progress

24 since 2010, most notably within the fire events

25 database, HRA and circuit failure. There also has been

1 progress through the FAQ process.

2 I think, in my opinion, we are still in need

3 of a transformative change and I think the working group

4 between EPRI and NRC on the cabinet heat release rates

5 is a step in the right direction. So, we are committed

6 to pursuing Fire PRA research to advance the state of

7 practice.

8 CHAIRMAN STETKAR: Great. It was painful

9 wasn't it?

10 MS. LINDEMAN: Kind of.

11 MEMBER SCHULTZ: Not really. I just had

12 one comment and really a question for you, Victoria. I

13 was going to ask Ashley but as she went through the future

14 research listing, it was quite extensive in terms of what

15 is being planned. It followed a lot of good findings

16 that have come from the database review work.

17 And I just wanted to ask both you, Victoria,

18 and Joe as well, as we talked earlier, it is good to have

19 freeze appoints associated with the overall process.

20 Do we have freeze points where we are going to apply what

21 we have learned and the reduction of conservatism that

22 we heard so much about today, apply the research?

23 In other words, a tendency that people have

24 is well, EPRI is going to do this, this, and this. And

25 so when that is done in four years, we can then reduce

1 the conservatism because then we will really know. But
2 right now, we have got a lot of information that would
3 suggest conservatism in the models that have been
4 imposed.
5 MS. ANDERSON: Okay, so --
6 MEMBER SCHULTZ: The FAQ process is
7 intended to do that but as we already said, it is not
8 transformative. It is kind of gradual. It would seem
9 that we have got some things that we could really leap
10 upon and utilize.
11 MS. ANDERSON: Right. And the freeze point
12 process is written such that a licensee does have the
13 discretion to say well, we are not going to incorporate
14 things immediately --
15 MEMBER SCHULTZ: No, no. I didn't want to
16 get confused there. I was saying it would be nice to
17 be able with the research to say we are not going to wait
18 forever for the program to be done. We have good enough
19 information now on the research that has been developed
20 to reduce our conservatisms that we are imposing on
21 models about 805 or even FERAs and do that in a consistent
22 basis across the industry.
23 MS. ANDERSON: I mean are you asking is
24 there a point at which like everybody would incorporate
25 some specific information that comes out?

1 MEMBER SCHULTZ: Have it out there so that
2 it can be used and NRC -- because really NRC and the
3 industry to come to agreement and say this is going to
4 be the new information that we are going to utilize.
5 MS. ANDERSON: Right. And I think that is
6 the idea behind the process that Ashley and Research has
7 set up is that information is going to be coming out after
8 it has been reviewed through their panel. So, in other
9 words, we don't want to put a lot of information out there
10 because, as we discussed with the CPT credit, people had
11 to --
12 MEMBER SCHULTZ: But the panel process is
13 going to drive that.
14 MS. ANDERSON: Right, the panel is going to
15 drive it but we don't want to put raw information out
16 there. You know Ashley has all this great information.
17 You don't want to put it out there raw and then you find
18 out well, there is an interpretation problem or
19 something.
20 So, we wait until it has been vetted and
21 finalized by the panel of experts between industry and
22 NRC. But once it gets published, my understanding is
23 that you can use it.
24 MEMBER SCHULTZ: Thank you.
25 MEMBER BALLINGER: I have a question that

1 you probably won't answer. The database, the fire
2 incident database, is it evenly distributed amongst
3 plants or were there plants that sort of dominated
4 things?
5 MS. LINDEMAN: I can say just off the bat
6 there is a specific plant that always had a fire when
7 they started their diesel generator.
8 (Laughter.)
9 MEMBER SCHULTZ: This was in the '90s?
10 MS. LINDEMAN: I think it may still happen.
11 CHAIRMAN STETKAR: That is pertinent
12 because it comes back to my two-stage Bayesian stuff.
13 MEMBER BALLINGER: So, it was not evenly
14 distributed.
15 MS. LINDEMAN: Well, I can't answer. I
16 just know of this outlier because it was often. But what
17 we did is I think we counted one or two and then we said
18 the rest, they have a procedure. They know it happens.
19 They have a fire watch.
20 (Simultaneous speaking.)
21 MS. LINDEMAN: It is in the exhaust
22 manifold. It caught on fire. So, but other than that,
23 I can't answer that.
24 MEMBER BALLINGER: Okay because if it is
25 very unevenly distributed, that kind of messes up the

database.

CHAIRMAN STETKAR: That's right.

MS. LINDEMAN: I believe it is accounted for in the uncertainty.

MEMBER BALLINGER: Okay.

MS. LINDEMAN: If there is a pattern, the uncertainty is a bit greater.

MEMBER BLEY: It could be unaccounted for.

CHAIRMAN STETKAR: It could be unaccounted for if you kept the data out of it.

Anything else for NEI or EPRI? If not, thanks.

MS. LINDEMAN: Thank you.

CHAIRMAN STETKAR: Seriously, all of the ranting and things like that, part of it is to kind of probe to see how deeply you have thought about stuff. This is really good.

As we usually do, I will go around the remnants of who is left here at the table. Oh, I guess I should ask --

MR. LAI: They just told me nobody on the phone for the last four hours.

CHAIRMAN STETKAR: But I need to ask in the room. Is there anyone who wants to make any final comments?

1 If not, I will go around and two things, any
2 final comments that any of the members may have? Because
3 I usually like to ask this. Do you see any reason that
4 we should bring this up to the full committee? And I
5 will start with you, Steve.
6 MEMBER SCHULTZ: I'm still struggling with
7 this, with the second question in terms of discussion
8 with the full committee. And the reason is, I am still
9 trying to understand better the outcome of the 805
10 process that has led many licensees to a position where
11 they have what they are calling a Fire PRA initiated by
12 a desire to utilize a risk-informed process to address
13 a regulatory issue. And that result is so conservative
14 they have difficulty explaining to management what the
15 results mean in comparison to information that has been
16 developed earlier from IPEEE or from internal events
17 PRAs and so forth.
18 And that is not only affecting that
19 discussion but also their ability to move into other
20 risk-informed applications, including concerns about
21 how they are going to apply what they have now available
22 in the risk significance determination process and other
23 elements associated with findings and triennial audit
24 concerns and so forth.
25 So, I am just trying to understand that

1 better. But those are issues that I think the full
2 committee would be interested in understanding. I
3 just, since I haven't understood it yet from today's
4 discussions, I am a little bit hesitant to say it is time
5 to bring a full committee in that regard.
6 But I really appreciate the discussions we
7 have today because all the presentations have been very
8 helpful and very well done.
9 I also heard a lot of good discussion
10 between industry and the staff about ways in which we
11 can move forward appropriately to resolve some of these
12 issues as well.
13 The dichotomy of having a utility that
14 hasn't gone through the 805 process to be merrily working
15 forward with Fire PRA in a way such that they can apply
16 less conservatism and have a pie chart that makes sense
17 is very frustrating.
18 CHAIRMAN STETKAR: Dennis?
19 MEMBER BLEY: Yes, I, too, really
20 appreciate the presentations and discussions and pretty
21 open discussions. Ray, I think he is probably gone. On
22 the way he threw a hand grenade, kind of, in the room
23 about we ought to start over and come up with a new
24 approach. And I don't know quite what that would be.
25 It seems everybody else is kind of coming together but

1 going after the hard points here, I remain unconvinced
2 that you couldn't have done a whole lot better on this
3 conservative aspect if you had taken a real good
4 treatment of the uncertainty and supported that coming
5 forward. It just kind of baffles me a little.
6 But as far as coming to a full committee,
7 we wrote a letter, as I recall, some years ago and I am
8 not sure there would be much change. And I am not sure
9 just to get it there for people to hear it that could
10 come here. So, I don't think I can lean toward pushing
11 for a full committee meeting at this point in time.
12 I don't know where we might send that but
13 I am certainly open to talking about it inside the
14 committee.
15 CHAIRMAN STETKAR: Bob?
16 MEMBER BALLINGER: I'm all set.
17 CHAIRMAN STETKAR: Harold?
18 MEMBER RAY: I want to apologize for, I
19 wanted to learn as much as I could but I had a bunch of
20 conflicts that drove me out.
21 CHAIRMAN STETKAR: And you learned as much
22 as you could.
23 MEMBER RAY: A long session with the
24 lawyers is now. But in any event, I do appreciate the
25 presentations and getting an opportunity to begin to

1 learn here.

2 I think that this may be a paradigm for other

3 things in fire protection in terms of implementation,

4 as best as I could understand it.

5 As far as going to the full committee is

6 concerned, I am not in a position to make a

7 recommendation.

8 CHAIRMAN STETKAR: I think in summary,

9 again, I would like to thank everybody, industry,

10 representatives for bringing together a lot of

11 information, EPRI and NEI, staff, again. I think it was

12 a really useful discussion, an open discussion.

13 In my opinion, I tend to side with Dennis.

14 I don't' see value added at the moment for bringing it

15 to the full committee.

16 I am sensitive to Steve's concerns. I

17 think that is an area that I believe the full committee

18 would be interested in. But at the moment, I think it

19 is -- I don't know what the timing is.

20 MEMBER SCHULTZ: We can go over that. It

21 is certainly a broader issue.

22 CHAIRMAN STETKAR: You know we asked the

23 questions of the staff this morning about kind of lessons

24 learned from this whole process, not in the sense of

25 individual FAQs and stuff like that but the broader

1 issues. And the industry, I think at the same level,
2 in terms of looking forward, what has this taught us
3 about -- what do we really know not to do going forward,
4 I mean if we are honestly all agreed that taking
5 risk-informed performance-based approach to regulation
6 is a reasonable path forward? Because this, obviously,
7 from a utility chief executive officer, a chief
8 financial officer's perspective, is not a good marking
9 against that sort of philosophy. But I think it is
10 premature to have that discussion at the full committee
11 level. I don't know what we would benefit from that.
12 With that, unless there is any other
13 comments or discussion -- Joe?
14 MR. GIITTER: I would just add that as
15 Victoria said earlier, the NRC has a risk-informed
16 steering committee, as does industry. It is headed up
17 by the director, the office director of NRR and it has
18 deputy office directors from Research, NRO and NSIR and
19 other offices. And the goal is to meet every month.
20 But I would say one of the primary focuses
21 of that risk-informed steering committee is to, in part,
22 learn lessons from NFPA 805 and to understand what
23 obstacles have to be removed to ensure that in the future
24 we can, if we choose to do so, migrate to more
25 risk-informed decisionmaking processes within the

agency.

MEMBER SCHULTZ: Thanks for that addition, Joe.

MEMBER RAY: John, can I say one thing?

CHAIRMAN STETKAR: Yes.

MEMBER RAY: You know I was in charge of a plant for a long time. and I didn't want to go down this path for reasons that I felt there was some echo to here, and that is the amount of detail that you are having to cope with here, the opening up the cabinets and looking at the contents of them and the kind of relays and all that sort of stuff would just be an endless task that would be able to succeed in doing. So, John referred earlier to having a fire watch instead of doing something else.

I had lots of fire watches and this just seemed like a bigger challenge than it was purported to be, from the standpoint of how much detail there is in the electrical systems, for example, which are the primary source, not the only source but the primary source of fire initiation. I thought, my God, we will just never get here from here.

So, the lesson learned, the reason I spoke up at the end here was that I do think there is, as I said, there is a lesson to be learned here, which is how

1 much can we aggregate what we are looking as we use
2 risk-informed processes and not have to get done? If
3 we are going to talk about human performance, for
4 example, do we have to know the age and weight and
5 education of every employee and does that affect their
6 performance or is everybody able to be represented just
7 as an employee, period, and capture their capabilities
8 in some way that doesn't require the kind of detail that
9 inevitably we are led into here?
10 Which is not to say that doing it isn't worth
11 it. I was just telling you what my own feelings were
12 going back a number of years, that it would entail so
13 much detail, not only cable runs but everything else that
14 I couldn't see how it would be worthwhile doing.
15 I am glad people have taken it and gone
16 forward with it and I think they will benefit of it. So,
17 I am not being critical. And that is not why I wanted
18 to come and hear the positive things that were being
19 said. So, I hope it is successful.
20 But in terms of lessons learned, which is
21 what John was talking about, I would say one lesson would
22 be how far down the rabbit hole are we going to have to
23 go in modeling whatever it is we are trying to model,
24 in order to get the uncertainties down to the point that
25 it makes sense.

1 Sorry to have kept you here.

2 CHAIRMAN STETKAR: And I have to speak up.

3 I will keep it two minutes.

4 I think you are right, Harold. I think

5 quite honestly from my experience, what has been lost

6 in this effort is that there hasn't been a strong

7 experience direction that essentially does what you are

8 saying. It says I don't need the detail over here from

9 a risk perspective. From a real risk perspective, I

10 don't need the detail.

11 As much as somebody might like to model a

12 circuit or as much as somebody might like to run a --

13 what's it called -- a virtual experiment over here using

14 the best available tools, I don't need that. I do need

15 it here. And I only need it here. So you folks go away

16 and do it here.

17 The same is true for seismic analysis, where

18 you can get seismic consultants running off doing all

19 sorts of really neat analyses that they like to do.

20 Unless you have a strong direction that says in some

21 places I might need the detail but I use the risk

22 information to guide that, rather than trying to build

23 all of the detail and presume that you are going to get

24 a good risk assessment out of it.

25 And I think that is one of the lessons

1 learned from my perspective from this effort.

2 And with that, we are adjourned.

3 (Whereupon, the above-entitled matter

4 went off the record at 6:11 p.m.)

5

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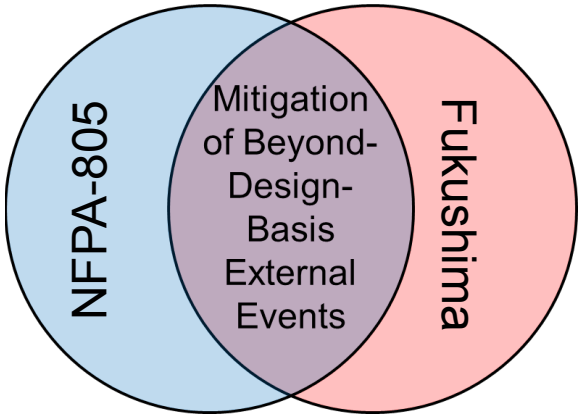
Status of NFPA-805 LAR Reviews and Key Fire PRA Technical Challenges

Joseph Giitter, Director
Division of Risk Assessment
Office of Nuclear Reactor Regulation
September 18, 2014

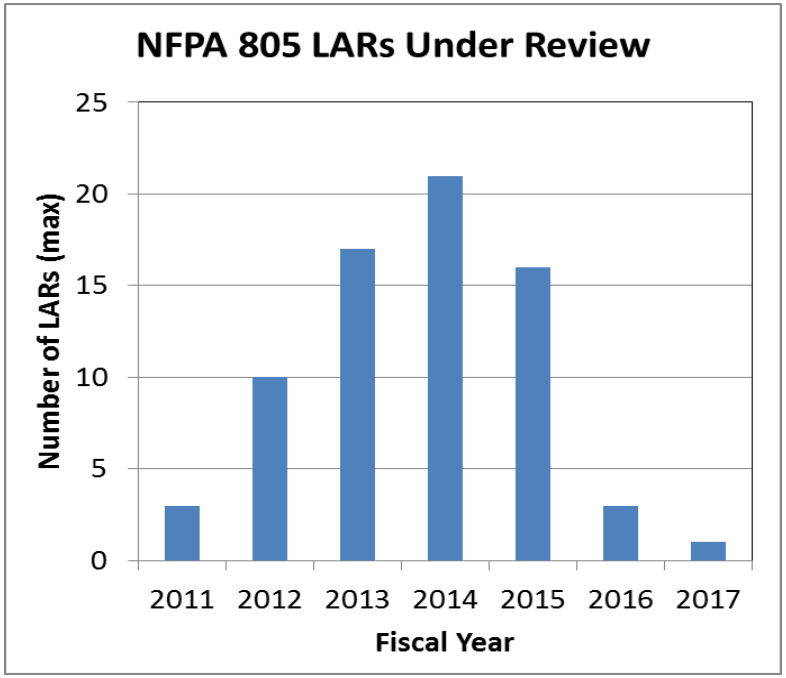
Transition to NFPA 805 has considerably advanced safety

- Safety improvements
- Licensee knowledge
- Licensee ownership



We are Focused on the Success of the NFPA 805 Program

- Challenges
  - Resources
  - New Methods
- Efficiency
- Communications



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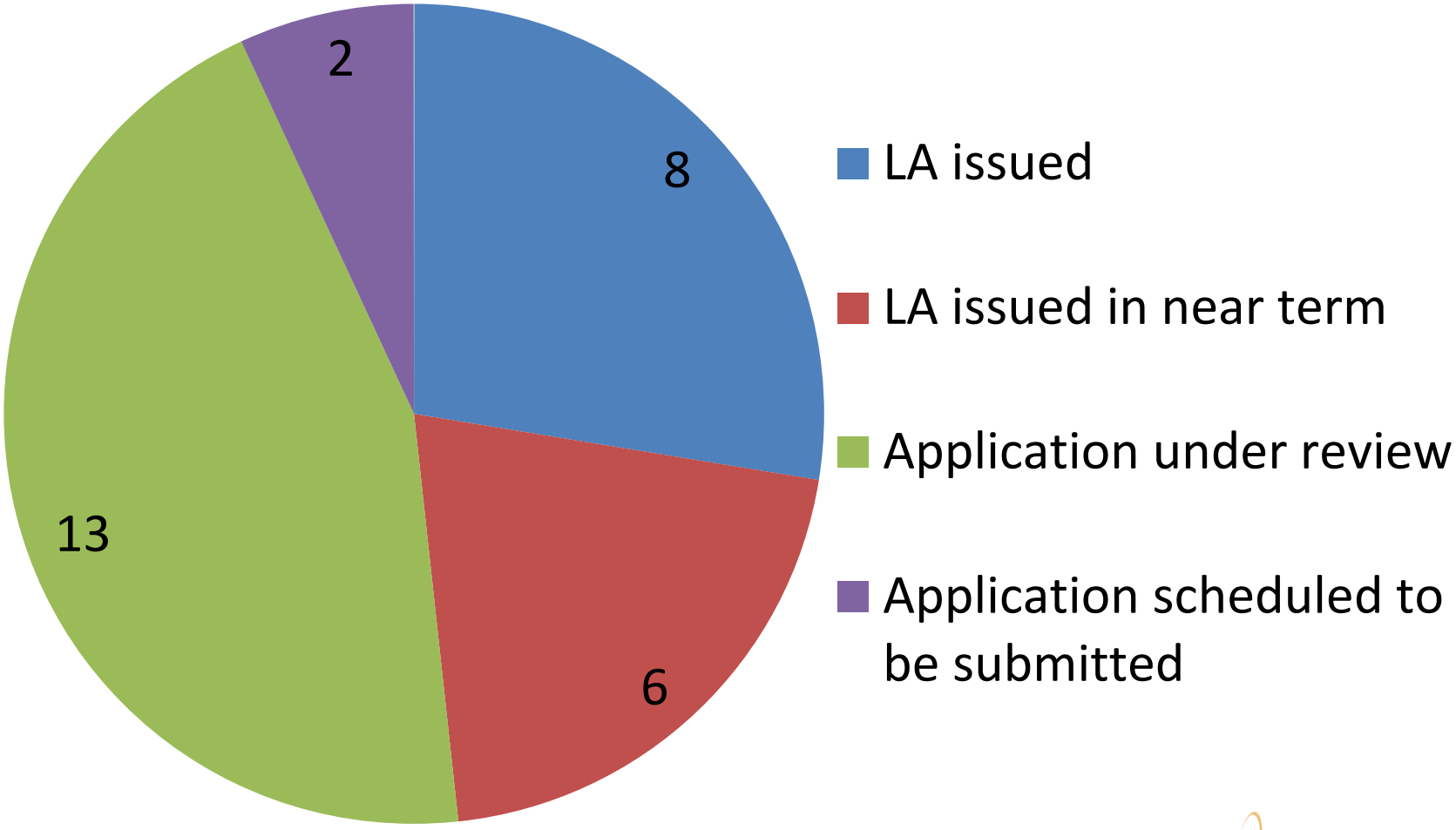
Nearly Half of the NFPA 805 Reviews Will Be Completed in the Near Term



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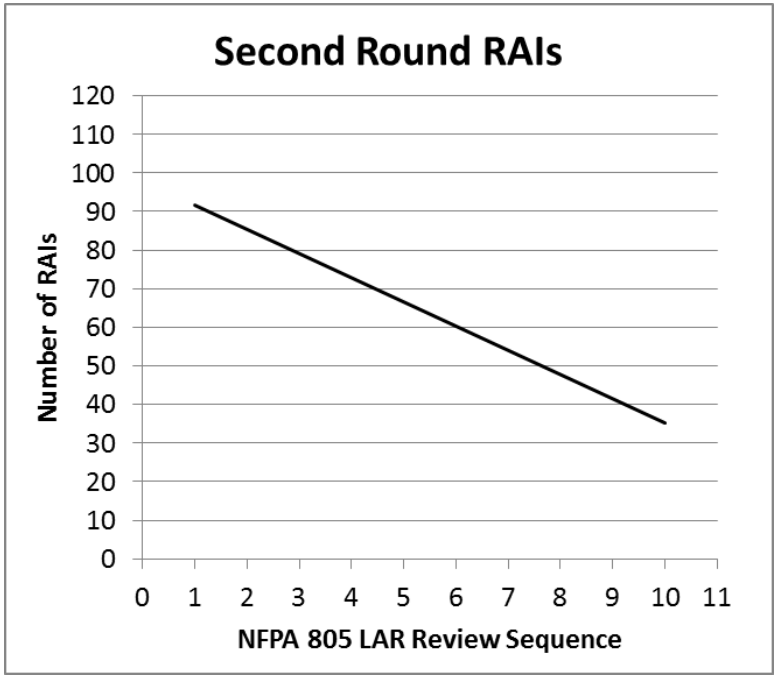
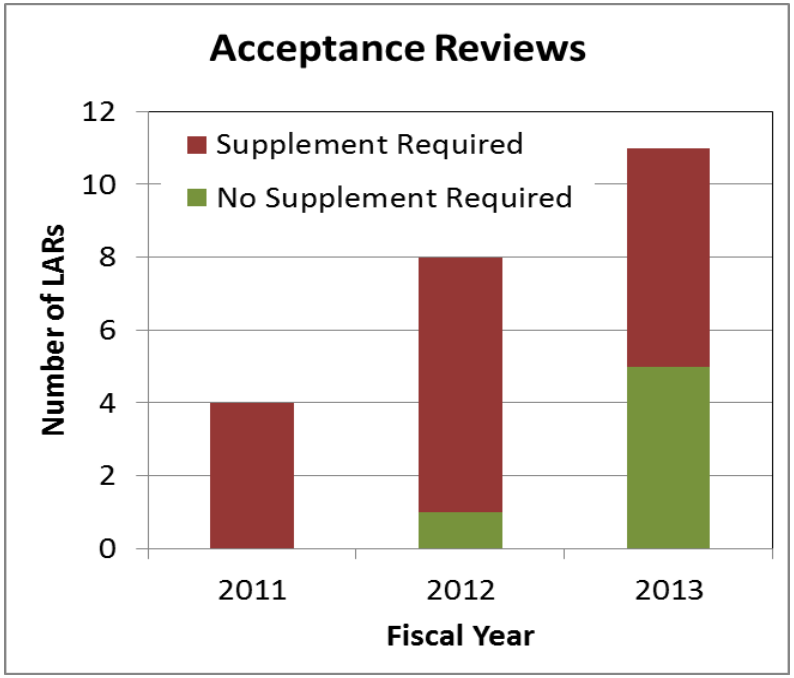
NFPA 805 LAR Quality Has Improved





NFPA 805 “War Room”

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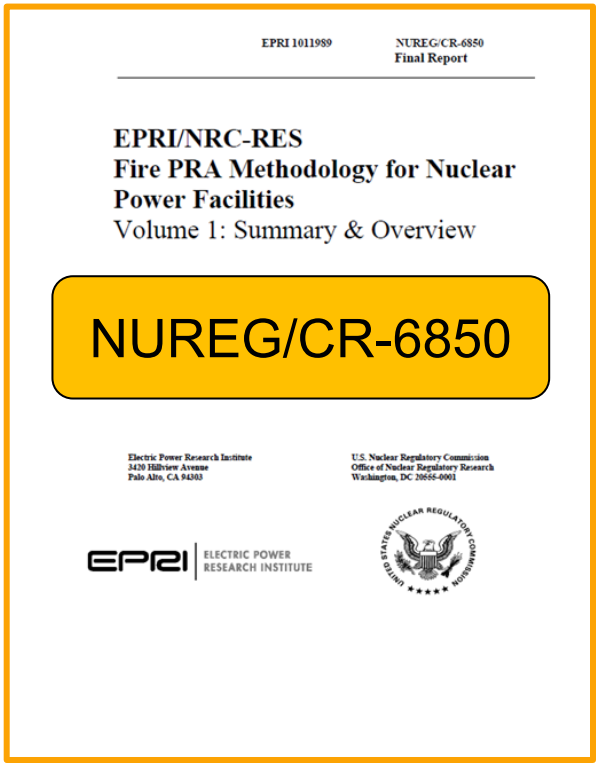
Technical Challenges Related to Fire PRA

- New methods are used in LARs and evaluated during review process
- Impact
  - Resource Challenges
  - Review Schedule
  - Consistency
  - Stability of Review Process
- Freeze-point concept implemented


EPRI 1011989 NUREG/CR-6850
Final Report

EPRI/NRC-RES
Fire PRA Methodology for Nuclear Power Facilities
Volume 1: Summary & Overview

NUREG/CR-6850

Electric Power Research Institute
3420 Hillview Avenue
Palo Alto, CA 94303

U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Washington, DC 20555-0001

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Joint Fire PRA Method Development Efforts Have Been Successful

- New methods and guidance have been developed by NRC and Industry
  - Fire testing by NRC/RES (e.g., Electrical Cabinet Heat Release Rate testing, Incipient Detection System Testing)
  - Joint Fire PRA research efforts by NRC/RES and EPRI
- FAQ process is used to provide interim guidance on various Fire PRA technical issues

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List of Deviations from Accepted Methods and Approaches

LEGEND:	Generic	NFPA 805	Unreviewed Analysis Methods (UAMs)

	Different Methods, Approaches, Factors Identified in Current Applications	Plants Impacted	Method or Guidance Development Needed	FAQ	High Priority	Status - Comment
1	Incipient detection (VEWFDS) credit – Area-Wide	some	TBD	13-0001		**RESOLVED**
2	Incipient detection (VWEFDS) credit – Control Room/Complex	some	TBD		X	**ACTIVE** - credit beyond regular detection requires justification - NRC/RES experimental program in progress
3	Incipient detection (VEWFDS) credit – Used to justify Non-Abandonment	some	no			
4	Control room abandonment (0.1 CCDP screening value)	many	yes	13-0002		**ACTIVE** - Guidance for using 0.1 CCDP screening value is under management review. Further work is planned on loss of habitability.
5	Not using lower failure threshold for sensitive electronics	some	no	13-0004		**RESOLVED** - sensitive electronics defined in more detail and approach enhanced. Closure memo available at ML13322A085.
6	Fire propagation from self-ignited cable fires and hot work induced cable fires	some	no	13-0005		**RESOLVED** - NRC/RES addressed self-ignited cable fires and hot work induced cable fires. Closure memo available at ML13319B181.
7	Modeling junction box scenarios	some	no	13-0006		**RESOLVED** - Closure memo available at ML13331B213.
8	Transient Fire Frequency Likelihood (Administrative control frequency reduction Areal factor)	0	yes (?)	14-0007		**ACTIVE** (not being evaluated at this time) - handle separately from NFPA 805 FAQ 64.
9	Main Control Board Treatment	some	no	14-0008		**RESOLVED** - clarified the definition of the Main Control Board, and to extend the definition to cover rear side of the main control board (Closure memo available at ML14190B307)
10	Non-abandonment with loss of function	many	yes			Need consistent industry approach or guidance. Work on loss of function will follow the work on loss of habitability.

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List of Deviations from Accepted Methods and Approaches

LEGEND:	Generic	NFPA 805	Unreviewed Analysis Methods (UAMs)

11	*Database driven factor for propagation of fire beyond the originating electrical cabinet (not accepted by NRC via ADAMS ML12171A583)*	some	yes		**X**	**ACTIVE** - alternative approaches that are developed should have phenomenological basis; NRC/RES experimental program in progress (Note: EPRI 1022993 found inadequate by NRC via ADAMS ML12171A583; not applied in LARs)
12	Credit for CPT in probability of spurious operations	all	no			**RESOLVED** - Interim guidance provided by RES. More comprehensive RES report provided in NUREG/CR-7150, Vol. 2.
13	Hot work factor from administrative control credit	some	no			**RESOLVED** - closed by Panel and June 21, 2012 letter to NEI (ML12171A583). New frequencies for cable fires by welding and cutting established.
14	Transient fires (some use 75%ile values)	some	no			**RESOLVED** - closed by Panel and June 21, 2012 letter to NEI (ML12171A583), with minor clarification.
15	Alignment factor for oil pump fires (similar approach to FAQ 44)	some	no			**RESOLVED** - NRC issued its position on use of different split fractions from the Panel resolution officially through the June 21, 2012 letter (ML12171A583).
16	Administrative control frequency reduction	some	no	NFPA 805 12-0064		**RESOLVED** - closed by NFPA 805 FAQ 12-0064. FAQ includes credit for significant administrative control
17	Generically use lower HRR for transient combustibles (even though higher HRR is possible) to compensate for perceived lower frequency of occurrence	some	no	NFPA 805 12-0064		**RESOLVED** - this was resolved by NFPA 805 FAQ 12-0064 which allows the use of fractional influence factors to account for the likelihood of transient combustibles being present. There is no approach that allows reduced HRRs as a surrogate for lower likelihood.
18	Not using 0.001 as lowest value for failure of manual suppression (using values less than 0.001, even 0)	some	no			**RESOLVED** - no one is allowed to use values <0.001, and anyone currently doing so has provided sensitivity analyses or revised their PRA. This is usually an issue just for the MCR.
19	Not putting transient fires at pinch points (i.e., putting them at non-pinch point locations)	some	no			**RESOLVED** - This was addressed through generic RAIs.

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Testing Supported by NRC for NFPA 805

Title	Date
NUREG/CR-6931, Cable Response to Live Fire (CAROLFIRE)	2008
NUREG/CR-7102, Kerite Analysis in Thermal Environment of Fire (KATE-FIRE)	2011
NUREG/CR-7100, Direct Current Electrical Shorting in Response to Exposure Fire (DESIREE-FIRE)	2012
NUREG/CR-7010, Cable Heat Release, Ignition, and Spread in Tray Installations During Fire (CHRISTIFIRE) (Phase 1 – Horizontal trays, Phase 2 – Vertical)	2012 and 2013
Heat Release Rate Testing (HELEN-FIRE)	(2014 – 2015)
Determining the Effectiveness, Limitations, and Operator Response for Very Early Warning Fire Detection Systems in Nuclear Facilities (DELORES-VEWFIRE)	(2014 – 2015)
Flame Spread on Electrical Cables and Effects of Fire on Cable Coatings	(2014 – 2015)

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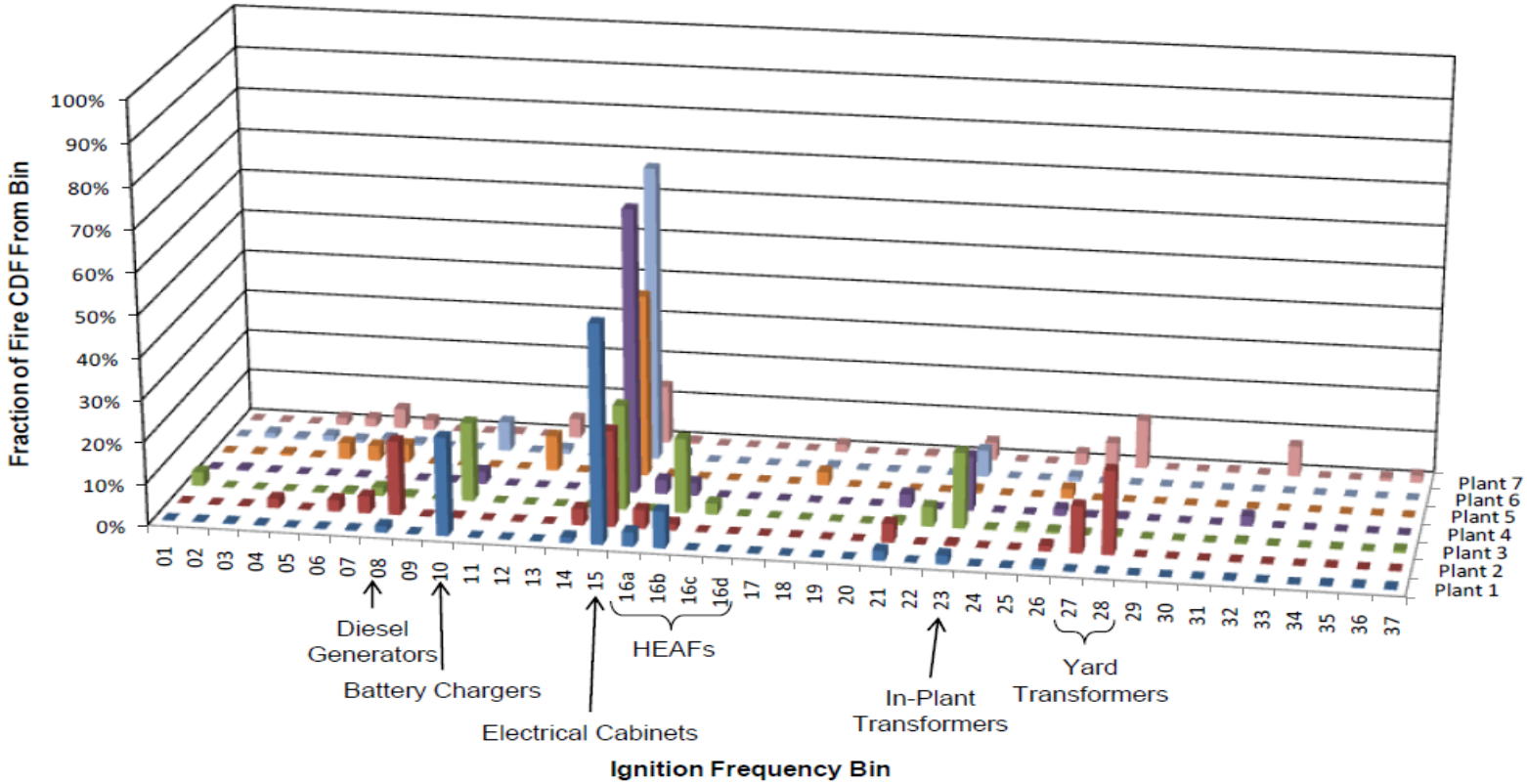
Fire CDF Contribution by Ignition Source



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Conclusions

- NFPA-805 advances safety
- Process improvements implemented
- Deviations from accepted methods have had a profound impact
- Industry and NRC must continue to focus on solutions
- Lessons learned must be addressed to ensure the success of future risk-informed initiatives

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Summary of Key Fire PRA Challenges

J.S. Hyslop,
Stephen Dinsmore
Reliability and Risk Engineers
PRA Licensing Branch, US NRC

Presented to ACRS Subcommittee on PRA, 9-18-2014

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Background

- Large number of deviations from accepted methods in NFPA 805 License Amendment Requests (LARs)
- Deviations from comparison with joint NRC/EPRI reports: NUREG/CR-6850 (2005) and Supplement 1 (2010), and NUREG-1921 (2012).
- Deviations identified
  - By licensees in LARs
  - In peer review Facts and Observations (F&Os)
  - During site audits
  - By generic RAIs, based on deviations identified in previous LAR reviews

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Key Challenges

- Key challenges derived from deviations from accepted methods
- Resolution required before completing LAR review
- Key challenges resolved by FAQ solution, additional research and testing
  - Sensitive Electronics
  - Self Ignited Cable Fires and Hot Work Induced Cable Tray Fires
  - Transient Fires
  - Spurious Operations
- Developing more realistic, generic fire PRA approaches is complex process

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Key Challenges (cont.)

- Important issues are being worked by RES
  - Fire Ignition Frequency and Suppression
  - Very Early Warning Fire Detection System (VEWFDS)
  - Electrical Cabinet Heat Release Rate (HRR)
  - Main Control Room Abandonment
- Staff must make decisions from review of specific LAR and accompanying RAIs prior to development of general technical solution

Sensitive Electronics - Background

- State of knowledge:
  - NUREG/CR-6850 specifies that solid state components are sensitive electronics with a failure threshold of 65°C or 3 kW/m²
- Failure threshold for sensitive electronics is much lower than key fire PRA targets, cables, which are 205°C or 6 kW/m² for thermoplastic cable and 330°C or 11 kW/m² for thermoset cable
- Examples of early LAR treatment
  - Sensitive electronics assumed to be protected by cabinets
    - Hot gas layer will be above the panels and
    - Heat isolated from the sensitive electronics by the steel structure and volume of air in panel
  - F&Os against FSS-C6 issued to some licensee's that assumed no damage, but not all plants assuming no damage got F&Os

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Sensitive Electronics - Resolved

- Fire PRA FAQ 13-0004 solution provides further definition of sensitive electronics and determines surrogate criteria for failure threshold for those located within cabinet
- Definition includes some integrated circuits, excludes electro-mechanical devices
- Sensitive electronics located within a cabinet not damaged unless thermoset cable failure criteria applied to exterior of cabinet
- Basis of surrogate is Fire Dynamics Simulator (FDS) computer runs which translate conditions outside the cabinet to within

Self Ignited Cable Fires and Hot Work Induced Cable Tray Fires - Background

- State of knowledge:
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  - NUREG/CR-6850 Appendix R provides guidance for modeling propagation of cable fires due to hot work (HWICF) (E.3)
- Potential for large propagating fires, contrary to expectations and operating experience
- Examples of early LAR treatment
  - Assumed that cable trays in which fire initiated damaged for SICFs and HWICFs, but no propagation
  - Procedural controls credited for hot work
    - Staff rejected no hot work fires because of continuous fire watch
    - Staff rejected several plants' analyses that applied a "procedural compliance factor" (0.01) to reduce hot work fire frequency in areas with hot work procedural control.

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Self Ignited Cable Fires and Hot Work Induced Cable Tray Fires - Resolved

- Fire PRA FAQ 13-0005 solution brought operating experience to bear on such risk evaluations
- Fires are confined to the cable tray of origin in the model
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  - Initially entire frequency of physical analysis unit (PAU) is applied to worst cable tray as defined by CCDP in PAU
  - If more refined results needed, then apply tray frequency to worst tray and assign remainder of PAU frequency to second worst tray, etc.
- Suppression cannot be credited prior to damage of entire cable tray
- Basis for constraint on propagation is operating experience, and tests (and presence of fire watch for hot work fire)
- Constraint on fire propagation applied to junction box fire risk analysis too (FAQ 13-0006)

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Transient Fires - Background

- State of knowledge:
  - NUREG/CR-6850 establishes a 98% fire peak HRR (317kW) which is generally applied as a portion of applicable peak HRR.
- Licensees claim that this overestimates the combustible loading in some plant areas and resulting 98% HRR
- Examples of early LAR treatment
  - Applied lower maximum peak HRR for transient fires to a room with no fixed ignition sources, difficult to access, no violations over a 5 year period, and no combustible storage and no hot work during power operations
  - Examples of reduced HRR are 69kW and 140kW
  - Staff rejected a “procedural compliance factor” (0.01) to reduce transient fire frequency in areas with procedural controls

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Transient Fires - Resolved

- EPRI Fire PRA Panel position provided guidelines for adjusting transient fire HRR from established values in NUREG/CR-6850. NRC adopted with few clarifications.
- Maximum peak HRR may be reduced upon considering potential presence of transient combustibles due to need, potential for traffic and congestion, and any violations of transient combustible controls
- HRR maximum may be increased due to these considerations, although the staff has not seen this applied in the LARs
- Confirmed that a particular ignition source need not be identified to postulate a transient fire
- Although beyond the statement of this resolution, transient fires may be excluded only if physically impossible (as opposed to just unlikely)
- Basis for relaxation of maximum peak HRR is collective judgment of staff and industry

Spurious Operations - Background

- State of knowledge
  - Control power transformers (CPTs) credited per NUREG/CR-6850 to decrease spurious operation likelihood by ½.
  - Calculation of probability of AC duration in FAQ 08-0051, NUREG/CR-6850 Supplement 1
  - No credit for DC duration; therefore, probability of DC hot short duration remains 1.
- At NEI Fire Protection Information Forum, industry personnel indicated ½ credit for CPT is unwarranted; CAROLFIRE and DESIREE-Fire results confirm
- Examples of early LAR treatment
  - Full credit of ½ applied to all applicable spurious operation probabilities. Staff requires sensitivity studies removing credit for CPT

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Spurious Operations - Resolved

- RES/EPRI provided updated and expanded guidance on spurious operations in JACQUE-FIRE (NUREG/CR-7150 EPRI 3002001989, May 2014) from expert elicitation of existing data
- Spurious operation likelihood divided into SOV Single Break Control Circuits, MOV Single Break Control Circuits, and Double Break for each group as well
- Approach no longer distinguishes according to control power transformer (CPT)
- Revised likelihood of AC duration, and provided DC duration
- Indicated that more sophisticated technique (option 2) from NUREG/CR-6850 for calculating spurious operation likelihood was flawed.
- Basis is test data from DESIREE-FIRE (NUREG/CR-7100), CAROL-FIRE (NUREG/CR-6931), Omega Point NEI testing, Duke proprietary tests

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  - 2008 EPRI report 1016735 contains frequencies relying on 1990-1999 data, which is endorsed by NRC in FAQ 08-0048 NUREG/CR-6850 Supplement 1
    - Fire ignition frequencies decreased overall from NUREG/CR-6850 values
    - FAQ 48 specifies need for sensitivity study using NUREG/CR-6850 frequencies for frequency bins in FAQ 48 with large uncertainty. If RG 1.174 guidelines exceeded, then additional fire protection defense in depth must be identified
  - Suppression values reevaluated from NUREG/CR-6850 in FAQ 08-0050 NUREG/CR-6850 Supplement 1 to credit suppression prior to fire brigade arrival
- Examples of early LAR treatment
  - FAQ 48 frequencies adopted by all
  - Associated sensitivity study not initially included
    - Sensitivity study results will exceed RG 1.174 risk acceptance guidelines if change in risk values near acceptance guidelines
    - Search for defense-in-depth measures performed

Fire Ignition Frequency and Suppression Probabilities – Active

- Joint RES/EPRI research program in progress.
- Comprehensive fire event data collection effort over the years 2000-2009 by EPRI.
- Fire ignition frequencies rely heavily upon new data, with 1968-1999 data supplementing sparse 2000-2009 frequency bins.
- Codified criteria for classifying events, enabling reproduction of basis for events that count towards frequency
- Recalculated suppression failure probabilities to rely upon same data set
- Suppression analysis captures control of fire
- Current approach: Staff is applying FAQ 48 for NFPA 805 applications for frequency and FAQ 50 for suppression

Very Early Warning Fire Detection System (VEWFDS) - Background

- State of knowledge
  - FAQ 08-0046 NUREG/CR-6850 Supplement 1 for VEWFDS installed to monitor conditions inside cabinet
  - Industry proposes draft FAQ 13-0001
    - Credit proposed for all potential installations: in-cabinet, area-wide, and main control room (MCR)
    - Staff recommends that industry withdraw FAQ due to ongoing RES testing and its importance to FAQ
  - No established staff-approved method for determining risk reduction credit for area wide application
- Examples of early LAR treatment
  - FAQ 46 adopted whenever applicable
  - Staff rejected several cases where the FAQ 46 credit was applied to installation for area wide and MCR

Very Early Warning Fire Detection System (VEWFDS) – Active

- RES research program underway
- Confirmatory research related to FAQ 08-0046, NUREG/CR-6850 Supplement 1 on in-cabinet installation; research will address area-wide installation also
- Establish advanced notification beyond traditional detection
- Wide variety of detectors tested
- FAQ 46 event tree approach
  - Addition to FAQ 46: examine events in new fire events database to determine which experience incipient stage
- MCR installation not pursued in testing program due to lack of interest
- Current approach: FAQ 46 for in-cabinet installation for NFPA 805. No credit for area-wide installation. 5 minutes for advanced notification for installation in MCB (main control board) per NUREG/CR-6850

Electrical Cabinet Heat Release Rate (HRR) - Background

- State of knowledge
  - NUREG/CR-6850 postulated probability distributions for peak HRRs for electrical cabinets
    - Based on NUREG/CR-6850 team expert judgment relying on available testing
    - Factors to distinguish among HRR included cable type, internal cable configuration, cabinet type
- Industry claims that peak HRRs do not comport with data in fire events database upon which frequencies developed
- Examples of early LAR treatment
  - Peak HRRs determine if damage occurs to targets outside cabinet; utilized in pre-calculated zones of influence or more detailed fire modeling

Electrical Cabinet Heat Release Rate (HRR) - Active

- RES and EPRI have working group underway
- Purpose: Perform testing and reevaluate cabinet peak HRRs
  - Fires not established to be bounding fires
- Factors in HRR testing matrix include:
  - Many different cases of cabinet type, internal cabinet configuration, cable type, ventilation
- Range of ignition sources tested to produce ignition
  - Minimal energy ignition sources were used in testing
- EPRI to participate in evaluation of data for production of probabilities of peak HRR
- Current approach: Apply NUREG/CR-6850 HRRs

Main Control Room Abandonment - Background

- State of knowledge
  - HEPs associated with shutdown after MCR abandonment can be estimated with existing methods but actions are complex
  - Timing of abandonment reasonably straightforward for habitability
  - Identification of which equipment is failed by the fire and which survives the fire is very complex
  - Modelling all different scenarios too complex but oversimplified approaches of indeterminate accuracy
- Examples of early LAR treatment
  - Staff rejected single CCDP/HEP of 0.1 for failing to shutdown
  - Impact of different amounts of equipment loss and different numbers of spurious operations addressed with binning (i.e., assigning all frequency to a small number of representative scenarios)

Main Control Room Abandonment - Active

- Worked in fire PRA FAQ process
- Consists of abandonment due to loss of habitability and due to loss of control
- Draft FAQ 13-0002 on loss of habitability issued by industry which describes framework for evaluating remote shutdown operations
- Staff issued interim guidance on remote shutdown operations due to loss of habitability to support 0.1 human error probability
  - Arose from industry examples presented as a method to perform evaluation
  - Heavy on plant specifics to ensure common understanding of important factors
  - Staff provided additional relaxations to guidance with proper justification
- Research program to be conducted to examine loss of habitability driven abandonment more closely and examine loss of control
- Current approach: Staff is making decisions from review of specific NFPA 805 LAR and accompanying RAIs prior to development of general solutions
  - Industry is transitioning from coarse conservative analyses to more detailed solutions to characterize CCDP for loss of habitability

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Concluding Observations

- Numerous deviations from accepted methods have been introduced since NFPA 805 implemented in the transition
- NFPA 805 pilots Harris and Oconee did not truly test the readiness of fire PRA methods
- Final aggregate change in risk estimates using only accepted methods is required to complete review of NFPA 805 submittal
- Fire risk modeling approaches improved, yet continue to evolve, since NUREG/CR-6850 (EPRI 1011989).

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Summary of Key Fire PRA Challenges

J.S. Hyslop,
Stephen Dinsmore
Reliability and Risk Engineers
PRA Licensing Branch, US NRC

Presented to ACRS Subcommittee on PRA, 9-18-2014

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Background

- Large number of deviations from accepted methods in NFPA 805 License Amendment Requests (LARs)
- Deviations from comparison with joint NRC/EPRI reports: NUREG/CR-6850 (2005) and Supplement 1 (2010), and NUREG-1921 (2012).
- Deviations identified
  - By licensees in LARs
  - In peer review Facts and Observations (F&Os)
  - During site audits
  - By generic RAIs, based on deviations identified in previous LAR reviews

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Key Challenges

- Key challenges derived from deviations from accepted methods
- Resolution required before completing LAR review
- Key challenges resolved by FAQ solution, additional research and testing
  - Sensitive Electronics
  - Self Ignited Cable Fires and Hot Work Induced Cable Tray Fires
  - Transient Fires
  - Spurious Operations
- Developing more realistic, generic fire PRA approaches is complex process

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Key Challenges (cont.)

- Important issues are being worked by RES
  - Fire Ignition Frequency and Suppression
  - Very Early Warning Fire Detection System (VEWFDS)
  - Electrical Cabinet Heat Release Rate (HRR)
  - Main Control Room Abandonment
- Staff must make decisions from review of specific LAR and accompanying RAIs prior to development of general technical solution

Sensitive Electronics - Background

- State of knowledge:
  - NUREG/CR-6850 specifies that solid state components are sensitive electronics with a failure threshold of 65°C or 3 kW/m²
- Failure threshold for sensitive electronics is much lower than key fire PRA targets, cables, which are 205°C or 6 kW/m² for thermoplastic cable and 330°C or 11 kW/m² for thermoset cable
- Examples of early LAR treatment
  - Sensitive electronics assumed to be protected by cabinets
    - Hot gas layer will be above the panels and
    - Heat isolated from the sensitive electronics by the steel structure and volume of air in panel
  - F&Os against FSS-C6 issued to some licensee's that assumed no damage, but not all plants assuming no damage got F&Os

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Sensitive Electronics - Resolved

- Fire PRA FAQ 13-0004 solution provides further definition of sensitive electronics and determines surrogate criteria for failure threshold for those located within cabinet
- Definition includes some integrated circuits, excludes electro-mechanical devices
- Sensitive electronics located within a cabinet not damaged unless thermoset cable failure criteria applied to exterior of cabinet
- Basis of surrogate is Fire Dynamics Simulator (FDS) computer runs which translate conditions outside the cabinet to within

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- Fire risk modeling approaches improved, yet continue to evolve, since NUREG/CR-6850 (EPRI 1011989).

Industry Perspectives on NFPA 805

September 18, 2014

Elliott Flick

Sr. Director, Engineering Operations

Exelon Generation®

NFPA 805 Historic Experiences

- Unpredictability of expectations
- Cost and schedule challenges
- Resource Challenge
- Planning Challenges

Result is $M of added cost, high level of rework, reduced NRC and industry resources, and uncertainty regarding the final outcome

Highlights - What's going well?

Fire risk safety improvements and Operator burden reductions are being implemented

Improved understanding within Industry and NRC

Openness to reviewing the process and seeking common ground to make things better

- Lessons learned meeting (October 2013)
- RES and EPRI renewed working relationship
- Audit schedule changes and better focused RAIs
- Endorsement of freeze point concept

Leadership engagement

- A high level of Leadership Engagement has been required to ensure the process moves forward with consistency

Incremental vs Transformative Progress is being made

Industry Concerns

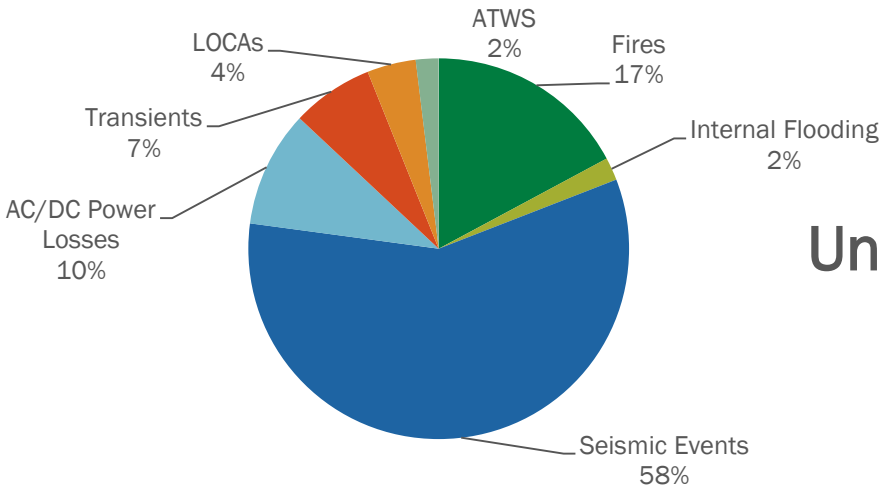
Fire PRA risks are over-stated – do not comport with OPEX - distorts safety and investment priorities

Cost of LAR and SE development and compliance modifications significantly exceeds NRC and Industry estimates

Expedite ability to utilize research results (Heat Release Rates, Fire Frequencies, Incipient Detection)

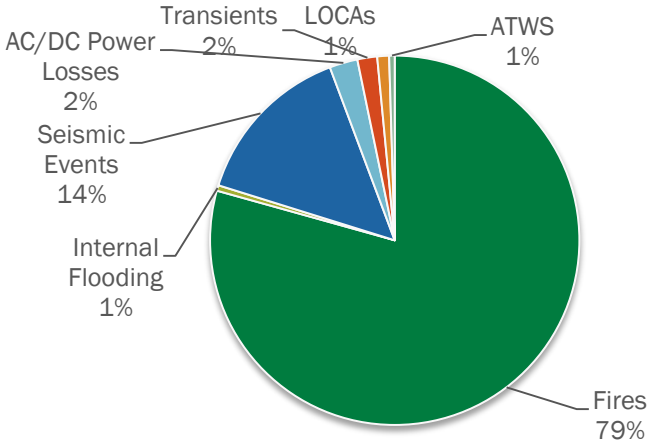
Need simplified process for changing LAR commitments (mods) based on PRA realism improvements

Large Conservatism in Fire PRA

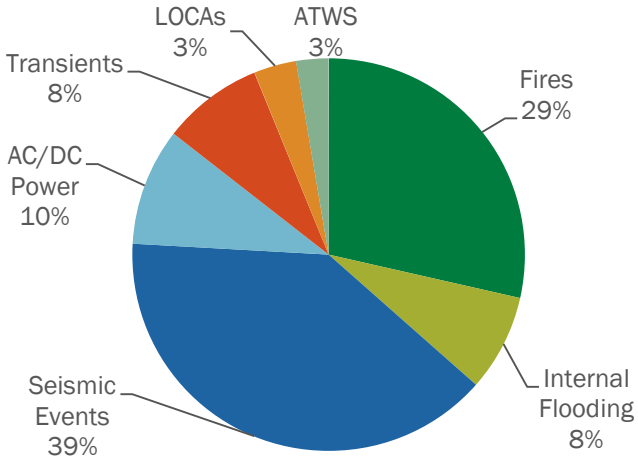


IPEEE Fire

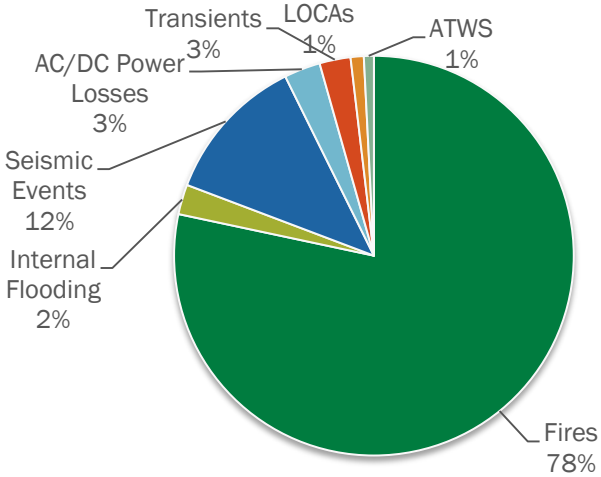
Unit A



NUREG 6850 Fire



Unit B



Compounding conservatism reduces effectiveness of decision making tool

Exelon Generation

Current Hard Spots

Fire PRA conservatisms continue to hinder progress:

- Improvements to realism since December 2010 ACRS Subcommittee Meeting have been minimal
- NRC and industry began cooperative effort to address these conservatisms more aggressively in 2013; results are helpful but may not be timely enough to support most plants

Significant room for improvement of processes:

- Must support timely State of Knowledge improvements
- Use Operating Experience Process to update models
  - Establishment of freeze point for PRA
- PRA peer review process must work and be trusted:
  - Majority of RAIs are derived from PRA
    - Refining results, not changing outcomes
    - Deterministic conservatism distorts PRA outcomes
  - Return to Basics – RG 1.200 RISC Working Group

Future Concerns

- Executive disillusionment with PRA
  - Instability and uncertain outcomes
  - Time and resource drain
  - Unnecessary costs
  - Overstated risks results in skepticism about insights
- Significant concern in industry for how NFPA 805 experience could affect and translate into other future Risk Informed Initiatives:
  - NFPA 805 pilots were not effective at vetting out significant issues
  - We appear set up for similar experience with Seismic and Flooding PRA

Action is needed now to address hard spots and ensure success of future Risk Informed initiatives

Conclusions

Unpredictable process and over-stated risk hinders progress for RI programs and properly targeting safety improvements. Therefore,

- focus on long-term solutions as well as short-term process changes is needed,
- when allowed to work, existing processes (peer review, use of OE and model updates) address PRA technical adequacy and incorporate state-of-knowledge.

Risk Informed approaches must be an alternative, not another layer on top of deterministic processes.

Need improved alignment within NRC regarding the PRA Policy Statement to increase incentive for industry to expand use of Risk Informed approaches.

Significant progress requires addressing underlying Process and Culture issues

Overview of Industry Panel

- Implications of Fire PRA Conservatisms – Mike Saunders (ERIN)
- FPRA Realism Status and NFPA 805 LAR Implications – Bob Rishel (Duke), Anil Julka (NextEra), Ray Fine (FENOC)
- Fire PRA and NFPA 805 Process Improvement Efforts – Victoria Anderson (NEI)
- Fire PRA Research Plan – Ashley Lindeman, EPRI

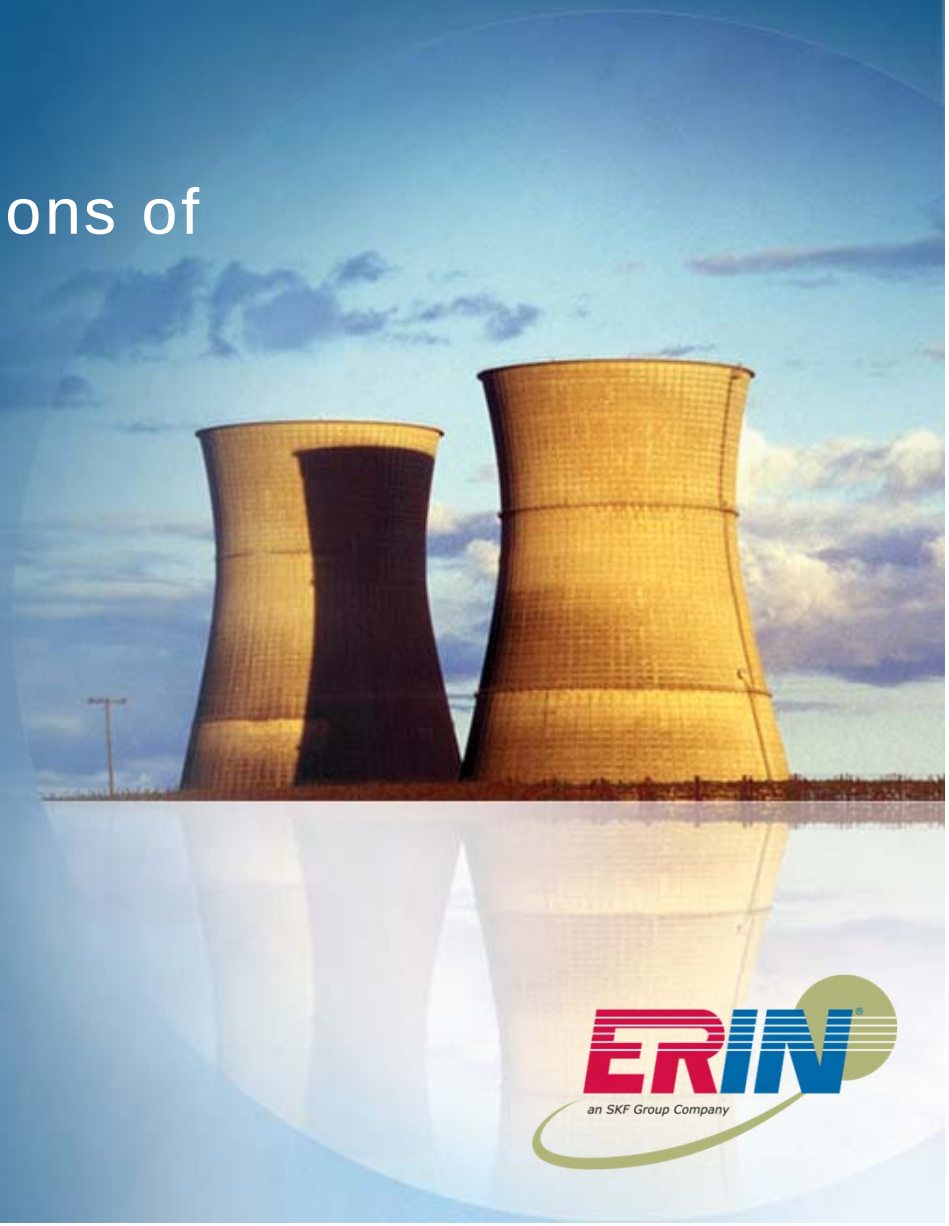
Characterizing Fire PRA Quantitative Models: An Evaluation of the Implications of Fire PRA Conservatisms

ACRS Subcommittee

September 18, 2014

M.B. Saunders, E.T. Burns

ERIN Engineering and Research, Inc.



Background on Fire PRA Development

- NRC PRA Policy Statement
  - "...as realistic as practicable..."
- NUREG/CR-6850 not fully piloted
  - Resulted in conservative or bounding data, rules, and methods
- On-going Methods Development
  - Fire PRAs being used for decision-making may not reflect realistic modeling of fire scenarios

Unrealistic Fire PRA Effects

- Decision-making may be compromised
  - Improper insights may result
  - Inappropriate allocation of resources
  - Approach or exceed safety goals which restricts proactive use of risk insights to apply resources to areas of highest safety significance

Purpose of Analysis

- Characterize Fire PRA Models
- Identify select areas of potential bias
- Evaluate degree of potential conservative bias
  - CDF
  - Dominant Contributors
- Identify potential implications of conservative biased fire PRAs

Methodology

- Identify select areas with potential conservative bias (e.g., fire ignition frequencies)
- Categorize each area into 1 of 3 types
  - Type 1 areas have “matured” (e.g., fire ignition frequencies)
  - Type 2 areas have “not matured” (e.g., Heat Release Rates)
  - Type 3 areas have “lack of knowledge” (e.g., fire HRA)

Methodology

- Identify three (3) PRAs for three (3) plants of differing designs
- Quantify sensitivity studies
- Develop three point estimates
  - "Upper Bound": Uses NUREG/CR-6850 guidance
  - "Nominal": Incorporates Type 1 areas
  - "Lower Bound": Incorporates all Types

Quantify Sensitivity Studies

- Select the specific area of interest (e.g., Fire Ignition Frequencies)
- Identify a source that provides a range for the possible change (e.g., NUREG/CR-6850 and Supplement 1 of NUREG/CR-6850)
- Insert the change into three (3) PRAs
- Using the sensitivity studies, Calculate the bounds for the three (3) plants (e.g., “nominal” includes Type 1 area sensitivities)
- Display combined range of results

Sensitivity Study CDF Results

- Type 1 Areas ("Matured")
  - Fire Ignition Frequency
    - 20-25% Decrease
  - Transient Fires
    - 3-11% Decrease
    - FAQ 12-0064 application
  - Spurious Operations and Duration
    - 22-41% Decrease
  - Electrical Cabinets (Cabinet Factors Method)
    - 8-65% Decrease
    - Damage threshold

Sensitivity Study CDF Results

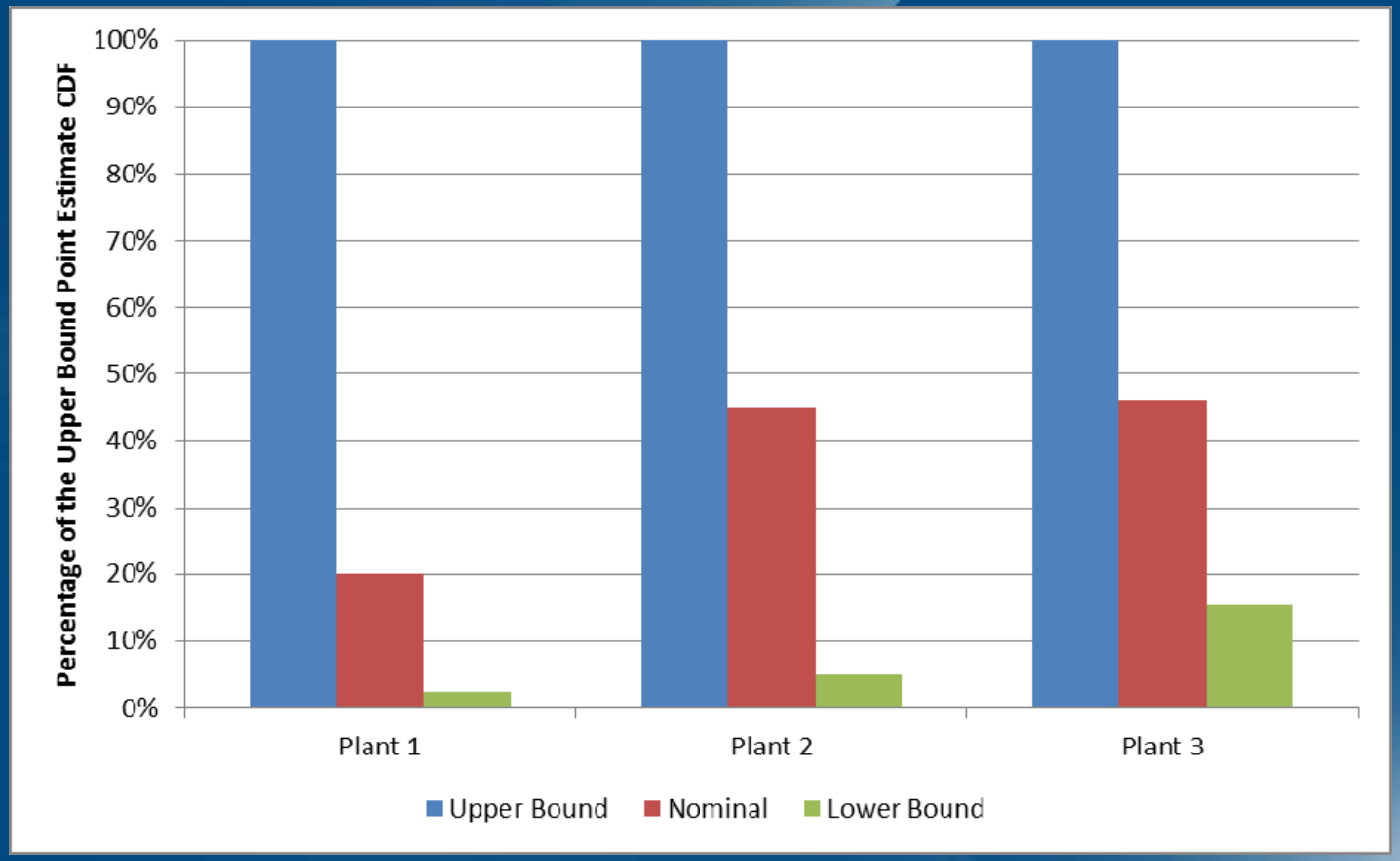
- Type 2 Areas ("Not Matured")
  - Fire Control and Suppression
    - 1-64% Decrease
    - Room volume and damage threshold
  - Heat Release Rate
    - 34-72% Decrease
    - Spatial separation

Sensitivity Study CDF Results

- Type 3 Areas ("Lack of Knowledge")
  - Fire HRA
    - 13-46% Decrease
    - MSOs and cable routing
  - Fire Induced Trip
    - 4-21% Decrease
    - MSOs or other induced initiator (e.g., loss of offsite power)
  - MCR Abandonment
    - 0-10% Decrease
    - MCR volume and ventilation
  - Offsite Power Recovery
    - 1-18% Decrease
    - Cable routing

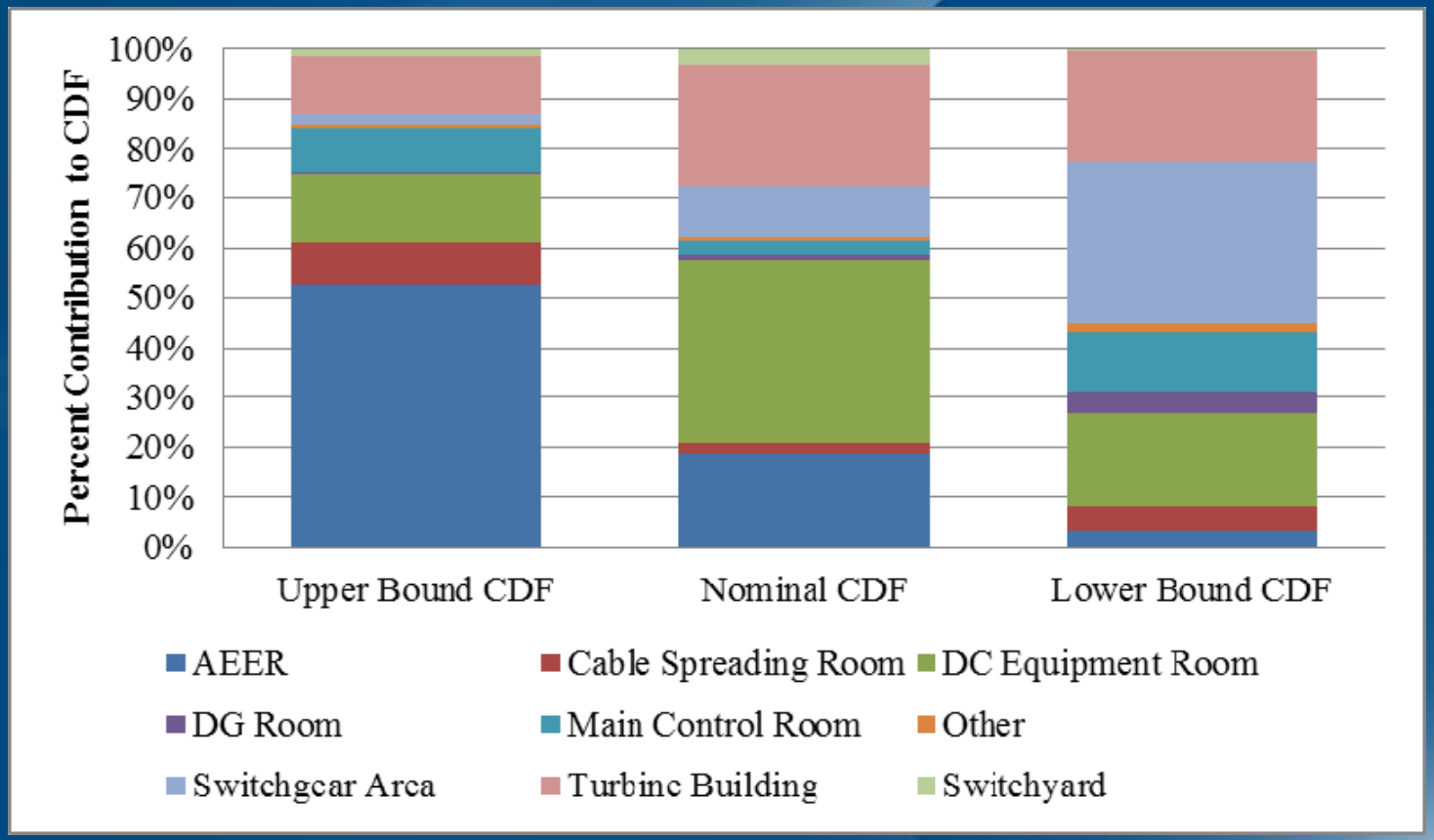
Example CDF Results for Three Plants

Relative Comparison of Fire CDF to the Upper Bound Estimate



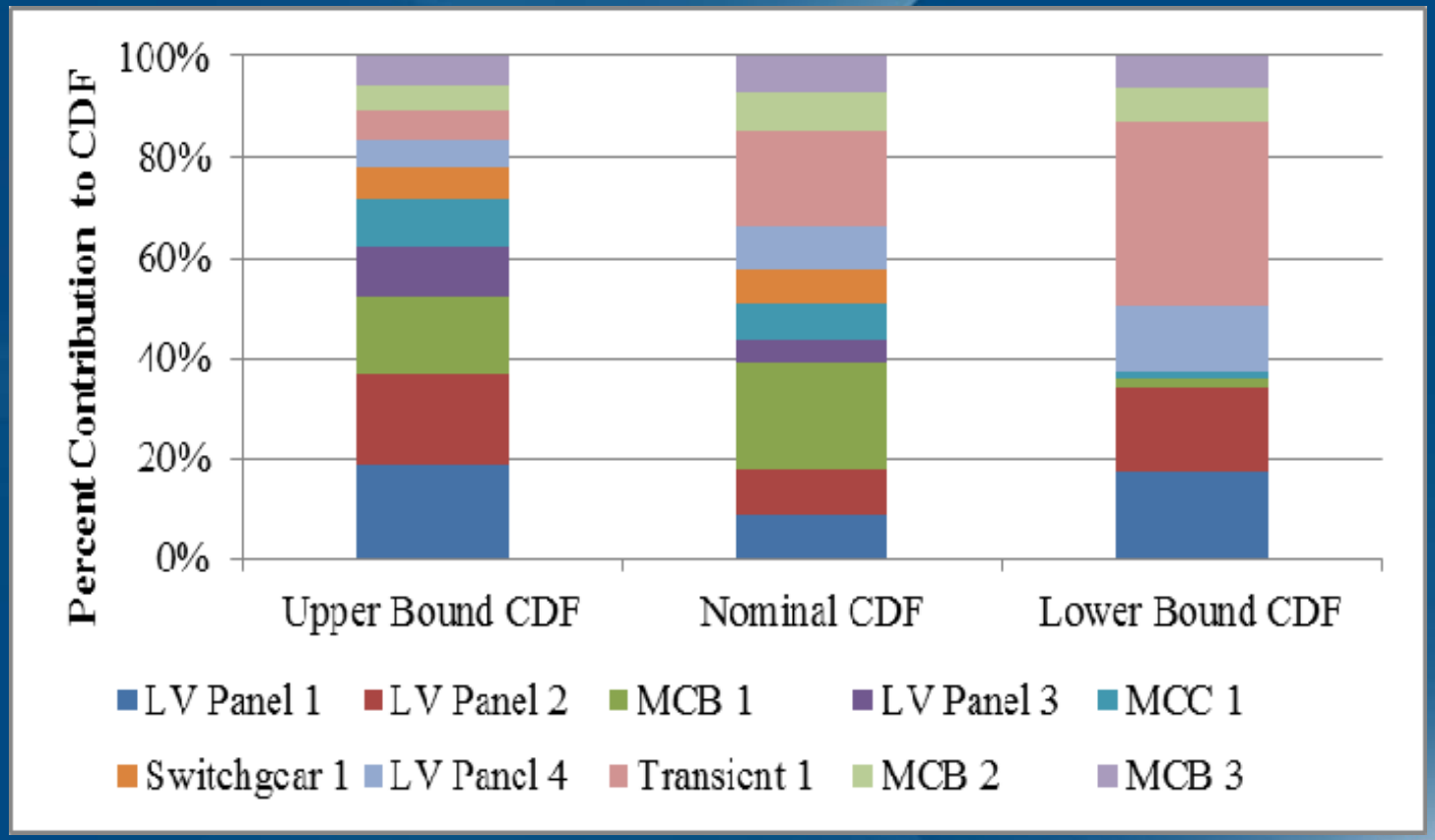
Example CDF Results for One Plant

Comparison of Fire CDF by Plant Location



Example CDF Results for One Plant

Comparison of Fire CDF by Fire Scenarios



The Masking Effect

- "Upper Bound" Model Basic Event Importance tend to be "as expected" for a conservative analysis
- "Lower Bound" Model results in new important basic events
  - Equipment
    - MCCs, CRD, DC Equipment
  - Operator Actions
    - Align alternate DC supply

Conclusions

- Conservatisms could result in high CDF (i.e., > 1E-4/yr.)
- Use of current industry consensus methods results in reduction in CDF by more than 50%
- Additional refinements may result in more than 80% reduction in CDF
- Reductions in LERF expected
- Other inputs not explored expected to increase realism in fire PRA (e.g., cabinet fire growth and cable damage (THIEF))
- Dominant contributors may be incorrect and may be masked and could extend to other hazards

Conclusions

- PRA most useful when it presents realistic assessment of risk
- Removal of conservative biases will likely change priority of plant or procedural changes
  - Risk reduction of plant changes may be overstated
  - Beneficial plant changes may be masked
- Conservative bias fire PRAs may be problematic for other applications (e.g., 4b, SDP, LARs)
- It is critical that the limited available resources be applied to the most beneficial areas to public safety

Duke Energy and NFPA 805 September 18, 2014

DUKE ENERGY®

Overview

- Overview and status of Duke Energy under NFPA 805
- NUREG/CR-6850 and Fire PRA issues
- Duke Energy Fire PRA risk contribution
- Changing NRC requirements for Fire PRA and NUREG/CR-6850
- Going forward

All sites have submitted a NFPA 805 LAR using NUREG/CR-6850 for the Fire PRA

- Harris completed transition to NFPA 805
- Oconee completed transition to NFPA 805
- Brunswick expecting SE in November 2014
  - Four rounds of RAIs
  - Some additional RAIs as NRC requirements have changed
- McGuire has received first round of RAIs
  - NRC Audit visit completed in August 2014
- Robinson RAIs received
- Catawba RAIs in late October

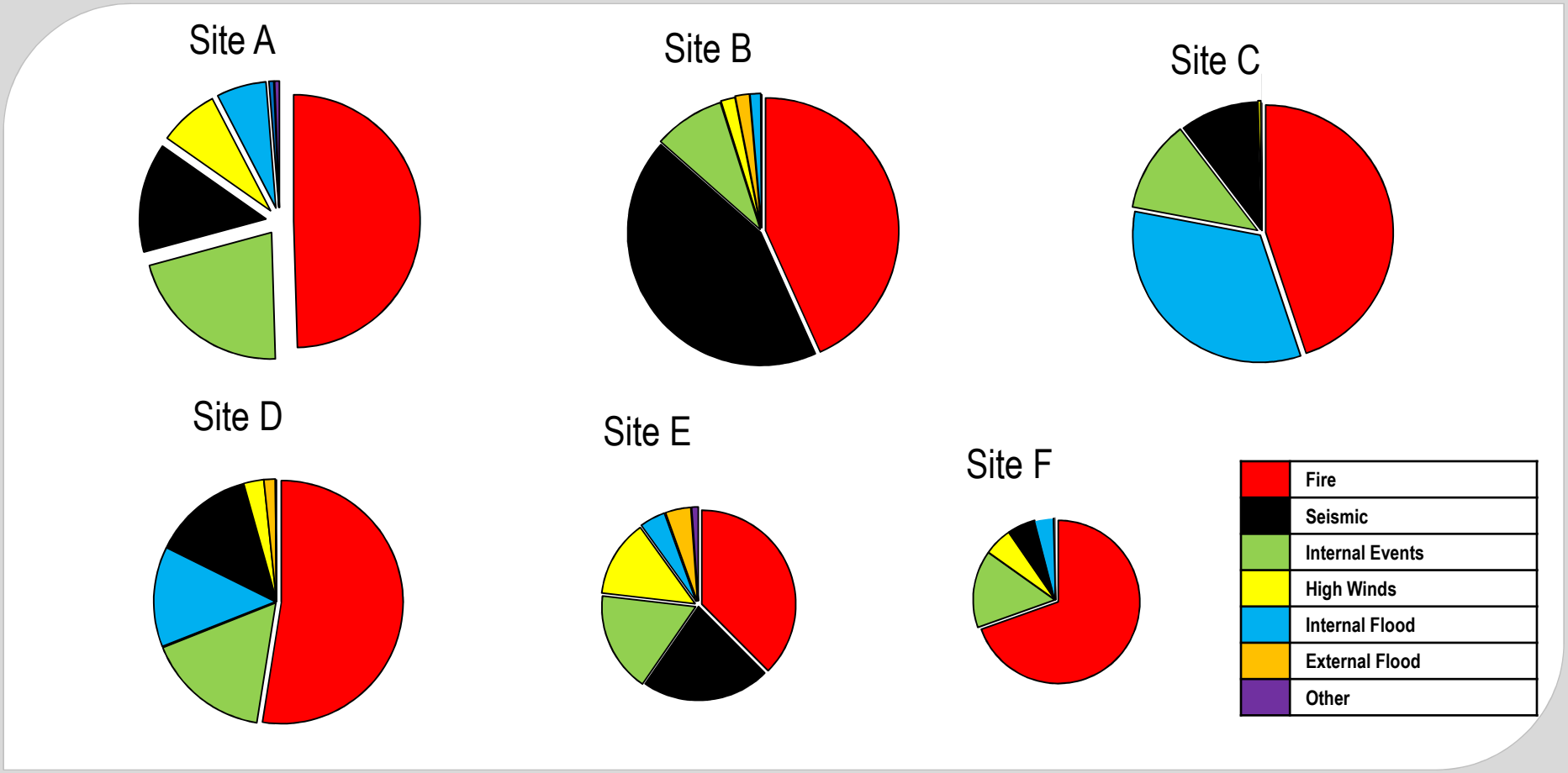
Issues with NUREG/CR-6850 Fire PRA and application

- Fire risk most dominant risk at each site
- Fire risk CDF values raise question of credibility of results in sites organizations
- Fire risk developed in accordance with NUREG/CR-6850 must be used for all risk applications not just NFPA 805
- Current Fire CDF results leave little room for other risk informed submittals
- Additional modifications being evaluated to partly compensate for fire CDF results
- Use of deterministic approach for Technical Specifications changes is becoming a preferred approach and NRC is approving them

Cost of NFPA 805 and Fire PRA are high

- Initial Fire PRA development costs is over 50% the NFPA 805 LAR
- Cost of NFPA 805 maintenance going forward is high
  - Review of engineering changes for Fire PRA impact (+3 PRA FTE for all of Duke Energy sites)
  - Fire PRA update ($.75M recent periodic update)
  - Fire PRA models using NUREG/CR-6850 are very complex (600 - 3000 fire scenarios)
- Currently no NRC allowance for Fire Source Scenario uncertainty under NFPA 805 (FAQ submitted)
  - Results from NRC Fire Program Triennial inspections

Combined CDF Per Site/Unit



NRC changes in requirements for Fire PRA

- Changes in Fire Frequency
  - Can use newer EPRI and NRC Fire Frequency, but must do sensitivity with older numbers and show still meet criteria for all applications
- Circuit Spurious Probability
  - Early plants used NUREG/CR-6850 values only
  - More recent submittals had RAIs to double the circuit failure probabilities based upon early NRC view of the data from circuit testing
  - Most Recent RAIs require using the latest values from NUREG/CR-7150 for circuit failure

NRC changes in requirements for Fire PRA

Fire Growth in cable raceways

- Earlier submittals assumed:
  - 35 degree fire burn to ceiling from fire source
  - Cables in this ZOI were faulted
  - For qualified cables (IEEE383) once the fire source was out cable fires stopped growing
- Recent RAIs require (plant specific armored cable issue?)
  - Fire growth till suppression in all cables in ZOI and expanding ZOI at specified cable growth rates, beyond 35% fire burn
  - Such assumptions reduce the benefit to NFPA 805 (much more complex and very close to current Appendix R assumptions)

NRC changes in requirements for Fire PRA

Human Reliability Analysis (HRA)

- Early RAIs did not specify an HRA dependency floor for a Fire PRA
- Early RAIs did not require comparison to NUREG/CR-1921
- Current NRC RAIs have both requirements and if not complying, revise Fire PRA

NRC changes in requirements for Fire PRA

Analysis of Fires in closed cabinets

- NUREG/CR-6850 Section 11 on Fire Scenarios has one restriction on fire propagation outside of a closed cabinet
  - High Energy Arc Faults scenario always cause fire propagation
- NRC now requires for closed cabinets to be less than 440v to be considered non-fire propagating
  - Not a requirement of section 11, section 6 is not referenced or referred to
  - 440v is a requirement in NUREG/CR-6850 section 6 for sealed cabinet and only applied to cabinet counting
- Increased cost and increase calculated CDF with little technical basis

NRC changes in requirements for Fire PRA

- NFPA 805 has resulted in overall reduction in fire risk
  - Modifications installed
  - Use of Incipient detection systems
  - Less reliance on operator recovery actions
  - Increased awareness of fire risk by plant staff

- NRC Staff has difficult task in review of Fire PRAs
- Some changes are necessary with new information
- Those changes that provide more realism need to get higher priority

NUREG/CR-6850 and Fire PRA Pilots Success?

- Lots of staff interaction during pilot process
- A lot of NUREG/CR-6850 technical gaps resolved early in the FAQs process
- Staff was generally reasonable and flexible in application of NUREG/CR-6850
- Pilots followed NUREG/CR-6850 as a guidance document not compliance
- Number of areas NUREG/CR-6850 had no or limited guidance
  - Bus Duct Fire
  - Closed Motor Control Centers
  - Operation Actions (HRA)
  - Control Room evacuation analysis
- Results not out of line with current efforts

Harris

- Fire PRA results benefited by crediting Incipient Detection
  - Early warning (incipient detection) was very controversial with NRC staff
  - Demonstration tests were held with staff and Senior NRC Management
  - NRC allowance for PRA credit was in doubt (final issue not resolved)
  - Harris has significant amount of fire wrap (Hemyc), which is adequate for the hazard
- Harris installed significant modifications, which mitigated risk significant scenarios
  - Auto start Reactor Coolant Pump seal injection system with independent power
  - High Energy Arc Fault shields
  - Meggitt Cables

Oconee

- Oconee Fire CDF is in line with rest of industry
- Significant modifications developed
  - Protected Service Water
  - Fire detection modifications
  - Fire wall penetrations upgrade
  - Circuit breaker electrical coordination
- Fire PRA for Oconee is being revised based upon recent additional NRC guidance

Going Forward

Near term potential improvements in Fire PRA realism

- Fire frequency per component (minor impact)
- Heat release rate / Fire growth modeling (major impact)
- Improved HRR distribution (major impact)

Other areas for potential conservatism

- High Energy Arc Fault Zone of Influence (ZOI) distribution

Need to use operational experience as input for PRA realism improvements

Questions?

Development of Fire PRAs for NFPA 805 application

Anil Julka

Manager Risk and Reliability

Nextera Energy

ACRS Subcommittee presentation

2014

AGENDA

- Objective
- Background
- Discussion Points
- Expected benefits of Fire PRA
- Lessons learned
- Conclusion

OBJECTIVE

Provide insights and lessons learned from development of Fire PRAs for NextEra sites.

BACKGROUND

7 of 8 NextEra NPPs transitioned to NFPA 805

- Seabrook's design incorporates multiple spurious operation requirements and as such did not transition.[newer plant]
- Although DAEC transitioned, it would have been OK without transitioning since very few and relatively inexpensive modifications were identified as required.

BACKGROUND *Cont'd*

- **DAEC** - first BWR site to obtain SER.
- **Turkey Point** and **St Lucie** close to obtaining SER [by the end of 2014 and spring 2015, respectively]
- **Point Beach.** SER late 2015.
  - Pilot site for the new NRC process
  - Received RAIs prior to on site audit
  - Intent to limit several rounds of RAIs

    New NRC process provides RAIs before the audit – this should reduce the # of rounds of RAIs. Some sites went thru 3 rounds of RAIs.

DISCUSSION POINTS

IN THE BEGINNING:

- **In-house resources were insufficient** to support the significant long term commitment, and the staffs did not have the fire modeling expertise and familiarity with the new (and evolving) regulatory standards.
- **Limited industry technical resources, expertise and experience** were available when projects initiated; the NRC and even experienced contractors were on a steep learning curve.
- **Regulatory requirements** were being updated and redefined throughout the process; and continue to be refined.
- **EPRI modeling tools and NEI guidance** were in development and continued to be refined to address model complexity and quantification efficiency –still ongoing.

DISCUSSION POINTS *cont'd*

AT THE END:

- **Results are conservative**. Industry does not believe the risk is as high as depicted by the NFPA 805 application.

  Conservatism is a result of the 6850 criteria which is applied in a manner to ensure conservatism related to uncertainties related to fire modeling, cable locations, spatial considerations, material behavior, etc.

- **Resulting models are more complex than expected**. Better quantification tools/methods are needed.

  [Note that quantifying the entire fire model takes many hours and as such is problematic since development is an iterative process requiring many quantifications]

- **Technology transfer** will be a challenge and as such a challenge for utilities to maintain the fire models. This will also be the case when using contractors other than the original developers.
- **FAQs** are still in progress to clarify requirements – i.e., still a work in progress and will require more model and documentation changes – both labor intensive.
- **Unexpected scope growth** resulted in costs significantly beyond original estimate. Without mods, cost per NEE plant varies from $10M to $35M.

EXPECTED BENEFITS OF FIRE PRA

Developed new insights that can improve site focus

- Areas important for fire
- Maintenance practices
- Handling of combustibles
- Focus on detection and suppression
- General awareness of fire issues

EXPECTED BENEFITS OF FIRE PRA *cont'd*

- Previous fire PRAs may not have represented the complete risk
- There are modifications initiated to lower risk to the plant
- Potentially significant savings as a result of not performing modifications necessary for compliance

LESSONS LEARNED

Fire PRA is Conservative – Overstates Risk.

- Still follows deterministic approach to a large extent.
- Default on 6850 clarifications tends to be conservative
- Risk associated with other hazards are masked due to high risk associated with Fire [i.e., because of its conservative approach to addressing uncertainty as compared to internal events for example]
- Insights based on comparison to other hazards can only be used to the extent that differences in uncertainties and conservatisms are well understood; this will be a challenge.

LESSONS LEARNED *Cont'd*

- **HFE COMBINATION VALUES** – industry currently reviewing
  - Mandated floor value of 1E-05 masks insights from other fire risks [and internal events]
  - Floor values appropriate for addressing uncertainty (sensitivity analysis) but not for baseline PRA models
  - Increases CDF at some sites > 25% [or more] on top of other conservatisms. Creates unnecessary pressure for mods
  - Not a requirement of the PRA Standard
  - EPRI task force is evaluating this issue; report expected this year
- **Bottom Line: Significant difference in results of Fire PRA 6850 vs other, non-NFPA 805, Fire assessment methods**.

  See following comparison between Seabrook (non-NFPA 805) and St. Lucie (NFPA 805)

Seabrook

HAZARD	SIGNIFICANT CONTRIBUTORS	INSIGHTS
	EXTERNAL FLOODING	
	▪ **Ocean storm surge** assumed to fail all Ocean SW pumps. The SW Cooling Tower (SWCT) pumps remain available for plant cooling. Core damage occurs due to failure of SG heat removal and feed & bleed cooling fails. ▪ **Degraded Barriers**. Recent flooding event OEs show that degraded barriers can lead to significant flooding that can lead to core damage Note: *SWCT pumps/electrical are located separate from, and higher in elevation than, Ocean SW pumps/electrical and are not impacted by the same flood.*	▪ **Dominant scenario is a low probability event**. There is no specific mitigation action needed to reduce the risk of this event. However, assess the need for any site wide flood mitigation actions after flood re-evaluation is complete. ▪ **Small physical margin modifications that were recommended as part of the post-Fukushima external flood walk-downs are complete** [weather strip EDG room external doors D300, D305, D306 (EC#278369)]. ▪ **Verify flood barriers** that prevent undesired in-leakage are not degraded.
	HIGH WIND	
	▪ High wind events (tornado, hurricane, straight-line winds and associated missiles) were screened from detailed evaluation based on low probability of unacceptable tornado missile damage met SRP criteria of E-6 to E-7 per year. However applying current standards these events would not screen out – PRA update is planned. ▪ OE indicates risk significance of degraded sheet metal attachments on buildings containing critical components or storing loose material that can become highly energetic missiles. This could lead to premature failure of sheet metal during high wind events, exposing interior SSCs.	▪ **Maintain high wind and missile protection barriers functional** per existing monitoring programs. ▪ **Operations to maintain awareness and receive training on Severe Weather Procedure OS1200.03 relative to high wind events**. ▪ **Minimize Missile Hazards.** Restrict storage of material that could become highly energetic missiles near critical SSCs – suggested stand-off distance of at least 200 feet. **Sheet metal siding attachments** –verify building panels and sheeting attachments are not missing or degraded and are secured as designed.
	FIRE	
	▪ **Control Room Fire** causing PORV to open with subsequent failure of remote actions by operator to cool down plant. ▪ **Essential Switchgear B Fire** with subsequent emergency generator A failure. ▪ **Essential switchgear A** Fire with subsequent loss of Service water B train.	▪ **Essential switchgear fires are dominated by the electrical energy in the switchgear**. Assure good maintenance practices are followed that focus on minimizing the potential for high energy arcing faults, e.g. frequency of cleaning, validation of correct assembly and alignment, etc. ▪ **Operations to maintain awareness and receive training on Remote Safe Shutdown Control OS1200.02A/**B series procedures. ▪ **Implement the RCP "Shutdown Seal"** design to reduce risk of seismic-induced RCP seal LOCA.
	INTERNAL FLOODING	
	▪ **Flooding/line break in Turbine Building** that impacts relay room causing LOSP with subsequent emergency power failure. ▪ **SW common return-line ruptures** in yard which could result in failure of all SW; operator action needed for timely transfer to SW Cooling Tower. ▪ **Major SW flood in PAB** causes a loss of SW/CC with subsequent EFW random failure.	▪ **Orifice plate** has been installed in FP header to reduce flooding risk to essential switchgear room as a result of the internal flooding study. ▪ **Operator training and procedures** should address early identification and quick response to high risk flooding scenarios. ▪ **Implement routine pipe inspections** per plant monitoring program. Place emphasis on prompt mitigation actions and evaluation when leaks are identified.
	SEISMIC	
	▪ 0.7G earthquake with subsequent failure of EDGs due to relay chatter with operator failure to start SEPS. Seal LOCA occurs. ▪ 1.0G earthquake with subsequent EDG due to relay chatter and SEPS failure due to the earth quake. Seal LOCA occurs. ▪ Seabrook has a high seismic demand but also has a robust seismic design capacity.	▪ **Implement the RCP "Shutdown Seal" design** to reduce risk of seismic-induced RCP seal LOCA. ▪ **Maintain FLEX strategy and B5b equipment** in proper storage area, functional and proceduralized. ▪ Assure **FLEX and B5b** equipment properly stored, functional and readily available for post event mitigation and their implementation is linked to front end procedures (e.g. EOPs, AOPs, and ARPs).
	INTERNAL EVENTS	
	▪ **RCP Seal LOCA Sequences.** ▪ **Plant Transient with Loss of EFW Sequences.** ▪ **Small\Medium LOCA with ECCS Failure Sequences.** ▪ **CDF includes LOSP due to severe weather.**	▪ **Maintain supplemental power supply (SEPS) reliability** to reduce risk of SBO-type conditions. ▪ **Implement the RCP "Shutdown Seal" design** to reduce risk of RCP seal LOCA during SBO-type conditions.

Saint Lucie

HAZARD	SIGNIFICANT CONTRIBUTORS	PRA INSIGHTS
INTERNAL FLOOD EXTERNAL FLOOD HIGH WIND SEISMIC INTERNAL EVENTS FIRE	**INTERNAL FLOODING**	
	Dominant sequence represents Loss of MFW, Failure of AFW, and Failure of Once-Through Cooling. Ruptured city water/FP piping flood both trains of AC/DC power. Only manual operation of AFW TDP is available to mitigate loss of secondary heat sink sequences.	**Perform "leak-before-break" visual inspection of city water/FP piping and SFP cooling piping.** **Flood Mitigation.** Validate that operators can quickly identify/isolate cooling water system breaks and that procedures facilitate these actions.
	EXTERNAL FLOODING	
	Hurricane Storm Surge	Ensure **all penetrations for pipes and electrical ducts are encased in concrete or enclosed in a pipe boot** designed to prevent seepage to assure complete isolation. Ensure that **manhole drain line check valves operate properly**, to prevent back flooding of electrical manholes.
	HIGH WIND	
	No significant contributors identified by the IPEEE. The following actions already in place reduce High Wind Risk: ▪ Both units are placed on hot-standby upon hurricane and high wind warning, thus significantly reducing the risk. ▪ Proceduralized walkdown and tie-down of loose items outside the buildings upon hurricane or high wind warning support expedited recovery from potential events.	**Reinforce importance of hurricane preparation.** **Consider external flooding event concurrent with high winds during hurricane preparation.**
	SEISMIC	
	Global point estimate based on 2014 EPRI GMRS data. Resolution not adequate for identifying significant contributors. The PSL units are located in an area of very low seismicity.. Seismic CDF is a bounding estimate using a plant-level fragility curve.	Ensure that FLEX and B5b equipment is properly stored, functional, and readily available for post event mitigation and that their implementation is linked to front-end procedures (e.g., EOPs, ONOPs, ARPs).
	INTERNAL EVENTS	
	• Only IA system is shared between units. • Only EDGs, CST (from U2 to U1 only) can be cross tied between units. • Unit 1 differs from Unit 2: ➢ U1 PORVs are half the size of U2 PORVs. ➢ U1 has only one train ECCS recirc to RWT versus 2 trains in U2. ➢ U1 CST is dependent on reserved supply in U2 CST. • U2 has dedicated HPSI lines for simultaneous hot/cold injection while U1 depends on alternate flow paths using LPSI, HPSI and CS systems	Maintain the following SSCs in green health status: ▪ **U1 ECCS recirculation flow path to RWT** ▪ **RWT level instruments** ▪ **HPSI PPs.** ▪ **U2 SRVs AND PORVs**
	FIRE	
	Risk Significant locations: ▪ Cable Spreading Room, ▪ Control Room, ▪ 1B Switchgear Room, ▪ 2A DC Equipment Room. Note: Electrical equipment room, cable spreading room, and static inverter room configuration and layouts are different between the units.	**Maintain detection and suppression in critical areas.** **Improve plant controls for transient fire materials in critical areas and manholes**. **Risk Monitor** implements Fire PRA results for critical areas and associated Risk Management Actions. Assure plant personnel responsible for plant configuration and maintenance are aware of this function. Focus training on the importance of controlling the following in Critical Fire Areas: ▪ Combustibles ▪ Welding ▪ Grinding ▪ Racking in breakers (flashing) **Ops Training** should include mitigation of fires scenarios in Critical Areas and their consequences. Recovery actions should be understood and procedures related to these actions should be clearly linked to front end procedures (e.g. EOPs, AOPs, ARPs).

CONCLUSION

- **Uniform Treatment of Uncertainties.** Prevent conservatisms from masking fire insights and insights from other hazards. For example, develop an accepted method for developing a fire PRA outside of the NFPA 805 application specific 6850 requirements.
- **Communication of Risk.** Identify and share industry best practices for communicating risk insights to plant personnel. Risks should not be simply added together due to large uncertainty in fire.
- **Document Financial Benefit**. Despite unexpected scope growth and high cost, plants that have implemented NFPA 805 still have a net reduction in modification costs when compared to compliance modifications.
- **Improve Efficiency of RAI Process**. NRC has changed RAI process to be more effective but further improvements can be made to this very time consuming and labor intensive process.
- **Accelerate Improvements in Fire Modeling Realism**. Increase resources and funding for EPRI and NEI initiatives to ensure Licensees are spending funds to resolve right issues.

FENOC

NUREG/CR-6850 Conservatisms

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September 18, 2014 ACRS Subcommittee Meeting on NFPA 805

Overview

- **Conservatisms in Ignition Frequencies**
- **Conservatisms in Likelihood Analysis**
- **Conservatisms in Heat Release Rates**
- **Masking Results**
- **Summary**

Ignition Frequencies

- **Methodology**
  - Summary of NUREG/CR-6850 pg 6-2: Take the bin frequency from Table 6-1 and divide it by the number of components that fit in the bin to get the /source frequency.
    - Note: The sum of the Frequencies provided in Table 6-1 result in fire ignition frequencies of ~3.05E-01/yr (6850) or ~1.59E-01/y (EPRI), that's representative of 1-3 fires every 10 years that result in serious plant damage
- **Logic Argument**
  - Bin 08 Diesel Generators (EPRI Bin Frequency 5.04E-03/yr)
    - Plant X: 3 EDGs, 1.68E-03/source-year
    - Plant Y: 2 EDGs, 2.52E-03/source-year
  - A plant with fewer diesels is more likely to have a fire per diesel then a plant with more diesels. If X and Y have a similar plant configuration, Plant Y will have a higher CDF.
  - Is the solution to buy extra equipment to reduce the per source frequency?
    - Obviously the answer is NO, the Plant Bin Frequencies is the wrong approach. <u>The Frequencies should be based on a per component basis (EPRI is in process of developing this) that tracks with operating experience.</u>

Ignition Frequencies/ Heat Release Rates

- **Transient ignition frequency**
  - Apportionment Guidance in NUREG/CR-6850 is based on occupancy, storage, and maintenance, but <u>it does not permit customization for compartments with stricter transient controls</u>
  - There is no reconciliation between real transients and what is postulated per NUREG/CR-6850 guidance. Some areas may have larger transients (e.g. gallon(s) of lube oil to the RCP) while others may not allow such large quantities and yet every compartment is to assess a 317 kW fire.
  - The NRC made a large push to have utilities track their transient combustibles, but it is of no benefit when using the NUREG/CR-6850 guidance provided.

Ignition Frequencies

- **A sensitivity was run comparing the ignition frequencies from using NUREG/CR-6850 (0.3 fires/ Rx-year) and EPRI 1016735 (0.1 fires/ Rx-year)**

Unit	Reduction in CDF
A	-35.43%
B	-35.55%
C	-49.70%

Ignition Frequencies

- **A sensitivity was run at a FENOC site to see the impact on CDF by reducing EPRI Bin frequencies (0.1 fires/Rx-Year) by a factor of 10 (0.01 fires/Rx-Year)**

EBinID	Location	Plant Count	CDF % Change
Bin 06 Transient Fires Caused by Welding and Cutting	Control/Aux/Reactor Building		-1.65%
Bin 07 Transients	Control/Aux/Reactor Building		-3.87%
Bin 08 Diesel Generators	Diesel Generator Room	3	-0.93%
Bin 10 Battery Chargers	Plant-Wide Components	9	-1.02%
Bin 15 Electrical Cabinets	Plant-Wide Components	977	**-12.87%**
Bin 16b HEAFs (Medium Voltage)	Plant-Wide Components	59	-4.80%
Bin 19 Miscellaneous Hydrogen Fires	Plant-Wide Components	5	-1.27%
Bin 21 Pumps	Plant-Wide Components	116	**-48.67%**
Bin 23a Transformers (Oil)	Plant-Wide Components	17	-6.72%
Bin 23b Transformers (Dry)	Plant-Wide Components	48	-1.26%
Total Reduction			-82.52%

Likelihood Analysis

- **Methodology**
  - NUREG/CR-6850 Section 10, page 10-6 says "From the appropriate table (Table 10-1 to 10-5), select the probability estimates for the failure modes of concern."
    NUREG/CR-7150 published May 2014, in which more details of the circuit will need to be identified but the values are still provided in a table format.
- **Argument**
  - The failure rates provided in the updated guidance are still conservatively high
  - The updated guidance provides failure rates close to 2.0E-01, but to get 2.0E-01, it would have required on average noticeably more spurious operations (377) out of the 1,885 industry fires recorded. <u>These values do not match the industry OE.</u>
  - In order to take credit for the timing analysis provided in NUREG/CR-7150 considerable T/H analysis needs to be done to account for timing. <u>This adds to cost, time, and complexity to build and maintain the fire models.</u>

Likelihood Analysis

- **A sensitivity was run using the NUREG/CR-7150 Value on spurious PORV lift.**
  - The table below also reports the increase in CDF due to removal of the CPT credit.
  - The table also reports a sensitivity of NUREG/CR-7150 on a Spurious Opening of the PORV.
  - All 3 units are assuming they can withstand a short amount of time (3-5 minutes) with a spurious PORV lift before it clears, therefore assigning it a duration factor of 0.1* (0.6 goes to 0.06).

Unit	CPT Removal change in CDF	NUREG/CR-7150 change in CDF
A	+2%	-25%
B	+10%	-16%
C	+9%	-6%

*0.1 was chosen from NUREG/CR-7150 Vol. 2

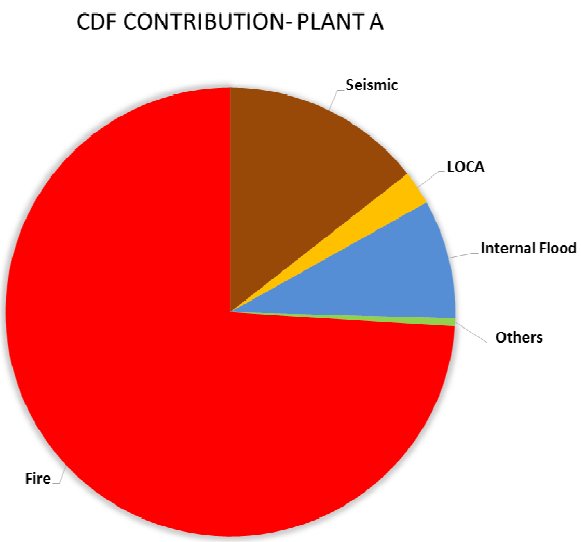
Cumulative Change (IGF and CFMLA)

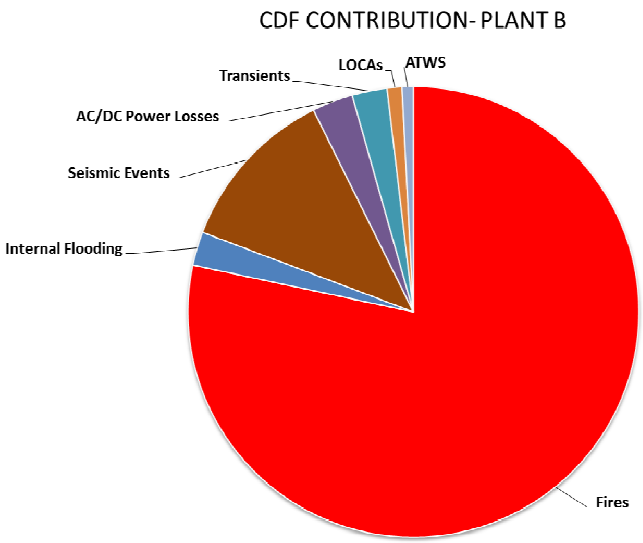
- A sensitivity was run to show the reduction between EPRI frequencies (when compared to 6850) and the probability of spurious PORV operation reduced by a factor of 10 (0.1 duration factor) to show the cumulative impact on fire CDF
  - **The total change in CDF is -51.43%**
- A second sensitivity was run to reduce the EPRI IGF by a factor of 10 (when compared to 6850) and reduce the probability of spurious PORV operation by a factor of 10 (0.1 duration factor).
  - **The total change in CDF is -91.66%**

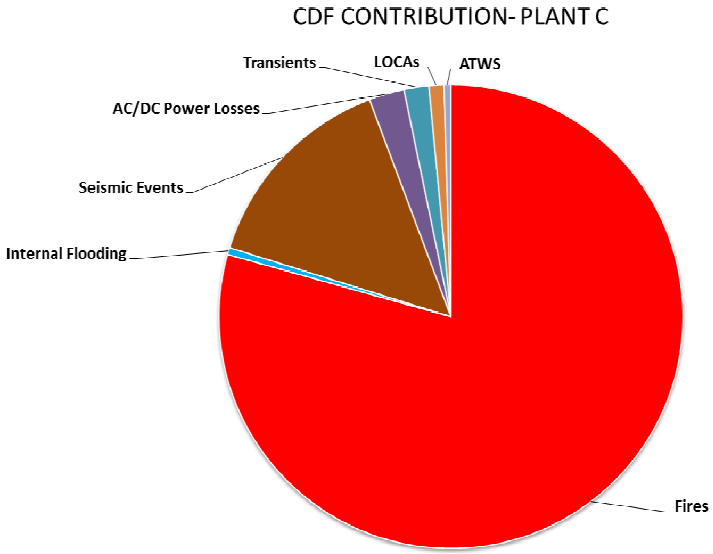
Heat Release Rates

- **Methodology**
  - NUREG/CR-6850 pg 8-9: "The recommended heat release rate value for screening is the 98th percentile of the probability distributions for the different ignition sources listed in Appendix E or G."
- **Argument**
  - The FIVE methodology used the 75th Percentile HRR and was used during the development of the IPEEE which made the damage set smaller and lower CCDPs so the analysis was not as complicated and areas screened more easily
  - Why the change between the FIVE methodology of 75th Percentile to the 98th Percentile? Was the 75th percentile not conservative enough?
- **Changes to the HRR at this point will cause a lot of re-work by the utility which can add more cost to the project as well as adjustments to the LAR**

CDF Contributions – After Modifications installed



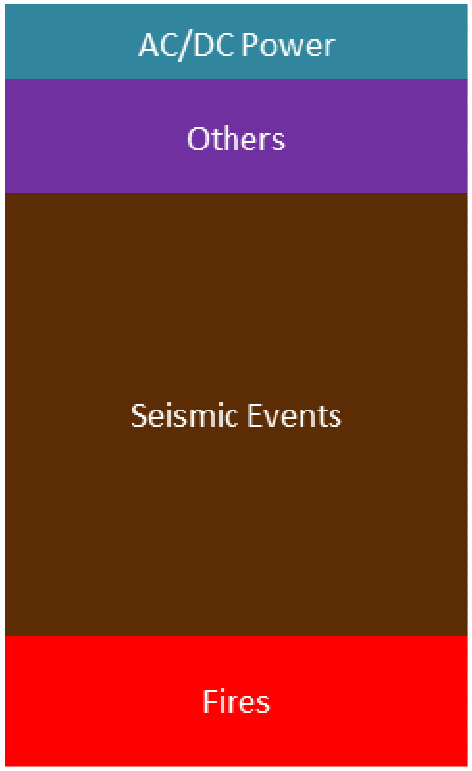




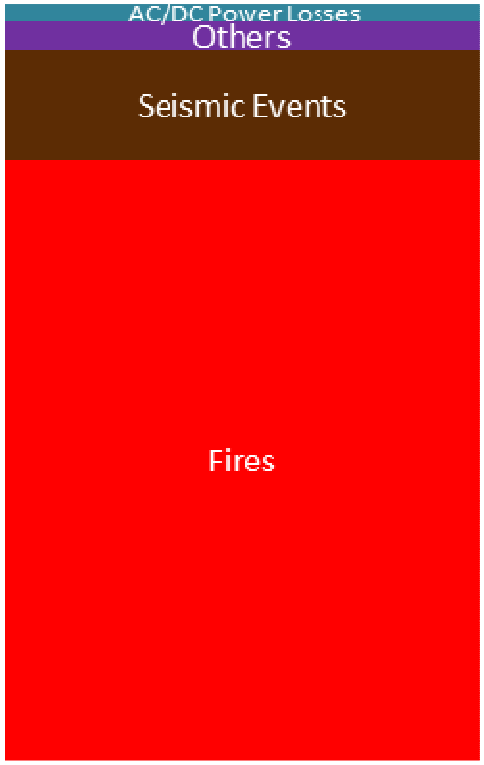
IPEEE vs NUREG/CR-6850

Unit B- IPEEE

Unit B- 6850



Unit C- IPEEE



Unit C- 6850

Summary

- **NFPA 805 using NUREG/CR-6850 methodology is too conservative and is closer to deterministic considerations**
- **We appreciate the effort the NRR and EPRI has gone through in order to help remove some of the conservatisms, but more work needs to be done**
- **The PRA was intended to remove conservatisms**
- **Realism is needed to ensure proper safety focus and increase confidence in decision-making**

Conservatism	Ease of Implementation	Cost	CDF Reduction	Match OE?
Ignition Frequency	Simple, update calc then PRA	Low	Large	
Likelihood Analysis	Simple, if circuit parameters are known and only the table values are updated.	Low	Medium	No, there are fewer than 377 spurious events over the course of 1,885 fires
	Complex, if new circuit parameters need to be determined.	High		
Heat Release Rates	Complex, new Detailed Fire Models will need to be developed due to the change in ZOI	High	Large	No, in the fires reported a majority of them did not cause damage beyond the source itself

Fire PRA and NFPA 805 Process Improvements

Victoria Anderson, NEI

September 18, 2014

Context of NFPA 805 and Fire PRA

- NFPA 805 and modern-vintage Fire PRA emerged hand-in-hand
  - Issues with both became apparent during pilots
  - NFPA 805 transition schedule, even staggered, resulted in accelerated application of modern-vintage Fire PRAs
  - Degree of conservatism in these Fire PRAs became apparent in course of NFPA 805 transition effort
  - Pilots were able to use NUREG 6850 as a framework and integrate plant-specific improvements to realism, follow on plants have not been able to do so in their applications
- Addressing NFPA 805 issues required addressing NFPA 805 process issues, as well as underlying difficulties with achieving Fire PRA realism
  - NFPA 805 processes substantially improved
  - Fire PRA realism not yet fully realized

NFPA 805 Process Improvements

- NRC initiated
  - New audit process launched in 2014, resulting in more focused audits and LAR reviews
  - RAIs have generally become more focused and more site-specific, making better use of NRC and industry resources
  - FAQ process has allowed for generic resolution of NFPA 805 related issues (application and implementation)
- Industry initiated
  - Task force to address emerging issues
  - Continuous revision of LAR template to support incorporation of lessons learned
  - Transition workshops to support consistent implementation throughout the fleet

Fire PRA Realism Improvement Efforts

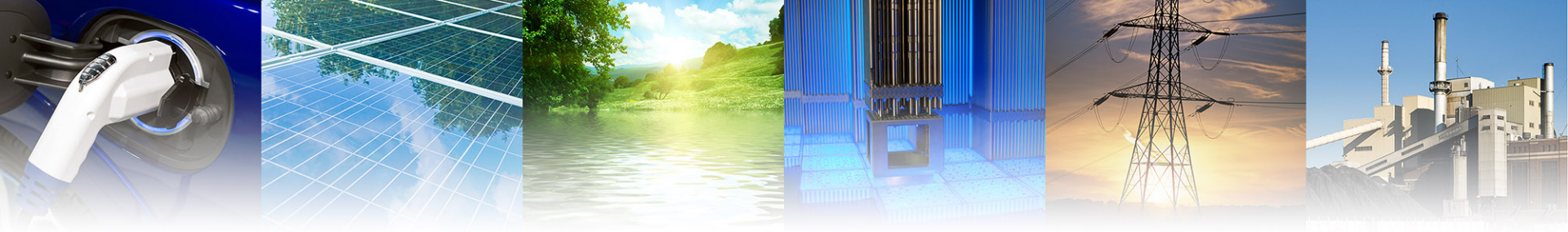
- 2011-2012: EPRI-led review panels
  - Insufficient regulatory footprint
  - Key improvements: pump oil fires, transient fires
- 2013-2014: Fire PRA FAQ process
  - Only addresses interpretations of existing methods, not new methods
  - Key improvements: Junction boxes, cable fires, sensitive electronics

Fire PRA Realism Improvement Efforts

- 2014: EPRI-NRC RES methods development panel
  - Allows for development of new methods and makes new data available for use
  - High confidence in regulatory footprint
- Continuous improvement efforts
  - Freeze point concept
    - Allows licensees to “freeze” their PRA information supporting the licensing application, addressing changes in bulk rather than individually
    - Better use of licensee and NRC resources
  - Post-transition integration of improved methods and data

Moving Forward

- Continue improving Fire PRA realism in key areas
  - Timely improvements better support NFPA 805 transition
  - Other applications must be supported as well
- Leverage processes in place to allow licensees to incorporate improvements
- Achieving results that comport with operating experience is essential to maintaining viability of risk informed regulation
- Joint NRC-industry Risk Informed Steering Committee effort on PRA technical adequacy to streamline process of making methods (fire and others) available for use in regulatory applications



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Fire PRA Research Overview

Ashley Lindeman
Technical Leader / Project Manager

ACRS PRA Subcommittee
September 18, 2014

Introduction

Probabilistic risk assessment (PRA) of fire is a major focus of research at EPRI

- EPRI was co-author of most widely used analysis framework, NUREG/CR-6850 (EPRI 1011989)
- Results of fire PRAs indicate that fire can be an important risk contributor
- Improvements still needed to the tools, methods, and data for performing fire PRA to ensure proper insights are gained and to support better decision-making

Modest, incremental changes in PRA methods have been made slowly since publication of NUREG/CR-6850

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Introduction (continued)

Improvements in fire PRA technology needed to

- Enhance realism of fire PRA elements to make results more meaningful and useful; e.g., address elements that led to this statement in Regulatory Guide 1.205:

  However, recognizing that merely using the methods explicitly documented in NUREG/CR-6850/EPRI 1011989 may result in a conservative assessment of fire risk, licensees may choose to perform more detailed plant-specific analyses to provide greater realism in the fire PRA model.

- Make fire PRAs more manageable and efficient

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Presentation Overview

- Research progress since 2010
  - Significant update to Fire Events Database
  - Improved treatment of circuit failures
  - Detailed human reliability analysis for fire PRA
- In-progress research
- Planned future research

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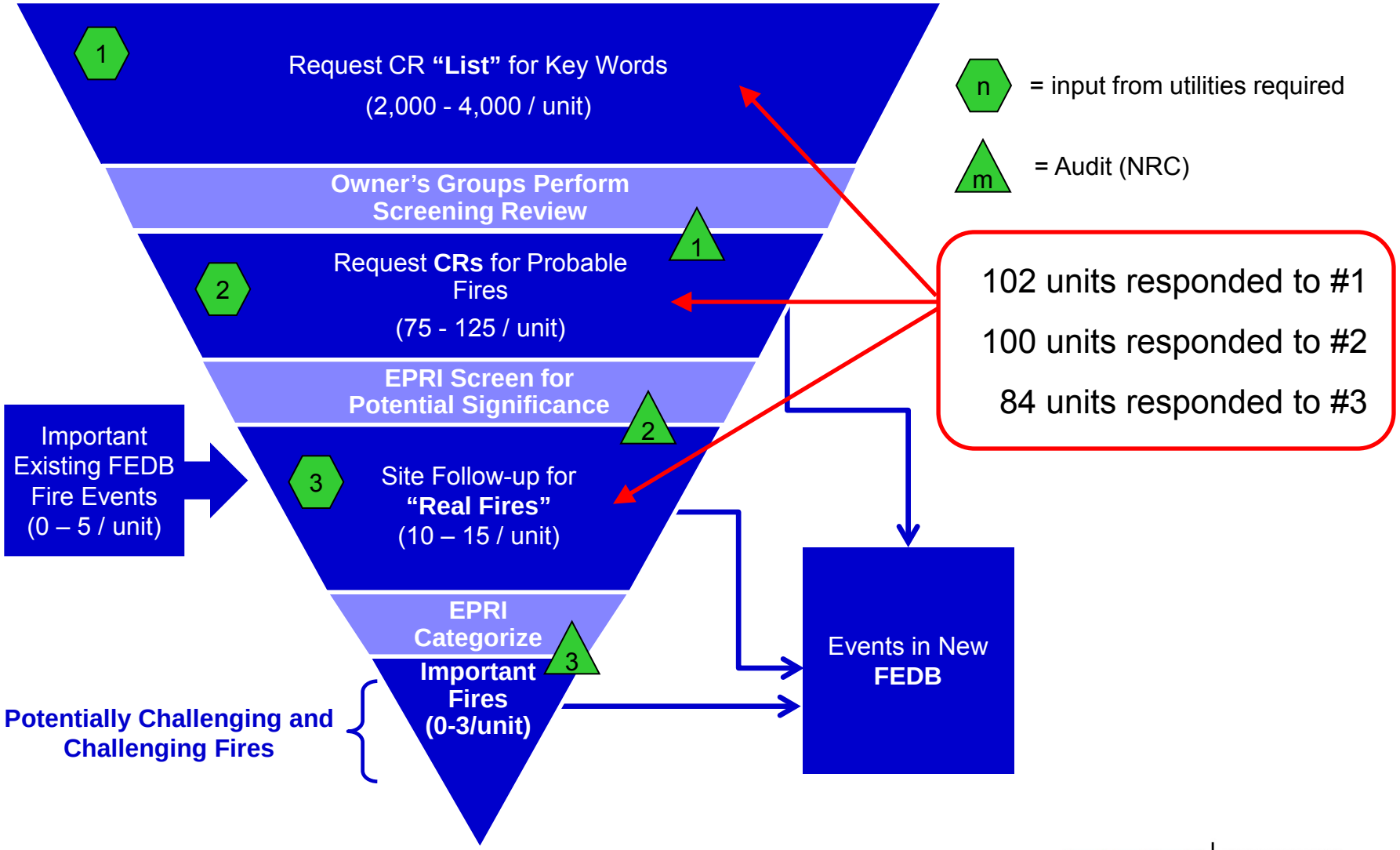
Fire Events Database



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Fire Events Database (EPRI 1025284)

- Published in July 2013
- Data collection comprehensive for 1990-2009
- FEDB insights indicate vast majority of fires were small, contained to the ignition component source, i.e. did not spread or cause collateral damage
- Fire growth and suppression timing observations raise question of consistency with fire PRA applications
  - Many long duration fires have no damage outside the component of origin
  - t^2 growth from onset of fire may not be applicable

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JACQUE-FIRE I (PIRT Panel)

- PIRT panel chartered to investigate and rank phenomenon applicable to fire-induced circuit failures based on available test series
  - Collective look at available data to make informed decision on what the data as a whole is telling us
  - Considered AC and DC circuit types
- PIRT panel conclusions served as a primary input to the follow-on PRA Expert Panel
  - Spurious operation probability
  - Spurious operation duration
- Considered the following modes INCREDIBLE
  - Spurious operation of three-phase AC motor shorts due to proper polarity
  - Ignition of secondary fire from an open circuited CT secondary circuit with a turn ratio of 1200:5 or less

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JACQUE-FIRE II (PRA Panel)

- Building from PIRT panel results, expert elicitation used to develop
  - Likelihood of spurious operation induced by hot short
  - Conditional probability of spurious operation duration
- Results replace values in NUREG/CR-6850 Tables 10-1 through 10-5 and eliminate option #2 as a credible methodology
- Supersedes AC hot short duration in FAQ 08-0051 and adds DC duration treatment

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Fire HRA Methodology

- NUREG/CR-6850 Task 12 provided a framework and screening approach for Fire HRA
- NUREG-1921 (EPRI 1023001) provides method for developing best-estimate human error probabilities (HEPs) that account for performance shaping factors (PSFs) and fire-related effects
- Provides three approaches for quantification of HEPs
  - Screening
  - Scoping
  - Detailed

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EPRI Research In Progress

- Update of fire ignition frequencies and non-suppression probability estimates with fire experience through 2009
- Re-quantification of electrical cabinet heat release rates
- Exploration of effects of cabinet construction on plume temperature calculations
- Fire location factor guidance
- Realistic oil spill HRR
- FPRA uncertainty guidance
- Treatment of loss of habitability for MCR (to kick off in Fall 2014)
- Update of fire modeling V&V

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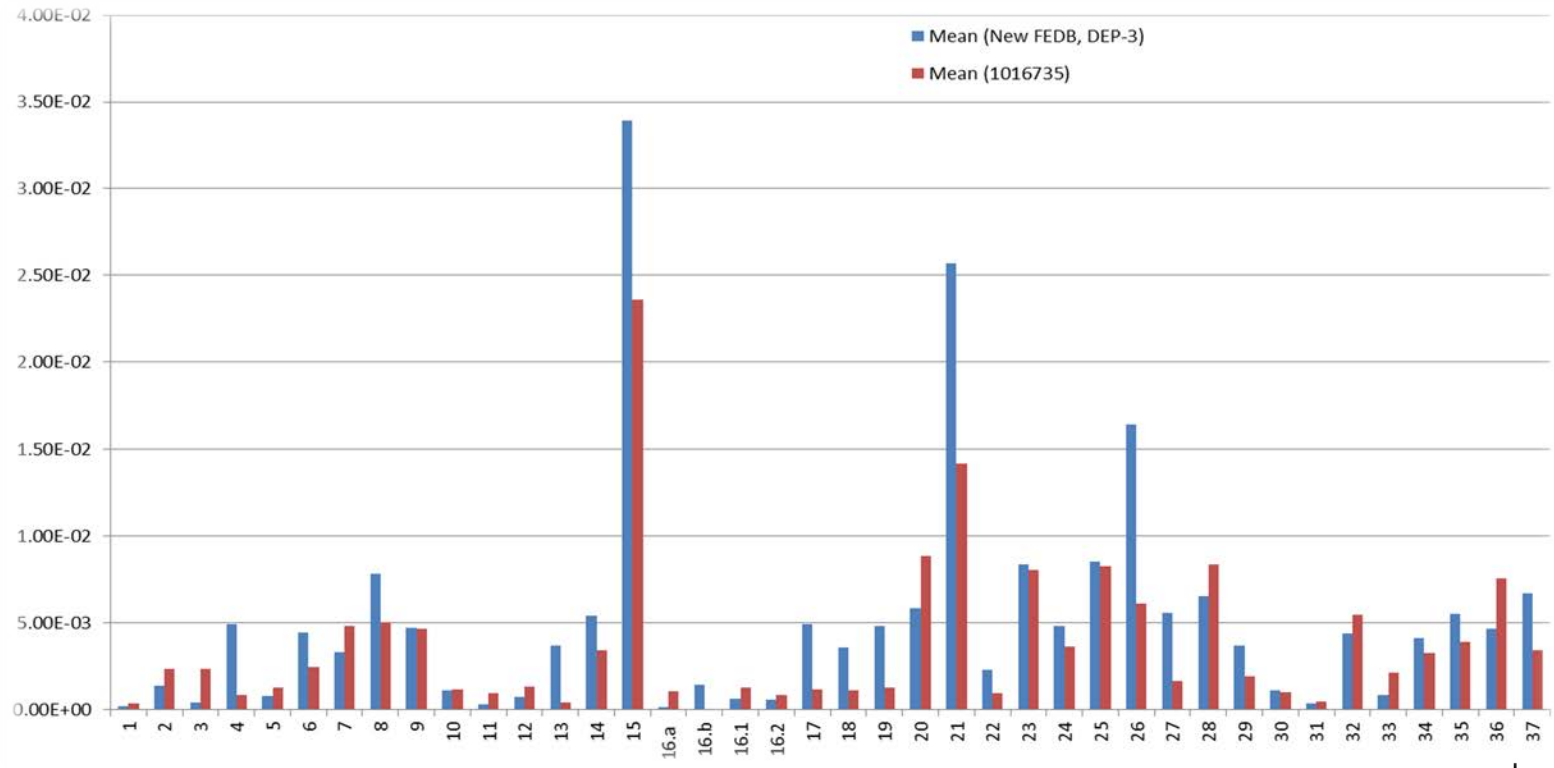
Fire Ignition Frequencies

- NUREG/CR-6850 EPRI 1011989 2.89E-01
- EPRI 1016735 1.5E-01
- Updated FEDB 2.1E-01



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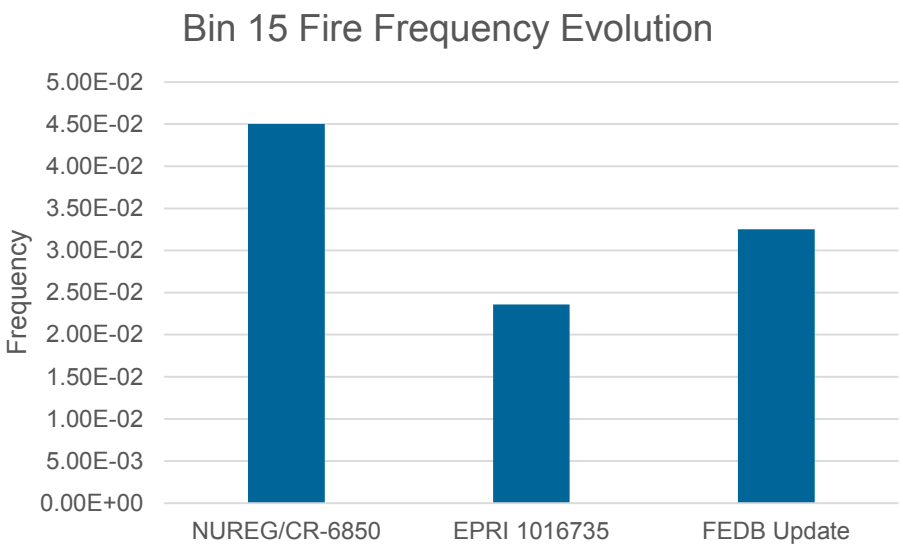
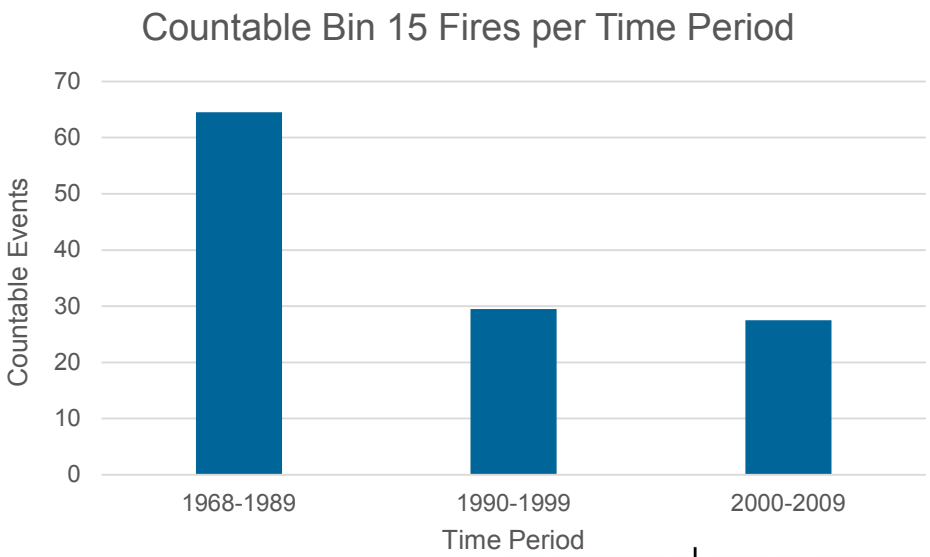
Fire Ignition Frequencies – Bin 15

- NUREG/CR-6850: included data from 1968-2000
- EPRI 1016735: frequencies influenced by most recent data from 1991-2000
- FEDB Update: frequencies driven by recent 10 years of data (dense bin) with 1968-1989 used to develop prior
  - Note that counts from 1990-1999 and 2000-2009 are approximately the same
  - New frequencies higher due to small number of reactor years versus 1016735





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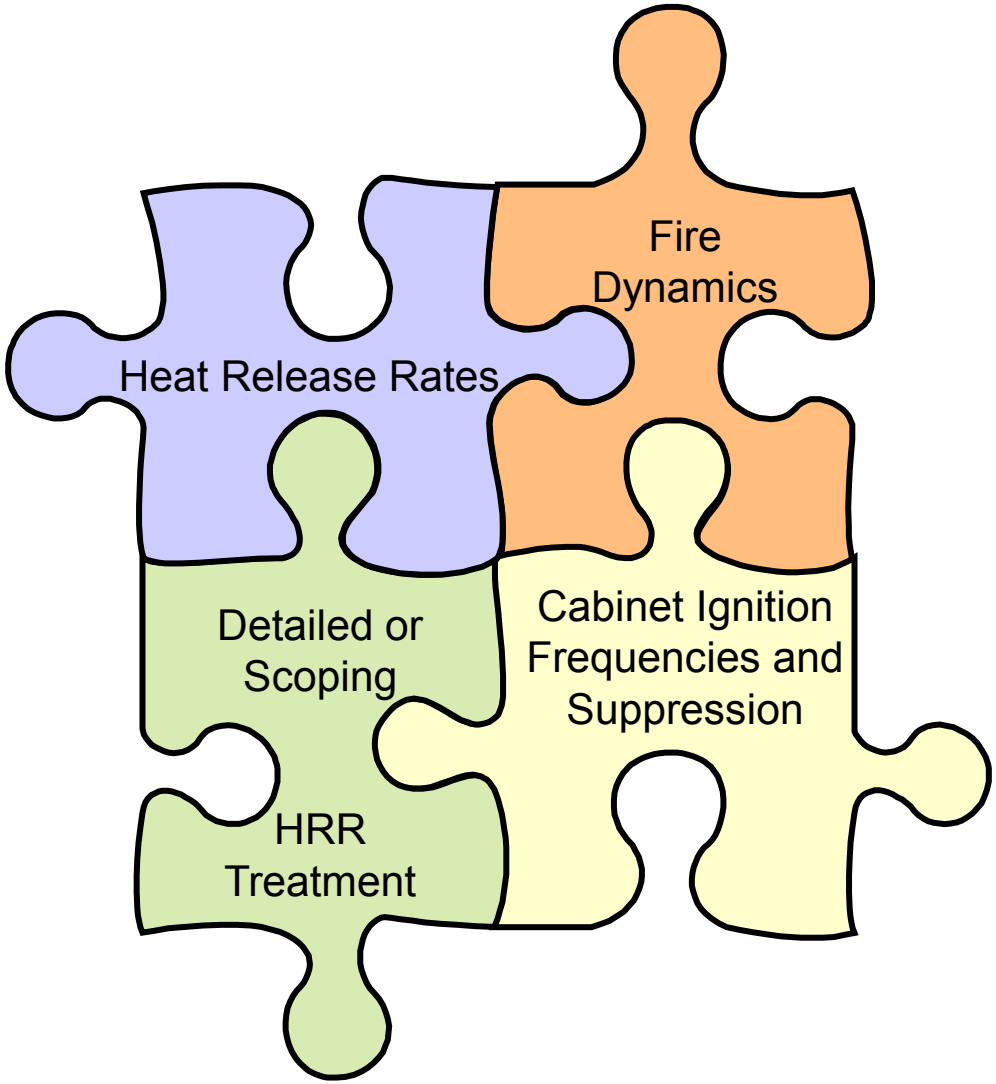
Electrical Cabinet Fire Modeling

- A complicated issue with many variables and simplifying assumptions
  - Fire growth rate
  - Fire elevation
- HRR distributions from test data and ignition frequency and suppression credit from events
- Postulated scenarios do not align with operating experience



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Electrical Cabinet Heat Release Rates

- Limited options for HRR distributions
  - 2 or 3 options depending on cable insulation type
  - Tests backing up distributions aimed at achieving large fires and initiated with transient sources

Table G-1
Recommended HRR Values for Electrical Fires

Ignition Source	HRR kW (Btu/s)		Gamma Distribution	
	75th	98th	α	β
Vertical cabinets with qualified cable, fire limited to one cable bundle	69 [1] (65)	211 [2] (200)	0.84 (0.83)	59.3 (56.6)
Vertical cabinets with qualified cable, fire in more than one cable bundle	211 [2] (200)	702 [3] (665)	0.7 (0.7)	216 (204)
Vertical cabinets with unqualified cable, fire limited to one cable bundle	90 [4] (85)	211 [2] (200)	1.6 (1.6)	41.5 (39.5)
Vertical cabinets with unqualified cable, fire in more than one cable bundle closed doors	232 [5] (220)	464 [6] (440)	2.6 (2.6)	67.8 (64.3)
Vertical cabinets with unqualified cable, fire in more than one cable bundle open doors	232 [5] (220)	1002 [7] (950)	0.46 (0.45)	386 (366)

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Electrical Cabinet HRR Re-quantification

- EPRI is working with NRC-RES on revising heat release rates
  - New test series available
  - FEDB data
- The working group proposed new bins and has agreed on HRR distributions

Bin	Closed – TS	Closed – TP	Open – TS	Open – TP
Power – Switchgear / Load Centers			N/A	N/A
Power – Motor Control Centers & Battery Chargers			N/A	N/A
Control - Large				
Control – Medium & Inverters				
Control – Small			N/A	N/A

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Electrical Cabinet Zone of Influence Definition

- Plume calculation most crucial affecting the vertical zone of influence (ZOI)
- Current plume calculation does not account for fires inside cabinets, assumes no influence on plume temperature for fires obstructed by top of cabinet
- Series of virtual experiments using FDS explored various
  - Obstruction geometries
  - Heat release rates
  - Fire elevations
- Results compared to Heskestad and McCaffrey plume correlations

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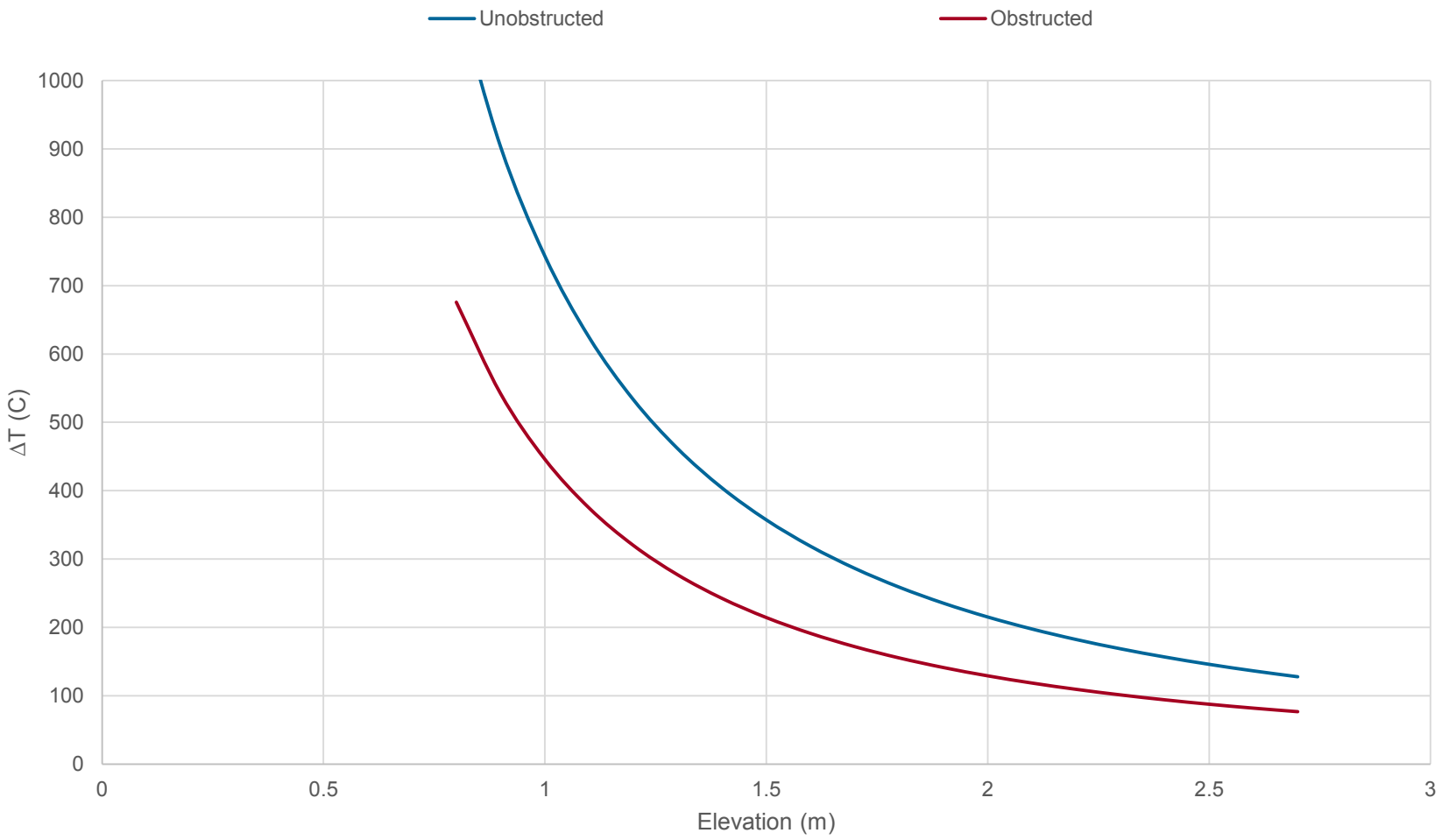
Zone of Influence Definition – Electrical Cabinets



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Future Research to Improve Realism

- Fire Frequency Advancement
  - Component based fire frequency feasibility
  - Review of international treatment
  - Review of dense fire bins, specifically Bin 15
  - Review of current fire event data (2010-2014)
    - INPO collecting fire event data in ICES database
- Treatment of Transient Fires
- Finish electrical cabinet refinement efforts
  - Fire growth or progression modeling
  - Treatment of motor control centers
- Pump HRR
- Zone of influence for bus ducts and high energy arcing faults
- Addition fire modeling or fire testing to revisit critical assumptions

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Future Research to Improve Realism

- Treatment and guidance for fires leading Main Control Room Loss of Control
- Fire effects on instrumentation circuits
- Fire effects on instrumentation circuits
- More challenging refinements
  - Main Control Board Treatment
  - Current assumption that all fires cause a plant trip
- Methodology cleanup in needed areas
  - Structural steel
  - Multi-compartment analysis

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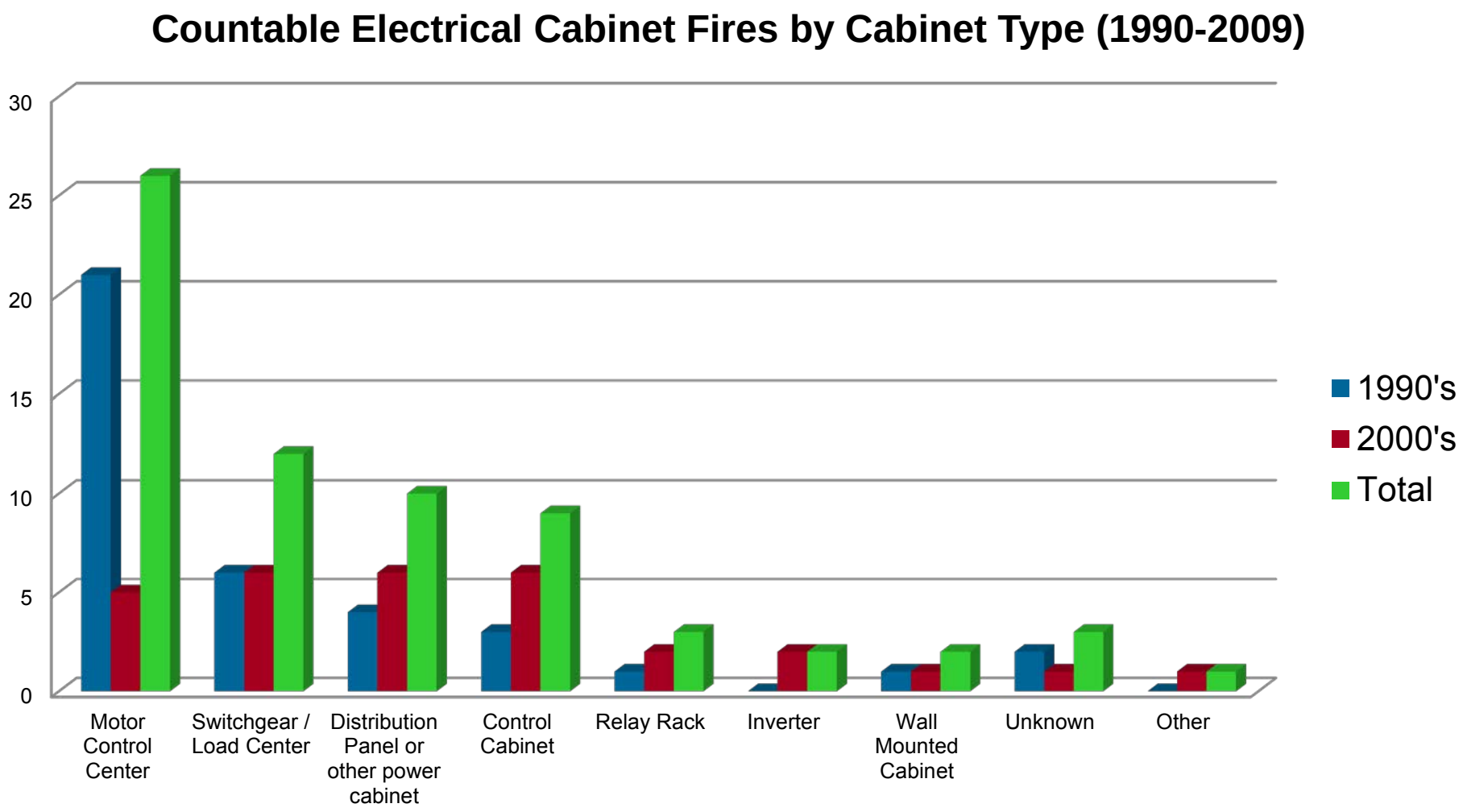
Breakdown of Bin 15 Fires by Cabinet Type



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Transient Fires

- NUREG/CR-6850 has 317 kW HRR regardless of plant location, transient storage, or administrative controls
  - Approximate ZOI is 10ft x 10ft x 10ft
- FEDB experience has shown ignition sources are very small with very limited evidence of fire propagating outside the ignition source
- Typical transient fires from the Updated FEDB
  - Burnt extension cords / temporary wiring
  - Small temporary equipment (temporary air compressor, portable heater, floor scrubber, temporary a/c, lamp, strip heater, vacuum cleaner, temporary oil heater)
  - Smoldering oily rags on floodlight
  - Small transients (cardboard, trash, cloth)

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Qualitative FEDB insights (Electrical Cabinets)

- Reviewed fire event data attributes looking for patterns between challenging (CH) fires and potentially challenging (PC)
- All challenging fires were over 10 minutes in duration
  - Mean time to suppress: 34.5 minutes
- 55% of potentially challenging fires were 5 minutes or less
  - Mean time to suppress: 8 minutes
- Only 15% of fires detected by fixed detection systems
  - Plant personnel detect 67% of CH fires and 53% of PC fires
- In regards to fire suppression
  - Fire Brigade extinguishes 33% of challenging fires and 23% of PC fires
  - Plant staff extinguishes 33% of challenging fires and 48% of PC fires

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Summary

- Advances have been made in the areas of fire event database, human reliability analysis and circuit failure analysis
- Limited progress also achieved through NEI FAQ process
- Still need transformative change to achieve realism in FPRA methods
  - Joint effort between EPRI and NRC on electrical cabinet panel is a step in the right direction
- Improvements to basic methods fundamental to supporting more efficient process

EPRI is committed to supporting method and data enhancements

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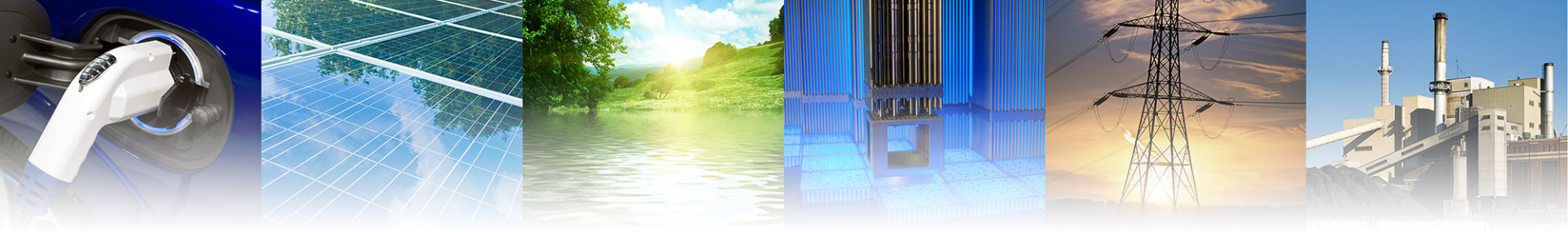

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