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UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

RELIABILITY AND PRA SUBCOMMITTEE

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TUESDAY,

NOVEMBER 16, 2010

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, Rockville, Maryland at 8:30 a.m., John W. Stetkar, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

JOHN W. STETKAR, Chairman

SAID ABDEL-KHALIK, Member

WILLIAM J. SHACK, Member

<u>NRC STAFF PRESENT</u>:

MARK CUNNINGHAM, NRR

DONALD HARRISON, NRR

ALEXANDER KLEIN, NRR

JOHN LAI

MARK SALLEY, RES

SUNIL WEERAKKODY, NRR

GIRIJA S. SHUKLA, Designated Federal Official

<u>ALSO PRESENT</u>:

TOM BASSO, NEI

BIFF BRADLEY, NEI

KEN CANAVAN, EPRI

JIM CHAPMAN, ScienTech

MARDY KAZARIANS, Kazarians & Associates

DOUG TRUE, ERIN Engineering

RICK WACHOWIAK, EPRI

T-A-B-L-E O-F C-O-N-T-E-N-T-S

T-A-B-L-E O-F C-O-N-T-E-N-T-S (cont.)

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

8:33 a.m.

CHAIRMAN STETKAR: I guess we'll get started. The meeting will now come to order. This is a meeting of the Reliability and PRA Subcommittee. I'm John Stetkar, Chairman of the Subcommittee meeting.

ACRS Members in attendance, at the moment, are William Shack and Said Abdel-Khalik. Some other of our colleagues may join us later, depending on their availability, I guess.

Girija Shukla of the ACRS staff is the designated federal official for this meeting.

The purpose of this meeting is for the Subcommittee to review the current state of licensee efforts on the Fire Protection Program transition to NFPA 805. We will hear presentations from the nuclear industry and the NRC staff.

We have received written comments from the Union of Concerned Scientists addressing concerns from external stakeholders. We have received no requests for time to make oral statements from members of the public regarding today's sessions.

There will be an open phone bridge line. To preclude interruption of the meeting, the phone will be placed in a listen in mode during the presentations and Committee discussions. I will open the phone line for comments from interested participants at some time before the close of the meeting, in case anyone wants to make a statement or add any additional information.

The entire meeting will be open to public attendance.

The Subcommittee will gather information, analyze relevant issues and facts and formulate proposed positions and actions, as appropriate, for deliberation by the Full Committee.

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

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

Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the Subcommittee. Participants should, first, identify themselves and speak with sufficient clarity and volume, so that they may be readily heard.

Before we get started, I would like to provide a little bit of background and context for why we are here and where we are going.

This effort, as probably most if not all of you in the room are aware, is derived from a Staff Requirement's Memo from the Commission dated June 25th of this year. And I would just like to summarize the statement in that memorandum, so that we are all clear on what, at least, our charter is.

And it says "The ACRS should conduct a review and report back to the Commission on the current state of licensee efforts to transition to National Fire Protection Association Standard 805. The review should include methodological and other issues that may be impeding the transition process, lessons learned from the Pilot Projects and recommendations to address any issues identified.

The review should determine whether the level of conservatism of the methodology is appropriate and whether any adjustment should be considered. The review should not influence the staff's actions regarding the Pilot Projects or the pending license amendment reviews."

So that's basically our marching orders. We have had some discussions among ourselves about the most effective way to respond to this SRM.

And, first and foremost, I think, one of our roles is to develop assurance that the technical information and the guidance methods that are available are sufficient to provide adequate assurance that, indeed, we are addressing safety issues in nuclear power plants and that the staff and the Commission has a reasonable technical basis for any regulatory decisions that they make.

So because of that thus far, and I think through the end of our interaction, at least right now, I'm trying to keep most of the discussions focused on technical issues, if possible. That doesn't mean that we can't discuss other programmatic issues. In fact, I'm very interested in hearing about those, but I would like, as much as possible, to keep our discussions focused on technical issues.

Internally, the process that we have established here is that we are, right now, in the, what I would call, information gathering phase of our activity. And this meeting and the report from our consultant, who we will hear from later -- by the way, for introductions, I forgot to introduce our consultant, who will be here, Dr. Mardy Kazarians is a consultant to the Subcommittee for the purposes of this. We will be here. I have heard he is in the building, so we will see and hear from him later.

As I said, this Subcommittee meeting and Mardy Kazarians' report will effectively -- and what I'm calling this information gathering phase, during this phase, what we are trying to do is develop a sense of the technical issues that may be most difficult in terms of either a lack of adequate supporting information, lack of adequate guidance, perhaps methods that are still in a state of evolution, we're not sure.

We have had interactions with a number of stakeholders at the, what I would call, practitioner level. We will hear later from Dr. Kazarians about his efforts, but he has been out talking to people both on the staff and in industry at the level at which the analyses are being performed. So, essentially, people who are in the trenches doing the work to get a sense of where they feel their problems are, the primary issues that they are facing.

This Subcommittee meeting today provides a forum to hear perhaps some of the same information, perhaps a different perspective on some of the same information from both the staff and representatives from industry.

Going forward, we will take all of this information. Hopefully by the end of today, although I can't promise that, we may be able to identify a few key technical issues. I'm not sure whether we will be able to accomplish that today and we will talk a little bit more about that toward the end of the meeting when we talk about planning for the next Subcommittee meetings, which are currently scheduled for December 13th and 14th.

In those Subcommittee meetings, what we would like to do is to coalesce the information that we have gathered through this point in the process and have a reasonably focused technical discussion. In other words, bring forth the technical issues, any significant, let me call it that, programmatic issues that may be involved, make sure that we have a focused discussion about each of those, so that our Subcommittee understands -- make sure that we understand the issue, make sure there is no misunderstanding between perhaps our interpretation of what we might have been hearing and others.

And if at all possible, identify areas where there is some agreement that, indeed, a particular issue may be a thorny problem, what a path forward might be and try to close out those discussions at least in this open Subcommittee forum to provide the end of the input to our subcommittee.

Then what will happen then is our Subcommittee will write a report to the Full Committee, essentially, summarizing what we have learned. The Full Committee will receive the report probably some time in January. At our February Full Committee meeting, we, as a Full Committee, will deliberate on this matter and write a letter report to the Commission transmitting our findings, conclusions, recommendations, whatever they may be.

And that according to the SRM, that report is due by the end of February. So that's a bit of what we are doing, a bit of sort of the philosophy of the meetings, the time schedule and so forth.

We can talk a little bit more about the schedule and we probably should toward the end of the meeting. I think we have enough time allocated today to make sure that we aren't particularly rushed in the presentations. And I think it's important in terms of all of the participants' preparation for that, those December Subcommittee meetings, which I feel are rather important to our final conclusions, that we understand what the expectations are, basically.

And with that, I will turn it over to Biff

Bradley.

MR. BRADLEY: Okay. Thanks, John. I appreciate the opportunity to be here today and discuss these issues with the Committee. And I hope we can have a productive meeting. Oh, can I get my slides up, please?

CHAIRMAN STETKAR: I have no idea.

MR. BRADLEY: Sure. Mouse.

CHAIRMAN STETKAR: Ken, move the mouse on the left.

MR. BRADLEY: Oh, there it is.

CHAIRMAN STETKAR: There we go.

MR. BRADLEY: It's in the folder 11/16.

MR. CANAVAN: All right, 11/16.

MR. BRADLEY: Got it.

CHAIRMAN STETKAR: Way over to the right.

MR. CANAVAN: Got it. All by itself. Which one is you?

MR. BRADLEY: Yes, second from the bottom on the right. Sorry, I didn't realize we had to do this on our own. You have heard about the budget cutbacks. The heat goes off in December.

CHAIRMAN STETKAR: Okay. I'll bring a coat to the next Subcommittee meeting.

MR. BRADLEY: Okay. Thanks. Ken, why

don't you advance the slide for me?

Okay. We do have a team here today to provide a whole series of presentations. And I don't want to take too much time, because we have a lot of technical information to get through today and I know the schedule can sometimes be a challenge for these meetings. So I'm going to just briefly set this up and overview the issue.

Ken Canavan of EPRI is going to provide some management level perspectives. EPRI was a co-author of NUREG/CR-6850 and is the lead on our industry effort to achieve improvements.

And then I think we are going to get to the meat of our presentation today. We have two of the primary consultants in the industry that have produced a large number of Fire PRAs over the last couple of years to support NFPA 805 implementation.

They have the benefit of insights from a large body of work they have performed. So we have moved beyond the pilot stage where we had a couple of plants. We now have 30 some plants worth of PRAs that are nearing completion and so we are able to get more robust insights on the methods.

So Doug True and Jim Chapman will be discussing those insights from the PRAs they performed. And then Doug will have a separate presentation on sort of your issue, John, which is what are the technical areas that are, from our perspective, driving the issues and sort of a roadmap for improvement.

And then Rick Wachowiak from EPRI will talk about the specific activities that industry has set up over the next couple of years to achieve improvements to Fire PRA methods.

And finally, last, but not lease, Tom Basso from NEI, who is our project manager for 805 implementation, is going to discuss there are some non-PRA issues that do have an impact. And we need to get some time to discuss those, so hopefully we don't squeeze Tom off the end of the agenda at the end of the morning.

Okay. So as a lot of us that have been around the industry for a long time know, fire protection has been a challenge for both the industry and the regulator, I think, going back at least 20 years, at least with my experience. And we remain hopeful that NFPA 805 can provide a platform to achieve a closure of some of the longstanding issues, such as multiple spurious and operator manual actions.

We believe this does provide a better

safety-focused platform and ultimately can achieve improvements in both safety-focus and the regulatory approach.

A challenge we have now is achieving stability in this process. It is a very complex process. And Tom, who will speak further to this -- but we are observing instabilities going from the first pilot to the second pilot already. So there is some concern that with a process this complex, we need to move toward a stable regulatory state.

Fire PRA is a part of that, but there are other issues as well that are driving that.

We do have about half the industry right now committed to adopt NFPA 805 50.48(c). I think a lot of the industry is looking at what is going on with both PRA regulatory stability pilot efforts and they are holding back on making a decision as to whether they want to move forward with 805. I don't anticipate seeing plants come forward, additional 805 plants, until some of these issues are better clarified.

So today, we want to go through some of the Fire PRA issues as well as some of the other issues that we believe need some clarification and stability in order to achieve, I think what, the

Commission's goal and our goal as well, would be to have widespread, you know, adoption of 805. So we have a mutual goal, so we need to figure out how to get there.

We have actually been discussing these Fire PRA issues for about nearly three years now. This was first identified when the quantification of the early pilot PRAs was nearing completion back in late 2007. We did provide an initial letter to NRC, to Mark Cunningham, in January of 2008 that actually did provide a list of, what we believed to be, some of the technical issues that were in need of improvement for Fire PRA.

And I think to compare what we had identified them to today, some of these issues remain. So we have identified some new ones, but the basic substantive issues were realized three years ago. At that point, we did enter into a process with NRC to try to achieve some resolution in the near term to cause a large number of plants moving to 805 on an expedited schedule.

This was called the FAQ process and over a couple of years, there were a number of interactions. There were about 15 of there FAQs relating to different areas of Fire PRA. The FAQ process extends beyond Fire PRA. Most of the FAQs have to do with non-PRA elements in NFPA 805, but it was believed that that was a good process to extend over to the PRA side of the house as well.

I think to be honest, we have had some frustration in that process, in that it was -- we didn't believe that we were getting timely, effective technical process progress through those interactions. There was some incremental improvements and we appreciate that that has occurred, but it is far from where we need to ultimately get to have realistic Fire PRA.

And late last year, starting in late 2009, there were no more Fire PRA-related FAQs submitted.

CHAIRMAN STETKAR: With this?

MR. BRADLEY: Yes.

CHAIRMAN STETKAR: If I could ask a leading question, that last bullet, is that because you are satisfied as an industry that you basically asked all the questions that need to be asked and you are simply waiting for resolution or are there other questions that you need to ask, but you've just given up?

MR. BRADLEY: It's the later. There are other issues that we need to bring before the process.

CHAIRMAN STETKAR: I would hope, are we going to hear about some of those?

MR. BRADLEY: Yes.

CHAIRMAN STETKAR: Okay.

MR. BRADLEY: Some of our later presentations are going into more detail about that.

CHAIRMAN STETKAR: Good. Thank you.

MR. BRADLEY: Okay. Okay. Following actually a lot of our interactions through the FAQ process, we elevated the concern to the Commission level. We did provide a letter in December of last year to the Commission discussing our continued concerns and this was after much of the FAQ interactions had occurred and our belief that we still weren't achieving significant improvements to get us into the -- closer to the realm of realism.

And we also, at that time, provided to the Commission the initial version of our action matrix and that's industry's plan that Rick Wachowiak will be talking about later, with many, dozens of, activities to address many areas of Fire PRAs.

We are committed to improving Fire PRA. There are a lot of reasons besides NFPA 805. Fire PRA and many other risk applications where a good realistic Fire PRA would be a tremendous tool to have and this includes everything from the oversight process to the maintenance rule to the risk-informed tech specs.

Our goal is to try to achieve, you know, a level of realism that is compatible with internal events. Some of our applications are trying to weigh internal events risk against fire risks, so we need to be careful that we proceed, you know, judiciously in those comparisons.

So we are going forward and you are going to hear a lot about our plan. And go ahead and advance the slide.

We are going to come back to this, but I just wanted to setup the major things we are going to tell you today. When you look at over 30 PRAs that have been performed in support of NFPA 805 and you start looking at some of the intermediate level results of those models, what we are finding is that the manner in which fires are characterized, that is the frequency of ignition, their growth rates, their heat release rates, when compounded together do not appear to conform with operating experience when compared to the actual types and numbers of fires that we are having.

Given that, it would appear that the level of quantified risk for damage frequency is overstated, as compared to operating experience. And we are going to show some comparisons on some CCDP and other metrics to provide some evidence of that.

We are concerned that the level of conservatism in fire PRA may or may not be level, even, and that we have got to be careful that these conservatisms aren't leading to incorrect decisions for plant modifications or other actions that fall out of NFPA 805.

I think there are some significant implications for the 805 submittals and these are -- some of them are regulatory processes used that need to be considered. We are under an Enforcement Discretion timeline. There is a strong scheduler element with NFPA 805 and we have -- the indications are that the Oconee, the second pilot SE, will be issued this December, at which point we have a large number of plants, on the order of 25 plants, that would have submittals due six months after the issuance date of the Oconee SE.

We are concerned that our timeline to effect these PRA improvements is not compatible with the 805 schedule. We are concerned that plants, after submittal, will be able to make improvements to their model that may obviate or change some of the commitments or other elements of the submittal that they have already put on the docket.

These submittals are over 1,000 pages long. There is a lot of work that goes into them and while it is theoretically possible to come back and redo your LAR on the basis of new information or better PRA results, it is extremely burdensome and we would like to think there is a more efficient and effective process to recognize that these PRA-based decisions may change going forward and some recognition of the need to have an open and reasonably efficient process to reconsider potential commitments made in your initial 805 submittal.

We do understand the Commission is under a lot of pressure on schedule on this. There is external pressure. We recognize that.

We did send a letter in just yesterday, which you may -- probably the Committee hasn't seen, but some of the staff has probably seen, suggesting that the idea of having 23 plants come in a the same time may not be the most efficient or effective way to pilot 805. Seeing as we have some disconnects between the first pilot and the second pilot, there appears to still be an evolving process here as well as the PRA issues.

So we are looking at -- we proposed a different, more along the lines of a license renewal, a sequential type of submittal schedule. The purpose for that wasn't really to address Fire PRA issues. It was more to allow for a more efficient review and structured review and better feedback from one plant to the next.

For plants that happen to be in the front of the queue, obviously, that wouldn't help, even if that was approved with a Fire PRA. But I did want you to be aware that we did send this letter in yesterday.

So that's all I really wanted to say today and I'm going to turn it over to Ken Canavan to pick up the next part of our presentation.

CHAIRMAN STETKAR: Bill?

MR. BRADLEY: Yes?

CHAIRMAN STETKAR: Before you close, you mentioned a couple of times, essentially, you mentioned, the term instabilities. You mentioned differences in terms of, I would call it perhaps, lessons learned between the two pilot projects. Are we going to hear some details about those? Because I'm pretty interested in that.

MR. BRADLEY: Yes.

CHAIRMAN STETKAR: That's part my charter, you know, what lessons have we learned from the Pilot Projects? And we, I believe, I lose track of time, so don't quote me, some time in the last year had very brief presentations from both of the Pilot Projects, but they are a fairly high level, basically, to say where they were and what progress they were making and things like that.

MR. BRADLEY: Yes..

CHAIRMAN STETKAR: So I'm interested if there are distinct differences, things that, for example, Oconee had to redo or do differently because of what they learned, maybe didn't work the way Harris did it. That's something I'm pretty interested in.

MR. BRADLEY: Yes. The answer is yes.

CHAIRMAN STETKAR: Okay.

MR. BRADLEY: We will be discussing those. Tom Basso is here today to discuss some of those issues.

CHAIRMAN STETKAR: Okay. Thanks.

MR. CANAVAN: Well, good morning. For the record, I'm Ken Canavan, the Director of Plant Technology at EPRI. It's always a pleasure to be here and speak to you guys.

I'm a little bit more today about

historical perspective. And you just heard NEI's perspective. I think I'll reiterate some of the same stuff, but I'll give you a little bit more of, hopefully, a technical slant on it and certainly a little bit more of a down-in-the-trench type of view of the last couple of years. It feels longer, I can say that.

Background on EPRI 1011989 and NUREG/CR-6850. Biff had mentioned this briefly and I actually thought he was going to use the word coconspirators there for a second and I don't think I would have objected.

The method was developed jointly between EPRI and NRC RES. The method outlined in EPRI 1011989 and NUREG/CR-6850 really did succeed in providing a standard framework pulling together all the elements that we had learned in the IPE and making those inputs a little bit more consistent.

And in attempting to provide that standard framework, it, indeed, was an advance on how we were doing Fire PRAs. Now, I get asked a lot of times about Fire PRAs and, interestingly enough, I'm going to diverge for a second and say the word seismic PRAs. The reason why we get into those discussions is we can do Fire PRAs now and we can do seismic PRAs now and we can do other PRAs, but they tend to be, what I like to refer to, as boutique or unique or one-off or not as consistent as they could be.

The methods are more of the IPEEE-type error and this was the first step away from those IPEEE methods. And it was, indeed, a successful first step.

CHAIRMAN STETKAR: Ken, since you are a coconspirator, and you characterize yourself --

MR. CANAVAN: I knew I shouldn't have said that.

CHAIRMAN STETKAR: -- as kind of a knuckle driving trench sort of guy, so you talked about standardization of framework and standardization of methods. I think some of the experience has shown us that fire risk, you mentioned seismic risk, also, some of these types of hazards and the evaluation of those hazards may differ tremendously from plant to plant.

Fire, in particular, because of the specific routing of cables, for example, the specific configuration of electrical cabinets in a given room that, although, two plants might be the same general vintage supplied by the same NSSS vendor, the architect engineer following whatever deterministic guidelines for routing cables, you could have completely different sources of risk at either of those plants.

I'm kind of interested in hearing people complain about the methods not being standard enough. Is it that the methods are not as well-defined and so comprehensive that they can prejudge any possible condition that you might need at any particular plant, which is something that no methodology can ever do, or are there fundamental problems with methods that don't allow flexibility from plant to plant?

MR. CANAVAN: Well --

CHAIRMAN STETKAR: Yes, sir.

MR. CANAVAN: -- I think --

CHAIRMAN STETKAR: And you don't need to answer that now, but just sort of keep that in the back of your mind.

MR. CANAVAN: Okay.

CHAIRMAN STETKAR: Because when we talk about methods there --

MR. CANAVAN: I think you are on to something.

CHAIRMAN STETKAR: Okay.

MR. CANAVAN: I think the first step we took was get sort of a standard high-level framework. We will talk a little bit more about that in my slides. We also got consistency of inputs. And my point all along has been as more of these plans come in, we had two pilots, we certainly didn't see everything we were going to say.

There is a question that you posed is are we going to see a lot of different things that we can't possibly cover? I would say no. But right now, we are covering those type of things at such a high level, that there is not enough guidance to effectively assess them. We will talk a little bit about how we just --

CHAIRMAN STETKAR: Okay.

MR. CANAVAN: -- already handled that.

CHAIRMAN STETKAR: Keep it a little bit, because it's something --

MR. CANAVAN: Sure.

CHAIRMAN STETKAR: -- that I have been curious about.

MR. CANAVAN: That's a good one. I like that.

I will point out, that from our perspective, one of the biggest things that we failed to do was obtain industry support and perform a full pilot. We took all the individual tests and we did it. There is a lot of reasons for that. I could give you them all. You know, people got into -- we had a few people volunteer that got into the effort and found out how much work it really was and said well, we really can't do this, lack of drive in the industry, at the time.

In other words, why do a Fire PRA? You know, this is a nice to do, not an I have to do. Nobody was committed to transitioning. So CR-68.50 and EPRI 1011989 were not integrated. They didn't have integrated pilots. They had individual task pilots. And while that was useful for those individual tasks, as we can see later, there are some integrated issues that we stopped it from still today.

Okay. So Fire PRA is complex. IPEs were relatively inconsistent. They relied on judgment. They had a goal of identifying vulnerabilities. We are in a different world now. We are looking at a different application of this study or this type of work. Keep that in the back of your head.

And 68.50 and EPRI 1011989, they aim to address these failings, these issues of the IPEEE methods by defining discrete tasks, by applying simplifications and boundary conditions on the problem, so fire events were binned, heat release rates were binned, suppression and control was binned.

They all were brought together with bins and then bounding assumptions were employed on the bins, which is exactly how you do simplified analysis.

It is the proper approach. It's the engineering approach. We use it in internal events all the time. We model a large LOCA in internal events. It is actually a range of LOCAs. It actually goes quite small. It's defined by the ability of the plant to depressurize. So it's a pretty big range. We take that big range and then we apply the maximum success criteria, which represents the double-guillotine ended break.

Now, the beauty of that is we do that even today in our studies. It doesn't contribute for a variety of reasons. One is the risk of having the double-guillotine ended break, as well as large LOCAs are rare.

Number two is there are other things that contribute that are much higher. And so this doesn't tend to get a lot of attention, but when those bounding conditions start affecting how we are going to do our study or how we are going to interpret the results, that's when those bounding conditions and simplifications start becoming important.

And as we are going to hear through today, through a lot of other presentations, I'm sure you are going to hear from us and perhaps even from the staff, is that there is an awful lot of these in the area of fire risk. That's one of the challenges. This isn't one thing that is contributing. We can't go after one item.

There is a bunch of different simplifications that come together in different ways in the studies that make it more challenging. So it's one thing to go after. Let's just go fix the large LOCA and life will be great or let's sharpen our pencils and analyze loss of off-site power a little better and we'll reduce the risk by 60 percent.

There is actually a whole bunch of little places to go and when you see later the matrix that Rick Wachowiak puts up, you will see all those areas.

Okay. Our perspective on frequently asked questions, I want to be careful here. We had 15 Fire PRA-related FAQs that were submitted after the NEI letter and that's about -- so you might hear slightly different numbers.

Very recently EPRI, I hate to do this to you guys again, 1019250 or NUREG/CR-6850 Supplement 1 was very recently published. That contains the FAQs. Each FAQ did, indeed, improve the technical understanding of the issues that it talked about. And most of those FAQs individually produced the risk reduction.

I will also point out that every one of those FAQs is currently in the Action Plan Matrix still, which means it wasn't completed. So they were good first steps. If you look in the front of the Supplement 1, you will find that there is a paragraph in there that says they are good first steps. And a lot of them are long-term research items.

Now, I want to draw a very big distinction between very early frequently asked questions, which were appropriate. They were frequently asked questions that turned around and said, I would like an interpretation on this piece of text in 6850 or EPRI 1011989 and those were the right uses of FAQs, frequently asked questions.

Later frequently asked questions, especially these 15, became this method is missing from the analysis and I would like to ask a brief question that resulted in a 100 page response. A 100 page response that contains technical details is not a frequently asked question, it's a research project.

And so I personally believe that the frequently asked question process suffered from any problems, mostly that it was the wrong tool for what we were trying to do. When it was used right, it seemed to work well. When we started asking it questions like, you know, define new methods for X, it didn't really work well, because it's a research project and wasn't really given to the frequently asked question process.

What ended up happening is the frequently asked question process, being the wrong process, was extremely slow and extremely ineffective at getting those answers. And basically, it missed its mission of establishing the realistic Fire PRA methods.

CHAIRMAN STETKAR: You mentioned slow and ineffective. I'm interested in effective. My experience has been as soon as you talk about something being a research project, it transitions from being slow to being geologic. So getting an answer within a year or so from a frequently asked question is better than embarking on a multi-year research project.

MR. CANAVAN: Here is --

CHAIRMAN STETKAR: Ineffective I'm interested in hearing about.

MR. CANAVAN: Let me give you both. Interestingly enough, I would agree with your statement, except in this case.

CHAIRMAN STETKAR: Okay. All right.

MR. CANAVAN: And the reason why I would agree that it goes from slow to geologic, it actually was reversed, because the number of people involved in the FAQ process would tend to be much larger. The public -- the process was public. It became a nightmare trying to bring along 40 people to make decisions in the area of fire research, whereas a small research team might have been more effective.

And so I would argue that this process was difficult to get through. And I don't think you will get -- I don't think you will have a different comment that it was difficult to work through from anybody who was involved.

CHAIRMAN STETKAR: We'll ask the staff about that, too.

MR. CANAVAN: Yes, I think you should.

CHAIRMAN STETKAR: The ineffective part, because that implies that I'm interested in, maybe we will hear about it later or perhaps you could comment on it, the ineffective statement implies that the resolutions that you receive, regardless of when they came in, and whether they were a paragraph or 100 pages, may not have been effective at addressing the real effectiveness.

MR. CANAVAN: No, I think we were effective at addressing a small part with a really lot of resources.

CHAIRMAN STETKAR: Okay.

MR. CANAVAN: And that were left with even at least a part that is as big as what we solved.

CHAIRMAN STETKAR: Okay.

MR. CANAVAN: To continue to solve. And so it was slow from the perspective of getting it out timely and it was resource-intensive for what we got. In other words, we put a tremendous amount of resources into getting a very small answer and we are left with another bigger part we have to solve later. And you will see that when you see the matrix.

CHAIRMAN STETKAR: Okay. Okay.

MR. CANAVAN: The correlations.

MR. BRADLEY: One more comment just quickly on that subject. When we get into the insights today from all the models that we produced, keep in mind that those are including incorporation of the FAQs. So every -- the insights that you see, we have already taken, that will give you a perspective on what the result was.

MR. CANAVAN: Yes. And what I'm trying to tee up is I just believe that the process is probably the wrong process, at least it feels wrong because of the amount of resources. Not that the small answer we got wasn't a really good small answer, but we paid a price for it and it was big. I think we could be more effective.

CHAIRMAN STETKAR: Okay. But I'm going to play a bit of the devil's advocate. We are not -- I don't want to get into a large debate over these things. I just want to make sure we understand some of the things that are being said. There have been research projects in this Agency that have dragged on for decades and they still continue under issues that affect both deterministic and probabilistic regulatory decisions.

MR. CANAVAN: Yes.

CHAIRMAN STETKAR: I'll mention GSI-191 as an example. There are many others that you're familiar with.

MR. CANAVAN: Yes.

CHAIRMAN STETKAR: The fact that we are still learning about those hasn't necessarily stopped us or prevented us from being able to make at least current state of the knowledge decisions regarding the risk of those issues. We might learn more in the future.

MR. CANAVAN: Right. I think --

CHAIRMAN STETKAR: You know, what I'm saying is it's certainly good to strive for perfection, perfect knowledge, perfect information, but --

MR. CANAVAN: I don't even think we are -- it's not even in the same ballpark.

CHAIRMAN STETKAR: Okay.

MR. CANAVAN: And I think Rick will take that up when he --

CHAIRMAN STETKAR: I hope we hear about that.

MR. CANAVAN: Okay.

CHAIRMAN STETKAR: That portion.

MR. CANAVAN: Yes, because he will show what is remaining in some of these tasks.

CHAIRMAN STETKAR: Good.

MR. CANAVAN: And I think you will be surprised at where we are.

CHAIRMAN STETKAR: Okay.

MR. CANAVAN: The implications. Well, I put this up in a number of different formats in front of this Committee and other Committees over time. And I don't think it's any different. I think the original methods contain simplifications and conservatisms, that that was appropriate.

I believe it was expeditious. I do believe that all simplifications and all conservatisms erode to the level of realism. It's a question of how much? And in the large LOCA, that erosion of the level of realism is acceptable. So when we model the large LOCA in the PRA, that's acceptable.

In other cases, it's not. If you treat loss of off-site power extremely conservative at your nuclear unit in the United States when we know it is generally a large contributor, that would not be acceptable.

I think that the original method did what it was supposed to do. And what we are talking about now is not an impugnment of the original method, it's how do we refine it quicker to get more realism to more appropriately reflect the results that we need it to reflect in a reasonable fashion with the right amount of resources in the time that it supports the submittals.

I'm going to point out again, we didn't pilot it in an integrated fashion, otherwise, we would have understood a little bit more of this prior to today. And as we go through more pilots, there is some interesting things happening, in that we are seeing some more of these conservatisms that we didn't see before, although I don't think that there are lots of them, but there are a few though.

Okay. And just to summarize, I think getting realistic results and insights is going to take us -- we are going to have to refine the methods. The rest of these presentations that follow are all devoted to the questions that I have you all thinking in your heads, which is, you know, what are the specific simplifications we are talking about? We're going to give you a few examples.

What are the specific methods and the methods we are talking about as we move forward? And we're going to talk about that as well.

You shouldn't be surprised that we are where we are, when we have tried this out twice, one and a half, number two isn't finished, one and three-quarters.

We are certainly committed, EPRI is certainly committed to supporting the methods, enhancements improving the state of the technology. We want to do that for a variety of reasons, not only NFPA 805, but other risk applications as well. We need to make sure that these methods are appropriate for use in risk-informed decision making in total.

I think you are going to find out a lot through the next series of slide presentations. This is, you know, all designed to give you information and, you know, I hope get you thinking, asking us questions. We will do our best to respond.

MR. BRADLEY: Can I say one thing?

MR. CANAVAN: Sure.

MR. BRADLEY: I forgot to mention as part of my presentation, you discussed that there was another Subcommittee meeting in December. We are going to be providing a technical paper to ACRS that summarizes the issues. Today's presentation is sort of a preview of what you are going to see, but we will be providing a detailed basis paper to the Subcommittee.

MR. CANAVAN: And the Action Plan.

MR. BRADLEY: Right.

MR. CANAVAN: And the Action Plan moving forward.

CHAIRMAN STETKAR: So talk more. I can ask you now. Do you have any idea of when that will be or we can discuss that toward the end of the day.

MR. BRADLEY: It will be -- we recognize your need to have it, something other than the day before than that Subcommittee meeting. Our goal, I think, is to get it to you a couple of weeks around that part of the month.

CHAIRMAN STETKAR: Let's talk a bit about that.

MR. BRADLEY: Right.

CHAIRMAN STETKAR: Because I think after Mardy Kazarians makes his presentation toward the end of the afternoon, we do need to discuss a bit about the schedule, because I want to make sure that those-- it's a two day Subcommittee meeting, so we have a lot of time scheduled and I want to make sure that we use that time very effectively.

And it's important for us, as Subcommittee Members, to have input as soon as we can get it. And I think it's important for all of the other participants, both the staff and anybody from industry who is coming in, to, essentially, have some time perhaps or communications with our staff to understand what specific topics we actually want to focus on.

So that's another reason not to get it in the day before the meeting. I mean, we read things pretty quickly, but it's not useful.

MR. BRADLEY: Yes.

MR. CANAVAN: We want you to have time to consider it, so, yes.

CHAIRMAN STETKAR: Okay. Thank you.

MEMBER SHACK: Just coming back for a second to your ineffective process, now, what's your proposal for an effective process?

MR. CANAVAN: Good question. I did think about that a little bit. I guess my real problem is research performed in extremely large groups and in the public is -- especially when there is preliminary results that come out, especially when they might say things, you know, when you initially screen them, they might have implications and it's being done on a public phone call, it's not going to work.

People aren't going to be as up front. They are not going to be as open as they could be. I know that process doesn't work. The process that we used with the smaller groups of really involved industry stakeholders or people, a small group of very knowledgeable people to create the first iteration on the method and then allow that method to be slowly socialized through the community, what happens when you use this set of plans? To the staff, what happens? What are your concerns about how you would review this?

And, basically, building out from that

small group works a lot better than to start with everybody and try and get agreement. And the fact process which is really good for answering those questions that were interpretations of the methods and it wasn't as good the other way because of that. And having survived many facts, I just think we could devise a little bit better of a process.

CHAIRMAN STETKAR: Okay.

MR. CANAVAN: Thank you.

MR. BRADLEY: So would Doug and Jim --

CHAIRMAN STETKAR: You've given yourself a daunting challenge here, Doug, to just get through all this stuff in one day.

MR. TRUE: Yes. Yes, no shortage of topics discussed today.

CHAIRMAN STETKAR: Who's up first, Jim?

MR. TRUE: We're going to move together. Primarily, I'm going to talk and Jim is going to add in on a few topics.

I'm Doug True from ERIN Engineering. And Jim and I are here for two reasons. One, EPRI asked us if we would be interested in doing this. And secondly, because we are both pretty concerned about this area. We have done a lot of PRAs between our two companies to support 805 and other Fire PRA-related studies.

And we are concerned about the status of things and the progress that we have been able to make or were unable to make over the last several years. So we're going to talk today about insights from the performance of industry Fire PRAs far beyond the pilots, but also including some of the insights from the pilots, too.

So, anything, Jim, you want to add?

MR. CHAPMAN: And I'm Jim Chapman from ScienTech. And I'm here to virtually operate Doug's computer, so let's go.

MR. TRUE: Okay.

CHAIRMAN STETKAR: When they turn the ventilation off in December, the migrating remains pegged, which won't be a problem any more.

MR. TRUE: So the purpose of this presentation is to provide insights from industry PRAs that have been performed using EPRI 1011989 and NUREG/CR-6850 with what I'll call NUREG/CR-6850 from this point forward, including the FAQs that help support things that Biff said in his first presentation, which was that the manner in which fires are characterized doesn't seem to conform with proper experience at the level of quantified risk.

It seems to be overstated when you look at it from an operating experience perspective. And we have some concerns, particularly as we move forward in 805 and beyond, about the level of conservatisms and uneven levelness of conservatisms and how they may mask insights and make decision-making more difficult.

So --

MEMBER SHACK: Of course, when you are adjusting an answer to get to an endpoint, that's sort of an unsatisfactory process, because there are lots of ways to twiddle the knobs to get to this, you know, to adjust things at the endpoint. So do you -- is there more information to deal with, rather than the fact that you don't like the final answer?

MR. CHAPMAN: Yes. It's in the presentation.

MR. TRUE: Yes. And it --

MR. CHAPMAN: Yes.

MR. TRUE: -- will be in the subsequent presentation, which I'm going to make. We are, basically, trying to say that we have been saying for three years there is a problem. We're going to show you why we really believe this is a problem. And then we will talk about how we want to go about solving that through additional development.

Okay. So the basic methodology for constructing a fire scenario involves setting up individual ignition source bins that have a plant-wide frequency that is derived from operating experience. This is the way that 6850 is set up.

So plant-wide, there is a fire frequency for pumps, like for cabinets, transient sources, diesels, whatever, there are 30 some-odd bins of ignition sources. Those ignition frequencies are allocated to a particular individual source within the plant, based on an allocation process.

For each of those bins, there is a growth rate assigned and a peak heat release rate, distribution is a sign that is intended to reflect that bin. Suppression is credited both automatic and manual suppression. The manual suppression is credited through a broad class of fires, electrical fires, oil fires, welding fires, etcetera.

You take that input and you put it in the fire modeling. We define damage footprint or sometimes we call it zone of influence that defines this is what the damage looks like from that particular ignition source developing in this way.

And then we take that damage footprint and we put it in and connect it to the PRA model and we calculate a conditional core damage probability for that scenario. It's a step-wise process that has been laid out. It's not much different than the way we have always done PRAs.

One difference about 6850 that I wanted to clarify is it has all been more of a cookbook, I think, than most of the past attempts at this. And I think that's where some of the issues have come about in applying it.

So when we go to calculate the core damage frequency for a particular scenario, it becomes a function of what is the frequency of this particular fire? What are the characteristics of that particular fire from a severity perspective? How fast does it grow? How big does it get? What's the probability of suppressing that fire versus time? And then what's the resulting conditional core damage probability that reflects how likely we are to get from that damage condition to core damage?

One of the challenges we have is that, as we have gone to apply this, we are seeing that there are conservatisms that were applied kind of in each one of these components. And this Ken hit on this a little bit that these were done in kind of discrete steps in the process and there were more conservatisms attached to each one.

And so when you go and apply to an individual basis, Ken mentioned, they apply tasks at individual plants, they looked at it and said okay, that seems right. Then we look at the next thing, it seems all right, seems all right.

The problem is that is when you combine them, the combination of those conservatisms, it's leading us away from realism.

CHAIRMAN STETKAR: Doug?

MR. TRUE: Yes?

CHAIRMAN STETKAR: Let me stop you right there and how is that different from the conservatisms that we apply in internal events PRA? When I looked at the fact that every motor-driven pump is a motor-driven pump and I have generic data for the frequency of motor-driven pump failures to start over a broad class of motor-driven pumps. The success criteria that I apply for a system in order to do a really detailed thermal hydraulics analysis would say that well, there might be a 90 percent probability that I can get by with one pump, but there is a 10 percent probability that I might need two pumps for the class of initiating events that I have grouped together, so I'm going to use two pumps as my success criteria.

MR. TRUE: Yes.

CHAIRMAN STETKAR: And the timing of the event is well, I'm going to say that I need to have injection before a certain time and I'm uncertain about when the RWST might be drained or when something might uncover. So I use the shortest of those time windows and that gives me a time window for operator response. Those also are cumulative conservatisms that we live with and are very happy in internal events PRA.

MR. TRUE: I think --

CHAIRMAN STETKAR: And this process, to me, doesn't sound any different than that.

MR. TRUE: It doesn't. I mean, in principle and again as Ken pointed out, the large LOCA example, it's not that much different. But I think as you know, what we have done with internal events over the last two decades or whatever it has been, 15 years, is we have refined a lot of those methods, so that we are trying to address a lot of those things that we might have treated very simplistically.

There is a lot more plant-specific data collected to make sure you are reflecting the particular types of pumps and their application. You are a lot more sophisticated thermal hydraulic analysis to refine the inputs. And that's not -- shouldn't be too surprising that in 20 years of doing internal events PRAs, rigorously, we have gotten that far. But today, we have fire PRA methods that they are. They are just not to that level.

And, you know, there shouldn't be a huge surprise about that.

CHAIRMAN STETKAR: How different are these methods, maybe we will get into it later, than the methods that were applied 25 years ago during the first Fire PRAs that were done in the mid-1980s?

MR. TRUE: I think in concept they are quite similar. We have some new wrinkles, spurious ops, for example, that have come in that weren't really treated in prior studies. But in principle, they are similar. But I think that there are some -- the binning and the handing off from task-to-task, I think has made it a little bit less of a scenario-based evaluation and more of an, okay, well, this is an electrical cabinet and I'm going to treat that like this and I'm going to do this with it and that. It's just a little bit too discrete.

MR. CHAPMAN: I think what you are --

CHAIRMAN STETKAR: Are you going to get into some of that?

MR. TRUE: Yes.

CHAIRMAN STETKAR: Okay. If you are, I'll let you go.

MR. CHAPMAN: I'll show you the results. But what fundamentally is happening is that the frequency of severe damage or risk significant damage, we think is being calculated much too high, at a high level. I think that's the fundamental difference. I don't think it's in the actual PRA modeling in terms of what happened.

CHAIRMAN STETKAR: Well, that's -- yes. And where I'm trying to get to, I hear that, but I hear it at high levels. So what I'm interested in is I think one of the things that I would like to come away with, perhaps in the Subcommittee meeting and if not, shortly thereafter, is an understanding of is this a process of conservatisms that are 50 percent or a factor of 2 too high multiplied together?

So you get 2 x 2 x 2 x 2 which is 16 factor of conservatism in the result or are there several conservatisms that are probably within the range of the uncertainties that we normally accept, let's say, within internal events PRAs, but one or two areas where you feel that there are, you know, substantial conservatisms?

In other words, if it is a factor of 16, we are getting most of that factor of 16 from one, rather than the cumulative effect of several things.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Because that's a much different perspective on --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- where do you go from here.

MR. TRUE: We're going to get to this.

CHAIRMAN STETKAR: Okay. All right. So--

MR. TRUE: I'm just not sure we are going to entirely satisfy you, but --

CHAIRMAN STETKAR: Well, I'm --

MR. TRUE: -- because this is, as you would --

CHAIRMAN STETKAR: -- planting the seed about what I would like to hear.

MR. TRUE: As you pointed out early on in this when Biff and Ken were talking, this is very plant-specific, there are scenario-specific issues and it's very hard to make general statements about anything in this area.

CHAIRMAN STETKAR: Okay.

MR. TRUE: You will see some general--

CHAIRMAN STETKAR: Well, yes, but I'm hearing general statements here, so I'm trying to pull you back into --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- what we are looking for.

MR. TRUE: Right. But --

MEMBER ABDEL-KHALIK: General statements aside, would it be fair to say that course binning is a common contributor to the conservatisms --

MR. TRUE: Yes.

MEMBER ABDEL-KHALIK: -- in each of these four components?

MR. TRUE: Yes. Course binning is an important conservatism that is driving the results, I believe. But that said, that permeates across all of these dimensions and across all of the bins to varying degrees.

MEMBER ABDEL-KHALIK: It's, essentially, a resolution issue?

MR. CHAPMAN: It's a resolution and a knowledge issue, in my mind, in terms of agreement on prevailing good practices for what might be appropriate assumptions to adjust what is clearly, in my opinion, over-predicting results, which we are going to get to. It's on Slide --

MEMBER ABDEL-KHALIK: Okay.

MR. TRUE: We'll get there.

MR. CHAPMAN: -- 16, right?

MR. TRUE: Yes, we'll get there.

MR. CHAPMAN: We have to get there.

MR. TRUE: So this is saying, we don't think there is any one factor.

MEMBER ABDEL-KHALIK: Right.

MR. TRUE: Not even sure it's a small handful of factors and the results are very scenario-specific, which means they are a function of the plant, a particular location in that plant, ignition source, what is driving which plant's risk.

Speaking of that, this is a little skyline chart. It's a graph of some results from a selection of PRAs, literally sort of randomly collected, that I can pull in through a common format.

And what you have on the y-axis is a fraction of CDF, so it's all on a relative basis. And across the x-axis in front is the -- each of the ignition bins from NUREG/CR-6850, the 37 different bins. And then there are seven plants. We could have made it more plants, but the message I'm trying to get across here is, I think, pretty clear.

First, electrical cabinets, that ridge running down the middle is important everywhere. Electrical cabinets are important. Not a huge surprise there, but they are important.

But the other thing you notice is scattered around in different places you have got different little bumps that are somewhere between say 10 and 20 percent of the CDF. So if you beat down the electrical cabinets at a certain plant, you are going to run into something else pretty fast.

CHAIRMAN STETKAR: This is risk assessment?

MR. TRUE: It is risk assessment. It's another reason why we don't believe there is a single factor that we can -- you know, one technical issue we can go to just solve that. We can solve this whole thing.

CHAIRMAN STETKAR: Okay, Doug, but given the fact that this is risk assessment and you have very graphically pointed to that very steep, very large, on a relative basis anyway, ridge line for electrical cabinets, if I'm hearing that the methods are insufficient and the numbers are too conservative, the first thing I'm interested in hearing about then is what are we doing wrong in evaluating fires in electrical cabinets?

Because if we are doing that pretty well, I don't care about the rest of this stuff, quiet honestly.

MR. TRUE: Okay.

CHAIRMAN STETKAR: I would like to be perfect in everything, but if that, indeed, we are doing fairly well, we have some sort of limit at which we can expect to have resolution.

MR. TRUE: Right.

CHAIRMAN STETKAR: So I hope we will get to talk about a level of that.

MR. TRUE: We will. That will actually -- that won't be in this particular presentation, but in my next one --

CHAIRMAN STETKAR: Some time today.

MR. TRUE: -- there will be a fair amount devoted to that particular subject, because it is important. EPRI has ongoing activities right now targeting some of the aspects of that.

CHAIRMAN STETKAR: Just out of curiosity, one thing on this slide that I don't see, and I think I probably know why I don't see it, but I want to hear it from you, is I don't see anything that says cables. You have highlighted diesels, battery chargers, electrical cabinets, high energy arcing faults, transformers and, you know, surprisingly not that there are transformers, but it's a plant-specific analysis.

MR. TRUE: Yes.

CHAIRMAN STETKAR: I don't see cable fires.

MR. TRUE: Self-ignited cable fires?

CHAIRMAN STETKAR: That --

MR. TRUE: They are one of the bins I have -- personally --

CHAIRMAN STETKAR: Yes.

MR. TRUE: -- I don't know which bin it is, but --

CHAIRMAN STETKAR: But, essentially, self-ignited cable fires are not an issue.

MR. TRUE: They are not.

CHAIRMAN STETKAR: At least across --

MR. TRUE: Across this set of plants.

CHAIRMAN STETKAR: Okay. And that's probably because we have learned an awful lot about the frequency of self-ignited cable fires as opposed to the consequences.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Are the electrical

cabinet fires manifesting their damage through that, through fires in the cabinets themselves or the ignition of nearby cables?

MR. TRUE: Mostly nearby cables.

CHAIRMAN STETKAR: Okay. Thanks. That helps that perspective.

MR. TRUE: Okay. So those bins or resolutions, it's a useful simplification that -- we think it has really been one of the significant contributors to the introduction of conservatisms that had led us away from what we are seeing in the operating experience and overstates the consequences for the assigned frequency.

See, that's another thing, we've got the frequency sort of dealt with over here and then we have the consequences dealt with over here and the connection to those two isn't always clean. And one of those will be a little conservative here and it will be a little conservative here. And then we put them together and suddenly we find a more significant issue.

I'm going to walk through a simple example of diesel generator fires. Why did I pick diesel generator fires?

CHAIRMAN STETKAR: Because it's easy to

do.

MR. TRUE: Yes.

CHAIRMAN STETKAR: I wish you would have done the one that was important and difficult to do and that's the electrical cabinet fires.

MR. TRUE: I know. And --

CHAIRMAN STETKAR: So sometime before the end of December, we are going to do that.

MR. TRUE: We will talk about electrical cabinet fires. And there are probably other people who could also participate in that.

CHAIRMAN STETKAR: Yes.

MR. TRUE: Because, like I said, there was a lot of work going on right now with EPRI trying to tackle that one.

Diesels are very straightforward to understand the process and it does a nice job of illuminating some of the concerns.

CHAIRMAN STETKAR: Okay.

MR. TRUE: It's not -- you can look back at the previous slide or two slides ago, whatever it was, and see there was only one plant where it's really a significant contributor. It's not -- I didn't pick it for that reason. I picked it because I can get through it in a few slides and you get the picture real quickly.

CHAIRMAN STETKAR: Yes. I understand. I'm just trying to --

MR. TRUE: Okay.

CHAIRMAN STETKAR: By the way, it is interesting that that particular plant shows yard transformers and diesels as relatively important contributors.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Which tells me they have some problem in their electrical system.

MR. TRUE: In their power supply or something that is gleaning to.

CHAIRMAN STETKAR: Yes.

MR. TRUE: So diesel generator fires are Bin 8 of the 37 bins. It applies to diesel generator rooms. It applies to all the diesel generators at the site. In the original report, it had a frequency of around 2.1 x 10^{-2} that was based on some 49.5 event. Somebody is going to say 49 and a half, how do you get half of an event?

Well, it's actually 60 events. 39 were fully counted. There were 21 events that were indeterminate, which meant that the analyst couldn't-- didn't have enough information from the description of the fire to exactly weight it in the way that they knew how significant the fire was, so they have it a value of .5.

CHAIRMAN STETKAR: Doug?

MR. TRUE: Yes?

CHAIRMAN STETKAR: For the benefit of the other Subcommittee Members, at some time during the day, is there going to be a discussion of that weighting and screening process and the data that was accomplished as part of the NUREG/CR-6850?

MR. TRUE: There will --

CHAIRMAN STETKAR: An analysis?

MR. TRUE: -- not in detail. What we have, there is a big project going on right now also with EPRI and NRC on the Fire Events Database to enhance that, that we are not going to talk -- we are going to talk about the fact of what is going on and some of the aspects of it, but not into the details of that.

CHAIRMAN STETKAR: Can you at least, if you are not going to talk about -- you know, you brought up the fact that this was counted as 49.5 events derived from 60. Could you briefly describe the types of decisions that went in when -- there has -- I'm stammering here a bit. But there has been a lot of discussion about the fact that the fundamental fire event frequencies are accessibly conservative and that there is a need to refine the methods to bin the events together, evaluate the events for whether they are a valid fire or whatever.

Could you at least tell the Subcommittee for the current database, the data that -- notwithstanding the FAQ resolution, but the current database that is published in NUREG/CR-6850, what type of general process was done? You had a collection of fire events that came from the industry, what was done with that?

MR. TRUE: Well, the author, or sometimes the authors, review each of those events and use several criteria to determine whether the fire was a challenging fire. It had to do with how much was the dollar value of the damage that was done, if that was known, the number of fire extinguishers that were involved in putting out the fire and I think whether there was damage to any external equipment is another criteria. So a handful of criteria.

Where they could determine that those criteria were one of those criteria met, they counted it as a challenging fire. And that's -- on this case, out of 39 of them, they had a clear enough description to be able to make that judgment.

In other cases, the database was a cobbled together selection of information that had been gathered from the industry and, frankly, some of the descriptions are not very complete, in fact, pretty incomplete. And so the analysts were left with, okay, what do we do with all these events? We know what happened, we just don't know enough about them.

And they had to make some judgment about whether they were a potentially challenging fire or not. And where they were, they assigned them an indeterminant condition and gave them or rated as .5.

Some of the fires they were, you know, self-extinguished or were not a significant threat and those weren't even counted towards the frequency. They were kept in the database for information, but they were not counted towards the frequency.

CHAIRMAN STETKAR: So this frequency of 2.1×10^{-2} per year, in a sense is a, I don't know how to characterize it, severity-informed frequency. In other words, there had been events that were characterized as a fire for whatever reason and we all are familiar with, you know, how reports are written.

MR. TRUE: Right.

CHAIRMAN STETKAR: But they were

characterized as a fire and discarded, because the people reviewing the data, they concluded that, indeed, it wasn't a significant fire. Some were clearly significant, some in between that got counted halfway, so that the events that are retained, your 49.5 events, are judged by either conclusive evidence or more expert opinion --

MR. TRUE: Yes.

CHAIRMAN STETKAR: -- that, indeed, they were severe enough to be counted as a legitimate fire for the purposes of this.

MR. TRUE: Whole fire or half fire, right.

CHAIRMAN STETKAR: Okay. Okay.

MR. TRUE: Yes. I don't remember the exact numbers, but I think in the diesel case there were another maybe 40 or 50 that were not counted at all.

CHAIRMAN STETKAR: Yes.

MR. TRUE: But are in the database, but aren't counted toward the frequency.

CHAIRMAN STETKAR: And that's normal for anybody's data.

MR. TRUE: Yes.

CHAIRMAN STETKAR: It's pump broke, fix pump.

MR. TRUE: Right.

CHAIRMAN STETKAR: Is it a failure or not?

MR. TRUE: Yes.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Yes. So in the FAQ process, one of the successes that -- it mentions success and applies here is FAQ-048. EPRI did a bunch of work to update the fire frequencies. What we found was there were sort of disproportionate amount of fire experience in the early operating years, from, actually pre-operational period up through and until Appendix R was fully in place, there were a lot more events than there were in the more recent years.

And so EPRI did a report where a statistical analysis was used, much like we do for internal events, initiating events. We weighted the more recent experience more heavily. And that ended up resulting in about a factor of 4 reduction in the CDF in this case.

CHAIRMAN STETKAR: Doug, did --

MR. TRUE: That's a pretty large reduction, I would say, across the bins. That was one of the largest.

CHAIRMAN STETKAR: It's a surprisingly large reduction. Did that analysis you performed do a hierarchial Bayes analysis where you counter the plant-to-plant variability in the events that you are looking at?

MR. TRUE: I don't remember exactly for this bin. I know we did in certain bins where we felt that it was appropriate.

CHAIRMAN STETKAR: I know the NUREG/CR-6850 did that.

MR. TRUE: Yes.

CHAIRMAN STETKAR: So the uncertainty -- the mean frequencies account for the uncertainty with plant-to-plant variability. So for example, if you had one plant that had six diesel fires in it, for example, it might be an outlier, but it is counted as an individual, rather than put into just an industry average.

MR. TRUE: Right. We followed a similar process of 6850, but we ended up dividing the data into two bins and had the older data and the newer data and did a Bayes update with the newer data. So we kept all the older data to inform the prior, but used the new data as the --

CHAIRMAN STETKAR: Did you just use the new data as evidence, but not on a plant-specific basis?

MR. TRUE: Yes.

CHAIRMAN STETKAR: Upon a plant-specific basis or?

MR. TRUE: No, not on a plant-specific basis.

CHAIRMAN STETKAR: Okay. The only point here, people are looking at me saying well, I'm getting pretty esoteric, you're making a point that the frequency was reduced by a factor of 4. If you don't treat the uncertainty correctly, that could be a fairly high fraction of that reduction.

MR. TRUE: Pretty certain.

CHAIRMAN STETKAR: Okay.

MR. TRUE: That's correct.

CHAIRMAN STETKAR: I wanted to make sure that you did it.

MR. TRUE: We could have a whole day presentation on that single effort report, if you would like, but that's one step forward we made in the FAQ process.

Ken talked about interim solutions and ineffective and we made some progress and we got the frequency down, but there are still some more things we would like to talk about about this bin. Okay?

So we take that plant-wide frequency of

5E-3 now in our study and we apply it to the plant. Well, the plant with two diesels and has a frequency of 2.5 x 10^{-3} for each of their diesels. A plant with four diesels has a frequency of 1.3 x 10^{-3} per diesel per year. So each diesel room gets allocated its fraction of that total plant-wide frequency.

The next thing we look at is well, how do we characterize those fires, in terms of what kind of threat they make to the plant?

And the authors of 6850 went through and looked at the events and said --

MEMBER ABDEL-KHALIK: I'm trying to understand this. The seven recent events --

MR. TRUE: Yes.

MEMBER ABDEL-KHALIK: -- did these involve more than one diesel?

MR. TRUE: No. All individual diesels.

MEMBER ABDEL-KHALIK: All individual diesels. And so the 5 x 10^{-3} is a frequency allocated to fire in an individual diesel or in individual plants?

MR. TRUE: Plants.

CHAIRMAN STETKAR: Explain that for the Committee Members.

MR. TRUE: Well, all of the frequencies in the NUREG/CR-6850 were developed on a plant-wide basis. It was the number of events divided by the number of reactor years, basically, that was used in the calculation. And then for each of the bins, you go through a process and there is an explanation of how to do it for each bin type.

You allocate that frequency through the number of components you have of that type in the plant. And, in fact, this is one of the areas where EPRI has a research task to go forward and say well, really, we ought to do this on a component basis rather than on a plant-wide frequency basis.

CHAIRMAN STETKAR: Okay.

MR. TRUE: And I have some more information in the later presentation. It shows you that variability. And it can be pretty dramatic. A factor of 8 may be from the top to the bottom in certain bins. So in some cases, we are overstating the, potentially, frequency and, in some cases, we are potentially understating the frequency.

But this is the way the process is used. And we think that's an important thing to address in this new Fire Events Database Project that is going on jointly with the NRC and EPRI is going to help tackle that particular problem.

So those events that allocated frequency for that particular diesel then is partitioned into two types of fires, electrical fires were found to be about 16 percent of the fires and oil fires were 84 percent of them. So that was based on a review of the events in the Fire Events Database.

Electrical fires are characterized by the electrical components identified in the inventory for that diesel generator. Oil fires are assigned to distribution of fires. The first bin is 2 percent of the fires are assumed to involve 100 percent of the oil inventory. 98 percent of the fires are assumed to involve 10 percent of the oil inventory.

And then the heat release rate that goes into the fire modeling is based on if you spill that oil, whatever your inventory is, you know, if you have a diesel day tank, they have 500 or 1,000 gallons of fuel oil in it, either spread that 500 or 1,000 gallons or spread 10 percent of it over whatever area it can spread, calculate heat release rate, figure out what is damaged by that heat release rate.

If we look back at actual operating experience that comprised about 84 percent, this is from the data in the Fire Events Database, the fires don't really look like that. We've got about half of them are coming from exhaust manifold fires, which are fires that occur inside the exhaust manifold. Sometimes flames are coming out through a damaged gasket. Sometimes it's actually internal to the exhaust.

19 percent of them came from turbocharger fires, a similar kind of thing, with an internal fire to the engine. 16 percent came from lube oil leaks. Almost all of those were very small quantities, at least in the descriptions that were provided. About 10 percent involved some sort of an explosion inside the crankcase. And about 8 percent involved some sort of a fuel oil leak, again, a very small quantity.

But those don't really align with the 98 percent/2 percent split, both of which involved large quantities of oil being spread across a large area generating a very large heat release rate.

CHAIRMAN STETKAR: Doug, is the information on this pie chart available to me if I'm doing a Fire PRA today?

MR. TRUE: I think the Fire Events Database is available to all EPRI Members, yes. It may even be publicly available, I'm not sure.

CHAIRMAN STETKAR: So that if, for example, diesel fires, diesel oil fires were driving my risk, I could, in principle, come back to this and say well, I can now refine a fraction of those fires that I would expect to be some large pool fire?

MR. TRUE: You could.

CHAIRMAN STETKAR: Which is where you are going?

MR. TRUE: The problem with the challenge that the industry is facing is there is a lot of pressure to stay within the NUREG/CR-6850 method. Don't deviate from the cookbook, because that's the cookbook that has been approved.

CHAIRMAN STETKAR: That's why I asked that question. That's what I want. I want to really understand that also from the industry's perspective.

MEMBER ABDEL-KHALIK: This pie chart is for all 60 events. Is that correct?

MR. TRUE: It's for the oil fire fraction. There is 84 percent of the 60 or whatever.

MEMBER ABDEL-KHALIK: Right. What does it look like for the recent events?

MR. TRUE: I didn't do that, but I think that it is not vastly dissimilar. There are few exhaust manifold fires, I would say. It might not be half any more, but still a significant contributor. But other than that, it's about the same kind of thing.

Certainly, none of them had anything to do with large releases of oil.

MEMBER ABDEL-KHALIK: Right.

MR. TRUE: And I don't -- I want to be careful, because I'm not trying to impugn what the author it trying to do. They were trying to provide a method that was traceable, followable, it's probably conservative, certainly burning up 10 percent of the fuel inventory is a conservative approach to it. It is fine. It was a good way to start doing Fire PRAs.

We've got to get beyond that and get ourselves to a level of refinement where we've got something that matches what we actually see.

CHAIRMAN STETKAR: Well, we are running long, but we have time, I think.

MR. TRUE: Yes.

CHAIRMAN STETKAR: What I'm trying to get to is something that you said that there has been reluctance among people using the methodology to deviate from numbers that are specified in NUREG/CR-6850. For example, if I had this information available to me, I might be able to build a case if I felt it was cost-beneficial for me to do that in terms of effort involved versus risk/benefit to present this information as justification for why I might want to deviate from that guidance.

Because after all, it's a NUREG. It's not a rule for tables of numbers.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Okay.

MEMBER ABDEL-KHALIK: If instead of having one bin called diesel generator oil fires, I had five bins that addressed each one of the leaks, would that refinement improve the process?

MR. TRUE: In this -- that philosophy of having more bins would definitely improve the process, but make doing the PRA a little more complicated.

MEMBER ABDEL-KHALIK: Right.

MR. TRUE: Of course. So it's just a tradeoff here. I think that certainly if you had a different damage vector you were going to apply to exhaust manifold fires, fuel oil leak fires, then that would definitely change the result.

Right now, basically, if you take even the 10 percent fire and put it in a diesel room, you are going to burn the room up. I mean, you don't even have to do a calculation. You are going to burn the room up.

CHAIRMAN STETKAR: Right.

MR. TRUE: So that's --

CHAIRMAN STETKAR: I think the only downside of, you know, creating yet even more well-defined bins is we did that 30 years ago in collecting things like valve data. We had valves defined to such a fine level of detail that it was difficult to populate the bins, most of the bins, with any failures at all.

MR. TRUE: Right.

CHAIRMAN STETKAR: And in practice, when you look at failure events, now, people are much better at reporting information, there is much better communications these days, but you still eventually get to the pump broke, fix pump sort of issue that there still needs to be judgment. So just having more bins to throw things into, in some cases, makes the data analysis job more difficult.

MR. TRUE: Exponentially more difficult.

CHAIRMAN STETKAR: And inserts more uncertainty in the thing that you are actually deluding yourself you know more about.

MR. TRUE: Right, yes.

CHAIRMAN STETKAR: So there is that fine line.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Anyway, I'll let you get going.

MR. TRUE: So that's the -- we kind of captured this, I think. So our heat release rate doesn't really align with this experience.

So to just kind of summarize here, FAQ-048 results in a significant decrease in the emission frequencies. We have got this issue of allocation process, so a plant with more diesels has more -- has a lower per room frequency.

The heat release rate doesn't seem to match the actual fires, most of them were localized. Again, the data isn't particularly complete on this, but most of them didn't involve any kind of actuation of automatic suppression. Most of them didn't even demand a plant shutdown.

And yet, we have put them into the PRA as burning up the room, we have to shutdown the plant. We have got an initiating event and we are now contributing to risk and --

MR. CHAPMAN: And even at 5E-3 per year, you would expect to see an event of this severity every couple years.

MR. TRUE: Right.

MR. CHAPMAN: And, obviously, we are not.

MR. TRUE: And that's another thing to calibrate whether the 5-3 crosses 100 plants, because it's a plant-wide frequency is about a probability of .5 per year we would have a fire like that.

CHAIRMAN STETKAR: A diesel fire?

MR. TRUE: A diesel fire.

CHAIRMAN STETKAR: A major fire.

MR. TRUE: A diesel fire that's characterized as --

CHAIRMAN STETKAR: Well, a diesel fire that was severe enough for you to include it in the database. So I'm not -- apparently, we are seeing those because that's the frequency.

MR. TRUE: Right. But not with 10 percent of the oil spill burning up the room.

CHAIRMAN STETKAR: That's different. That's different.

MR. TRUE: Right. No, right.

CHAIRMAN STETKAR: Okay.

MR. TRUE: It's a disconnect between the ignition frequency and --

CHAIRMAN STETKAR: Not a --

MR. TRUE: -- the severity.

CHAIRMAN STETKAR: Right. But we are not saying that we would expect to see that severe oil fire every other year.

MR. TRUE: Yes, pretty much.

MR. CHAPMAN: That's how it has been modeled.

MR. TRUE: Pretty much.

CHAIRMAN STETKAR: That's the way it is being modeled? Well --

MR. CHAPMAN: For the most part.

MR. TRUE: Yes. How do I go back?

MR. CHAPMAN: For the most part.

CHAIRMAN STETKAR: Okay.

MR. TRUE: So what we do is we take that 5-3 and we multiply it times .85 and then we multiply it times .98.

CHAIRMAN STETKAR: Okay.

MR. TRUE: So it's not quite 5-3, but it's close.

CHAIRMAN STETKAR: Okay. I see it, yes.

MEMBER ABDEL-KHALIK: And so how is that original assumption made?

MR. TRUE: I don't know. I was not an author of the document.

CHAIRMAN STETKAR: The assumption --

MEMBER ABDEL-KHALIK: The 2 percent.

CHAIRMAN STETKAR: -- on the bottom is the one we're challenging, right?

MEMBER ABDEL-KHALIK: Right, right.

CHAIRMAN STETKAR: That's the --

MEMBER ABDEL-KHALIK: Yes. How was that?

MR. HYSLOP: I believe that -- my name is JS Hyslop. I have done the research and I was the PM of 6850. The assumption held across the board for pumps, all oil fires, it wasn't just for diesel, we find for certain cases, like main feedwater pump fires, that it is much too large and we have addressed the fact.

There was an expert solicitation among the authors of 6850 with 2 percent and 10 percent. The question I want to ask you, Doug, when you were talking about the frequency of diesels, was that including the failure suppression and those things? Because when you look at diesel fires as big as you are talking about, there is more than just the frequency involved.

There is the failure to fire protection systems to act and all that. So that's the frequency that you compare.

MR. TRUE: So maybe I better wait. You are -- well-put, JS. I apologize.

MR. HYSLOP: Okay.

MR. TRUE: Actually, the frequency that we should be seeing is about every other year, we should be seeing a fire big enough to actuate automatic suppression in a diesel generator. Most plants have automatic suppression in their diesel room, so you would expect that to be the state that you would see at that frequency. So that was a good point, JS.

Okay. So we think we have demonstrated there is a disconnect here with the operator experience.

Okay. So much spurious ops, one of the big issues that we are facing in the industry right now is addressing this issue of spurious operations. And it's an essential part of the transition to adopting 5048(c). Our operating experience has shown that we haven't had a spurious op since Browns Ferry back in 1975.

So we went back and pulled out an intermediate state for some PRAs to see what does the Fire PRA predict would be the frequency of a spurious operation? We take the assumptions in 6850 and we apply them. What would we calculate as our frequency plant-line frequency as spurious ops?

And so we looked at a couple of PRAs. This is not a small task, so I only picked a couple of plants to do this on. We happened to have their data in a relatively convenient form. So we focused on CDF, but there are a lot of intermediate states and spurious operations are included in the fire scenarios.

So what we did was we went through a PRA and we looked for scenarios that had one or more spurious operations involved. Many fires that have one spurious op, have more than one spurious op in the way they are modeled in the Fire PRA.

But in two of the plants that we -- in these two plants we looked at, the frequency came out around 4×10^{-3} per year plant-wide is the frequency of fire at those plants that would lead to one or more spurious operations.

We also did, Jim and I did, kind of the back-of-the-envelope check against another study done by his guys and we concluded that it was about in the same range. It might be a little higher, it might be a little lower, but it's in about the same kind of a range.

So if you take that 40-3 and spread it across the industry, we would expect to see a fire involving a spurious op every two or three years. Yet, as I said, we haven't seen one since 1975. So we think this is another demonstration of the disconnect between what we are putting into the PRA, what we are calculating, versus what we are seeing in operating experience.

CHAIRMAN STETKAR: Can I ask you something kind of JS was asking you is that frequency of .0041 after failure of the spurious suppression system to extinguish the fire before you achieve target damage?

MR. TRUE: Yes, it is. The problem is, and we will talk about this some more, that unless you have automatic suppression, which is actually not that common in plants, as you know, we are not getting a whole lot of credit for --

CHAIRMAN STETKAR: Suppression.

MR. TRUE: -- main suppression, because the fire growth rate is so fast.

CHAIRMAN STETKAR: But you are saying that that is close to a multiplier on the fire frequency by the Commission.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Okay. So we think we are overstating the frequency.

So fire risk. Now, obviously, it is really difficult to compare a CDF calculation operating experience and then draw any conclusions, because we haven't had any fire core damage events to look at, fortunately.

But we can look within the PRA kind of like we did on the spurious ops side. We can look at the high CCDP scenarios. And we have a lot of industry programs. NRC looks at high CCDP conditions through the Accident Sequence Precursor Program and through the Reactor Oversight Process all the time.

So we can go into the PRA, see what the representative frequencies of fires are for each plant for those scenarios that have high CCDPs. And then we can compare that frequency of high CCDP conditions to industry experience and see how we come out.

In the ASP Program, they maintain a list of the significant precursor events. Those are events where the conditional core damage probability is greater than or equal to the 10^{-3}. And every year they put out a trend on high CCDP events, which were those with values greater than 10^{-4}.

The significant precursors are relatively rare. There hasn't actually been one in the U.S. operating experience in the last eight years. Davis-Besse was the last significant precursor. And of the 34 for the whole operating experience of the industry, only one of those involved a fire and that was the Browns Ferry fire.

CHAIRMAN STETKAR: Is that because -- I can ask the staff, but is that because they don't have fire models, so they don't run fires through their fire models to see whether there are significant precursors?

MR. TRUE: I'll let you ask the staff that question.

CHAIRMAN STETKAR: Okay.

MR. TRUE: But I what I will say is that you don't need a fire model to do a CCDP. You have a fire.

CHAIRMAN STETKAR: Right.

MR. TRUE: It causes damage.

CHAIRMAN STETKAR: Right.

MR. TRUE: You can go to your spar model, plug that damage in and calculate a CCDP. So the lack of fire models is --

CHAIRMAN STETKAR: Well, except for things like --

MR. TRUE: -- not --

CHAIRMAN STETKAR: -- spurious operations, which --

MR. TRUE: Well, that's on the other side.

This is only looking at CCDPs, which is why --

CHAIRMAN STETKAR: But the CCDP I have to understand whether I have a spurious operation, don't I?

MR. TRUE: Well, but the event would have either had one --

CHAIRMAN STETKAR: Oh, I see, I see. I see what you are saying, yes.

MR. TRUE: The event was the event.

CHAIRMAN STETKAR: Yes, yes, you're right.

MR. TRUE: So it either had a spurious op or not.

CHAIRMAN STETKAR: Right.

MR. TRUE: You had damage or not.

CHAIRMAN STETKAR: Yes. Yes.

MR. TRUE: You had suppression or not. It was what it was. Okay?

MR. CHAPMAN: You're going to like this next slide. It's small numbers.

MR. TRUE: You want to do it?

MR. CHAPMAN: No, no, no.

MR. TRUE: Okay.

MR. CHAPMAN: You're doing great.

MR. TRUE: I broke it into three pieces, because I want to give you the data first. So the left column is some set of plants. The middle column is from those Fire PRAs for those plants, what's the predicted frequency of conditional core damage probability, events involving conditional core damage probabilities greater than 10^{-3}?

And you will see it's actually pretty tightly grouped in the 10^{-3}s with the plant being maybe a little big higher, but sort of the low 10^{-3}s.

On the right column, we have the high CCDP events, which are the ones that attract annually and by the ASP Program. CCDPs greater than 10^{-4} and those again are pretty tightly packed also in the low 10^{-2}s.

CHAIRMAN STETKAR: And this is the result of three of four different teams, correct?

MR. TRUE: Yes.

CHAIRMAN STETKAR: At least three?

MR. TRUE: Three different teams.

CHAIRMAN STETKAR: Your team, my team and another team?

MR. TRUE: And another one, yes. So this is not one analyst's perspective.

CHAIRMAN STETKAR: Okay.

MR. TRUE: It's multiple PRAs across --

CHAIRMAN STETKAR: Different types of plants.

MR. TRUE: -- different types of plants.

CHAIRMAN STETKAR: Yes.

MR. TRUE: Different analysts and approaches.

CHAIRMAN STETKAR: Right.

MR. TRUE: Okay. So if we take that frequency and again try and turn it around, what should we be seeing from an operating experience perspective? We should be seeing a high CCDP fire or significant precursor event about once every one to 10 years in that range, every few years. And the high CCDP events, we should be seeing one, two or three each year. We should be seeing lots of them.

In reality, we haven't had a 10^{-3} since Browns Ferry. And the latest ASP report shows data from 2001 to 2009 and there are none in that period. I'm pretty sure there are none before, but there is not a ready resource I can go to to look at that. The ASP Program folks would have to tell -- say whether there were any that had that high CCDP in the previous time.

But even still, even in the nine years, we should have seen, you know, 10 to 30 of them probably in the industry and we haven't seen any.

MR. CHAPMAN: And a couple of points.

Each of these plants has on average 1,000 ply damage states, so it's not for a lack of effort.

And the second point is with the exception of one plant, these results reflect design or procedure changes or commitments that are resulted in reduction in the calculated risk factor of 3 to 5 or in one case much higher.

So if you reflect back prior to those conditional decision --

MR. TRUE: Right.

MR. CHAPMAN: And again, as best we can tell, the evidence is clear and it is driven by the, in my opinion, excessive frequency of damage to risk significant equipment that we are not observing. And that's the intent of this chart. Okay.

MR. TRUE: Okay. To be clear about what Jim said about the status of these, some, most of these PRAs they have already finished their analysis. They have committed to mods as part of their transition to 805. And the models reflect those improvements they have already made.

So the pre-mod value would be --

CHAIRMAN STETKAR: In effect, what you are saying is --

MR. TRUE: Which is real comforting, yes.

CHAIRMAN STETKAR: -- it follows the state of the practice of doing a PRA according to the guidance and data that are available. This is what -- with whatever plant-specific improvements each of these individual plants decided to make, for whatever reason --

MR. TRUE: Form whatever reason.

CHAIRMAN STETKAR: For whatever reasons. Each of these plants would expect to see this type of result.

MR. TRUE: And that would even -- and since that is a --

CHAIRMAN STETKAR: These are results from the PRA.

MR. TRUE: Yes, yes.

CHAIRMAN STETKAR: Yes.

MR. TRUE: No. This is --

CHAIRMAN STETKAR: I mean, you know, if they were projecting forward.

MR. CHAPMAN: Yes.

COUNCIL MEMBER THOMAS: Right, projecting. That's an important point. It is projecting forward, whereas --

CHAIRMAN STETKAR: Right. Projecting. No, let's look at this closely.

MR. TRUE: -- past experience, which is what I'm focusing and comparing to would have been expected to be higher than that.

CHAIRMAN STETKAR: Right. The absolute -- well, I understand why you want it conditionable, so that's -- go on. This is good.

MR. CHAPMAN: Well, this is the way to gain insight.

CHAIRMAN STETKAR: Yes.

MR. TRUE: Okay. So this is the SECY that talks about the 2001 to 2009 experience. For eight events, none of them had fire, involved fires. Whereas, the PRAs would have predicted something like 9 to 30 or however you want to count industry-wide for the same period. So we think we have learned. We think there is a significant disconnect there.

All right. ROP is another place where CCDPs are looked at. And you are well-familiar with any CCDP or CDP we are going to value around 10^{-6} is considered or below 10^{-6} is green. 10^{-6}, 10^{-5} is why we own up to yellow and red.

Today there have been no actual fire events. I'm talking about fires in plants that had either a yellow or red finding, so that drops us down to 10^{-5}. I haven't been able to check -- I haven't checked this, because it's a lot of data to go through, but I don't believe there are actually any whites that are fires.

But I know it is true that none were yellow or red. Whereas, our models would have predicted that many of those would be happening each year. So again, we think we have got this disconnect in both the spurious ops and in the CCDP calculations. And that rose -- both directly contribute to our fire spars that we have being higher than we think they should be.

Okay. Masking of risk insights. I don't have to tell you guys this, but the PRA policy statement, obviously, pushes us towards a more realistic approach to doing PRAs. And one of the reasons that that is important is that if you aren't realistic, you can mask important insights. And as Ken talked about in his large LOCA example, as an unimportant contributor, you can tolerate conservatisms. But when it is a very large contributor, you have to really focus on whether those conservatisms are skewing your insights and results.

And this kind of goes to the conversation we had about internal events and the refinements we have been through over the years to attack those more obvious conservatisms in the dominant contributor internal events.

But there is another interesting aspect to this that may not be obvious to everyone and that is that there is a difference in vocation for a likelihood conservatism, that is when you have overstated a probability of something happening or frequency of something happening versus when you overstate damage.

Likelihood conservatisms, we will say that I decide that my initiating event frequency, whether it is a fire or anything else, I have overstated it by a factor of 10, when I do a delta risk calculation on that compared to 1174, I will be biasing that delta high, because my input is a factor of 10 higher and my delta is going to be a factor of 10 higher.

So maybe that you can tolerate that in a risk-informed decision-making approach. But when you have conservatisms in damage vectors or damage predictions, you have the opposite problem. You have introduced new dependencies into the process, this fire causes this damage, so that you may actually understate any delta risk. I'm going to show you a little example of how that plays out.

I have a cabinet here and I have got a

couple of cable trays nearby to that. I have some fire that has some heat release rate of X and I calculate some zone of influence for that fire. And that zone of influence catches both of those trays.

If I want to calculate the CDF from that particular scenario, I have a frequency of that scenario that would include the ignition frequency, nonsuppression and all those things and then a CCDP. My CCDP would be calculated with both System 1 and System 2 fails, because both of the cable trays are affected by that zone of influence.

Okay. Now, let's say I have a smaller fire, my heat release rate I'm predicting is lower and I have a smaller zone of influence and now I'm only going to be damaging System 1. When I look at the CDF for that scenario, I have the same frequency, a different CCDP now, because I only have System 1 fail, so my CCDP is going to be smaller, because I have more capability remaining available.

So my CCDP for Scenario A where I have the most damage is going to be much greater probably in order of magnitude or more greater than the CCDP where I only have the one system failed. And my CDF, of course, would be expected to be larger. I have more damage to my important system. I would have a larger

CDF. Okay. So that's my baseline risk.

I could be comfortable with this. If I want a conservative result in my baseline risk, I can -- ZOI A gives me a conservative baseline risk result.

If I then look at a second scenario where I'm interested in looking at a delta risk, I have a system out of service, it looks like my animation is messed up here, where I have System 2 out of service, my CDF in that case is the same as it was before, because it doesn't matter whether System 2 is in or out of service, because if it's damaged by the fire, it doesn't matter.

For ZOI B, the smaller zone of influence though, now, I have a different scenario where my CCDP is a lot higher, because by taking System 2 out of service, I have, essentially, disabled it and that gives me a larger CCDP. And I end up with, in that case, System 2 out of service, a CCDP being the same.

And so my CDFs end up being the same. There was my -- sorry about that. But the problem is is that if I'm looking for a change in risk, if I'm doing a tech spec submittal or I'm doing an evaluation of NOAD or something, my -- if I have a more conservative zone of influence, I'm not measuring the change in risk associated with that equipment out of service.

I'm going to say there is no change in risk. And really, if a more realistic ZOI was applied, there might be a fairly potentially significant change in risk from having that piece of equipment out of service.

MR. CHAPMAN: And independent of the methods, you know for sure that the conditional probability of it being bigger than smaller is a small conditional probability.

MR. TRUE: Right.

MR. CHAPMAN: The problem is the modeling of the stuff, which is why Douglas picked two alternatives. A where I get both systems, B where I only get System 1, but it's real. That's one of the challenges.

CHAIRMAN STETKAR: Well, I see what you are doing. I'm not sure I agree with the thing you are calling S(i), because I think those are actually different frequencies in the real world.

MR. TRUE: They can be.

CHAIRMAN STETKAR: No, they will be.

MR. TRUE: No. Well, I'm sorry.

CHAIRMAN STETKAR: They will be because you are talking about a frequency of a particular fire severity there to get -- the CCDP is simply what is damaged and what happens in the rest of the plant with whatever succeeds and fails. So that's irrelevant of the fire frequency or the fire -- the frequency of a particular damage footprint.

MR. TRUE: Okay. So we take our --

CHAIRMAN STETKAR: So they can't have the same frequency.

MR. TRUE: Let's take our diesel generator case. We had a --

CHAIRMAN STETKAR: We're going to have to stop for a break here pretty soon.

MR. TRUE: Okay. Well, I think I have one set left.

CHAIRMAN STETKAR: Yes.

MR. TRUE: But let's take the diesel generator case. So I have a ZOI that is based on an oil leak that burns up everything in the room and probably if I have offset power going through that room, it knocks that out too.

CHAIRMAN STETKAR: Yes.

MR. TRUE: Okay? That's an assumed ZOI. In reality, the ZOI should be applied, it appears from the operating experience, to be much smaller than that, right? So I get a conservative estimate in my baseline risk by using the current assumptions on diesel impacts, but I completely obscure any decision-making about the significance of those fires.

CHAIRMAN STETKAR: I understand. I want to talk about --

MR. TRUE: That's one of the frequencies --

CHAIRMAN STETKAR: -- that later.

MR. TRUE: The frequency, the way it is applied right now in 6850, is the same for the risk.

CHAIRMAN STETKAR: Because the stylized way is the zone of influence.

MR. TRUE: Because the stylized way is -- yes.

CHAIRMAN STETKAR: Okay. That's -- I want to get back to that later, but after --

MR. TRUE: Okay.

CHAIRMAN STETKAR: -- you know, this.

MR. TRUE: All right. Last one. So I think I have made -- hopefully I have made these points already. We think that the simplifications are driving the results. It's a compounding of conservatisms. There is not a simple fix for that. We don't think we are comporting with operating experience. And we are worried about making good decisions and it's a complicated problem, both for 805 and beyond in trying to use these PRAs out further.

CHAIRMAN STETKAR: Thanks for your time.

MR. TRUE: Thank you.

CHAIRMAN STETKAR: Any questions, Subcommittee Members? Okay. With that, we're going to recess. We will come back at, I'll be generous, 10:40, that will be 17 minutes.

MR. TRUE: Thanks.

(Whereupon, at 10:23 a.m. a recess until 10:41 a.m.)

CHAIRMAN STETKAR: Okay. We're back in session. And I guess we will hear more from, I don't know, Doug and Rick, I guess.

MR. TRUE: Yes. Do you want to introduce yourself?

MR. WACHOWIAK: Yes. I'm Rick Wachowiak from EPRI. And mainly I'm up here to ease the next transition into the next presentation, but also to answer any questions associated with what we are doing to try to solve some of these problems.

MR. TRUE: Okay. And I'm Doug True from ERIN. And we are going to talk about what we have come to call the Roadmap for Attaining Realism in Fire PRAs. It's an activity that EPRI started really back in late 2009 when the first Action Matrix was put together.

And I have been asked to pull that together into a report with the help of NEI, Fire Bureau Task Force to identify the important areas where the assumptions and simplifications are unduly influenced in the results.

And the key objectives of this report, which is the report that Biff mentioned to you that you will get in a couple of weeks here, is to look at or identify the key areas, illuminate what the causes are, identify and organize a set of reasonable near term research activities and then inform and update the EPRI Fire PRA Action Matrix itself.

So we have a connection to what the PRA were telling us and what we need to be doing in these research areas.

The way we went about this is that we set up kind of a framework of categories of types of issues. The Fire PRA is a -- the fire analysis is really a continuum. There is some adverse condition that exists that leads to a fire event, some incipient period, eventually smoke, then flame and then the fire grows into some growth phase or, as we call it, the T-squared burning phase, hits some peak and then drops off.

As we go through that, we have a number of constituents that feed into those pieces. And we have just used this as a framework to kind of identify categories of activities that we have put into the Fire PRA Action Matrix.

So I'm going to start with this first category, which is all of the things related to the Fire Events Database, estimation of ignition frequencies, severity characterization and nonsuppression probabilities.

And in the Action Matrix in the report, we have identified four major areas. I'm going to talk to your -- because we have limited time and I think we are going to have a hard enough time getting through just the first blue bullets there. But the report goes into some detail on all four of these.

The first really important activity relates to the characterization of the data, the Fire Events Database and the calculation of fire ignition frequencies. We made some progress in FAQ-048, but we are moving forward with that to get us both more data, more recent data, better data and a better technical basis for some of the ignition frequencies and other characterizations throughout the Fire PRA.

The next one deals with the incipient and growth phase of the fire and oil fire severity. We talked a little bit about the diesel generator oil fire and JS mentioned that the same oil fire model is used elsewhere, that's another area where we think some additional refinement would be helpful.

CHAIRMAN STETKAR: Okay. Let me ask you, I'm going to keep pressing you guys to get specific about something eventually. Oil fire severity, I haven't see a Fire PRA in years where oil fires were at all important. So you apparently have. Are they?

MR. TRUE: Yes, can be.

CHAIRMAN STETKAR: No. I understand they can be.

MR. TRUE: No, I mean --

CHAIRMAN STETKAR: In practice --

MR. TRUE: -- I wouldn't say in every single plant they are, but there are certain plants --

CHAIRMAN STETKAR: Well, your little histogram there tells me that maybe in one of the seven plants they might have been, because only one of the seven showed diesels as being important.

So I'm curious about, you know, highlighting oil fire severity as a significant issue that we need to address as an area of conservatism versus other things.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Now, I want to get away from this one-size-fits-all that we have to make everything perfect. I want to understand what it is that we need to address that is, indeed, really driving the conservatism --

MR. TRUE: Within oil fires --

CHAIRMAN STETKAR: -- across the board.

MR. TRUE: -- there are actually three parts. I'll get to this actually.

CHAIRMAN STETKAR: Yes.

MR. TRUE: But there are actually three parts. There is diesel pumps and transformers.

CHAIRMAN STETKAR: I understand.

MR. TRUE: And you saw that transformers were also important in a number of things.

CHAIRMAN STETKAR: Yard transformers, you're going to have a difficult time convincing me that they don't blow up.

MR. TRUE: And in-plant transformers, right, right.

CHAIRMAN STETKAR: Okay.

MR. TRUE: It's not a one-size-fits-all solution either.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Right? So anyway, incipient detection fire suppression is another aspect we're going to cover. We covered before, we're not going to talk about today.

CHAIRMAN STETKAR: There is a FAQ out by the way on incipient, how to handle incipient detection.

MR. TRUE: There was a FAQ.

CHAIRMAN STETKAR: Are you going to talk about that later?

MR. TRUE: In fact, there was a FAQ-048 on ignition frequencies also. We'll be addressing that. There was a FAQ on incipient detection and there was a FAQ on fire suppression.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Also as Ken mentioned, most of those FAQs got some interim solution for them, where we made some refinement, but the slow process that was coming vast resources, we didn't get as far as we would like to have. And it is still important.

The incipient one, I'll just stress, because I don't talk about it later, the answer in the FAQ is if you do exactly what Harris did, then you can do this. Well, that may not be exactly what every plant is going to be able to do. There is a lot of plant-to-plant variability that there is really no guidance on how to implement incipient detection and credit it in your PRA.

CHAIRMAN STETKAR: Sorry, I thought the methodology in the FAQ is different from what Harris did. The staff accepted what Harris did was okay. Nod your head.

MR. TRUE: I don't --

CHAIRMAN STETKAR: Harris did their analysis before the methodology --

MR. TRUE: Yes, that's true.

CHAIRMAN STETKAR: -- and model and the FAQ came out.

MR. TRUE: Yes, right.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Yes. But the -- so, yes. The licensee --

CHAIRMAN STETKAR: It had to do with the way Harris did it or you could kind of do it --

MR. TRUE: Right, right.

CHAIRMAN STETKAR: -- the way the FAQ does.

MR. TRUE: Right. But the FAQ leaves a lot of the branch probabilities open in the model. So the structure was basically the same. You can follow Harris and do exactly that, I misspoke, or you have to go off and develop your own bases for all these branch points in the event tree and the FAQ.

And what we believe needs to be done is that needs to be further developed, so that we can make that usable as a mitigation capability for other plants and repeatable. Harry?

MR. BARRETT: Yes, my name is Harry Barrett, NRC staff. I was heavily involved with Harris SE development. What we allowed Harris to do was use the methodology they had, but we wanted them to update it to the FAQ methodology, because they used a much more simplified approach.

The difference between what Harris has done or what the FAQ is doing and what you are talking about is area-wide detection has not been -- there has been no methodology that has been put forth to the staff that we an end up reviewing for area-wide use of incipient detection.

We have done it for cabinets with limited caveats. There are some caveats that we provided in there. If you end up meeting those caveats, then you are going to end up using incipient detection for electrical cabinets. But area-wide, there is a lot of issues there that we need to work through that have not been either proposed or reviewed. So there is more work to do for the area-wide use of it.

MR. TRUE: Sure. Okay.

CHAIRMAN STETKAR: Thanks, Harry.

MR. TRUE: Okay. So fire event data characterization and this Fire Events Database activity, I'll go through this pretty quickly. But the events in the current Fire Events Database we talked about the half events and full events. And so it's sort of a little bit of a mixed bag and the authors, I think, had a really tough job of trying to link what happened in the plants to what we tried to model.

So we are trying to go back and get that database squared away, so that those links can be better, so we can do a better job on suppression, a better job on characterization of the severity, a better job on ignition frequencies and extend the data up past 2000 where the last database stopped. Get a more robust event descriptions and a more traceable scheme for how those were all categorized and the bases-wide. You know, get rid of the .5 kind of things where there is not an adequate description.

And then we also know long-term if we are moving into an era of risk-informed performance-based fire protection. We are going to need to have a long-term basis for maintaining that data and analyzing it. Those are all parts of the program that is ongoing right now.

On fire ignition frequencies, this allocation technique has some limitations. We talked about it doesn't really comport with all of the ways that we do current data analysis and it doesn't totally handle the plant-to-plant variability issues.

And another area which we are concerned about a little bit is the transient ignition frequencies don't have a good way of addressing administrative control. So, in effect, if you have an area that is a transient-free zone, it could be treated the same way as an area that is not a transient-free zone, which means the administrative controls we put in place to control transients don't really -- aren't really reflected in the PRA calculation. It doesn't seem to follow.

CHAIRMAN STETKAR: Now, that's -- let me see if I can understand this. On the last bullet, you are not arguing about the plant level frequency of transient fires. It sounds like it is the --

MR. TRUE: Allocation.

CHAIRMAN STETKAR: -- allocation of those transients among specific compartments for my plant.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Because of the way I do business at my plant. Okay.

MR. TRUE: This --

MR. HYSLOP: Doug, excuse me.

MR. TRUE: Yes?

MR. HYSLOP: There is a range allowed, the GSI Level where adjusted transients are low, medium and high. It's true that, you know, you will assume some sort of transient below. In any case, you don't say that there are no transients in this particular area, because there are violations of that.

MR. TRUE: Right.

MR. HYSLOP: So we do include that. But there is an adjustment mechanism.

MR. TRUE: There is. It's pretty crude. Based on insights from some of the PRAs, it needs to be readjusted.

CHAIRMAN STETKAR: Okay. Are transient fires -- there's feedback here. Are transient fires typically contributing significantly?

MR. TRUE: It really is plant-specific.

CHAIRMAN STETKAR: It is plant-specific.

MR. TRUE: There is one plant that has got a pretty significant fraction coming from that.

CHAIRMAN STETKAR: Okay.

MR. TRUE: That I know of.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Maybe others, but --

CHAIRMAN STETKAR: But it's not the same? You know, I'll go back to that histogram that showed--

MR. TRUE: Right.

CHAIRMAN STETKAR: -- cabinet fires.

MR. TRUE: We're going to get to the electrical.

CHAIRMAN STETKAR: No. I know you will, but I'm trying to understand, you know, across the span of things where the different contributors are. You mentioned oil fires and --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- I challenge you on that. So I was trying to understand where the transient fires are across the board.

MR. TRUE: It's not across the board.

CHAIRMAN STETKAR: Okay.

MR. TRUE: And as I said in that chart, the problem is certainly electrical cabinets we can pull out right away.

CHAIRMAN STETKAR: Yes. Okay.

MR. TRUE: Beyond that, then you get into stuff. And as we said in the results presentation, it's not like we are just a little bit off in predicting these things. We are -- we think we are way off --

CHAIRMAN STETKAR: Okay.

MR. TRUE: -- in predicting them. And so if you drop that one bar down, you are still going to run into other things that are going to keep you from getting to where we are lining up with our operating experience. But that's our belief.

CHAIRMAN STETKAR: Well, eventually, I mean, you are going to talk about operating experience. But I'll tell you, a 10^{-5} frequency per year, we have to operate the industry in the United States for 1,000 years and expect to see one core damage event per year. So operating experience on absolute core damage frequency isn't going to win a lot of things.

MR. TRUE: But that's why --

CHAIRMAN STETKAR: Conditional core damage probability or frequency of severe damage in fires.

MR. TRUE: Right, right. But that's why

we went -- that's why we approached it the way we did and we think that's showing that we are off by a significant amount in those intermediate states, based on operating experience.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Obviously, not CDF.

CHAIRMAN STETKAR: Okay.

MR. TRUE: The next few slides I don't want to spend too much time on them. I just went through a batch of PRAs that we had in the database.

MEMBER ABDEL-KHALIK: I'm trying to sort of cycle through what you just said. I mean, if -- you know, the whole argument is that whatever you calculate doesn't match the operating experience, if you're going to go ahead and tweak this process so that ultimately you would match the operating experience, what is the value of this exercise? What additional insights would you gain then?

MR. TRUE: I don't think it's our intent to tweak it to get it to match the operating experience. I think that we are saying that we are no where near operating experience right now. And that means that we are skewing our perspective on what the results are.

As we bring that closer on an average

level to the industry operating experience, you will still get plant-specific insights, because you still have a room with a cabinet that is near an important set of cables or a pump that is near some important target that will come out of that study for the plant-specific results.

So we will always get plant-specific insights in these studies. But the base risk values we are coming out with, we don't think reflect anything like what we are seeing in operating experience.

MEMBER ABDEL-KHALIK: Okay. Just keep going. I'll just continue to process what you just said, because I think this is sort of a circular argument that -- well, how good a match would you need to be able to derive that benefit?

MR. TRUE: Derive that benefit?

MEMBER ABDEL-KHALIK: The benefit of gaining insights on an individual plant basis.

MR. TRUE: I think that I'm not saying that you can't get insights even from the current method. You can get insights. The problem is -- well, two problems. One is knowing that the insight that says this is more important than that may not be correct.

MEMBER ABDEL-KHALIK: Right.

MR. TRUE: Because if you have characterized this as a 10 percent oil -- of all the oil burning at the same time and this one is something more realistic, you might get a completely skewed perspective. So that's one problem.

MEMBER ABDEL-KHALIK: Right.

MR. TRUE: The other is, at the end of the day, outside of 805, we want to use these Fire PRAs to make risk-informed decisions. And even within 805, we need to make risk-informed decisions about changes to the plant. And in that case, you need to make sure that that risk calculation is giving you good calculations of the impacts of your decisions, whether it is trying to make an enhancement or whether it is to a decision on whether you take something in or out of service.

You know, on my maintenance condition or a tech spec condition or a NOAD or whatever, so we need a result that we can compare to internal events. Because if we have fire masking everything else, then the rest of it --

MEMBER ABDEL-KHALIK: Well, but --

MR. TRUE: Artificially, artificially masking the results.

CHAIRMAN STETKAR: Artificially, but it might.

MR. TRUE: It might.

CHAIRMAN STETKAR: We have done a heck of a lot of things on these plants to drive down internal event risk. And just to say that we want -- it's our desire to have the absolute core damage frequency from fires to be smaller than the internal event core damage, because --

MR. TRUE: That isn't what I was saying at all.

CHAIRMAN STETKAR: -- we know that.

MR. TRUE: That's not at all what I was saying.

MR. CANAVAN: This is Ken Canavan. If I might make a comment? I guess my thought on this is that when -- we are trying to verify that the model even is within a workable set of parameters. If you can't match operating experience, you can't use 4 CCDP. You can't trust core damage, which means you can't make decisions with it.

And so at least those decisions need to be very, very high level decisions. Things like this, no credit for transient combustible control and, while let's say limited control of transients, how can you make a change to your plant if your model doesn't reflect transient combustible controls that are in place? You get no credit for it, so why do it?

You could take this even further, in my humble opinion, at say stuff like why would I protect something when the zone of influence says it has failed, because I did it conservatively, why would I protect that train? I don't get anything from protecting it. Or I think I'm getting a lot for protecting it, the opposite. I think, you know, the zone of influence fails it, so I'm going to make this big mod, spend all this money, resources and effort for something that really you didn't need to do.

And so I guess it is fidelity of the model to be able to be used is what the real question is in my mind.

CHAIRMAN STETKAR: Thanks.

MR. CANAVAN: Thank you.

CHAIRMAN STETKAR: Thank you.

MR. WACHOWIAK: And I think if we weren't more than on order of magnitude away from the operating experience, we probably wouldn't be bringing this up. If it was, you know, in the right order of magnitude, we would say, yes, we are predicting pretty well. But we're more than an order of magnitude high on these intermediate results and it's just not -- it doesn't match what we see.

MR. TRUE: Okay. So the next series of graphs just show some inventories of different bins. And shows the variation across the industry as compared to some median value. And then on the right hand side, I have showed kind of relative frequencies to the average, which essentially the averages would be the plant-wide smearing across all of those.

In this case, it's about a factor of 4. I mean, one plant has 400 or so cabinets, another one has 1,300. And this is done on a per unit basis, not a per site basis.

CHAIRMAN STETKAR: Let me see if I understand this though. Right now, essentially, people are using that word median, right? It's the frequency of cabinet fires on a plant level basis?

MR. TRUE: Yes, something like the median.

CHAIRMAN STETKAR: Some -- I don't want to argue median.

MR. TRUE: Right.

CHAIRMAN STETKAR: It's that horizontal line there somewhere.

MR. TRUE: Right.

CHAIRMAN STETKAR: Does that mean that if instead of quantifying a frequency on a per plant and allocating it by cabinets in my plant for the largest inventory of cabinets you have there on a factor of 2 perhaps conservative on a per cabinet basis --

MR. TRUE: Yes.

CHAIRMAN STETKAR: -- and for the smallest plans on the factor of about 2 optimistic?

MR. TRUE: Actually, the other way around.

CHAIRMAN STETKAR: I'm sorry, the other way around?

MR. TRUE: Yes, the other way around. If you have more cabinets, you have a lower per cabinet frequency.

CHAIRMAN STETKAR: Yes, you're right. I'm sorry.

MR. TRUE: Right.

CHAIRMAN STETKAR: I'm trying to make a point.

MR. TRUE: Right.

CHAIRMAN STETKAR: But doing it wrong. But the fact of the matter is, in terms of frequency, at least for this example, I'm talking about a factor of 2 at the most?

MR. TRUE: Yes.

CHAIRMAN STETKAR: In terms of --

MR. TRUE: Well, from high to low it's a factor of 4. But for an individual plant --

CHAIRMAN STETKAR: Yes, but for an individual, you know --

MR. TRUE: Right.

CHAIRMAN STETKAR: Given the fact I'm going to randomly sample my plant as being one of these --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- I'm probably at most a factor of 2 off, either high or low.

MR. TRUE: Right.

CHAIRMAN STETKAR: You know.

MR. TRUE: Right.

CHAIRMAN STETKAR: Okay.

MR. TRUE: And relative to the overall impact, that's probably pretty small. But it is --

CHAIRMAN STETKAR: Well, that's -- see, this is where I'm trying to get a handle on is that, you know, is it 2 to the 4^{th} or is it --

MR. TRUE: Yes.

CHAIRMAN STETKAR: -- something like that, different?

MR. TRUE: So I'm ready to go through each one of these.

CHAIRMAN STETKAR: Yes.

MR. TRUE: The same basic message. This one has a little bit broader span, because of a couple of outliers.

CHAIRMAN STETKAR: Yes.

MR. TRUE: This one is --

CHAIRMAN STETKAR: This one is not so--

MR. TRUE: -- tighter maybe. This one is kind of all over the place.

CHAIRMAN STETKAR: Yes.

MR. TRUE: And maybe a factor of 8 range on this. So but it just shows you that there is this variability we haven't accounted for that we could and we actually intend to as we go forward. The owners groups are collaborating with EPRI on this database effort. They are out collecting information from the plants and inventories. And we are going to feed that back into an improved allocation process that will be, I think, generally more component-based, rather than just smeared across the number of components.

CHAIRMAN STETKAR: Rick, are you going to talk more about that later or not?

MR. WACHOWIAK: In general, I'm going to say that we are doing it.

CHAIRMAN STETKAR: Okay.

MR. WACHOWIAK: But the specifics, no.

CHAIRMAN STETKAR: To do this, you actually need a lot of information from all of the plants --

MR. WACHOWIAK: That's correct.

CHAIRMAN STETKAR: -- and the industry, basically, component counts.

MR. WACHOWIAK: Right.

CHAIRMAN STETKAR: We have not done that at all for any internal event data period.

MR. TRUE: Right.

CHAIRMAN STETKAR: So why is it so important to do that, except for perhaps diesel generators, which everybody seems to like to count? And there are small numbers of it. People don't go out and count up the number of pumps in their plants particularly. They count up, approximate, number of pump demands, approximate total number of pump operating hours, which we then combine together into generic data.

MR. TRUE: That's not so true any more, John. I think that under our Maintenance Rule, we are pretty -- for the risk significant components, where we track pretty closely --

CHAIRMAN STETKAR: Yes. Has it been

factored back into any generic databases though?

MR. TRUE: Sure.

CHAIRMAN STETKAR: Is my point. Okay.

MR. TRUE: Yes, because EPICs, the staff should probably talk about that, but NUREG/CR-6928 actually relies on EPICs.

CHAIRMAN STETKAR: Has more of that? Okay.

MR. TRUE: And those are the monitored components under the Maintenance Rule, a fixed set of those. And they keep -- it's always reported regularly on hours of operation. They are allowed, in some cases, to estimate, but demands are also provided. And they do, I know, a really nice job, I think, on the data analysis with them.

CHAIRMAN STETKAR: Okay.

MR. TRUE: And it's also subdivided beyond just pumps. You know, it would be service water pumps, CCW pumps, safety injection, oxygen --

CHAIRMAN STETKAR: Once you start counting them.

MR. TRUE: Yes, yes.

CHAIRMAN STETKAR: It's pretty amazing.

MR. TRUE: So I think it's a pretty good-- that NUREG/CR-6928 is a really good resource for the industry.

CHAIRMAN STETKAR: Okay. Okay. Thanks.

MR. TRUE: Okay. So the database and ignition frequencies, the current FAQ requires reliance on some of the old data for several of the bins and, in fact, electrical cabinets, which is the ridge, were required to use both the new data and the old data from the EPRI work.

And so part of the agreement was that once we collected all the new data, then we would be allowed to use the improved result of that analysis. And that's -- for the retro-cabinets, it is about, I think, a 40 percent or a 60 percent reduction in that ridgeline that would occur, if you just relied upon the new EPRI data.

CHAIRMAN STETKAR: When you say new data, is it -- you said you are collecting data post-2009 and weighting that more heavily than the old data. You are not discount -- discarding the old data, are you?

MR. TRUE: No, no.

CHAIRMAN STETKAR: Okay.

MR. TRUE: We are not discarding the old data. But the new data I was referring to there was the FAQ, the work that EPRI did that fed to the FAQ.

That has a new set of --

CHAIRMAN STETKAR: Yes.

MR. TRUE: -- ignition frequency bins that weighted the post-1990 data more heavily. But it kept the old also. We are required to use that value as well as the overall value from 6850. There is about a 60 percent difference or 40 percent difference, I can't remember which it is in the actual cabinet ignition frequencies between those two, which directly propagates into that ridgeline.

So if you use the EPRI results, in general, you would see a pretty good shrinkage of that in that bar. But we are not allowed to do that until we collect the new data and then --

CHAIRMAN STETKAR: Is the new data still treating every cabinet as equal? For example --

MR. TRUE: In the first pass it will.

CHAIRMAN STETKAR: All right.

MR. TRUE: In the first pass we are going to do exactly what 6850 did. We are going to use the same allocation technique.

CHAIRMAN STETKAR: Right. Let me ask you, why are you doing that? This is the industry, why are you doing that?

MR. TRUE: It's a matter of

expeditiousness. It's in particular to get that done as soon as possible.

CHAIRMAN STETKAR: Well, that's what you did before and you found out it wasn't very good. So why are you perpetuating that expeditious treatment of something that we know is not very good?

MR. TRUE: Well, we are expediting the second phase also, but it just takes longer than the first phase.

CHAIRMAN STETKAR: But you are talking about the integrated frequency of a fire with the associated heat release rate. I'm interested in the frequency of fires that happen in telephone cabinets that probably don't have very substantial heat release rates compared to the frequency of fires that happen in 480 volt switchgear which probably do have substantial heat release rates.

So how is this new effort helping the process?

MR. TRUE: The new effort is helping the process by giving us more data to support the --

CHAIRMAN STETKAR: Same old binning.

MR. TRUE: -- current binning and then in the next phase, it will attack the allocation piece of it and will provide an improvement.

CHAIRMAN STETKAR: In how many years?

MR. TRUE: I don't remember the schedule for that. I think it is next year we will have the first phase done and I think it is the beginning of the following year or something like that the second level will be done.

CHAIRMAN STETKAR: Any fundamental reason why you just couldn't do it once next year?

MR. TRUE: I think that there is another issue related to implementation that everyone's PRA is set up with the current method. And so if you give them new improved data, that level lower -- that will almost certainly lower this key bin, particularly, electrical cabinets by a substantial amount. Then they can just plug that in and they are done.

If you go back to a new method, then the whole process of calculating --

CHAIRMAN STETKAR: Yes, the whole allocation process is all different therefore.

MR. TRUE: That is --

MR. HENNEKE: Yes, Dennis Henneke of GE Hitachi, representing the Owners Group, BWR Owners Group. We are collecting the information for the component counts. And remember, only half the plants are doing Fire PRA. So the other half we have to go collect the data and we have to -- we are having to then go do walkdowns. So that's slow.

We could collect the first half and call it good, but --

CHAIRMAN STETKAR: But then you are artificially restricting the new data.

MR. HENNEKE: Yes. So it's based on the plants we have.

CHAIRMAN STETKAR: When you apply the frequency of --

MR. HENNEKE: So we are trying to collect data from the majority of the plants or most of them before we implement it. So that's been very slow. We were hoping to finish it at the same time, but it is lagging behind a good, I don't know, five or six months or something like that.

MR. TRUE: It's particularly problematic for the BWRs, because relatively few BWRs are going to 805.

CHAIRMAN STETKAR: You're right. Thanks, Dennis. I didn't even think of that.

MR. WACHOWIAK: The PWRs are a little bit farther ahead on that.

CHAIRMAN STETKAR: But as soon as you say that you are dealing with a subset of 50 percent of the population in the denominator, if you will, of the fire frequency versus 100 percent in the numerator, and given the rare event nature and the plant-to-plant variability, you want to be sure you have the whole population. So okay, understood.

MR. HARRISON: John, can I clarify one thing?

CHAIRMAN STETKAR: Yes.

MR. HARRISON: This is Donnie Harrison from the NRC staff. Even though there is only about half the industry going to 805, there is a significant number of plants doing other applications that will need to have a Fire PRA.

So it would be naive to assume that other half is not going to provide component counts to improve the Fire PRAs. The reality is the majority of them will be wanting to do tech spec initiatives that need it. So there should be some incentive for the entire industry to try to provide that information.

CHAIRMAN STETKAR: Yes, I understand. You know, it's pretty critical of them in terms of what the industry is proposing to do and the time line. Obviously, a particular plant, it's a voluntary process where they want to do a particular risk-informed application, so they then need to make that value judgment about when they, you know, calculate their fire frequencies or the inventory of equipment. So I understand that problem now. Thanks.

MR. TRUE: Okay. I wasn't quite done with this. We will also be able to deal with these indeterminant events. And, in fact, as far as this process, we are going back and collecting some of the older data also as well as the post-2000 data to try and build and fill-in some of the blanks for some of the more significant pathed events.

The other thing that we are trying to get out of this work is that right now, all the fire events are treated as being at the beginning of this t^2 growth phase. And the reality is, even if you read the descriptions currently, they are far from that, many of them. Some of them, I think Ken Canavan's favorite example is the diesel generator panel lightbulb that sparked and flamed and went out, got treated as if it was, you know, a full-on electrical cabinet fire.

So as part of this data collection effort, we are also trying to get a better handle on where we are in the actual progression of the fire as part of this evidence. So we are gathering not just the significant fires, but also some of the less significant ones to see if we can get a better handle on this progression through the incipient kind of pre-fire stage before we get to the t^2 phase and make a better connection between those.

CHAIRMAN STETKAR: So the goal then is not only to develop a better frequency ultimately on a component-specific basis, so the frequency of pump --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- fires accounting for, you know, plant-to-plant variability, both in the inventory of pumps and the inventory --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- of fires is within that category to develop a conditional probability of fires of a certain severity?

MR. TRUE: Well, I think we want to --

CHAIRMAN STETKAR: Is that what it is?

MR. TRUE: -- see what all the data tells us before we exactly say how we are going to frame that. But we are collecting enough data to be able to get a more refined treatment of that, however that ultimately falls-out. And this is, again, a joint effort between EPRI and NRC. There is a lot of back and forth on the approach and the rules and while industry is collecting the data and doing the first run analysis, that both of us are working on it.

CHAIRMAN STETKAR: Okay.

MEMBER ABDEL-KHALIK: A lot of plants have roving fire watches.

MR. TRUE: Yes.

MEMBER ABDEL-KHALIK: And that would impact to the extent to which the fire progresses.

MR. TRUE: Yes.

MEMBER ABDEL-KHALIK: At the end of the day, if a plant goes through this entire process, they may do away with those fire watches. How do you account for that change?

MR. TRUE: That's a good question. I don't think we have tackled that or accounted for that question. It is true, I can't speak specifically to roving fire watches, but it is true, if you look at the data, the vast majority of the fires were detected by someone's nose.

MEMBER ABDEL-KHALIK: Right.

MR. TRUE: And not by some alarm or something that came in or actuation of a suppression system or something.

MEMBER ABDEL-KHALIK: Right.

MR. TRUE: It's quite early in the process. And I don't know that we have an answer to that, to your specific question about how the truncation of roving fire watches might impact that. I don't know. I don't know that we have before and after data on how many roving watches there are today versus future which you would have to have in order to do that.

MEMBER ABDEL-KHALIK: But if you are extracting data that would give you an idea about the extent to which the fire progresses and a significant parameter that impacts the extent to which the fire will progress, you know that that will ultimately change.

MR. TRUE: It could.

MR. WACHOWIAK: In the new database, the data structure includes information on how the fire was detected. And so the new data structure will tell you which fraction of fires, if you will, were detected by the fire -- by somebody being near it versus automatic detection.

So we recognize that that's an important piece of information. And in the new data coding, we are asking for that information, so that that can be factored in. It's not necessarily there in the old data.

MR. TRUE: Another thing about the roving fire watches, there is a disconnect with the Fire PRA, too, because the way that the events, and we will talk about this just in a minute here, electrical cabinets are assumed to progress from the event in the database to full-on fire in 12 minutes.

Well, the roving fire watches are there once a shift, twice a shift, something like that, so they are not really going to be helpful in that period. It's really the longer period in between in that development phase that they actually come into play.

So let me also say that, and you sort of brought this up, but it also applies elsewhere, having this better database with more complete data and these additional fields are going to also give us good input into other activities like nonsuppression, like control of fires versus suppression of fires that we can feed into other parts of the Fire PRA.

So this is a really important foundational piece for getting ourselves in a good position to improve the Fire PRAs as we go forward.

CHAIRMAN STETKAR: I hate to ask this, but why wasn't this done back, you know, five years ago when NUREG/CR-6850 was developed? Originally, Fire Events Databases that people put together 25 years ago looked at the types of things that you are looking at, except for the fact that they couldn't count piece parts among plants.

But they looked at when the -- you know, how was the fire detected, estimates of the size. Now, that might have been crude, you know, small, medium, large type fires before it was extinguished. I'm curious why a lot of this stuff wasn't done, you know, to assist -- and you probably worked during this, so --

MR. TRUE: I wasn't involved. I wouldn't want to speculate. JS maybe has something to --

MR. HYSLOP: JS Hyslop with Research. The existing Fire Events Database developed by EPRI does have places to put detection, who detected it. It has places for all those, but often, as it was, it was filled out incompletely or sparsely.

CHAIRMAN STETKAR: Okay.

MR. HYSLOP: And so that was the circumstance. And so the 6850 EPRI 1011989 Team went forward with what they had.

CHAIRMAN STETKAR: With what they -- okay, okay.

MR. HYSLOP: Yes.

CHAIRMAN STETKAR: Thanks.

MR. TRUE: Okay. Incipient growth phase of the Fire Events Database, as I mentioned, all the events in the database were treated as being right at the beginning of this growth rate. And the results of that is because that growth rate is assumed to be fairly rapid, taking electrical cabinets, for example, being 12 minutes, then it is, basically, a very limited window for any kind of suppression or control, which is not what we actually see in the field, but it's an artifice of the calculation.

CHAIRMAN STETKAR: Okay. When you say it's an artifice of the calculation, who made the decision, when and why, to treat these fires that way?

MR. TRUE: The authors of 6850, I can't speak for them as to why, it was probably their best estimate at the time with the data they had available to make the -- to decide how to treat it. I'm sure they did it with all the intentions of it being a reasonable set of assumptions.

CHAIRMAN STETKAR: Well, what I'm trying to get at is did they do it with the intent of being a reasonable set of assumptions or did some individuals in isolation do it because it was an expedient way to do something that they felt was probably conservative, but not ridiculous?

MR. TRUE: I can't answer that.

CHAIRMAN STETKAR: Okay.

MR. TRUE: I mean, I have my own opinions about --

CHAIRMAN STETKAR: That's all right.

MR. TRUE: -- that, but I wouldn't want to speculate.

CHAIRMAN STETKAR: I would like to understand that, because I see a lot of -- I mean, we can talk about ignition frequencies, which is certainly a big important part of the problem. But that first bullet there, the assumed status of the fire at the point of ignition --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- and the way it is treated going forward in the PRA modeling is a key assumption.

MR. TRUE: Yes.

CHAIRMAN STETKAR: Understanding the basis for that --

MR. TRUE: It's a key assumption.

CHAIRMAN STETKAR: -- assumption and the potential amount of realism or conservatism that is in that assumption, I think, to me, is pretty important, especially given, you know, cabinet fires.

MR. TRUE: We are actually going to talk about that.

CHAIRMAN STETKAR: There is a principle for everything with cabinet.

MR. TRUE: We are going to talk about that in some detail, John.

CHAIRMAN STETKAR: I'll let you go.

MR. TRUE: But Dennis wants to add something.

MR. HENNEKE: Yes, Dennis Henneke, GE Hitachi. I was a reviewer on 6850 and I had -- a number of these counts you see are in Volume I. 6850 there were open comments on control of fires, all these things. This particular one, t^2 growth came from the two sets of tests where the heat release rates were based on and it was the growth in the tests themselves, they were piloted tests where they have a Bunsen Burner in the bottom and they grew, so they curve fit and used some extra judgment to pick a single t^2 growth of 12 minutes from those tests.

CHAIRMAN STETKAR: But those are people doing fire growth tests within a cabinet given a pre-existing ignition source.

MR. HENNEKE: Yes, yes.

CHAIRMAN STETKAR: And that is not

integrated with actual operating experience.

MR. TRUE: We are going to get to that.

CHAIRMAN STETKAR: Yes.

MR. TRUE: We have a bunch of slides on that.

CHAIRMAN STETKAR: Go for it.

MR. TRUE: We'll get to that. Okay. Oil severity. Just with the highest level, we think that the treatment -- I think it was probably a conservative assumption. Let's see how this works out kind of thing. And we found that that is true.

FAQ-044 addressed that for main feedwater pump fires, because what we found was if you use those assumptions, you burn down the turbine building pretty much every time, then that wasn't very helpful to the analysis.

So we now adjusted the main feedwater pump oil fire distribution from the 98.2 percent thing we showed before to a new one. But there were other components that need that same kind of treatment also, pumps, transformers and diesel generators.

CHAIRMAN STETKAR: Was that adjustment based on actual experience data?

MR. TRUE: Yes, a combination. Mostly experience, but there were some, obviously, judgments involved.

Okay. We'll turn now to Category II, the Fire Growth Rate, which also is going to include this 12 minute thing as well as the peak heat release rate discussion.

I want to talk about fire growth assumptions, peak heat release rates and detail. We have some other areas we think need some further refinement. Again, a lot of these were FAQs that got to some state, but we think need some further development. Energy arcing faults, bus duct energy arcing faults, sensitive electronic equipment and how that is treated.

Electrical cabinet propagation within the -- propagation within the cabinet and then fire modeling. There is a NUREG out for drafts, there is work going on currently on refining that method. I'm going to talk about these first couple here in some more detail.

Fire growth assumptions. Electrical fire growth rates is very course and don't really address much in the way of their bin. There are a handful of bins, but they really only look at a cabinet and what type of cable is in the cabinet and maybe the quantity of cabinets, but doesn't always address things like ventilation, limited conditions. It certainly doesn't address the voltage of the cabinets and so it's a very course approach.

And we have the other problem of the fires in the database don't appear to be right there where they are ready to grow and then we connect those events to this 12 minute growth thing. And that 12 minutes turns out as pretty limiting in terms of intervention actions and doesn't allow us to get credit for much in the way of detection control or suppression.

Improved database is going to help this, but I want to go through some of the background on this. So the 12 minute growth rate assumption comes from a series of tests that were done and, basically, the majority of those tests were done in a situation where they put a polyethylene bucket that -- a quart of acetone and a pound of kimwipes in there, fluffs up the kimwipes and lit it on fire and had a flame of the height of about 33 feet high and it burned for about 35 minutes.

CHAIRMAN STETKAR: Just to make sure for the transcript, that's a flame height of 3 feet high, right?

MR. TRUE: 3 feet.

CHAIRMAN STETKAR: Okay.

MR. TRUE: What did I say?

CHAIRMAN STETKAR: 33.

MR. TRUE: Oh, 3 feet. I stuttered I guess. 3 feet. And then, you know, the first test they did it, that wasn't enough, so they had to separate the cable bundles apart, so there was more surface area on the cables to make sure that they caught on fire.

So this was a test that was done for a very specific purpose. It was to look at, you know, the maximum magnitude you might see out of this. But it became a reference point for how we are trying to realistically portray a PRA.

CHAIRMAN STETKAR: I don't remember, Doug, do you remember the date on that NUREG? Was it --

MR. TRUE: Oh, it was probably in the late '80s because 450 was 11/15 and that was late '80s. So it was probably in that mid to late '80s, I would guess.

So if we -- out of this NUREG there is a graph that actually shows just the heat release rate of the ignition point. And it shows that in, lo and behold, about a 12 minute period, that buck of kimwipes and acetone gets up to a limit, burns for a while and then eventually tapers off.

If we take that trace and we look at it compared to some of the other tests that we have that are used to actually set the heat release rates for the fires in the cabinets, here is a set of five traces. A couple of interesting points.

The first two tests, ST1, down there in the solid black line, actually didn't even ignite the cables, didn't have any propagation at all. I'm sorry, that's ST2. ST1, there was no burning. The second one, it burned the cable locally, but never actually propagated.

If we overlay that curve I just showed you from the ignition source only, you can see that it basically overlaps those first two tests, which makes sense. If there was no real burning propagation, you would expect to get about the same curve.

The problem comes in that the peak heat release rates that are shown in ST5 and 4 and 3 are the peak heat release rates that are used to set the peak heat release rates or at least inform the peak heat release rates in the analysis, but they don't actually subtract out the heat release rate input from the fire.

So at 136 kilowatts that are shown up

there in ST5, there is a data point in there, but 30 kilowatts of that is actually coming from the fire, not from the panel itself.

So we have got a little disconnect here in how the data was interpreted. Even if you accept the fact that kimwipes and acetone are relevant to the ignition of a fire that we see in our Fire Events Database, there is a disconnect in the way this was applied.

Certainly, the way it has been applied is conservative. Certainly, it would reflect that of significant, more significant impact than we might see from the real events. But it -- there is just a disconnect in this. And it is interesting that the 12 minutes is pretty consistent across all the studies. In fact, there is quite a table, maybe even in here, that is in 6850. It shows they are all about the same. And I was like why are they all the same? It doesn't make sense it would grow at the same rate.

Well, it's because the flames are getting big at that rate and that's the peak point that occurs right after that flame builds up.

CHAIRMAN STETKAR: Do you have any -- maybe this is a leading question, if I drop the peak heat release rate, you know, give me the 12 minutes, but if I drop the peak heat release rate from 135 down to 100 kilowatts, 90 kilowatts whatever make a lot of very big difference on the zone of influence?

MR. TRUE: Yes, it does.

CHAIRMAN STETKAR: Okay.

MR. TRUE: 12 minutes is --

CHAIRMAN STETKAR: The 12 minutes is more important than --

MR. TRUE: -- more important.

CHAIRMAN STETKAR: -- the magnitude of this.

MR. TRUE: But the problem -- yes, right.

CHAIRMAN STETKAR: Okay. That's --

MR. TRUE: There are some other issues, too.

CHAIRMAN STETKAR: No, no, I am just trying to get a feel for --

MR. TRUE: Yes, I think that's a fair question.

CHAIRMAN STETKAR: All right.

MR. TRUE: The other thing is that a lot of the tests in order to get a big fire going with all that nice acetone and kimwipes in there, the doors are open to make sure there is plenty of air to feed the fire. Well, of course, when you walk through a nuclear power plant, you don't see a lot of electrical cabinets with their doors open.

So there is actually work going on with EPRI that we're looking at this ventilation limited condition where we have less flow of air that may be controlling the rate of growth in the rate of peak heat release rate from those fires. So that's that.

My other favorite test is PCT4 there where they put 15 gallons of, essentially, gasoline in the bottom of the cabinet, that's also used to inform the growth rate in the peak heat release rate information, too.

And then you also see that benchboard and vertical are kind of altogether. That happens also in the assignment of the peak heat release rates. Benchboard cabinets are like the control room type cabinets versus a vertical cabinet, more like a, you know, electrical distribution cabinet.

Whoops. There is also a mixture of qualified and unqualified cables that are included in the tests. And our ST1 and ST2, this is a table that actually shows that time to peak heat release rate, so this is the thing that comes up with the 12 minutes. It was actually 11.4 and they rounded it up to 12. And you can see they are all pretty consistent in their growth rate, which, given the ignition source, that's not entirely surprising.

And another concern that we have is that the qualified and unqualified cables are not aligned with the rules in 6850 on how you assign the peak heat release rates. So that when we look at the results of the peak heat release rate stuff in 6850, it doesn't really fit.

Now, if you look at the conclusions, these are actually cut and pasted right out of 4575, it says that qualified cable fires invertible cabinets do not spread without the cabinet -- throughout the cabinet. This is with the acetone, with the heptane or whatever in there. They don't spread.

Unqualified cables easily ignite and propagate through the cabinet. And it does say that the burning rate is affected by the ventilation method, whether you have constraints or not. But those weren't carried forward in the assignment in 6850 of the heat release rates completely.

CHAIRMAN STETKAR: Doug, before -- I don't know which way you went on that one, but for my benefit and I think others on the Subcommittee, we are talking about heat release rates from cabinets. Now, you are talking about qualified versus unqualified cables within the cabinet.

In a practical PRA, I mean, the ones that have been, you know, done that you are familiar with, is there -- when you are developing a cabinet heat release rate, when you are going through the analyses, is it more important to understand that in terms of damage within the cabinet and the time to damage within the cabinet or is it for cables outside?

MR. TRUE: The cables outside.

CHAIRMAN STETKAR: Okay. The only reason I'm getting to that is the implications of maybe I don't need to know an awful lot of details about precisely what is in that cabinet, if I'm not looking at within cabinet things. Some of the implications from what you have shown here, at least led me to --

MR. TRUE: Are --

CHAIRMAN STETKAR: -- the conclusion that gee, I really need to know a lot of details about precisely what is in that cabinet, if I'm going to do that within that cabinet.

MR. TRUE: If you are going to do it within the cabinet. And that typically has not been done. It is mostly the external, which also then feeds the spurious op phase.

CHAIRMAN STETKAR: No, I understand that.

But I'm trying to get to in terms of what -- back to the ridgeline, in terms of what is driving the ridgeline, is that primarily within cabinet fires that you feel could be further refined to limit the damage within a cabinet or is it primarily external damage from the cabinet?

MR. TRUE: Primarily external.

CHAIRMAN STETKAR: Okay.

MR. TRUE: There is some internal, but primarily external.

CHAIRMAN STETKAR: Yes, but, in that sense, it's the cabinet-related heat release rate.

MR. TRUE: Yes.

CHAIRMAN STETKAR: And the time to develop, you know --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- the peak heat release rate --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- from the cabinet. Okay. It's important to know what kind of cabinet and, you know, general inventory of, I'll use the technical term, stuff that's in that cabinet, but not as important compared to doing a detailed within cabinet fire --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- ignition growth.

MR. TRUE: Now, there has been some dialogue about trying to model inside a cabinet and no one has --

CHAIRMAN STETKAR: That's --

MR. TRUE: -- that much confidence in the firewall.

CHAIRMAN STETKAR: Well, and if you tried to do that through your, what is it, 1,362 cabinets in the plant, it would be --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- difficult.

MR. TRUE: Right.

CHAIRMAN STETKAR: Okay.

MEMBER ABDEL-KHALIK: I --

MR. WACHOWIAK: Go ahead.

MEMBER ABDEL-KHALIK: I guess, okay, I listen to this and you think, you know, who in his right mind would design, you know, a set of experiments in this manner to give you these two parameters, the heat release rate and the time to growth?

What was the rationale for running the experiments the way they were run?

MR. TRUE: These were not PRA studies. These were fire protection studies.

MEMBER ABDEL-KHALIK: I understand.

MR. TRUE: These were done to try and burn things to see how -- the manner in which things propagate. What happens if you have a big fire going, what happens. And in that sense, and there is ongoing research that is being done the same way, let's burn the stuff up and see how bad it looks.

MEMBER ABDEL-KHALIK: But the basic experiment was not to get the two parameters that you are looking for.

MR. TRUE: No.

MEMBER ABDEL-KHALIK: Is it?

MR. TRUE: No, it was not its purpose. And it is, in fact, very hard to devise a test to get what we want. And, in fact, I believe there was work done by Sandia where they tried to start a fire by creating a fault and they couldn't get it to propagate.

CHAIRMAN STETKAR: Right.

MR. TRUE: But we know they propagate, because we have fires.

MEMBER ABDEL-KHALIK: Well --

MR. TRUE: I mean, so it's not that we

think the fires don't happen. We know they happen. It's just that you devise a test. It's a lot easier to devise a test that provides an envelope than it is to give you a realistic distribution of what is going on.

And I've got to give credit to the authors. They acknowledge that and they tended to put the results from these kind of fires at the high end of the distribution, 98^{th} percentile or 75^{th} percentile of the distribution. But it still pulls everything way up. And when you fit the code back, your bottom end doesn't really go down to even where we believe the real results are, particularly in light of all these other factors of ventilation, qualified cables and things that aren't accounted for.

MEMBER ABDEL-KHALIK: I'm just trying to figure out if this is a doable problem in terms of coming up with realistic data.

MR. TRUE: I think the work -- and we should -- maybe next time we should spend a little bit of time talking about the work that is going on right now with EPRI where they are trying to derive better information about these more limiting cases for specific cabinet configurations that will help us break that bin apart into the ones that matter.

There are bins -- places where this probably applies.

CHAIRMAN STETKAR: I think Said said that it's all telegraph. Certainly, in December we will want to hear more about this.

MR. TRUE: Okay.

CHAIRMAN STETKAR: From all interested parties.

MR. TRUE: All right.

CHAIRMAN STETKAR: The whole topic and I'll integrate it in terms of fire ignition frequency with corresponding heat release rate for electrical cabinets.

MR. WACHOWIAK: Yes, we should be ready to talk about that in December.

CHAIRMAN STETKAR: I hope so, because --

MR. WACHOWIAK: Right now --

CHAIRMAN STETKAR: -- if you are not, we are going to have some difficulties as a Committee.

MR. WACHOWIAK: -- the report is in the middle of the technical review process. So --

CHAIRMAN STETKAR: I mean, I've heard enough, you know. We have heard enough, I think, this morning and through other things that this is one of the larger, if not the, you know, tip of the iceberg, if you will, in terms of issues that people are struggling with. And in our charter in trying -- in terms of trying to understand the source of the problem, if it is a problem, and what may be done, which is where Said is kind of headed, as much as you can enlighten us in December --

MR. TRUE: Okay.

CHAIRMAN STETKAR: -- on this particular topic. And there may be others, but this one certainly.

MR. TRUE: Okay. So This growth rate has a lot of ramifications. You know, those were tests, as you pointed out, Said, designed to cause damage and all the fires in 6850 are treated as propagation is possible. The growth rate was set by this transient ignition source, basically, acetone and kimwipes, set the ramp up. We got the gasoline test, open and closed doors, qualified/unqualified cables, doors open on cabinets. There just needs to be additional refinement to this bin.

And, you know, for a first cut, let's go try this and see what the results look like. You know, it was a fine attempt, but we're finding that it is, obviously, not comporting with our operating experience, so we think we need to go back and make this refinement. It's the main theme of today.

It's hard to really figure out exactly how this plays out in the CDF. I think it is probably on the order of a factor of 2-5 on overall CDF. It may be more that than depending on how much credit you take during the growth rate.

CHAIRMAN STETKAR: Given the presentation, I'm surprised that you are saying only 2-5, but --

MR. TRUE: Well, that's just the growth rate. The peak heat release rate is another factor.

CHAIRMAN STETKAR: Oh.

MR. TRUE: So we will be talking about that --

CHAIRMAN STETKAR: Okay.

MR. TRUE: -- next.

CHAIRMAN STETKAR: You are just talking about the 12 minutes.

MR. TRUE: This is the 12 minutes.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Just the 12 minutes.

MEMBER ABDEL-KHALIK: 2-5 here?

CHAIRMAN STETKAR: No, no. Okay.

MR. TRUE: So the bins are pretty simple. They -- it's a mix-and-match of test results to assign those and we will get into this in a little bit more detail. Distribution doesn't seem to comport with what we have seen in experience.

And another problem, and I apologize to the authors of 6850, but it's not exactly clear how they got to the conclusion they got to in assigning all the CDP heat release rates. I think we need to get to a more scrutable process for doing that.

And in today's time, it wouldn't really meet what we expect out of a PRA in the PRA Standard, for example, on how you do an expert judgment.

So it's a simple scheme. I think we have got that coming out. Electrical cabinets are a major contributor. We think we are overstating those effects in the spurious ops that come from that. And then we think it is going to make it difficult to make some decisions going forward.

CHAIRMAN STETKAR: Let me ask you, Doug, another kind of question. It's clear again from that ridgeline that we saw in the other slide that electrical cabinet fires are a major contributor. And, you now, your assertion is that that is not consistent with actual operating experience.

So it overstates the effects of fires. Do you have any sense at all whether we are somehow skewing the relative effects from fires in different types of cabinets compared to, I'll use, operating experience or what you might expect given what you have looked at in terms of the data and sources?

So for example, it's not just are we overstating the absolute magnitude from the cumulative effects from all electrical cabinet fires, given that we are treating telephone cabinets the same as, you know, 13kV switchgear with some minor differences?

But are we skewing the results because of that treatment, such that certain types of cabinets in certain configurations might present a higher relative risk than what we are calculating compared to other cabinets in other configurations that would be much lower?

MR. TRUE: I think so.

CHAIRMAN STETKAR: Which comes back to the fidelity of how do you understand the risk results.

MR. TRUE: I think Harris struggled with this, too, and one of their dominant contributors was a low voltage electrical cabinet. And yet, it was treated in the same bin as the, you know, 4kV switchgear with the same peak heat release rates.

And so my sense is, and we haven't got an operating experience basis clearly put together that says that it doesn't match up with operating experience, but my sense is, if you look at the events in the database, and you look at what we are calculating, we are -- we do need to sort of segregate out different types of cabinets more.

CHAIRMAN STETKAR: So, you know, what I'm saying is presume that the cumulative frequency of those fires remained the same, it's just that we allocated them differently and developed different heat release rates as a function of cabinet type --

MR. TRUE: Yes. I think --

CHAIRMAN STETKAR: -- you know, in principle some cabinets might be worse. We might have a higher frequency of more damaging fires that would reach cables at a larger distance above a cabinet, you know, Configuration X --

MR. TRUE: Yes.

CHAIRMAN STETKAR: -- compared to a different configuration where we are underestimating.

MR. TRUE: I think high energy arcing falls in not electrical cabinets.

CHAIRMAN STETKAR: High energy arching falls is a way to get around that.

MR. TRUE: There's another one though where I think we sort of treat everything as being susceptible and I think the evidence says maybe not everything is susceptible, which means that we are -- because we smear it --

CHAIRMAN STETKAR: Yes.

MR. TRUE: -- across those, which means we are understating the risk for a certain part of it and overstating the risk for another part. So yes, I think that exists in electrical cabinets and --

CHAIRMAN STETKAR: Okay.

MR. TRUE: -- in other areas --

CHAIRMAN STETKAR: Okay. I was just trying to get your sense --

MR. TRUE: -- of the --

CHAIRMAN STETKAR: -- a little bit, because --

MR. TRUE: Yes. I think --

CHAIRMAN STETKAR: -- I'm sensing not just the overall, it's the fidelity of the risk assessments as they are currently being developed to understand the contributors to risk, whatever the absolute magnitude of that risk is.

MR. TRUE: Right.

CHAIRMAN STETKAR: Because decisions are made based on those.

MR. TRUE: Right, exactly. And I think that's what we are concerned about is that we get the wrong dominant contributors and we don't have the best basis for making our decisions.

MR. HYSLOP: JS Hyslop with Research. There was a FAQ where we did distinguish among high energy arcing faults between low and medium volt cabinets for frequency. And so we have done that. And the model that we used is based on an event. And so we didn't use all high energy arcing fault events in establishing frequency as well, so there has been some specialization.

CHAIRMAN STETKAR: Okay. Thanks.

MR. TRUE: Okay. This is a table out of 6850 that -- this is the table that covers electrical cabinets. So there are five bins and you decide what kind of a cabinet you have and then you allocate your frequency to that cabinet based on which one of these categories it fits into.

I just want to highlight a couple of things on here. The first two are qualified cables. The other three are for unqualified cables. The first two, the 98^{th} of the first row, which was one cable bundle and the second row is the 25^{th} percentile, the second row.

CHAIRMAN STETKAR: Before you get into all of the numbers, let me just understand. You say, again, if I'm doing my PRA today -- you can keep the qualified underlined there. If I have a cabinet and I say my cabinet has qualified cables, does that mean every single millimeter of cable in that cabinet must be a qualified cable, if it's not, then I have, by definition, a cabinet that has unqualified cables?

MR. TRUE: I think that's the way it has been implemented.

CHAIRMAN STETKAR: That -- when you say think, is it? I don't know.

MR. TRUE: I am pretty sure. Dennis is nodding back there. I'm pretty sure that's the way it is being implemented.

CHAIRMAN STETKAR: Okay. So as long as I have one unqualified cable in this cabinet, and this could be an electronics cabinet that has got, I don't know, a couple of miles of qualified cables in it, but as long as I have on unqualified cable in it, it's -- they apply the unqualified criteria?

MR. TRUE: Yes, and I think the general approach to this has been set up, so that people will tend to default to the more conservative --

CHAIRMAN STETKAR: Okay.

MR. TRUE: -- position.

CHAIRMAN STETKAR: I just wanted to make

sure how -- whether there was any thought about, you know, the majority is qualified or --

MR. TRUE: The cable trays are the same way.

CHAIRMAN STETKAR: The cable trays are the same?

MR. TRUE: Yes, one unqualified cable, then it is --

CHAIRMAN STETKAR: Okay. Thanks.

MR. TRUE: Okay. I should maybe explain this before I jump into it, too. So the distribution of heat release rates was -- were anchored to a 98th percentile and 75th percentile and then a distribution was fit into those to give you the distribution for -- of different peak heat release rates for your analysis.

So and those peak heat release rates, the anchor points, were set based on tests. And it turns out that the 98th percentile in the first room was anchored, for a single bundle, to a test of unqualified cable. And the 75th percentile on the multiple cable bundle was anchored to that same test result.

Well, if you look at the results of 4527, it says "Qualified cable and unqualified cable behave entirely differently and will propagate fire. Qualified cable won't propagate."

So we have already mixed and matched now our test results, which are unqualified and applied them to qualified cables.

The 702 one that the industry likes to bandy about, the 700 kilowatt fire, is actually a benchboard test with open doors. It's like, you know, just open the whole thing up and lots of cables in it. And that is being applied, essentially, into almost all of the cabinets, because we can't go and open every single cabinet. And so if we can't open it to prove there is only one cable bundle, we're going to have to assume there is multiple cable bundles.

So we end up anchoring ourselves to these two tests that have, arguably maybe, less connection to what our real design is than we would like.

CHAIRMAN STETKAR: Just out of curiosity, was the benchboard test done with only qualified cables in those bundles or were they --

MR. TRUE: I don't recall.

MEMBER SHACK: The benchboard with qualified cable.

MR. TRUE: Qualified.

CHAIRMAN STETKAR: I knew you would have--

I saw you looking.

MEMBER SHACK: Right.

CHAIRMAN STETKAR: Okay. But that's a fully ventilated --

MR. TRUE: Yes.

CHAIRMAN STETKAR: -- configuration?

MR. TRUE: Yes, with a much -- with a quite large combustible loading also.

CHAIRMAN STETKAR: Yes, yes.

MR. TRUE: Because it's, you know --

CHAIRMAN STETKAR: It's a benchboard.

MR. TRUE: -- it's a benchboard. All kinds of stuff here.

Okay. Transient ignition sources, there are three bins that, based on different locations in the plant --

CHAIRMAN STETKAR: Could you go back to that? Again, it is too hard to run the numbers right now, but either for the paper or when you come back in December, I would be curious to see what the real parameters of those distributions are. You know, you're showing 98 and 75^{th}. I would like to see what the fifth and median and the mean are.

MR. TRUE: Yes, there is another table that has all that in it in 6850.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Yes.

CHAIRMAN STETKAR: In 63?

MR. TRUE: Yes, it's in 6850.

CHAIRMAN STETKAR: I'll find it then. Never mind.

MR. WACHOWIAK: And I think what you will find is that for the qualified cable bin, more than one bundle, the smallest allowable heat release rate associated with the fifth on the bin still gives you a fire that affects things outside the cabinet.

MR. TRUE: It is.

MR. WACHOWIAK: Even though the conclusion of the report was if you have qualified cable, it doesn't affect the outside of the cabinet.

CHAIRMAN STETKAR: I was just curious whether -- I didn't have a sense and I don't remember that distribution that -- going from the 98^{th} to the 75^{th} on that second line is a pretty broad range.

MR. WACHOWIAK: And it's a gamma distribution.

CHAIRMAN STETKAR: Yes. I don't have a sense of the gamma as well.

MR. WACHOWIAK: There is a table that elaborates that in 6850.

CHAIRMAN STETKAR: Okay. But the key is, you said even the fifth percentile is large enough to get you admission from -- at some reasonable distance above the top of the cabinet.

MR. TRUE: Think of the vertical cabinet, that's where they actually did strictly vertical cabinets. The maximum peak heat release rate that was observed was more around 100 kw.

MR. WACHOWIAK: Maybe under 100.

MR. TRUE: 80 or 90.

MR. WACHOWIAK: Yes.

MR. TRUE: Yes. And I'm not sure that accounts for the subtracting out of the source either, so they are much, much lower than 700. Not that 700 couldn't happen in a certain circumstance.

CHAIRMAN STETKAR: Oh, sure, yes.

MR. TRUE: But we are applying that now to every cabinet, essentially, in the whole plant.

CHAIRMAN STETKAR: Telephone cabinet, in principle.

MR. TRUE: Yes, yes. Okay. Transient ignition sources. There are three bins that are basically divided into different portions of the plant. The heat release rate data for those are based on tests that were performed on trash bags that had transient combustibles in them, which is, you know, fine. It was a calculation done to see how much heat you could get out of a trash bag that was set on fire.

The problem is that if we look at the Fire Events Database, the events that we are dealing with are not trash bags. There are very few events that have anything to do with a bag of trash that got lit on fire.

Most of them are things like space heaters, extension cords, some kind of scaffolding that got caught on fire and there is only one in the whole database that had anything to do with a trash receptacle was put into it.

And so again, we have got a disconnect between modeling it as these events cause this frequency, which causes this heat release rate, and that heat release rate is pretty substantial from the ignition -- transient ignition sources.

So we think that is overstating the transient combustibles. You asked earlier, John, how many plants will be affected by that. It's very plant-specific. There are some that would be affected by improving this.

CHAIRMAN STETKAR: Yes, the whole issue of heat release rate, given the fact that we are talking about transients, is a little more difficult in terms of uncertainty. I'm not quite sure how a databased approach might address that issue.

MR. TRUE: Well, again, the Fire Events Database will help us a little bit more in understanding what the real events are. But you ought to count the real events to the --

CHAIRMAN STETKAR: Well, people don't have all that many transient fires. Whether you are cutting fires during shutdown there is public good.

MR. TRUE: Well, those are bins. Well, I mean, could --

CHAIRMAN STETKAR: No, I -- yes.

MR. TRUE: Right. So other sources. We have been talking about electrical cabinets primarily.

CHAIRMAN STETKAR: Yes.

MR. TRUE: And there are issues there that need to be worked through. There are other problems we think that exist and other contributors that pop up from time to time in plants. And, in fact, Table G-1 of 6850, in a couple of cases, basically, took electrical cabinet fire test data and applied it to a pump and a fan and said we know this is conservative, but it's what we have. So they applied it.

So in the pump electrical fires, it's

anchored to the 98th percentile and 211, again, the same test as the vertical cabinets. And there is a note that specifically points to those pumps and motors and says those are -- no, it's not down there. We know it's conservative, but it's the best we could do.

CHAIRMAN STETKAR: Now, again, before we get to the framework here. If I think going forward you have talked a lot about cabinet heat release rates and the source of the estimates for those and you talked a little bit about transients and there are some other things that there might be concerns.

In terms of trying to focus on issues where right now, you know, given the knowledge that we have about the PRAs that, let's say Harris and Oconee, had been submitted and the other NFPA 805 Projects that are -- must be fairly well along in their Fire PRA Analysis.

Is it possible to say that we can focus on one or two areas in terms of heat release rate analyses that will solve the vast majority or problems or do we need to equally address every possible bin in terms of heat release rates, because we can't be confident until we do that?

MR. TRUE: Well, the --

CHAIRMAN STETKAR: Of course, I'm going to --

MR. TRUE: -- spectrum, right?

CHAIRMAN STETKAR: Well, yes.

MR. TRUE: So --

CHAIRMAN STETKAR: But honestly, in terms of pragmatism, I'm looking for issues that the industry has found to be very, very significant in areas where, in a sense, you get the most return on investment in terms of doing whether it is additional experimental testing or whether it is a more elaborate expert elicitation process using, you know, a broader source of other types of test data, I'm not sure what. But in terms of expediency and pragmatism, you know, are there specific areas that the industry would say yes, indeed, these should be addressed today to give us higher confidence in the studies that are being done today?

MR. TRUE: Yes.

CHAIRMAN STETKAR: Whereas, other issues yes, indeed, there are concerns. You know, you have highlighted a few on this slide. But in practice, at least where we are today, there is a less compelling reason to launch off into, you know, running tests on, you know, pump fires or something like that.

MR. TRUE: Yes. I think --

CHAIRMAN STETKAR: You don't have to answer that right now, necessarily, but think about it a little bit and maybe by the end of the day, you might confirm --

MR. TRUE: I understand where you are coming from and I understand the motivation. And I'm going to partially satisfy you, I think.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Certainly, electronic cabinets are an area of focus.

CHAIRMAN STETKAR: Okay.

MR. TRUE: And the first database chart we put up pointed that out.

CHAIRMAN STETKAR: Yes.

MR. TRUE: It's certainly an area of focus. And there are a couple of aspects of it. The heat release rates on the growth rates are important. The ignition frequencies, I think, are important.

CHAIRMAN STETKAR: Yes.

MR. TRUE: So I think we've got to do the ignition frequency work, right? Electrical cabinets certainly are a first priority and there is already work going on on that.

CHAIRMAN STETKAR: Okay.

MR. TRUE: The problem, this will be the dissatisfying part of that, is that, I think, those little blips that are out there are problematic for that individual plant, for that individual scenario. And right now the way that the process works is you are pretty much expected to follow 6850 as a cookbook and the standard for justifying a deviation is quite high.

CHAIRMAN STETKAR: Okay.

MR. TRUE: And so we are -- even those individual utilities where -- there are individual problematic scenarios hanging out there, if we don't try to do a more broad assessment than just electrical cabinets. In terms of priority, electrical cabinets and data are definitely first priority. We are working those.

The other ones, you know, it's going to be a case-by-case basis.

CHAIRMAN STETKAR: Okay. You know, some people, at one time, had really badly operated turbine-driven auxiliary feedwater pumps on a plant-by-plant basis that might have been maintenance or whatever.

MR. TRUE: Yes.

CHAIRMAN STETKAR: They got over that, you know, internal event. So again, what I'm trying to focus on is right now the areas that, across the board in the industry, would have the most benefit. Recognizing that, you know, hopefully the process is not going to end at the end of 2011.

MR. TRUE: No.

CHAIRMAN STETKAR: Well, no. Regardless of whatever timescales they are on.

MR. TRUE: Right.

CHAIRMAN STETKAR: PRA is a continuing process.

MR. TRUE: Right.

CHAIRMAN STETKAR: So you can always collect better data.

MR. TRUE: Okay. I want to go to the last one and this will actually bring up another one, I think, that is important, too, which this is the hot shorts and then moving into likelihood of how we translate that into the CCDP calculation.

CHAIRMAN STETKAR: Is this just -- it's noontime, Doug, can you finish up the last two or three in about 15 minutes?

MR. TRUE: Yes.

CHAIRMAN STETKAR: Do you think?

MR. TRUE: I can do it in 12 --

CHAIRMAN STETKAR: Okay. You're doing a heroic effort, so --

MR. TRUE: -- less than that.

CHAIRMAN STETKAR: If you can get through this in about 10 to 15 minutes, it's great. Otherwise, I was going to take a break.

MR. TRUE: Yes, no, I'm -- we're good.

CHAIRMAN STETKAR: Okay.

MR. TRUE: So hot shorts, I'm not going to go in through any of these in any detail, but I think hot shorts remain an area that we would like to get better refinement on. The DC Circuit testing has just been done. Right now, we are basically being forced in the DC Circuits to assume that if a hot short occurs, it stays forever.

And there will definitely be some improvement if we could assume that that cleared eventually and the tests will help us do that and that will feedback, because that affects things like some of the seal injection isolation systems and other things that are important risk contributors. So hot shorts is another priority area, I think, in the DC testing that has been done. It will help inform that.

Although again, we are making a leap from a test that was designed to burn to how do you apply that into a PRA.

CHAIRMAN STETKAR: Well, but again, given ignition, the test that they did, they were looking at the conditional probability of hot shorts. So they weren't concerned with the ignition frequency.

MR. TRUE: Right.

CHAIRMAN STETKAR: I mean, it's supposedly in the PRA, you have taken care of both the ignition frequency, the detection suppression frequency to the point where you don't get, you know, fire, cable burning.

MR. TRUE: Yes, right.

CHAIRMAN STETKAR: So, you know, in that sense, I think the tests that they did answered this conditional probability of hot shorts, given fire burning. They weren't trying to necessarily grow the fire over a period of time.

MR. TRUE: Right.

CHAIRMAN STETKAR: Yes, the tests weren't designed to do that.

MR. TRUE: Right.

MR. WACHOWIAK: You just need to be careful interpreting the information.

CHAIRMAN STETKAR: Yes, well, obviously. And it's a limited set of tests. Got it, you know, all of that is taken into consideration. You mentioned DC Circuits and I know the testing was just done, I guess, this year. Again, coming back to sort of the pragmatism and expedience, is the evidence and the sort of comfort level with the evidence for AC Circuits given the FAQ responses on, you know, timing of the duration of those hot shorts, is the industry fairly comfortable with those?

MR. TRUE: On AC, you're speaking of?

CHAIRMAN STETKAR: For AC, yes.

MR. TRUE: I think that it is not our top priority.

CHAIRMAN STETKAR: Okay. So DC is the --

MR. TRUE: I think DC --

CHAIRMAN STETKAR: There is enough plants with enough DC Circuits in critical?

MR. TRUE: Because of the way we are being forced to bound it as a --

CHAIRMAN STETKAR: Yes, yes. But I mean, it's in terms of --

MR. TRUE: -- permanent --

CHAIRMAN STETKAR: -- the inventory of DC Circuits and their function within plants, the DC Circuit issue is --

MR. TRUE: Is more important.

CHAIRMAN STETKAR: -- more important?

MR. TRUE: Yes.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Today.

CHAIRMAN STETKAR: Today.

MR. TRUE: Then we have an interim solution, too, for that.

CHAIRMAN STETKAR: Yes, okay. I was just trying to get a handle on it.

MR. TRUE: HRA, I shouldn't skip over HRA, because it is also an important area. There is a NUREG that was put out and a senior reg on human reliability in 1921 that came out that got a lot of feedback from the industry on how it was to be. And it has been going through a revision. That's something else that will be important to getting us further along in terms of the --

CHAIRMAN STETKAR: On the other hand, in terms of, you know, what we are faced with here, HRA will be a continuing issue, internal events/external events, Level 1/Level 2, you know, you name it. And, therefore, in terms of pointing specifically to HRA, although there may be different types of problems that need to be addressed within a Fire PRA, it is not something that I think, you know, merits a lot of focused attention right now.

MR. TRUE: We can't hold up all progress until we solve the human reliability.

CHAIRMAN STETKAR: Absolutely not.

MR. TRUE: That's for sure.

CHAIRMAN STETKAR: And what I'm saying is that right now the industry has a variety of different methods for doing HRA. And I think in fire risk assessment, we are, basically, going to have to live in that environment until, you know, more comprehensive progress is made, you know, across the whole industry.

So in terms of things that says, you know, why should we not perform NFPA 805 Fire PRAs today or that we don't have the same confidence in those PRAs as we would for internal events, HR -- you can list HRA as an area of uncertainty, but it's the same uncertainty that applies across the board.

MR. TRUE: It's a little bit different. I think Dennis is probably going to answer this, so I'll let him.

MR. HENNEKE: For the control room actions, even the local actions, those methods do work and they have uncertainty, but people have been able to apply with these factors.

What really is the key is the methods that are presently usable are not usable for control room evacuation, either a functional failure or evacuation to the smoke. And there is a lot of discussion about how operators are not willing to leave this. I'll never leave, all that kind of stuff.

So right now, the methodology, basically, gives you a .1 for control room evacuation using shutdown panel or a 1.0 if you have functional failures of your primary systems. There's no HRA involved in that. It's a point estimate of a screen evaluation and that's what is being used out there.

CHAIRMAN STETKAR: Okay.

MR. HENNEKE: Roughly speaking, that's about 10 percent of the core damage for an average PRA.

CHAIRMAN STETKAR: Okay. That's an interesting insight.

MR. HENNEKE: So it's really that control room evacuation where HRA is key.

CHAIRMAN STETKAR: Okay. But you are saying that people aren't really doing, what I would consider, an HRA for that, they are simply assigning under some conditions, taking no credit for controlling an alternate location. In another case, saying there is a .1 failure, right?

MR. HENNEKE: Simply because if you use Swain and Guttman or any other method, it doesn't apply. You can't really easily use it, because it's not a matter of 10^{-3} for turning the control room switch the wrong way.

CHAIRMAN STETKAR: Yes.

MR. HENNEKE: It's making decision of when the smoke is too much.

CHAIRMAN STETKAR: Yes.

MR. HENNEKE: When you have to leave. When you have had enough functional failures that tell you to leave, you know, what is their training? That kind of stuff. So it's a different thing than any of the HRA methods can do.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Thanks, Dennis. Okay.

MS. COOPER: Susan Cooper, NRC Office of Research.

MR. TRUE: Yes.

MS. COOPER: I don't know what John is going to want to hear in December, but I guess based on what Dennis just said, I would be very interested, as part of the Joint EPRI/NRC Team that has been developing the Fire HRA Guidelines, to hear more about this, because at least so far as the industry folks that have been on the team, the feedback I have heard is that this was not an important issue.

So I would like clarification.

CHAIRMAN STETKAR: Susan, I agree with you. You know, we could spend probably a week of Subcommittee meetings on anything that anybody could put up on a bullet in terms of fire analysis.

What I'm trying to do for, at least the December Subcommittee meeting -- because we are, indeed, goal-driven here on the ACRS and our goal is to submit a report to the Commission by the end of February, with that goal in mind, what I'm trying to do is to understand a bit more about what are the important issues that we really do want to talk about in December?

Right now, you have mentioned HRA. I now understand a little bit more that HRA, in particular, for control room evacuation may be an issue. I'm not yet sure where that issue fits into the grand scheme of all of the issues that we have been hearing about, whether it merits, you know, further detailed discussion in December or not. It's on the list. It's not off the list, but I understand a lot more than I did 10 minutes ago about what it is.

MR. TRUE: All right.

CHAIRMAN STETKAR: Thanks.

MR. TRUE: Okay. The last one, PRA model advancement. This is tying in of the PRA model to the damage. And one of the things which we have recently been discussing is the fact that, basically, every fire is assumed to lead to a plant shutdown of some kind, a plant -- either a controlled shutdown or a reactor trip. It's basically an assumption. It's not mechanistically-driven in the method.

And if you look at the real events, a large number of them don't lead to plant shutdown. And this may be an area where like the diesel generator fire, for example, if we burn the diesel up, we assume we trip the -- we have to trip the plant, it creates a probability we lose off-site power. It creates a demand for the diesel we just burned up.

When the case, that's not really what is happening at all in the fires that we have seen. So there is a connection there that may merit some additional evaluation. It could be significant in certain areas. There are other areas where the fire doesn't really cause it.

CHAIRMAN STETKAR: Okay. In my experience, that hasn't ever been a real issue.

Typically, the areas of the plant that are troublesome, it's relatively clear you are going to get some sort of transient event.

MR. TRUE: I think that's less clear now.

CHAIRMAN STETKAR: Is it?

MR. TRUE: Yes.

CHAIRMAN STETKAR: Okay. Okay.

MR. TRUE: Well, I wouldn't say -- I mean, I'm not saying that those areas aren't also there and unimportant. But I think it is --

CHAIRMAN STETKAR: Do you see contributions for --

MR. TRUE: -- this is a little on where you get this disconnect, you know, of are we being too conservative by assuming that is going to cause a problem?

CHAIRMAN STETKAR: Well, no, no. I understand that.

MR. TRUE: Oh, okay.

CHAIRMAN STETKAR: It's just in practice how much of the overall results are being driven by that, in some cases, an artificial assumption of a plant trip given a fire in this particular location? Because in many cases, if the location is relatively benign, it doesn't make any difference whether you have a plant trip or not. Do you know what I mean?

MR. TRUE: There is that --

CHAIRMAN STETKAR: The conditional core damage probability is relatively -- well, it would be a lot lower if you didn't have the plant trip.

MR. TRUE: Right. I'm not going to go through these, because we have already hit them multiple times as we have gone through it. This is kind of our summary of those three points that Jim and I set out to make and then kind of tried to reiterate some of the inputs to here.

And we think there are a lot of areas where expedited research is needed and this is where I was going to hand off to Rick, but I guess that is going to be after lunch.

CHAIRMAN STETKAR: Yes, that will be after lunch.

MR. TRUE: All right.

MR. WACHOWIAK: We're not too far behind.

CHAIRMAN STETKAR: Hum?

MR. WACHOWIAK: We're not too far behind.

CHAIRMAN STETKAR: We're not, don't worry. Doug did a heroic job. I'm really impressed. Thanks. Any questions from Subcommittee Members?

If not, we will recess for lunch. And

here, I'm going to be kind of a jerk. I'm going to bring us back at 1:00.

MR. TRUE: I think that's fine.

(Whereupon, the meeting was recessed at 12:12 p.m. to reconvene at 1:02 p.m. this same day.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

1:02 p.m.

CHAIRMAN STETKAR: We're a little bit behind schedule. Some heroic efforts have been made to see if they can bring us back on. Finish up I guess with Rick Wachowiak's presentation from EPRI and Tom Basso from NEI, and then bring the staff up as soon as we can.

MR. WACHOWIAK: Okay. Thank you. I'm Rick Wachowiak from EPRI and I am the project manager for the Fire PRA Program at EPRI.

And we've heard a little bit this morning about some of the issues that we're having with the Fire PRAs. And we want to let you know that there are things going on to resolve some of these, and my presentation is focused on what is it that we're doing to address some of these areas.

If any of you may have seen in the past the Fire PRA Action Plan or the Action Matrix, I think it was mentioned earlier today, it was initiated late 2009 to try to tabulate and make specific the things that we need to work on to address some of these issues. And it's a living document. It's being updated as new issues are identified and as other issues are being closed.

We have various organizations that lead the different activities, so some of it's EPRI, some of it's NEI. We've got the owner's groups involved. And to be comprehensive the matrix includes activities that the NRC is doing and that dovetails in with the work that we're doing in the industry.

For example, the DC circuit testing that's ongoing right now is one of those activities that's done that way.

As Doug mentioned, we're writing a paper, a road map to identify what the issues are and it aligns with the matrix. And as a matter of fact, when you get the road map you'll also have a copy of the matrix that goes along with it.

Our organization reports to NSIAC. We have an executive oversight committee and I'll show, you know, the type of people involved and who's involved with this. And we're coordinated through NEI.

I think we tried to make the point most of the day that if a Fire PRA is biased, it can mask important events and it can ultimately lead to making the wrong decisions. And sometimes it's changes that are made that don't improve safety. And in some of the evaluation of comparative risk-type events we may come to the wrong conclusion.

So our focus is to increase the level of realism to the extent that we can so we can support risk-informed applications to really get rid of the large departures from realism, get things back into the right order of magnitude, if you will, on some of these subsidiary or some of the intermediate metrics so that we have confidence in our PRAs.

Ultimately we'd like to have compatibility with the Internal Events PRA. That's a goal. Our matrix outlines those activities that we're doing to do that.

I said I was going to show the industry organization. NSIAC we've got our Executive Oversight Group. Includes executives from several of the utilities and we report to them frequently on what we're doing, and they're very interested in how we're proceeding and how it's going to help them solve their problems.

Over at the bottom, as I said, we have different leads that are running various projects. When I get to the next slide I think I have a few things that I can point out there. But it's the entire industry that's helping work with this. Some are led by EPRI, some are lead by the owner's groups, various activities.

So one box off to the side, the Technical Oversight Group, I think the question came about on what we were going to do instead of working on the FAQs, you know? So we had this FAQ process that we didn't think was quite appropriate for some of these new methods or things that weren't covered by the documentation in 6850. What we're trying to do through this process is develop methods or data or practices that can be used.

And then we have an industry expert team that is going through and looking at these things and critiquing and providing comments back. We'll call it a peer review of sorts for these methods. But ultimately we want to make sure that it's scrutable and that some of the questions; you know, why did you do it that way, those types of things are documented from this review process and make that available to those that need to review the methods and things that we're endorsing.

CHAIRMAN STETKAR: Rick, let me see if I understand that. This Technical Oversight and Peer Review Team, is the process that you're proposing is that for a particular issue, whatever it is, that the industry will develop a proposed methodology?

MR. WACHOWIAK: Yes.

CHAIRMAN STETKAR: And run it through, you know, this oversight committee, let's say, and then submit that to the staff for concurrence, or is this a wholly -- I'm trying to understand how this closes the loop in terms of staff confidence that indeed the method can be applied from whatever's being submitted to them.

MR. WACHOWIAK: Right.

CHAIRMAN STETKAR: Or is it just you're just going to do it and float it out there and let them look at the submittal?

WACHOWIAK: No, what we would like to do ultimately is figure out how in that oversight and review team, how the NRC fits in in that portion of the process.

CHAIRMAN STETKAR: Okay. And that hasn't been done yet?

MR. WACHOWIAK: We don't have that worked out yet.

CHAIRMAN STETKAR: Okay.

MR. WACHOWIAK: In the DC circuit testing, we have a combined expert review panel that's working right now. That's one of the things that we're doing.

In the heat release rate reports, we're doing it on our own and as soon as we're happy with that, we'll be bringing the NRC in to take a look at some of this. On the Fire Events Data Base side, that was divided up into chunks and some of the original methods were worked with the NRC and approved before they took the next step.

So we're trying to find the most efficient way to do this, but we don't have that answer yet.

CHAIRMAN STETKAR: Okay. Thanks.

MR. WACHOWIAK: And that's just an example of some of the people that are on the current review team for some of the projects that we've got going on right now. That list will change depending on what it is that we're specifically looking at.

So I mentioned the action matrix. So if anybody can read anything that's on there, great. It covers everything that Doug talked about this morning. So we're done. No.

What I'm trying to show here is that we have the matrix. It's broken. It covers approximately three years, spills into the fourth year for the horizon that we're looking at right now. We do have specific activities that are on there. And as you could see from the presentation this morning they're broken up into the category one-type events, the initiating event-sort of things. And then the next category is the fire modeling heat release rate-sort of things. And then the implementation and the PRA things. And then that fourth category is our ongoing activities such as training and standards development. And also this review of methods has also been down in the bottom.

MEMBER ABDEL-KHALIK: Now, let me ask you a big picture question.

MR. WACHOWIAK: Okay.

MEMBER ABDEL-KHALIK: What drove you into this; you know, we heard many examples this morning, is that the predictions are inconsistent with actual data, right? And you said that if we were within the same order of magnitude, we wouldn't have gone that route.

MR. WACHOWIAK: Yes, looking it that way. If we thought that the predictions were accurate, we probably would not be going through as many of the different activities here and trying to refine things quite as much. It would be good enough. It would be good enough.

MEMBER ABDEL-KHALIK: I'm trying to get to the point of when would you stop? When do you know that you've got this right? Okay?

CHAIRMAN STETKAR: That's a good question.

MR. CANAVAN: My answer is usually a little flippant to that, which is right after we finish internal events, which we're still working on. But the majority of the matrix activities, the things we think that really impact results and consistency, according to the schedule, is in 2014 for the known items. So I think we have a schedule that leads us through mid-2014.

MEMBER ABDEL-KHALIK: But I'm not worried about a schedule. Okay?

MR. CANAVAN: Right.

MEMBER ABDEL-KHALIK: But my question doesn't really pertain to schedule.

MR. CANAVAN: When do you know?

MEMBER ABDEL-KHALIK: Right. When do you know and --

MR. CANAVAN: Where is our monitoring in feedback loop in this process?

MEMBER ABDEL-KHALIK: And if I were to just use your qualitative assessment, if you're within the same order of magnitude would that alleviate your primary concern that the Fire PRA may be biased and can mask important events if you are within an order of magnitude?

MR. WACHOWIAK: Of --

MEMBER ABDEL-KHALIK: How close --

MR. WACHOWIAK: -- the experience? How close do we need to be?

MEMBER ABDEL-KHALIK: Right, in order --

MR. WACHOWIAK: That's --

MEMBER ABDEL-KHALIK: -- to alleviate that concern.

MR. WACHOWIAK: That's a good first cut at looking at this. Industry-wide, when we're close on some of these intermediate things that we can measure, you know, things that we could see some of or maybe have seen some of and that we would predict on the same order of magnitude, that's the first place to start looking. But remember from Doug's chart that there are individual plants that have individual problems. So if five plants have one problem and nobody else has it, well for those five plants that's still a big deal that may need to be addressed.

So as a first cut we're getting close when we can say that the predictions made with the Fire PRAs are in the ballpark for where we're going. But we still have to look at the individual outliers for the individual plants and see if there are outliers there.

So I think what we eventually will do with this is we've got some of the things that we know now, okay, the data base, which I'll talk about a little bit more in a minute, we know now. We know what we need to do to extract frequencies from that. We have some other things on heat release rates, so for electrical cabinets. We have a process that we're going through for that.

And I think what would be nice to come out of this is we have our big hitter that are generic-type examples and that it leaves behind it a process that others can use in more of an individual style to attack things that are important for a handful of plants but maybe are not important across the board. And I think if we can do that, leave some sort of a process that's repeatable and scrutable and acceptable then we would have done what we tried to accomplish.

MEMBER ABDEL-KHALIK: I guess I haven't heard the answer to my question, but other than, you know, we'll know when we get there.

MR. WACHOWIAK: At this point it's we'll know when we get there.

MEMBER ABDEL-KHALIK: Okay.

MR. WACHOWIAK: All right. The intent of

this was to show that we do have a multitude of activities here and they are laid out in a schedule. What tends to be in this is the activities that are early on and ongoing right now are associated mostly with the things that were in the ridge, the electrical cabinet sorts of things. So that's what we're focusing on now there, and on the data base. The data base is key to understanding all of this.

So I broke out from the matrix the first activity, which is the Fire Events Data Base. We worked with the NRC early on to determine are the fields that need to be collected in this data base. How do we categorize things within the data base? And a report was produced a while back that said, okay, this is what the data base is going to look like, and this is how we're going to gather the data, and this is how we're going to make sure that the data is complete this time. That's activity 1.1.1. We've moved into the next activity, which is where we went out to all the plants and requested information from the plants so that we can get started populating this.

The great thing here is we've had 100 percent response from the industry. The industry thinks this is very important and they're working with us to make sure that we have a complete data base here.

MEMBER ABDEL-KHALIK: Again, you know, I asked the question earlier about roving fire watches.

MR. WACHOWIAK: Yes.

MEMBER ABDEL-KHALIK: And you indicated that the data would designate when a fire was observed by one of those fire watches and what the state of the fire was. But ultimately the goal of the licensees is to eliminate these --

MR. WACHOWIAK: Right.

MEMBER ABDEL-KHALIK: -- roving fire watches. And the question then is would whatever data you collect be applicable to the end state where the plants are going to be?

MR. CANAVAN: Yes. I think it's a different question that you're asking. So for example, you'll be able to tell from the data, you'll be able to interrogate how detection occurred. There is a field for detection and it will be automatic, manual, person in the field.

Right now we don't credit manual fire watch. It doesn't affect the frequency. It doesn't affect the occurrence of fires. We could get 100 fire watchers, put them in the plant, nothing changes.

MEMBER ABDEL-KHALIK: But in the end if

people eliminate these --

MR. CANAVAN: Right.

MEMBER ABDEL-KHALIK: -- roving fire, you will not have that avenue for detection.

MR. CANAVAN: True.

MEMBER ABDEL-KHALIK: And yet the data reflects --

MR. CANAVAN: Yes.

MEMBER ABDEL-KHALIK: -- the fact that many of these fires are actually detected by people walking around the plants because that's their job.

MR. WACHOWIAK: Now let me just be clear on how we're doing some of this. The data that's going to be coded into the data base are not only the fires that have progressed into the fire state. The things that could progress into the fire state but were stopped short of that, my understanding is those are in the data base. They're just not counted against the frequencies that are generated out of the data base.

So I think what Ken was saying is if you went back into the data base when we were done and interrogated what credit did we get for these roving fire watches; maybe it's just fire watches in general, but if you could break it down from that, then what you could say is the data now -- the frequencies now contain this much credit for that. And if I'm going to eliminate a fire watch, you would have to add a factor to bump that up.

MEMBER ABDEL-KHALIK: Or the other way?

MR. WACHOWIAK: Or the other way. If you were adding, you could bring it down.

MR. CANAVAN: So I guess my point would be we want the model to reflect what factors affect the model. So you have to have them in there so that if you were to, for example, come up with a situation where you have a multi-million dollar mod, you're choosing not to do because you can augment the fire watch and maybe not need to do that. There would be some kind of way to figure out, well, what credit do you get for a fire watch versus a modification versus other alternatives? And so the point would be to be able to assess all of the factors in some way that affect either fire ignitions, growth propagations down the road. Have the model have some fidelity so it has more usefulness.

MR. WACHOWIAK: So to get back to one of the questions from earlier on the diesel generator information, how was this coded? How was this put together? That data base basically started with a pile of information and they tried to put it into a data base format that could generate frequencies. Here we're starting with what information do we need to perform these analyses? The first cut is to go and find out how many records we need to ask from the industry. So that was the first cut. We said do a keyword search of your corrective action data base. Find anything that might remotely be associated with fire, smoke, any of these things. We'll go through and find the ones that say, yes, this looks like it's a fire event.

Then we're going to ask you for your entire record of that event. We take that, put it into the data base and, you know, there have been some other presentations on this at other forums, but the way the data base is set up is it then tells you, okay, here's the missing information. And before you can close that record out in the data base, we have to get the information from the plants to fill the entire data base out.

So the indeterminate events shouldn't be there anymore. The things that the data base is intended to generate frequencies or insights for, all those fields are there and all the fields that are necessary to generate that information must be input.

So it's a long process, but we're in the stage now where we've got the information, the initial screening has been done for some of the plants and now we're getting the corrective action reports from the plants and populating the data base. At some point now, we think it's going to be within the next couple of quarters, we'll bring NRC in. I think I sent a proposal out to J.S. earlier last week, late last week explaining how we'd like them to come in and take a look at what we're doing. So they had agreed on what goes into the data base up front. We're populating it. We would like them to have confidence by looking at how we're populating it. Take a look at some of the records. Are we doing this right? And we'll see how we go forward from that point on.

The last thing that I want to mention on here is when we get the data from -- is it 2000 to 2009?

MR. CANAVAN: Yes, 1999 to 2009.

MR. WACHOWIAK: 1999 to 2009. When that data's in, that's not the end. The plan is to take this forward. We're working with INPO to have an ongoing data collection process that will keep this data base up to date and fully populated.

CHAIRMAN STETKAR: Rick, when you were

talking you just mentioned something that kind of piqued my curiosity. This enhanced data base that you're developing, how far back into history does it go? Back to day one at each plant?

MR. WACHOWIAK: 1999.

CHAIRMAN STETKAR: 1999? You're artificially restricting it to --

MR. WACHOWIAK: No, we have other information from the --

CHAIRMAN STETKAR: -- 10 years of data, 12 years of data? I mean, that would be troublesome, I think.

MR. MAYS: I'm Steve Mays from ERIN Engineering and I'm doing the data base work, so the request for information from the plants went from the 2000 to 2009 period for the CR searches. But we're including in the data base all of the events from the previous Fire Event Data Base from 1990 through 1999 that were either challenging events or undetermined events. So those will be pulled forward into the data base as well.

CHAIRMAN STETKAR: That's still only 20 years. My question is --

MR. MAYS: It is 20 years worth of information, yes.

CHAIRMAN STETKAR: My question is why don't we go back through day one at each of the plants to understand what fires have happened?

MR. MAY: Well --

CHAIRMAN STETKAR: Fires are not something that happens at the problem plants every day.

MR. MAY: Well, you're right. The problem is documentation and ability to get information from those. Plus the study that was done in the EPRI report that updated the frequencies did a study of the fire frequencies as a function of time showed that the pre-1990 period was in a different population, so we're basically gathering data from the current time period because that's when the data analysis suggests is appropriate.

CHAIRMAN STETKAR: I saw that study and I had some questions about where the arbitrary lines were drawn in terms of where the inflection points were.

I hearken back to an EPRI effort back in the 1980s to prove that indeed losses of off-site power were reducing year by year by year until they increased over two or three years. Then people changed the statistics and the way they counted things. And then people stopped doing that trending analysis only because there indeed are site to site and year to year variability in these rare events. It's not something that happens everyday, you know? So discarding something on the order of let's say 15 years of industry operating experience from the middle '70s or 10 years back to 1980 when we changed a lot of the fire protection requirements strikes me as being a bit curious.

MR. MAY: Well the data, it's not being discarded. If you recall the update that was done used the already generated frequencies from that thing in a two-stage process as a prior.

CHAIRMAN STETKAR: I understand that, but they're restricted by the bins and the information that you had available. So you're proposing here a complete restructuring of that binning process --

MR. MAY: Well, we have --

CHAIRMAN STETKAR: -- by component type and essentially by severity or detection time and things like that, however it's --

MR. MAY: And you don't have that information for those old events. Well, we'll have the information back as far as 1990. But to the extent that we don't have the information beyond that, that limits what you can potentially do with rearranging binning from a statistical standpoint.

MR. CANAVAN: And I'd also be careful on referring to them as rare though, because the events in the data base indeed aren't rare. There's 2,800 events in the data base right now and we're collecting another several thousand events. So we're not really rare. The big ones that we had, Browns Ferry, a generator exploded or a fire occurred, they might be something we want to go back and see.

CHAIRMAN STETKAR: I'm just trying to insert the sense that you're trying to reduce uncertainty in the generic data and try to make that generic -- increase the confidence in those frequencies by defining a larger number of fire events bins, if you want to call them that, and trying to develop more information about, you know, detection time, severity of the fire and things like that. I think that's all really, really good.

On the other hand, at times we've learned that by restricting the time scale of your data base, if indeed there are rare events that we're talking about, you can actually increase the uncertainty. You know, having one event, you know, at one plant, period, with a total exposure period of 20 calendar years for all of the plants indeed can insert higher uncertainty than having one event at one plant over a total industry experience of 30 or 35 years, in a bayesian sense.

MR. CANAVAN: I think I understand where you're headed, and I think we can look at the older data and make sure we're not missing any nuggets of information that are important to keep and to retain maybe not as a prior. So for example, if we look at a bin and we find out a cabinet went on fire in 1978 and it was a true real cabinet fire, we don't want to throw that out. I understand that. But if you look back at some of that data into the '60s and '70s --

CHAIRMAN STETKAR: No, no, no. No, I understand the limitations.

MR. CANAVAN: -- you just can't get there.

CHAIRMAN STETKAR: Right.

MR. CANAVAN: And so I think including it -- but I understand --

CHAIRMAN STETKAR: There might be creative ways to treat that earlier experience.

MR. CANAVAN: I agree, to take a look and see what we can see.

CHAIRMAN STETKAR: We can talk more about this in December.

MR. CANAVAN: Right.

CHAIRMAN STETKAR: We're obviously going to talk about and put it on your hit list, you know, data base in December.

MR. HYSLOP: Yes, the FAQ-048 -- J.S. Hyslop -- researched, part of the purpose said that we needed to do more research and collect more data, and that was also to verify the trend, at 1990 to confirm that the trend existed. And the trend itself is what established the treatment of the old data versus the new.

PARTICIPANT: Right. Thanks.

MR. WACHOWIAK: Okay. I'm going to move on. Conclusion for my portion, once again I just want to let you know that we are doing things about what we've been talking about all morning. We're focused on increasing the realism. We think that the data base is one important piece of it and some of these other methods that we're looking at especially with the heat release rates in the cabinets. That's another thing that we're focusing on.

We've been working with NRC on several of these tasks. I listed a few there where we've worked together under a Memorandum of Understanding that EPRI and the NRC has to share data or some of these activities. And once again, we have a road map report. It's going to include the matrix and all the activities and the current status of those activities. It will be provided as Biff said in the upcoming weeks. And that will set us up for the December meeting.

CHAIRMAN STETKAR: Rick, I want to make sure I understand a little bit of what you said. On this sort of summary and conclusion slide you've highlighted three specific areas where you're working with RES on the Fire Event Data Base, the DC testing and Fire HRA, and we discussed all of those to a greater or lesser extent this morning.

You mentioned orally the heat release rates, although that for whatever reason didn't make the --

MR. WACHOWIAK: We haven't figured out how we're engaging the NRC on the heat release rates yet. I picked these three because these are the three that really are --

CHAIRMAN STETKAR: Those are your --

MR. WACHOWIAK: -- those are the ones that have activities right now.

CHAIRMAN STETKAR: Right. And I'll come back to challenge you that we've heard a lot about the fire events and the binning of the events and the credibility of the events. We heard a little bit about DC testing and that it may be an important contributor to risk at a number of plants. We heard a little bit about the HRA. That didn't seem to be as important.

The question is; I recognize you have ongoing projects with RES, are all of these equally important to solving the problems of me if I'm doing my fire PRA today?

MR. WACHOWIAK: Yes, I think the Fire HRA is an activity that was --

CHAIRMAN STETKAR: It's been going on for awhile.

MR. WACHOWIAK: The report is winding down right now. That's going to publication. I picked these because these were the things that are happening today.

CHAIRMAN STETKAR: Okay. Understand.

MR. WACHOWIAK: We know we need to engage the NRC on the heat release rates.

CHAIRMAN STETKAR: But you haven't?

MR. WACHOWIAK: But we haven't done that yet.

CHAIRMAN STETKAR: Okay.

MR. WACHOWIAK: And the intent is to do

that and once we figure out what we want to say to the NRC. We've got to get to that point.

CHAIRMAN STETKAR: Okay.

MEMBER ABDEL-KHALIK: How much experimental work is involved in Action Matrix?

MR. WACHOWIAK: Experimental work? When you take a look at the full expanded, you'll see several testing activities that are in there. Most of those are the activities that the NRC is sponsoring. I don't think we have any independent testing activities in the --

MR. CANAVAN: Incipient detection is the only one that's planned and we were hoping that that would be a joint effort between us and the NRC. That's the only physical testing schedule that we have currently.

MR. WACHOWIAK: And remember, this is the Fire PRA Action Matrix. And as Doug mentioned earlier, it's hard to set up PRA tests. You know, you have fire tests and fire modeling tests and things like that.

CHAIRMAN STETKAR: That's true, but I mean if the staff can set them up, you guys could set them up, too.

MR. WACHOWIAK: I'm through. Want me to

find your --

CHAIRMAN STETKAR: Thank you. Any more questions for EPRI, because I think as I understand it, Tom's going to come back and talk now about important related but slightly different issues.

(No audible response.)

MR. BASSO: Thank you. Good afternoon. My name's Tom Basso from NEI. Do want to apologize, the handouts are from an earlier presentation, so I did update the presentation that's on the screens.

I do want to first start by saying though, you know, that the industry and staff have worked extensively to successfully resolve a lot of technical and process issues, you know, in transitioning the pilot plants and implementing 805. However, this has come about with the commitment and application of, you know, significant effort, you know, by the industry and by the staff. And I believe an outcome of this assessment and looking at some of the impacts to the transition could at least maybe arrest some of the expansion of the required transition efforts or bring them more towards the originally expected efforts.

I do want to say that an incremental increase in the requirements of expectations at this time from the pilot submittals or reviews can have significant schedule and financial impacts to remaining non-pilot stations, and I'll go through some of the examples. So we really want to get to a predictable and a stable environment in order for the non-pilots to transition effectively.

Go to slide two, please. As I did mention, significant effort and resources have been applied to developing the requirements and guidance for the NFPA transition, however, recent issues with potential impacts to 805 transition, you know, have come to light. The most significant one is the expectation to demonstrate safe and stable for indefinite period. And I'm going to go into some detail on that particular example.

That also will highlight some of the other issues, including deferral of resolutions of pilot issues by issuing implementation actions, you know, or licensing conditions. And also, one of the other issues is the request for additional technical justification for licensees to retain continued acceptance of pre-transitional licensing basis.

CHAIRMAN STETKAR: Tom, you going to give us some examples, specific examples of each of those?

MR. BASSO: Yes, I can give you specific examples towards the end.

CHAIRMAN STETKAR: Because it's a little difficult to understand. Thanks.

MR. BASSO: Well this first example highlights the first two bullets. And, you know, 805 defines safe and stable, you know, specifically as the ability to maintain sub-criticality with reactor coolant temperature at or below hot shutdown for BWRs and hot standby for PWRs. And with the definition of safe and stable in mind, one of the nuclear safety goals in 805 is to provide reasonable assurance that any fire during any operation mode plant configuration would not prevent the plant from achieving and maintaining fuel in a safe and stable condition. So I really highlighted the reasonable assurance, so keep that in mind.

Next slide, please? If you look at the Harris safety evaluation, you know, per their safety evaluation the licensing basis for Harris is to achieve and maintain safe and stable hot standby condition. However, they did have previous actions to be performed including actions and equipment to achieve cold shutdown. They retained those actions. The staff in their review found that the basis was acceptable because those actions are not required to meet the nuclear safety performance criteria, but they were defense in depth actions --

CHAIRMAN STETKAR: Tom, were those analyses done to support Appendix R-type?

MR. BASSO: Those were Appendix R actions.

CHAIRMAN STETKAR: Okay. Okay.

MR. BASSO: That's correct.

CHAIRMAN STETKAR: Okay.

MR. BASSO: Okay. Oconee proposed in their LER that the unit may remain in hot standby for the event and safe and stable condition would be deemed fulfilled if achieved for 72 hours. So they established a 72-hour criteria.

The licensee deemed such a time period to be sufficient to provide assurance that the performance criteria of 805 were maintained, and that included the nuclear safety goal of reasonable assurance.

Oconee did receive an RAI on their position of safe and stable. And as shown there, the RAI, it was requested that the licensee should be expected to demonstrate that safe and stable conditions be maintained indefinitely.

So, you know, although 805 doesn't specifically define the time period for safe and stable, indefinite is neither found explicitly or implicitly, you know, in the rule or guidelines regarding safe and stable. You know, additionally the expectation, you know, to demonstrate the safe and stable conditions can be maintained indefinitely, you know, doesn't align with the nuclear safety goal to provide reasonable assurance.

CHAIRMAN STETKAR: So if I can understand this; thanks for the examples, that this concept of safe and stable is essentially, if I translated it into PRA speak, the long-term success criteria for my PRA?

MR. BASSO: That would be correct.

CHAIRMAN STETKAR: Okay.

MR. BASSO: Yes.

CHAIRMAN STETKAR: And there's still consternation among the industry and apparently questions being asked by the staff regarding what that success state is?

MR. BASSO: Yes. I know there was some discussion as to a 24-hour period, because that's the way the --

CHAIRMAN STETKAR: No. Yes, that's --

MR. BASSO: -- risk models are run and what Harris, or I mean Oconee came in with was 72 hours.

CHAIRMAN STETKAR: Okay. Interesting. Now, I understand the concern.

MR. BASSO: Okay.

CHAIRMAN STETKAR: Yes.

MR. BASSO: Next slide? So just some of the impacts that this recent treatment of safe and stable has is, you know, Oconee's now going to have to reanalyze all the components and cables associated with going to and maintaining hot shutdown.

CHAIRMAN STETKAR: Yes, let me interrupt you there, because I'm trying to make notes here. You're saying Oconee is reanalyzing all components going to hot shutdown for the specific purpose of confirming that they can maintain those conditions indefinitely?

MR. BASSO: I'm not going to say that they're doing it for indefinite period, but that's -- you know, I haven't seen --

CHAIRMAN STETKAR: But they are actually making an effort to reevaluate things rather than -- does that imply that they weren't successful in convincing the staff on the RAI response that 72 hours was acceptable?

MR. BASSO: That's correct. I haven't seen the --

CHAIRMAN STETKAR: By the way, we have --

MR. BASSO: The final RAI response has not been published.

CHAIRMAN STETKAR: For your information, as far as what we've seen as a subcommittee, we have access to the Harris safety evaluation.

MR. BASSO: Yes.

CHAIRMAN STETKAR: I haven't and I don't think any of the other subcommittee members has seen anything on Oconee because it hasn't been released yet from the staff.

MR. BASSO: Right.

CHAIRMAN STETKAR: So that's a bit of my question, you know, to you on Oconee because --

MR. BASSO: Right. And I've not seen the file either.

CHAIRMAN STETKAR: Okay.

MR. BASSO: And I'm not sure if it's going in as an implementing action or it's going to be a license condition. I don't know that.

CHAIRMAN STETKAR: But the fact of the matter is Oconee is doing reanalysis work --

MR. BASSO: Yes.

CHAIRMAN STETKAR: -- as a result of that concern.

MR. BASSO: Right.

CHAIRMAN STETKAR: Thank you.

MR. BASSO: Yes. Now, for the non-pilots, you know, they've aligned their evaluations to support their licensing applications, you know, with the pilot process and specifically with Oconee, because Oconee being the last pilot, a lot of the changes implemented from Harris were factored into Oconee's LER. So a lot of the non-pilots really modeled their evaluations after that. So with this treatment, you know, they're going to have to make changes, and in some cases extensive analysis. And at this late time in the process it's going to challenge some of them meeting the June 2011 date, particularly those stations that have to analyze the cold shutdown. So some of them may have to go down to cold shutdown for this.

CHAIRMAN STETKAR: Because of the indefinite nature of that implication?

MR. BASSO: Yes, because they may not be able to show that they can stay in a hot shutdown.

CHAIRMAN STETKAR: For some period of time?

MR. BASSO: For some period of time.

CHAIRMAN STETKAR: Okay.

MR. BASSO: Yes.

CHAIRMAN STETKAR: Thank you.

MR. BASSO: So, you know, thinking of one of the perceived benefits of 805 from the onset and its development and rulemaking was with the risk-informed performance-based standard. The need to transition to cold shutdown was no longer a specific requirement and that achieving a safe and stable state would provide benefit to the licensees in the form of flexibility and meeting the rule. You know, that's potentially no longer the case for a number of the stations. And, you know, with the transition you expect to get some reductions in operating and training and maintenance costs. You know, this latest treatment in fact will drive some of the plants to be more -- could be more restrictive in Appendix R.

CHAIRMAN STETKAR: Do you have a sense, Tom -- this again is putting you on the spot, so you can say you don't know. This honestly, the reason I've asked a few questions, is the first time I've heard about this notion of this particular issue, the appropriate stable end state as being a significant issue. And I've seen words about it, but I didn't get the sense that it was as important as your presentation seems to indicate. And that last bullet on this slide it says that this might drive plants to more restrictive conditions in Appendix R, which obviously, you know, if I'm a plant decision maker and I look at the expense of doing a PRA and if it might indeed impose more restrictive conditions than what I think I might be able to achieve at a lower cost, I'm not going to do it.

Do you have a sense of what fraction of the industry might be driven away just on the basis of this issue, the uncertainty of what a stable end state is? Is it a significant issue in the industry, or is it more of a contributing uncertainty?

MR. BASSO: I think it could be a significant issue for those who might be thinking about ultimately transitioning to 805.

CHAIRMAN STETKAR: Okay.

MR. BASSO: I think those that are already in the process, they're so deep in the process at this point.

CHAIRMAN STETKAR: Yes, this is just more --

MR. BASSO: It's just going to be more work.

CHAIRMAN STETKAR: More work like Oconee. Okay.

MR. BASSO: And it could delay them in getting their submittals in in June.

CHAIRMAN STETKAR: Yes. Yes. But you think it's important enough that it might tilt the balance on a plant-specific basis for committing in the future?

MR. BASSO: I believe so.

CHAIRMAN STETKAR: Okay.

MR. BASSO: This was the number one issue when we had, you know, an industry call, you know, recently on concerns with the non-pilots.

CHAIRMAN STETKAR: Oh.

MEMBER ABDEL-KHALIK: Even if they know clearly what the definition of safe and stable might be that would affect people's decision in the future?

MR. BASSO: They would have to factor that into their cost benefit of transitioning and whether or not -- if it doesn't add the benefits of not having to go to cold shutdown, you know, it's just going to be a major factor in that.

MEMBER ABDEL-KHALIK: Good.

MR. BASSO: Okay. Next slide? Okay. So and I'll give you just maybe one other example. So at this point we're near completion of the pilots. In development of the non-pilots, you know, it's critical that we consistently apply the regulatory and issued criteria and guidelines. As I mentioned, any changes to requirements to a final review creates an instability and could significantly impact non-pilots since their analysis -- it really mimics, you know, the pilot plants.

Uncertainties for non-pilots have been created by deferring the resolution of some pilot issues by issuing implementation actions or licensing conditions. With the delay of resolutions, non-pilot stations will have to apply the guidance that they interpret to their specific situation without insights from the pilot process.

CHAIRMAN STETKAR: You have an example of that?

MR. BASSO: I'll give you one. One example is there were questions about Oconee's Fire PRA and the license condition that kind of closed or didn't really answer those questions yet was for Oconee to go and do a peer review of their Fire PRA. So some of the non-pilot plants that were waiting to see how some of those questions would be closed or resolved aren't going to have that before Oconee does their peer review, which I believe is scheduled for some time in the fall or later next year.

CHAIRMAN STETKAR: But the key is that it's issued as an implementation action or a license condition, so therefore the staff can write the safety evaluation report regardless of what the ultimate conclusion from that peer review is?

MR. BASSO: That's correct.

CHAIRMAN STETKAR: And it will then become -- I can ask the staff about what happens to it then. Thanks.

MR. BASSO: Okay. So really in closing, you know, although I don't have many recommendations for some of the issues that are license conditions or implementing actions, I think the resolution for safe and stable, you know, we can achieve that through our closure. We have an open FAQ-08-0054 that does have safe and stable, you know, in that. So we do have an opportunity to provide I would say better guidance or more definitive guidance on safe and stable there.

CHAIRMAN STETKAR: And that one's still open?

MR. BASSO: That one is still open. That's in FAQ --

CHAIRMAN STETKAR: Since it's 08, it's been open now for two years?

MR. BASSO: It's gone through a number of changes.

CHAIRMAN STETKAR: Okay.

MR. BASSO: Yes. So and I really can't over stress the need to attain, you know, a stable and predictable environment at this point in time in the process.

MR. MOULTON: This Charles Moulton, NRC staff, the frequently asked questions process owner. That FAQ-08-0054 has not been opened for two years with the staff. We received that this year. The numbering system is based on when the NEI task force first develops the question, not when it's submitted to the staff for review.

CHAIRMAN STETKAR: Thank you.

MR. MOULTON: So that has only been under review for a few months now, not a couple of years.

CHAIRMAN STETKAR: Thank you for clarifying that. That helps because I just go by the year issuance. Thanks.

PARTICIPANT: Was the time frame April?

MR. CANAVAN: April was the time frame.

CHAIRMAN STETKAR: April of 2010.

PARTICIPANT: Was it April it was submitted?

CHAIRMAN STETKAR: If this is an important issue, why did you wait for two years to finally send it up to the staff:

MR. CANAVAN: Well, I think 54 came out very late in the year. I was just looking at the number 54. That's probably pretty late in the year. So it's probably late '08, gone through --

CHAIRMAN STETKAR: Fine, I'll give you a year and three-quarters then.

MR. CANAVAN: No, then it gets submitted into the process with the staff and with the resolution. The resolution comes along with the FAQ.

CHAIRMAN STETKAR: That's not what I heard.

MR. BASSO: Yes, the issue about indefinite didn't come out until the third set of Harris RAIs.

CHAIRMAN STETKAR: Oh, okay. So second set, third set.

MR. BASSO: Oconee. I'm sorry.

CHAIRMAN STETKAR: Oconee?

MR. BASSO: So it didn't come out --

CHAIRMAN STETKAR: So are you saying that the uncertainty over what is actually interpreted as a long-term safe and stable state has evolved from whatever the original words are in FP-08-05 and

NUREG/CR 6850, but has evolved from Harris to Oconee to the current conditions? Am I hearing that we're less certain today than we were two years ago?

MR. BASSO: No, no. The words have changed. The position of what was accepted by the licensee has changed.

MEMBER ABDEL-KHALIK: I guess it wasn't the issue for Harris because they went to cold shutdown.

PARTICIPANT: No, they didn't.

MR. BASSO: No.

MEMBER ABDEL-KHALIK: They didn't?

MR. BASSO: They didn't go to cold shutdown. They had defense in depth actions that --

CHAIRMAN STETKAR: They didn't take credit for those actions. They simply mentioned -- they didn't take credit for them, as I understand it, in their submittal.

MR. BARRETT: Hold on.

CHAIRMAN STETKAR: They just mentioned them. Let me finish my erroneous interpretation.

MR. BARRETT: Yes.

CHAIRMAN STETKAR: Then you can correct me. I'm allowed to make mistakes. And then they credited those additional actions but only in their defense in depths nature, like to provide additional assurance for satisfying the defense in depth issues.

Now, you can correct me.

MR. BARRETT: Yes, the way the Harris safety evaluation was written and the way it was -- it based on the idea that they could maintain hot standby indefinitely. So while they were doing cold shutdown repairs or doing manual actions to get the cold shutdown systems returned to service, they could maintain hot standby and there was no time limit on how long they could do that. That's why the SE is written the way it is. It's that defense in depth actions really don't matter because they can maintain hot standby forever.

CHAIRMAN STETKAR: Okay.

MR. BARRETT: And that's the way the SE was written. And that's not really inconsistent with the way we asked Oconee. They said we've got a time limit of 72. And we said what do you do after 72 hours? And they couldn't tell us specifically as far as the way the RAIs were answered. So, you know, I mean, the rule says safe and stable and it doesn't have a time limit. So we're looking at it that you need to be able to show you maintain the reactor safe for whatever time you need.

CHAIRMAN STETKAR: At the moment I don't want to open up a debate. We're a little bit behind time. I don't want to open up a debate over Harris and Oconee versus Harris and Oconee primarily because it's sort or non-productive in this environment. And in particular, our committee has been told that we're to benefit from the lessons learned from Harris and Oconee. So understanding kind of the evolution of this issue of concern I think is important to us. There's nothing that our committee is going to recommend that will have any bearing whatsoever on the Harris or Oconee, you know, licensing application reviews or anything. So that's why I want to kind of stop a little bit of the discussion that I saw growing up here.

MR. BASSO: Yes, my point --

CHAIRMAN STETKAR: But it is a real --

MR. BASSO: -- in bringing it up is, you know, the non-pilots are facing now that issue.

CHAIRMAN STETKAR: And that is relevant to our activity here, so I appreciate that.

MEMBER ABDEL-KHALIK: For the record do we have copies of your revised slides?

MR. BASSO: I'll send them to you.

CHAIRMAN STETKAR: Make sure. Yes, we

have to put the change.

PARTICIPANT: It's actually on this computer.

MR. WACHOWIAK: Yes, it's actually on there. It's installed on the computer, so we can send you copies.

CHAIRMAN STETKAR: Tom, anything else?

MR. BASSO: That's all I have.

CHAIRMAN STETKAR: Any other subcommittee members have any questions for EPRI or NEI?

(No audible response.)

CHAIRMAN STETKAR: Nothing? We'll have a chance at the end.

Thank you. Thank you, thank you very much.

MR. BASSO: Thank you.

CHAIRMAN STETKAR: And thank you for really heroic efforts to partially get us back on schedule.

And with that, I guess we'll call the staff up. Mark?

MR. CUNNINGHAM: First of all, I'm Mark Cunningham from the Division of Risk Assessment in NRR. I'd like to thank the committee for the opportunity for us to give you an assessment of where we are with respect to the transition to NFPA 805.

Just by way of background, I got involved in this now just over three years ago when I came to NRR, and I think there were several things that all of us in the division have worked for over that three-year period, things like the reliability or the predictability of the process that we're using as these plants transition. We've always been interested in the issue of ensuring that the PRA that supports these 805 applications meets the intent of the PRA policy statement, particularly the realism of it. So we've done a lot of work over the last couple of years to develop regulatory guidance and a standard review plan, to develop inspection guidance and to use those and base those and learn from the pilot to pilot applications.

So I think we've made a lot of progress over the last few years in improving the predictability of it. I think we made progress too on the issue of the realism of the Fire PRAs, the 6850 Supplement 1 is an example of that. So I think we have a sense that we're in a good shape today to be able to move onto the non-pilots. I think we have a good situation with the two SEs that are coming out, have come out or are coming out. So you'll hear a lot more about that this afternoon from Donnie and from Alex.

We fully understand that there are issues that are still out there that could make things more predictable and the PRAs more reliable and more realistic. You'll hear from Mark Salley on what's going on in research in terms of that. So there are still issues that need to be resolved and still improvements that we could make, but I think we're in a good enough state now to be comfortable with moving on in a timely basis the application of 805 to the large number of non-pilots.

With that kind of introduction, I'll turn it over to Donnie and Alex for the gory detail.

MR. KLEIN: Thank you, Mark. Good afternoon. My name is Alex Klein. I'm the NRR Fire Protection Branch Chief and I've got in the audience with me several of my staff members who have been very involved in the reviews of these pilot plant license amendment requests.

You heard from Harry Barrett. You heard from Chuck Moulton. Harry, as you're aware was the lead reviewer for the Harris safety evaluation along with members from Donnie Harrison's group. And Chuck Moulton is the backup to the primary project manager for the Oconee SE. As you're aware, the Oconee SE is under development right now. That's why that lead person is not here today.

Anyways, if I could go to the objective slide. Really what I wanted to do here today is to just give you a flavor for what we did kind of for the pilot plants, the challenge ahead of us with respect to these large number of license amendment requests coming from the other plants. We call them the non-pilots, for lack of a better word at this point.

I'll touch upon the NFPA 805 infrastructure development that the staff has been working on along with the industry. You've heard a lot of that already today in terms of the FAQ process and the FAQs that we've worked on, and then some of the lessons learned.

Next slide, please? With respect to the Shearon Harris and Oconee transition to NFPA 805, I think you're all very well aware that we issued the safety evaluation for the Shearon Harris plant back in June of this year. But if you look back a little bit from that half year, I can take you back several years, actually maybe take you back a little bit more than that, NFPA 805 itself is a consensus standard. And by that I mean that we had different stakeholders involved through the National Fire Protection Association that led that effort to develop to NFPA 805. There were representatives from industry, insurance, government agencies such as the NRC and so forth. So all the major stakeholders were involved.

That was issued in 2001. Then in 2004 is when we actually issued the voluntary rule under 10 CFR 50.48(c). So about three years passed for us to go through that rulemaking. So that took us to 2004.

If you look at that top bullet, it was about one year later, almost exactly one year later that Shearon Harris came in with a license amendment request. And you'll see I'm not going chronologically, but there's a reason why I'm doing this. It's because, as I indicated, Harris is done at this point with their transition. So they submitted their license amendment request in 2005. Excuse me, they submitted their Letter of Intent in 2005. They submitted their license amendment request to transition in 2008. And then of course in 2010 is when we issued the safety evaluation.

Duke Energy actually preceded the Letter of Intent by Progress by about four months or so, that time frame. They submitted their license amendment request about the same time frame as Harris did. They submitted a revised license amendment request earlier this year, in the April time frame. You can see the dates up there for the major rounds of RAIs that the staff has issued to Oconee. And right now we have a tentative date to issue a safety evaluation in 2010 for the Oconee plant.

CHAIRMAN STETKAR: Alex?

MR. KLEIN: Yes?

CHAIRMAN STETKAR: In this forum is there -- can you give us a brief summary of the need? Why did Duke submit a revised license amendment request?

MR. KLEIN: Actually what I don't have in here, John, is I think Shearon Harris did the same thing.

CHAIRMAN STETKAR: Oh, did they?

MR. KLEIN: Yes.

CHAIRMAN STETKAR: Okay.

MR. KLEIN: And I don't recall the exact date.

CHAIRMAN STETKAR: Okay.

MR. KLEIN: But Shearon Harris also submitted --

CHAIRMAN STETKAR: (off microphone) the whole time line?

MR. KLEIN: Yes, I don't have the full

time line. Just for brevity it's --

CHAIRMAN STETKAR: Okay.

MR. KLEIN: That's why I -- because Harris is done, I figured that --

CHAIRMAN STETKAR: Yes, was --

MR. KLEIN: But there is no distinction there in terms of --

CHAIRMAN STETKAR: Okay. Thanks.

MR. KLEIN: -- what the two pilots did in terms of their license amendment requests.

CHAIRMAN STETKAR: Okay. I just wanted to understand if there was something unique to Duke that they had to, you know, jack up the roof and put a new house under it or something like that that Harris didn't need to do. Thanks.

MR. KLEIN: Okay. You're very well aware that about half the fleet is transitioning to NFPA 805. I've got some numbers up there. You're aware that of the non-pilots 47 units have sent in a Letter of Intent to adopt NFPA 805. We expect that most of these licensees, those 47 units, will submit their license amendment requests to us in 2011, calendar year 2011. There are some plants that will submit in 2012 only because they started the process later. Some of the multi-unit licensees staggered their start, their transition. One unit has not started their transition yet, although they've told us that they intend to do that, and that's the Perry plant. And one unit has withdrawn their transition to NFPA 805, and that's the Monticello plant.

Next slide, please? With respect to the infrastructure products, we talked a little bit about some of this, but what I wanted to let you know is that with respect to NFPA 805, when the rule was issued in 2004 approximately a year later the staff issued Regulatory Guide 1.205. And the staff worked with the industry. They put together their own guidance document under NEI 04-02 that was issued back in September of 2005.

The staff continued to work with the industry as we worked through the pilots, as we met with the pilots; and I'll give you some flavor of that a little bit later on. We understood the lessons learned. We took their frequently asked questions that had been closed out through our process and we worked with the industry to reissue Reg Guide 1.205. They worked on a reissuance of their own guidance, NEI 04-02. Issued that in December 2009. Excuse me, April of 2008. And then we issued our Reg Guide at the end of 2009. We came to the ACRS. I think you're very well aware of that change, of that new revision. At the same time, last year we also issued a Standard Review Plan for NFPA 805 plants.

You've heard talk about NUREG/CR 6850. I won't go into that in too much detail. September 2005 was the issuance date of that document. The Supplement 1 that some folks mentioned here today, that was issued just a couple of months ago, September of 2010. And what that supplement included, I believe, was something on the order of 15 frequently asked questions that were closed out by the staff in working with the industry. And I'll talk a little bit more about the FAQ process itself, at least my views on the FAQ process. The 15 or so FAQs that are included in Supplement 1, a lot of them had to do with how you count things in the plant. Some had to do with probabilities and a couple of them had to do with fire modeling.

The frequently asked questions process, I'll talk separately about that in a little bit.

The staff is also working on an NFPA 805 inspection procedure.

CHAIRMAN STETKAR: Alex, I know you're going into the frequently asked questions in a little more detail, but how does the staff and the industry interpret a closed frequently asked question? So for example, Supplement 1 of NUREG/CR 6850 was issued in December 2010. It compiles some number of frequently asked questions and the resolutions of those questions.

MR. KLEIN: Yes.

CHAIRMAN STETKAR: Now, those questions have been in progress over some preceding period of time.

MR. KLEIN: Correct.

CHAIRMAN STETKAR: In fact some of them I think were resolved, you know, maybe a year or more ago, or at least there's documentation out there that seemed to indicate that there was agreement. Is it the staff and the industry's conclusion that something is not resolved until it's published in an update to NUREG/CR 6850 and until that point it's still an open issue and could change?

MR. KLEIN: Well, the way the staff looks at it is in terms of a regulatory footprint. What is the right regulatory footprint to put on this? And by following our own internal processes for putting the right regulatory footprint on this, we do it either through a NUREG 6850-kind of thing, or we do it through our Reg Guide, the update to 1.205.

CHAIRMAN STETKAR: So for example, the FAQ responses, even though there might be concurrence on them and they might be closed, they're not interpreted as Interim Staff Guidance or -- they are interpreted as Interim Staff Guidance?

MR. KLEIN: They are interpreted as interim staff position on those issues.

CHAIRMAN STETKAR: Okay.

MR. KLEIN: But as I indicated, it's putting the regulatory footprint on it.

CHAIRMAN STETKAR: No. Yes, okay.

MR. KLEIN: Yes, the purpose of these closure memos that go out mostly under my signature and made publicly available is to give licensees some certainty that we've closed this issue out, at least we've reached technical agreement on the issue. And in order to put the right regulatory footprint on it, we just need to take that extra step of issuing a revising Regulatory Guide, which we did at the end of the last year. We included as many closed FAQs as we could into that update of that Reg Guide issued last year. Yes. So and then that puts the final regulatory footprint on it. In the meantime, as you said, it's an interim staff position at this --

CHAIRMAN STETKAR: Okay. There's some

uncertainty that it might change from a strict licensee perspective?

MR. KLEIN: Well, from a strict perspective I think that probability is extremely low to have that happen, because we've reached consensus with the staff on it.

CHAIRMAN STETKAR: Okay.

MR. KLEIN: We've got multiple concurrences on these FAQs.

CHAIRMAN STETKAR: Thanks.

MR. KLEIN: With respect to the last bullet, the inspection procedure, this is something that licensees of course are very interested in, how will the staff inspect these plants that have already transitioned to NFPA 805? And the staff is currently undertaking a major effort to develop an inspection procedure. In fact, the staff is intending to perform an internal tabletop exercise with some of our regional inspectors very shortly. We'll then hold a public meeting. We'll discuss it with licensees. At some point we'll finalize the inspection procedure, perhaps sometime early next year. My understanding is that the Harris plant may exercise and do a self-assessment using that inspection procedure. Staff may observe and we would look at how well that's done, how well it works through a self-assessment with the licensee. We may tweak the procedure if necessary. And then I believe that the Harris plant is scheduled for a triennial sometime in 2011. So the staff themselves will exercise that triennial inspection procedure in 2011 with the Harris plant.

CHAIRMAN STETKAR: This is a bit of a stretch from our charter, but it's somewhat relevant in light of the presentation that we just heard; and that is, as I understand it there was some uncertainty in the interpreted requirements, let's say, for the non-pilot plants, and maybe from others who were contemplating transitioning to NFPA 805, regarding technical issues that conceivably could have been resolved in an FAQ but; the example was brought up for Oconee, have been pushed off into either a license condition or some other venue that I assume will then be closed out through the inspection process. Is that the way it's going to work?

MR. KLEIN: Not necessarily.

CHAIRMAN STETKAR: Okay.

MR. KLEIN: Some of these items are either going to be implementation items, could be a license condition. The inspection procedure itself is written at a higher level than that. It won't go into specifics in terms of, you know, looking to close out some of these issues. I think the staff at NRR's preference would be to close out these issues in a more generic manner. For example, the issue with safe and stable that was brought up. If it's in FAQ-54 -- I've not read FAQ-54; my staff has. If it's in there and FAQ-54 was just issued to the staff, we'll work with the industry to address that.

CHAIRMAN STETKAR: I guess what I was asking is using that as an example. But a more generic question is if there are lingering questions regarding methodology or the interpretation and the application of a specific part of a methodology, and that for the purposes of the SER the staff was confident enough to issue the safety evaluation but recommended or required that the licensee enhance or improve that methodology, that's a question of now uncertainty in terms of what is the acceptable methodology, you know, looking forward to a new plant. And the question is if those will be closed out under the inspection process, are we relying on inspectors to make decisions about methodology issues? We've run into this in a few other places, so --

MR. KLEIN: Yes, and the answer -- if I can jump in. The answer to that is no.

CHAIRMAN STETKAR: Okay.

MR. KLEIN: That's not the intent. I don't want to talk about Oconee because that would be pre-decisional.

CHAIRMAN STETKAR: Sure. Right.

MR. HARRISON: It's still under review. But an example from the Harris review, incipient detection. They had their model. We found that based on their application we could approve them for transition to 805 using their model. Right? We did the review of it. We saw it. We understood it. We could approve the application. However, as part of 805 there's also self-approval subsequent to transition. In that context we said we weren't comfortable with them using that model not knowing the changes that were being made, what they could find and how they would use the model in the future. So in that sense we put in a condition that said you need to convert over to the FAQ-approved model to go forward to do the self-approval for your applications. So it was one of when we saw it and we can look at it, we can make that determination. We can actually write a safety evaluation that found that to be acceptable. But if we're going to let you do self-approval, we want you using something that we've agreed to the methodology on already. So that's one where they were limited in the license condition as an implementation item, I believe, that they had to use the -- before they could do the self-approval for a risk-informed piece they had to convert over.

CHAIRMAN STETKAR: Okay.

MR. HARRISON: Okay?

CHAIRMAN STETKAR: I think it got it.

MR. KLEIN: Next slide, please? Some other infrastructure development activities. As I mentioned to you, you know, with the time line at the beginning here when the rule was first issued and when the pilot plants issued their Letter of Intent, as soon as that process started the staff held pilot observation meetings with the two pilot plants. It was periodic. It was perhaps once every couple of months, once every two to three months, and then it accelerated as we got into it a lot more.

So we held periodic meetings between us and the pilot plants. I think we gained a lot of knowledge. Industry gained a lot of knowledge through those pilot observation meetings. We at the same time in those years also held a number of public workshops or meetings with the industry to allow other stakeholders, the non-pilot plants, if you will, some of our public stakeholders, to participate and hear what's going on with the pilot plant transitions.

With respect to the frequently asked questions process, this was a process that was started as a result of interactions with the industry. I think the industry proposed some sort of process being put together so that we can address in a collaborative manner some of the issues that were identified, whether they be technical issues, some of the technical issues you heard today, whether they be process issues, programmatic issues or what have you. So we put together a program. And we've met monthly since the development of that program. I think we're up to fifty-some-odd meetings at this point. So we were able to resolve a number of FAQs, and I'll get into that in a second. What I wanted to do is give you a flavor for the interactions that the staff has had with the licensees over the past three or four years, not only the pilot plants.

Next slide, please? With respect to some of the issues resolved during pilot transition, I'm not going to spend a lot of time on this, but I wanted to give you a flavor again on what some of the things, some of the issues that were identified that we worked through with the pilot plants. Certainly when the staff receives a license amendment request there's an acceptance review process that we go through. Because these license amendment requests were fairly complex, both the staff and the industry were learning at the same time. What is it that we need to have in a license amendment request? What minimum information is it that we're looking for? So that was a bit of an iterative process that we worked through with the pilots.

Recovery actions. I think you've heard about those in past meetings. My view is that we've been able to address that issue and we've come to resolution that in fact that's been documented in the last update to our Reg Guide 1.205.

Fire PRA quality was addressed, and that's with respect to, you know, the scope of the Fire PRA. Some of the peer review findings, how were they addressed? The resolution of PRA-related FAQs. And as you well know, the incipient detection as it was applied at the Harris plant.

We talked about radioactive release transition. There's a requirement in NFPA 805 to address radioactive release. Well, we worked through that issue.

Non-power operations transition is another major issue that we resolved with the industry through the pilot process.

And then the NFPA 805 monitoring program, because NFPA 805 requires, the standard requires that licensees have a monitoring program. Well, to what extent do licensees need to have a description, the information, just what level of detail is required in these license amendment requests? I think we've been able to work that out through the two pilots so that the industry well understands at this point what it is that the staff is looking for.

Next slide, please? I talk a lot about some of these. In actuality slide 8 is actually a duplicate of one of the other slides, so in brevity I'm going to go onto slide 9, if I could.

As I indicated, as lessons were learned through the pilot process we went through a process where we could at least document what some of the interim staff positions are, and that's the FAQ process. The FAQ process, as indicated, was established in 2006. So here we are in 2010 and we've held monthly meetings, public monthly meetings in a very open collaborative way with the industry. At this point 49 FAQs have been processed. Out of those 49 five remain open. FAQ-54, I think you heard before is one of them. There are actually I think two or three FAQs that we've reached technical agreement on with the industry. When I say that, the staff is in the process of issuing a closure memo once we've reached technical agreement on that.

CHAIRMAN STETKAR: Alex, if it's only down to a handful or less than a handful right now --

MR. KLEIN: Yes.

CHAIRMAN STETKAR: -- can you give us some indication of the issues that are related to that handful?

MR. KLEIN: Sure.

CHAIRMAN STETKAR: If you don't have it right off the top of your head or --

MR. KLEIN: I do have it in a general sense, but I've got my FAQ process owner and I've got Harry who knows these FAQs like the back of his hand.

But the FAQs in a general sense have to do with radioactive release. And I think that one is on a path to closure. Help me out here, guys. There were --

MR. MOULTON: Well, let me take over.

MR. KLEIN: Sure.

MR. MOULTON: Okay. There's currently

five FAQs that lack --

MR. HARRISON: Identify yourself.

MR. MOULTON: This is Chuck Moulton, NRC staff. I'm the FAQ process owner. There are currently five FAQs that lack a closure memo. The first one has to do with risk recovery actions. That's in the closure process right now.

CHAIRMAN STETKAR: Recovery actions in what -- the definition of what is a recovery action?

MR. MOULTON: What risk calculations need to be submitted for recovery actions.

CHAIRMAN STETKAR: Essentially the 1.205-type --

MR. MOULTON: Yes.

CHAIRMAN STETKAR: -- issue of -- okay. And that's still nominally -- is there anything more than what was in 1.205 on that one? Again, I hate to belabor these things, but --

MR. BARRETT: Harry Barrett.

CHAIRMAN STETKAR: -- (off microphone) this is technical and not programmatic, so --

MR. BARRETT: FAQ 30 basically gives you the detail guidance to transition existing operator manual actions to recovery actions.

CHAIRMAN STETKAR: Okay.

MR. BARRETT: Decide whether or not you need to do a delta risk and what you do with that delta risk as far as approval.

CHAIRMAN STETKAR: Okay.

MR. BARRETT: If it's a previously approved recovery action, then you end up basically passing it through.

CHAIRMAN STETKAR: Grandfather it, yes.

MR. BARRETT: If it's -- yes, grandfather.

CHAIRMAN STETKAR: Okay.

MR. BARRETT: But you still end up considering that in the overall risk structure.

CHAIRMAN STETKAR: So it's just more elaboration on the detail?

MR. BARRETT: Yes, it's more detail on how to do that process.

CHAIRMAN STETKAR: Okay. Okay. And that one in your -- that's close to --

MR. BARRETT: No, we have technical agreement. We just have to write the closure memo.

CHAIRMAN STETKAR: Okay. All right.

MR. MOULTON: Next one is FAQ No. 38. We also have reached technical agreement on that one; awaiting closure memo. That one has to do with multiple spurious operations.

Let's see. FAQ-53, which we're still working on. It's open. It has to do with the physical characteristics of kerite cables. There are research activities and testing ongoing on that that we're awaiting.

CHAIRMAN STETKAR: That's strictly for kerite cables?

MR. MOULTON: Yes.

CHAIRMAN STETKAR: I'll throw it out to the folks behind us, or maybe you know. What fraction of the plants have substantial problems with kerite cables?

MR. BARRETT: Oh, I'd probably say between 10 and 20 percent of the plants.

CHAIRMAN STETKAR: I was going to say, they're not in wide --

MR. BARRETT: It's not in wide use, but --

CHAIRMAN STETKAR: So closure of this one isn't a big picture one for the industry?

MR. BARRETT: Depends on whether or not you're one of the plants that has it.

CHAIRMAN STETKAR: No, I understand. But this is obviously a focused plant-specific concern.

MR. BARRETT: Yes. Yes.

CHAIRMAN STETKAR: Okay. Could be very important, but for a small fraction of the plants. Thank you. And that one's still open you said?

MR. MOULTON: Yes, it is.

CHAIRMAN STETKAR: Okay.

MR. MOULTON: Next one is FAQ No. 54, which you have already heard about. That's still open.

And then the fifth one is FAQ No. 56, which as to do with radioactive release transition information that licensees need to submit to us. And that one is in the closure process. The closure memo has been written and it's in the concurrence chain currently.

CHAIRMAN STETKAR: And is that similar in nature to the guidance regarding treatment of non-power operation modes, I mean in the sense of how you need to think about it, the types of analyses that need to be done short of, you know, a level two PRA-type of --

MR. MOULTON: Oh, I'm not sure this has much technical --

CHAIRMAN STETKAR: Okay. That's all I wanted to hear.

MR. BARRETT: It's even less. It is more

qualitative than that.

CHAIRMAN STETKAR: Okay. So am I correct then -- make sure I understand the -- of the five the kerite cables is open and it's still under discussion?

MR. MOULTON: That's right.

CHAIRMAN STETKAR: The issue of what defines safe and stable is open and still under discussion?

MR. BARRETT: That's part of the FAQ-54, which is compliance with chapter 4, which encompasses a whole lot of issues. It's a fairly good sized FAQ and covers a major part of the analysis process.

CHAIRMAN STETKAR: All right. That's appropriately vague. I mean, the industry brought up the definition of safe and stable as their concern highlighted under that particular FAQ.

MR. BARRETT: Yes.

CHAIRMAN STETKAR: Are there other significant technical issues under that FAQ that remain --

MR. BARRETT: I would say no, because the FAQ is basically writing down exactly what was done for the pilots as far as the documentation of how you met chapter 4.

CHAIRMAN STETKAR: Okay.

MR. BARRETT: There hasn't been a lot of issues back and forth between the staff and the industry on those issues.

CHAIRMAN STETKAR: Okay.

MR. MOULTON: Yes, we actually received FAQ-54 in September of this year, so it's only been a couple months.

CHAIRMAN STETKAR: Okay. But we can read thousands of pages in a week, so --

MR. CANAVAN: Just a quick thought on that. Is that when you originally --

CHAIRMAN STETKAR: Ken, you got to come to the microphone.

MR. CANAVAN: Ken Canavan. I just have a quick question. It's noted as an '08 FAQ. So you're saying September of this year is the first time you ever saw that FAQ? Is that correct?

MR. BARRETT: Yes, that's correct. The task force had that FAQ in development for that long.

MR. CANAVAN: It's never been submitted to you? It hasn't been in the FAQ log?

MR. BARRETT: It's been in the FAQ log, but they never gave it to us.

CHAIRMAN STETKAR: We can resolve the timing of who saw what when, you know, offline. I was just trying to get an understanding on the number of items and what technical issues are covered by those items.

MR. HENNEKE: Okay. This is Dennis Henneke with GE Hitachi. I was the author of five of the 15 FAQ for Fire PRA. I heard the word "consensus" and I heard the word "agreement," and I'm going to disagree with those words. Of those five, four of the words were changed in the Interim Staff Guidance, three of them significantly. So what we do is we would submit something. Like a hot short duration, I submitted that one. It was a fairly major effort of work. I gave an interim solution to DC circuits waiting DC circuits testing. Two-and-a-half years ago it was ready to go. That got pulled on the Interim Staff Guidance. So industry is left without a solution for three years when we had that solution three years ago.

Same thing on transient fires. I had a transient fire T-squared of six minutes. I submitted that. I disagree with the staff on it. They put in a two minutes on a six minutes. And now the industry doesn't know which to use, two or six because there's no guidance on how to use those.

The other one was on cabinet sealed but

not well sealed cabinets. We submitted a motor control sensor, significant. We submitted a severity factor for that and that got disagreed with.

So it's not a consensus process. It's one of the reasons that I personally -- I had no support from the owner's group on these FAQs. Just refuse to submit them because it's not a consensus process. It's we submit it. The staff goes to consensus, changes it and then issues the Interim Staff Guidance.

CHAIRMAN STETKAR: Okay.

MR. HENNEKE: And that's really where a lot of the problems lie. And we had solutions to a number of problems that got pulled and we continue to work on them today.

CHAIRMAN STETKAR: Let me try this, because I think I see a couple of different opinions here: For December what I'd like the industry to do -- and hopefully we can communicate on both sides, is that it sounds like there are some FAQs that the staff has essentially signed off as closed and yet there may still be substantial disagreement among people in the industry over whether or not that's an adequate closure or whether indeed all of the issues were addressed. Is that, from industry's perspective anyway, a fair characterization?

(No audible response.)

CHAIRMAN STETKAR: I see nodding heads for the record. If we could for December, because we don't have the time to do it today, list the top -- you know, I don't want 49, the top four or five, if that's the appropriate number, of those FAQs for which you still feel that there is substantial uncertainty or substantial technical disagreement. Because this is important. It doesn't impart uncertainty, you know, if I'm doing a PRA going forward. I may understand what the staff currently will accept, but I may not understand whether that's the most reasonable technical position.

So if you could take the action item to highlight the four or five or something, how many there are, not 49, and what the issue is so that we can understand what that issue is from a technical perspective. You mentioned the industry had proposed something and the staff came back and issued something else. And if the staff could also -- if we can get some communications there so that we can understand, you know, where the staff's closure sits in that space, I think it would help me an awful lot in terms of understanding, you know, how far apart you are, what the issues are and then how important those particular issues might be to fidelity of the final PRA results. In other words, I don't care if you don't agree if it's something that doesn't make any difference, quite honestly. I mean, I do eventually because I'd like to have perfection in everything. You understand?

PARTICIPANT: (Off microphone.)

CHAIRMAN STETKAR: Okay. We can go back over this, you know, at the end.

MR. BRADLEY: Are you talking about any FAQ or PRA-related FAQs?

CHAIRMAN STETKAR: PRA-related FAQs, because I'm still trying to keep us as much as possible out of the process-type issue, which is why on that one FAQ I wanted to focus more on what the technical issue was, you know, rather than how you demonstrate compliance with every line item in chapter 4.

Okay. Thanks. Any other discussion on that part of the FAQs?

(No audible response.)

CHAIRMAN STETKAR: As I said, at the end of the meeting we'll try to come back and go over some of these things for preparation for the December meeting.

MR. MOULTON: I'd just like to add you might want to examine Regulatory Issue Summary 2007-19. It describes the FAQ process.

CHAIRMAN STETKAR: 2007-19?

MR. MOULTON: Nineteen, yes.

CHAIRMAN STETKAR: Thank you.

MR. KLEIN: A full disclosure, however, to clarify what Chuck just said. When we tried to address some of these PRA-related FAQs through the 2007-19 process, we met with the industry and we came up with a modified approach, if you will, or process. Just so you know that there was a different process, a slightly different process from the 2007-19 process to close out these PRA FAQs that had kind of been sitting there. And so we wanted to move them along and get them closed out. So we initiated a different approach for that, just so you're aware.

CHAIRMAN STETKAR: So I'm interested in process, but less interested in --

MR. KLEIN: Understand.

CHAIRMAN STETKAR: -- understanding what --

MR. KLEIN: Understand.

CHAIRMAN STETKAR: -- the disagreements over what the technical issues are right at the moment.

MR. KLEIN: Okay. So anyway my last bullet. You know, I want you to get the flavor that the FAQ process I believe has had a significant impact on transition. I think it's had a positive impact, a substantial impact. To me it's been a positive impact. I think that we wouldn't be here today discussing some of these items and wouldn't be where we are today without that FAQ process having been implemented.

So next slide, please? I just want to touch upon some of these. These are some of the FAQs that I'm using as examples that were sometimes characterized too as FAQs that could potentially be showstoppers if they weren't resolved in some consensus-type manner. Some of these are process issues, not necessarily technical issues. So for example, the fire protection engineering evaluation one, I think you're very well aware of that one, so I won't go into any detail. The non-power operations FAQ I mentioned to you we've reached resolution on. And then incipient detection, Harry Barrett had given you some indication there. These were all very important FAQs for the industry to gain some alignment on with the staff, and I believe that we've done that.

My last slide talks about some of the lessons learned with respect to non-PRA implementation issues. And I'll just go quickly through this because I know that you want to hear the meat of it from Donnie and from Mark when they come up here.

That first bullet talks about FAQ-8.

The second bullet there talks about again the recovery actions that have to do with the primary control stations. We came to you I think the summer and fall of last year and we had a very detailed discussion with you folks on risk of recovery actions.

This implementation of safe and stable concept under NFPA 805, quite frankly this is the first time, at least to me, that it's been characterized the way it has been by the industry. I believe that we are treating both Harris and Oconee the same way. You heard the slide up there from NEI. They quoted the regulation. The words in the regulation out of NFPA 805 are what they are. The staff has to reach some conclusion with the licensees, the license amendment requests. And quite frankly, it's the licensees that choose how they want to address safe and stable. They have to demonstrate to us and we have to get reasonable assurance that they can achieve and maintain safe and stable. So I believe that we've worked it out with the Harris plant.

Oconee, because it's still pre-decisional at this point, we're still going through the RAI process. So I don't want to delve into that too much more.

CHAIRMAN STETKAR: Just out of curiosity; and we probably won't have an opportunity here, curious if indeed the interpretation of safe and stable is indefinite safe and stable and if the interpretation for some plants is that indefinite means cold shutdown. What assurance do I have that cold shutdown can be maintained indefinitely, that the equipment will continue to run forever and that water will never boil away and that operators are always perfect after some indeterminate period of time? So why does simply achieving cold shutdown provide assurance that I have indefinite safe and stable conditions any more than being at hot standby for 72 hours or hot standby for 18 minutes, or you know, some other time period, or you know, without being flip, 24 hours, which is typically the time window for most PRA studies?

MR. KLEIN: Right. NFPA 805, the standard, does have a definition about what safe and stable is. And as I indicated it's up to the licensee to meet that definition of what they believe safe and stable is and how they can meet that. So whether it's hot standby, hot shutdown, cold shutdown, if that's the end state that they choose to be at for that indefinite time period, they'll have to demonstrate that to us.

So I don't know if you want to add anything more with respect to the 24/72?

MR. HARRISON: Yes, I'll say two things. One is they need to describe their program. Right? And again, just in reference Oconee did originally propose a 24-hour time. Their basis was because that's what the PRA uses. Safe and stable is not a PRA issue. Safe and stable is a deterministic issue. And so in that context if you've got a PRA and you know at hour 25 all the equipment goes away because of some phenomena, your mission time would not be a 24-hour mission time. It would be a 25-hour mission time and those all would be failures. Right? The same thing would apply in that sense, that parallel world of the licensee that establishes a time for achieving safe and stable and then says, well, that's great. How are you going to maintain it long term? You need to describe that. You can't just say I made it for two days or I made it for three days and now I don't have to tell you anything else. It's got to be a complete story to be able to say how am I achieving and maintaining safe and stable? Again, that's not a PRA question. That's a deterministic question. So you need to describe it.

CHAIRMAN STETKAR: Okay. All right. Well, I'm assuming this will come up in December and we'll hear a little bit more details from everyone regarding what that definition means, because I'm reading, "The nuclear safety" -- from NFPA 805, the 2001 version, "The nuclear safety goal is to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition."

Doesn't say indefinitely. It just says "and maintaining."

PARTICIPANT: Right.

CHAIRMAN STETKAR: Now, I'm not sure what that means. So it's not a very good definition. Whoever wrote NFPA 805 obviously had never thought about doing risk assessment, otherwise they wouldn't have been this vague.

So I understand the industry's desire to understand whether that means 24 hours, 72 hours or, you know, the history of the universe and whether or not it requires a quantitative evaluation to demonstrate indefinite times, which is really difficult, or whether quantification of stable conditions for some agreed upon period of time with qualitative evaluations of capabilities beyond that is acceptable.

MR. KLEIN: Okay. My last bullet in regards to the monitoring program. What the staff learned is during the reviews of the pilot plant license amendment requests we believe that the description of the monitoring program needs to be more detailed. And we had RAIs with both Harris and with Oconee that provided those licensees the opportunity to provide those details back to the staff with respect to what we would need to see at the time of submittal for a monitoring program.

And we used the word "mature" here because I think when we first received these license amendment requests the description of the monitoring program, what the attributes might be, what the criteria are and so forth, were basically lacking out of those license amendment requests. So just wanted to point that out.

That's my very last bullet and that concludes my presentation.

CHAIRMAN STETKAR: Donnie, this is just a timing -- roughly how long do you expect?

MR. HARRISON: I was allocated like an hour-and-a-half. I don't expect to be anywhere near that. I've taken a different approach in dealing with methods, so --

CHAIRMAN STETKAR: What I was going to ask you though is once you get into this do we have a steamroller going that is difficult to interrupt in about somewhere in the next half hour, or --

MR. HARRISON: We can interrupt.

CHAIRMAN STETKAR: Okay. Thanks.

MR. HARRISON: There are easy stopping points.

CHAIRMAN STETKAR: Go forth and start.

MR. HARRISON: Okay. I'm Donnie Harrison. I'm the PRA Licensing Branch Chief in NRR.

You heard this morning and a little bit this afternoon about the methods issues by the industry. You're going to hear about research activities on refining modeling after me, so I'm not really going to spend a whole lot of time on Fire PRA methods.

I'm going to talk about -- at least what's on the slide here is other issues. And I'm really focused on the things I've seen or heard that are impeding or could impede a licensee transitioning to NFPA 805. These are kind of my perspectives, my opinions on what I've heard and seen.

What I've done is I've categorized them into four basic areas to talk about. One is what I call the Internal Events PRA/Fire PRA carryover issues. There's risk-informed application issues. There's Fire PRA peer review issues. And then there's just the scope of the 805 transition application. And then I want to close with a slide on what I see as the path forward.

Before I jump in though I think from a general sense given where the pilots are right now we're showing that you can transition. You can use a Fire PRA that's good enough to transition to 805. There may be issues. There may be things that licensees would prefer not to have to do in the area of doing modifications versus analysis, but it's possible to make the transition. So I'll repeat that at the end when I get done.

Internal events carryover. For most licensees the internal events were developed many,

many years ago, decades ago. They've been refined numerous times over the last couple of decades. They were probably peer reviewed over a decade ago. Depending on if they've made upgrades to their methods, they may have been re-peer reviewed in that last decade or they may have voluntarily done some peer reviews in the last decade.

The issue when it comes to transition to 805 is if you've got a peer review on your Internal Events PRA and you haven't resolved findings from that peer review, those issues linger and they carry right over into the Fire PRA. And so in addressing transition to 805, since we build the Fire PRA off the Internal Events PRA, you get this synergistic effect in the issue. And so issues that aren't resolved need to be resolved before you transition, otherwise you'll end up with the potential of trying to resolve internal event findings in the midst of your Fire PRA review and causing delays. And again, this is all what impedes transition. This would delay your ability to transition.

The other point is if you're in the midst of your application, if licensing makes an application to us and in the midst of our review needs to do a major change to their Internal Events PRA, that will directly impact their Fire PRA and could change some of their analysis. And that would also impede their ability to transition. So there's this synergist effect that we need to be aware of. It does happen and it's just more of, at least in my presentation, a reality check. These things do happen and we need to be ready for it.

CHAIRMAN STETKAR: They do happen and have happened already?

MR. HARRISON: Do happen. Have happened. Yes.

CHAIRMAN STETKAR: Oh, okay.

MR. HARRISON: Yes, some of these were issues within the pilots.

Risk-informed applications. Here's another thing that does happen and will happen likely. We have an industry of 104 plants. Some of them are very active when it comes to doing risk-informed applications. Some have done maybe one or two risk-informed applications in their life time. So you have a mixed bag of experience. Those that have limited experience, especially for an application such as NFPA 805 it's a large application and you're changing your entire fire protection program and its complexity. This can create problems for inexperienced or limited experience licensees.

The other issue here is though the Fire PRA methods have been around for 25-30 years, most of the licensees, their experience in doing Fire PRA is dated, if they still even have that experience. So there's a learning curve that's occurring within the industry and that can be a painful process. I refer to it as like your muscles atrophy. You used to be an athlete and now you're older and you don't exercise anymore. One day you wake up and the doctor says you have to start exercising again. The muscles hurt when you start back up. Right? So we're going through a little bit of pain in that learning curve.

And then the reality check is the third bullet. Within NFPA 805 we've had essentially in the last really five years, five-six years three things occur simultaneously. You've got a new Fire PRA methodology guidance. It's an improvement over what was there 25-30 years ago, but it is new guidance. It does different things. So you have to learn that. At the same time we have a new Fire PRA standard that's encompassed in the ASME/ANS standard. So that's how you're going to tell if your PRA's good enough for your application. And now we have this large application called NFPA 805 or 10 CFR 50.48(c). All those are coming together at the same time. That's an impact you need to be aware of, but it's also a reality of typically that's the only way things get done is you have to have an application to drive for methods to be developed. And once you start going down that path the standards have to make sure that you can do it well enough to support the application. So even though all these three things come together, it's not unusual. This is typically what -- one things motivates the other.

CHAIRMAN STETKAR: Donnie, recognizing that, you know, the staff has finished the Harris SE and that the Oconee is pre-decisional so you can't really talk too much about details of that, have you run into instances during the pilot projects where there are inconsistencies among those last three bullets, the guidance in the NUREG and interpretation of what the standards require and what may be required to conform with some interpretation of NFPA 805, for example?

MR. HARRISON: I would say within the implementation guidance that went with 10 CFR 50.48(c) there was the original issue of Reg Guide 1.205. There were things within that guidance that -- what drove us to develop a revision one to that last year was the fact that we saw lessons learned from the pilot that our guidance needed to be fixed. There were a couple of things I think we actually missed within the requirements of 805. And so I think within the last bullet in particular there was that issue.

The issue on Fire PRA methodology conservatisms, refinements --

CHAIRMAN STETKAR: Yes, that doesn't really --

MR. HARRISON: That doesn't really --

CHAIRMAN STETKAR: I was more considering, you know, that people had pointed out is the quality of my PRA adequate, which is sort of focused at the second bullet, the standards.

MR. HARRISON: Right. Right.

CHAIRMAN STETKAR: Do I meet capability categories 1, 2 or 3?

MR. HARRISON: Right.

CHAIRMAN STETKAR: But it does fold over into the methods that you're using.

MR. HARRISON: It does.

CHAIRMAN STETKAR: For example, how do you treat data? How do you treat uncertainties? You know, that sort of thing.

MR. HARRISON: It has that relationship.

I think there was a complaint at one point about the standard that it actually was referring back to the NUREG/CR as examples of how to do some things. And the standards not supposed to tell you how to do a thing. It's supposed to tell you what's good enough to achieve a certain thing. So there's been interaction in that within the Fire PRA standard to remove those how-to guidance from the standard.

The other part of that is even within NFPA 805 application, depending on what the applicant, the licensee's proposing, may change what level of quality you need in the Fire PRA standard. The example I would give, Oconee has made a submittal with modifications that make it a risk decrease application. Okay? So after the transitioned to 805 the risk has gone down. Right? The standard, the quality standard for that PRA is less than what would be one where it's marginally got a risk increase and you're at a threshold of being unacceptable risk increase.

CHAIRMAN STETKAR: Yes. Interesting.

MR. HARRISON: So even within an 805 application you can have two plants come in with two different approaches. That drives the quality requirements on them. So you can live with one that's maybe not as strong in a PRA as well as the other one.

So again, that's a phenomena of how the regulatory guidance allows the mixing of modifications with the application. We're going to touch on that just briefly.

CHAIRMAN STETKAR: Okay.

MR. HARRISON: The next topic I want to talk about is the Fire PRA peer reviews. And again, I have not been a peer reviewer on a Fire PRA. That's an industry activity that's performed. The staff typically looks at the findings of the peer review teams and evaluates that, how they've been resolved.

CHAIRMAN STETKAR: Before you launch into this, because I think this is maybe an interesting topic, correct me if I'm wrong, did Oconee and Harris have peer reviews?

MR. HARRISON: No.

CHAIRMAN STETKAR: Okay.

MR. HARRISON: No. Within the original Reg Guide 1.205 it stated that the staff would do the review of the PRA recognizing that they were pilots. That's something unique to the pilots, is the staff did the review.

CHAIRMAN STETKAR: So you served the surrogate peer review process for those?

MR. HARRISON: Yes and no.

CHAIRMAN STETKAR: Okay.

MR. HARRISON: The staff followed the guidance on the peer review guidance and were qualified per that guidance that existed at the time. I believe it was a draft of the standard at the time. But the outcome of those reviews were follow-on RAIs. The outcome of the Oconee one was a statement of a need for at least a focused scope peer review of elements that weren't complete. So there were outcomes that were slightly different than what a peer review would be.

CHAIRMAN STETKAR: But in a nutshell you haven't yet seen an application that indeed has been through the industry peer review process, is that right?

MR. HARRISON: Correct.

CHAIRMAN STETKAR: Okay.

MR. HARRISON: We have observed a peer review. We actually attended one; the staff did, and observed the performance of a peer review at one of the plants to get some -- and again, I think at one of these I have the comment that to gain confidence and understand the issues of those peer reviews.

So again, the industry conducts the peer review. We see the findings. So the observation of the one peer review is to gain some of that. We've talked about do we need to see additional peer reviews to gain further understanding and confidence in the process.

We did a similar thing on the Internal Events PRA when that standard went out in about the 2005 time frame. We went on five different pilots and did some checking to see how the guidance worked with our understanding. So we're doing it a slightly different way, but still trying to gain that confidence in the process.

CHAIRMAN STETKAR: Okay. Thanks.

MR. HARRISON: Okay. The things that can impede transition. Again, a peer review team is looking at the plant's PRA. If that plant is using some unique method or unreviewed model of some new way of splitting out the data and refining the heat release rates, peer review teams are usually on site for only a week. Jim, correct me if I say this wrong, they usually have a month before and a month after. Right? If all of a sudden a new method pops up that they've never seen before, that can cause them problems within the peer review. They can't get their job done effectively or they're making decisions on a methodology that they haven't really had enough time to think about.

And as a result I think it becomes a natural thing that says, well, if you use NUREG/CR 6850, the peer review team's going to have an easier time performing your peer review. If you deviate from that, then it's a peer review team that's going to set a high bar for justifying that or they're going to say you don't meet the capability category, because they just don't have the time to be able to do that.

In response to what was going on, I've been told the industry kind of responded to the fact that these peer reviews were holding NUREG/CR 6850 as the standard, as the only acceptable method. And as a result they've their peer review guidance. They've created this task force on PRA methods so that the peer review team has an outlet, if you will, where they can take a method and say we haven't had the time to evaluate and accept this. We'll push that off to the task force to review and evaluate that and bring it back to us.

The change in peer review guidance also results in us having to maybe ask some different RAI questions or get different information from a submittal because of the new guidance that they've published for the peer review teams, but that's a fairly minor issue. That just means we have to change the way we get information. That's all.

CHAIRMAN STETKAR: Well and in practice you haven't tested those waters yet either, right? Looking at a peer review-approved difference in methodology, let's say, compared to --

MR. HARRISON: Right. And I'm going to hit that on my next slide in a minute.

The big one on this one is that last bullet there, which is because of the scheduling for Fire PRA peer reviews. The licensees are lining up to do these -- submit the applications in June of this coming year. They need to get their PRA peer reviews done before that. You had a whole wave come through then. Some of those set dates for peer reviews and then when the peer review date came their PRA wasn't done. So the peer reviews reviewed what was available, but they were incomplete peer reviews and that would bascailly drive you to another peer review. So you'd have to at least come back and re-look at those things that were not peer reviewed and make sure that those meet the standard. That can cause cycling. It causes time for the peer review teams to keep coming back, but it also causes -- the licensee loses that time preparing for the peer review. They're not ready. They still do it, but then they've got to now fix everything and come back and do it again three, six months later. So that just recognizes -- that slows the process down. It's going to delay making submittals.

CHAIRMAN STETKAR: Is there a -- I'm trying to think how to ask this question appropriately. You emphasize the inefficiency of -- it's a kind of compounded inefficiency of trying to meet a specific submittal date, submitting something that may not be complete, but you have to get a time slot for your peer review because there's a limited number of, you know, quite honestly people who are capable of performing technically competent peer reviews. I suspect that's a fairly small number of people. And then learning that, you know, your peer review has told you you're inadequate because, you know, you're not finished. Shouldn't have been a surprise to you, but it is.

From a technical perspective -- at the moment I don't care too much about scheduling. Industry doesn't want to hear that. From a technical perspective; it would be better if I asked the industry this and they may want to consider commenting later, are we running a risk of having inadequate peer reviews simply because of the volume of studies that are on the table, let's say, and the limited number of really experienced peer reviewers that are out there capable of doing these things? Or do we have sufficient resources to have assurance that from your perspective when you do receive a license amendment request with the supporting analyses and the results of a peer review you can say yes indeed you have confidence that that peer review was technically adequate to essentially relieve you of some of your independence burden in terms of looking at every single technical detail and perhaps the way that you had to do it under the Oconee and Harris submittals?

You know, I don't know what the answer to that question is, but I'd be interested in any insights I could get, either from you or the industry.

MR. HARRISON: Yes, I love speaking for the industry, but --

CHAIRMAN STETKAR: Yes. I've heard of it a bit so this is the appropriate time to kind of ask it.

MR. HARRISON: And I think you've certainly also heard the concerns from the industry about resources, limited resources. And when you do a peer review oftentimes in the industry peer review process, as you commit to give up a staff member to do a peer review, if you get a peer review. And so that becomes also, if your NFPA 805 plant and you're trying to develop the Fire PRA to come in and now you have to give up a person because you just got peer reviewed, that does impact your ability in moving forward, to make changes to your Fire PRA moving forward. I think that's the reality of the limited resources and the process of how the peer review functions. I'd invite the -- if the industry wants to make a statement on that.

CHAIRMAN STETKAR: I don't know if anybody that's in the back --

MR. BRADLEY: Biff Bradley, NEI. It's certainly a challenge for us to do this many peer reviews on the schedule we're on. I think within the boundary conditions of what we've been talking about today with evolving methods that's another challenge. And Donnie I think correctly framed the way we're trying to deal with that by having these -- we can't put the onus of every method review on the peer review team in a one-week peer review, otherwise that does detract from the overall review.

I think we are doing a reasonable

technical job on these reviews. The owner's groups resources are limited. A number of these reviews are getting contracted out separately now because the owner's groups just -- for some of the reasons Donnie indicated with the horse trading reviewers and such, eventually you just run out of a spot in the queue and you have to do something else.

In a perfect world I would love to have more time to get these models developed and get this full value of peer review that I think we get out of say internal events where we have a very mature method and a large team of, you know, expertise.

Our peer review guidance does have qualifications. You know, the teams are good. You know, the peer reviews that take place, there are some very good individuals. They're very tough.

CHAIRMAN STETKAR: Okay.

MR. BRADLEY: I would welcome anyone to come observe one of these reviews. I think we're pretty tough on ourselves. And, you know, so --

CHAIRMAN STETKAR: That last point is what I was -- again, you know, I'm sympathetic to resource limits. I'm sympathetic to scheduling. I'm sympathetic to people who perhaps don't understand when they should call. But that again is a different issue. The point that you made that the peer reviews that are being performed, regardless of whatever constraints that are being performed, are indeed technically confident reviews and indeed are not simply, you know, pass throughs to check off a, you know, schedule requirement. That's in terms of our concern, I think.

MR. HARRISON: Yes, and I would state that the peer review that the staff observed was a contracted peer review and we were impressed by the team. They were industry experts. So it wasn't -- well, I'll say it wasn't a no-name team.

CHAIRMAN STETKAR: Yes.

MR. HARRISON: It was well-recognized people on the team that were experts in Fire PRA --

CHAIRMAN STETKAR: Good.

MR. HARRISON: -- and their elements.

CHAIRMAN STETKAR: Good, good.

MR. HARRISON: Again, the industry in dealing with some of these methods, new methods that are being proposed developed a task force and I think that's an appropriate thing. I champion the idea of developing that Fire PRA methods task force to address new methods. And again, here's my reality check. When a peer review turns that over to a task force to address, you've just added another layer of review, and that takes time. So you've gone from a one-week peer review to now it's being pushed off to a task force who's now going to look at that method. It may take time for them to look at the method and then to provide feedback back to the licensee in the peer reviews. So it's just a timing element of that. And again, that's just a reality.

The other part is is the task force comes back and either modifies or rejects what the licensee has proposed as a method. Then that would require the licensee to change their PRA method. And again, potentially that may drive you to now another peer review of whatever new method you might be using. So just again, this is just how the process works, or should work. And in the ideal world everything that goes to the task force will be perfect and they'll come back and tell every licensee that these new methods they've come up with are wonderful and well-documented and justified. I don't think that's going to help and we don't live in an ideal world.

We could either take a break now, John, or we could wait another four slides. I'll give you the option.

CHAIRMAN STETKAR: We're going to take a

break now because I am incapable of estimating the time to go through four slides. So we will recess until 3:25.

(Whereupon, at 3:09 p.m. off the record until 3:24 p.m.)

CHAIRMAN STETKAR: We're back in session.

Donnie, carry on, sir.

MR. HARRISON: Okay. The last topic I wanted to talk about was the scope of 805 transition. The licensee does a Fire PRA but they've got an application in mind when they do it in this case. It's not like the Internal Events PRA where you build an Internal Events PRA and then you start looking for applications. Here you've got the application in mind and building a Fire PRA for that application.

And I just want to make some points. The staff doesn't mandate how you do your PRA. The licensee decides on the level of detail and realism that they want to have in their Fire PRA to support the application they need to make. We evaluate the adequacy of that model for that application, but ultimately it's the licensee that makes that decision.

The other thing; I think you heard a little bit of this earlier, is Fire PRAs are built off the Internal Events PRA and they use a progressive screening approach typically. So what you do is you start at a screening level, a higher level and you slowly work in. What that allows you to do is focus in on those areas that have the highest risk. As you find things that are of low risk, you leave them and you move on. Those areas that get screened out under that process obviously are conservative because they may have been using screening methods. But again, like most things if I use a conservative approach and it gives me an answer I can live with, I don't mind letting it be conservative.

So the licensee then has options. He can retain that conservative screening approach if the results are acceptable, or he can make some decisions. If he's got a high-risk area and he needs to deal with that and the screening method doesn't support leaving it as it is, he's got choices. He can implement a plant mod or he can refine models. He can try to do things to bring that risk down either analytically or in physical reality.

And there are some considerations that go along with that. How much time does he have? How much effort is it going to take? How hard is it going to be justify what he's doing? And how much is it going to cost? So those are four elements that every licensee has to consider. What we've seen in the two pilots is plant modifications was an easier path, if I can say it that way, as opposed to trying to justify method modeling differences, modeling refinements and timing as well as cost of doing those analyses and how much effort it would take.

The good thing about plant modifications is that they can reduce risk in areas that are not just a fire risk. Matter of fact, the major benefit of some of the modifications proposed by the Harris pilot and the Oconee pilot, their biggest risk reductions are in the non-fire areas. I believe there's the alternate reactor coolant pump seal injection modification for Harris. There is the protected service water for Oconee. Both of those have large risk reductions for the plant associated with things that have nothing to do with fires.

The reality check on that is though most of them are being implemented after we issue our safety evaluation. So the issue for the staff is they've taken credit for a modification in their PRA supporting their application. How do we assure that that modification lives up to the credit they've given it? And so again that can drive you to an implementation item or a license condition as part of providing assurance after you install it and implement the modification, that it actually achieves what you said it could achieve. Especially if it's a case where you're going to be having to lay new cable and the concern becomes are you going to route in an area that you hadn't originally thought you were going to route it and now that's a fire-exposed cable and it maybe doesn't achieve the fire credit you thought it would. So that becomes a critical part of the decision making process for the staff in looking at some of these future mods that are credited in the application.

It can also result in limitations being placed on the ability to what I call self-approval to be able to implement the plant change evaluation and approve modifications during that transition or implementation period. If it's going to take you two years to get that modification installed, well your plant really doesn't have the credit that you've actually told us it had until that modification goes in. So for you to make plant change evaluations in the interim, you're doing it without actually knowing what the plant risk is at the time you're actually making the change. So that can result in us also limiting the ability of licensees to make self-approval changes, especially for the risk-informed pieces that you're taking those credits for.

Here I just want to talk about the fact that this is a large application. You're entirely rewriting your licensing basis for fire protection, both deterministically and now you're adding a risk-informed approach to it. You're adding self-approval. You're adding a whole lot of things that weren't there. Some things you have to go back and reverify. If you've had operator manual actions that you've had approved in the past, you have to verify that they're still feasible, you can still do them under the deterministic side.

You may also need to look at some of those operator manual actions and find out that they're recovery actions. And now you have to do a change in risk evaluation. You have to provide a delta risk calc associated with those recovery actions.

My last major bullet here is on the fact that what I call we're not getting clean transitions. People come to do NFPA 805 for a reason. It's not because they're just wanting to transition from Appendix R and come over and there's no benefit to them. They just want to do the right thing. That's not what's happening. They want to do the right thing, but they want to do it and still get credit for some variance they may have to the deterministic requirements and they'd like to keep those variances and make them part of their licensing base.

So it's not simply just transitioning from the old program to the new program and nothing really changes. It's transitioning over and, oh, by the way, I want to make sure that variance that I currently have now is okay by the regulator and he'll accept that and not make me have to fix it. So the method lets you do that. It does muddy the water because now I'm doing transition and I'm doing plant change evaluations at the same time and I'm bring two different concepts in at the same time. So you can have numerous change in risk calculations you have to do when you find these variances from the deterministic requirements. You have to look at not just the individual variances, but then you have to look at the cumulative impact of all those variances. And if you make Fire PRA simplifications, you can create conservative change in risk calculations.

An example I would give you for that is 805 applications are not affected by being conservative in the base model creating non-conservative deltas. We actually have, if you will, maybe a potential for a conservative with a conservative, because the way the pilots are doing their delta risk calculations is assuming without the variance a room is perfect. It's zero risk. So they're taking the entire risk of the room or the affected area and they're saying that's my delta. That's what Harris I believe did. So if you calculate the variance delta, all of that is the delta for a room. It makes it a conservative delta, and again if you can live with that conservative delta, then that makes it easy for us to approve it.

CHAIRMAN STETKAR: Donnie, you've mentioned several different delta risk calculations, some that are associated with --

MR. HARRISON: There's risk of recovery actions.

CHAIRMAN STETKAR: -- recovery actions, some that are associated with retained deviations from deterministic criteria. How are all of these rolled together, or are they? And, you know, is it applied at a plant level? Is it applied at a compartment level? Is it applied at an issue level? You do eventually some type of comparison against 1174 I'm assuming.

MR. HARRISON: Correct.

CHAIRMAN STETKAR: How is that done?

MR. HARRISON: Steve, do you want to give an answer?

MR. DINSMORE: Yes, this is Steve Dinsmore in the PRA Branch in NRR. I work with Donnie. I'm a senior reviewer.

Effectively the individual fires are disjointed initiating events, so you can kind of just add up the different deltas. Is that what you were asking? How do you get the cumulative or how do you do the individuals?

CHAIRMAN STETKAR: What I'm asking is, you know, I thought I heard Donnie saying things like, well, for this particular location my delta risk is X. Does that delta risk for this location mean anything, or is it simply the overall delta risk at a plant level compared to that -- what? Compared to a perfect plant?

MR. DINSMORE: Compared to a plant that does not have the failures associated with the variance from the deterministic requirement that they discovered.

MR. HARRISON: Yes, the delta's backwards in what we normally do. It's instead of having a base model and figuring out what the risk increase is, you're figuring out where you are with the variance and --

CHAIRMAN STETKAR: The base model presumes the risk was zero?

MR. HARRISON: That's what they've been doing. Nothing says you have to do it that way.

CHAIRMAN STETKAR: Okay.

MR. HARRISON: You could build one that says here's my base model, if I met the regulations, so I don't have a cable that runs through there that I'm not supposed to have. I just remove that and I leave the rest of the model alone. Then I build it with the cable in there like it exists and I do the delta between those two. But then I'm building two models. Right? What's happening is is the plants -- again, they're coming into this not like the internal events era. They're coming into this Fire PRA with the application in mind. So they're building their 805 PRA. Right? They're not building a base perfect plant PRA. So they're coming in with the 805 plant and then they're just saying, well, I'll just take the hit for that variance and that becomes my delta.

CHAIRMAN STETKAR: Right.

MR. DINSMORE: Steve Dinsmore again. I

believe Oconee subtracts the two.

CHAIRMAN STETKAR: Okay.

MR. HARRISON: I think Harris probably -- yes, but --

MR. HARRISON: I was referring to Harris, yes.

CHAIRMAN STETKAR: But the key is that the staff's examination of that delta risk is done at the plant level, is that correct?

MR. DINSMORE: At the fire area and the plant level.

MR. HARRISON: They have to show it's acceptable by the fire area and then they have to do a cumulative impact and show the plant total risk delta is acceptable. Again, you have to keep in your mind for transition you're allowed to offset fire risk increases with, if you choose, non-fire risk-related decreases. So if you add a modification, you can take credit for that to bring a risk down. Right? So you might have a room that is actually above our acceptance criteria but the total plant risk is actually below our risk criteria.

CHAIRMAN STETKAR: But that would be considered okay?

MR. HARRISON: Can be considered. It

depends. You could find a room that's so high above the acceptance guidelines that they have to fix something to bring it down. You could actually have a plant area that has to be fixed even though the total plant risk is acceptable. Because you have to do both. You have to find them both acceptable.

MR. DINSMORE: These things again are disjointed, so you can add them. So if you get a big minus in one room, and a small -- well, relatively large plus in another room, then you add them up to get your total. So that's how you can do them both at the same time, or that's how you could have -- one room is going to increase at 1.6 times 10 to the minus 6, but your total delta, when you add up all the other rooms, is minus 5 times 10 to the minus 6 or something.

CHAIRMAN STETKAR: Okay.

MR. HARRISON: Again, the point of the slide is exactly what you're making though. It's not easy.

CHAIRMAN STETKAR: No, it's not.

MR. HARRISON: It's not a straightforward risk-informed application. There are things you're doing. You're looking at the world backwards because you're looking at it from a --

CHAIRMAN STETKAR: Well --

MR. HARRISON: -- perfect and you're looking at --

CHAIRMAN STETKAR: But from what I've heard that's an individual licensee's decision.

MR. HARRISON: It is.

CHAIRMAN STETKAR: Because they could indeed calculate two risk numbers and subtract the two.

MR. HARRISON: That's correct.

CHAIRMAN STETKAR: You know, maybe it's not. So in terms of that conservatism, that's essentially a self-imposed accepted conservatism of how they calculate that delta.

MR. HARRISON: Correct.

CHAIRMAN STETKAR: All right.

MR. BARRETT: Harry Barrett. I just want to point out the NFPA 805 standard requires you to do the analysis on a fire area basis. And when you do the fire risk evaluation you have to evaluate the risk of that fire area. So you have to do it on a fire area basis and you then also have to sum them up.

MR. HARRISON: Right.

MR. BARRETT: You can't do both.

MR. HARRISON: Right. And within the 805 there's a paragraph that says you have to do it fire area by fire area and compare the risk using CDF and LRV. And then the next paragraph talks about cumulative impact has to be evaluated and determined to be acceptable also. So both pieces are within 805. Again, that's a little more complicated that most risk-informed applications that typically look at what's the delta associated with the total change, as long as they're related changes.

And with that, I want to come and just close with a path forward. I think the industry's task force is a needed thing. The staff plans to interact with the task force. We're still kind of working through that process. We're still going to be engaging on Fire PRA concerns and working with industry on those.

As Fire PRA methods, as the industry identifies conservatisms; and I appreciate the morning presentations, because some of those were the first times the staff is actually hearing specific examples of conservatisms, where they're actually being identified by the industry. We need to go further into that. We need to address those issues and work together to come to resolution. And I personally don't have a vested interest in task force fact process. My interest is are we working towards a resolution? There's a fact process there that can be used. We did struggle a couple years ago with that process. We worked out some specific tweaks to the method to make it work for the Fire PRA stuff, so it's a valid approach. We've put out the Supplement 1 to the NUREG/CR 6850.

And, Ken, I'm never going to be able to figure out the EPRI numbering scheme, so it's 1,000 or whatever, 1 million-something.

We're going to continue to interact with the industry. I think a big thing, and I really didn't touch on it, is the need to develop and train more industry and staff in Fire PRA methods. There's an EPRI research Fire PRA course. They're adding modules to it it seems like every year or two to expand it. And for us to move forward that's a critical area that needs to be carried forward.

And again, as demonstrated by the two pilots, you can get through the process and you can come to an application and transition to 805. No licensee has gained the ideal solution of coming over and not having to make modifications or not having to deal with certain recovery actions and deal with issues, but the process does work. And it's shown to be of benefit from a risk perspective at the two pilots due to modifications that make the plant physically safer. And again, we just need to work through the issues.

And with that, I'll see if you have anymore questions.

CHAIRMAN STETKAR: Any questions?

(No audible response.)

CHAIRMAN STETKAR: Thank you. Next?

MR. SALLEY: I'm Mark Salley. I'm going to talk to you guys a little bit about fire research. And any questions or anything as I go through it, please stop me and I'll be happy to tell you where we're at and what we're doing.

The goal here is to give you a high-level view of what we're doing. A couple underlying or underpinning items. We want to continue to improve the state of the art and to expand the knowledge base. So continue to refine things, to improve our methods, to improve our data sets, and that's what we're looking for in research in the fire protection area. So again, that's the goal here is that, you know, we continue to advance the state of the art and the sciences.

Next slide? Just a talk a second about how do we do research? How do we get projects? I mean, what's our process for doing that? There's basically three methods that the Office of Research in total uses.

The first one is a formal office to officer user need request. For those of you who are not familiar with that, one of the offices, NRR, NMSS, will come to research at the office director level and say we would like you to do X. And the office director will agree to do that, and this is how our scheduling and our manpower and our budget come together. With the tasks, for example, one, we're working with NRR in the fire protection area is there are 32 unique separate tasks within that one letter. So it's one agreement that has a number of different tasks that we work on.

And with that, having so many tasks and diverse tasks, the offices will sit down at the working level now at mine and Alex' level and we'll discuss, okay, you know, NRR, here's your user need request. There are 32 unique items in there. What's your priority? I can't do them. You know, I've got roughly 8, 10 people. I can't do them all at once. And Alex and NRR and Donnie will sit down and say, okay, this is the most important thing we need right now, so we'll make this a high-priority. You know, these can wait a year or two for. Make these medium. These are long-term. We'll make them low. So that's how we set our priorities.

It's not that I sit down and say, you know, I really want to explore sprinklers, so we're going to do sprinklers. It doesn't work that way at all. So it's definitely driven by that user need. And again, NRR is the big user with us. We do do some work with NMSS and very little with New Reactors at this point. But NRR is our big customer.

The other of course is at the agency. If the commission level wants us to do something, obviously we'll do that.

And the final term is, a little part of what we do is our long-term research where we tend to look at things and say, okay, this is something that's going to be coming down the road in the future. We want to get a leg up on it and we'll start doing some work. So that's how our priorities are defined for us in the Office of Research.

Start at the top with the methodology. Again this is a joint document. It was developed over a number of years. It was a partnership under our

Memorandum of Understanding with EPRI in fire research. At the time it was state of the art, which was 2005. Of course now it's been used a little bit and it's getting some use, and we're learning things with it as it's used, as you would expect.

There were a number of FAQs that questioned or had questions about the methodology. I believe there were 15 of them. Those have all been resolved and we've come to agreement on that, and we've published Supplement 1 to this. So you have to go to 6850 on the Web page and you can see there will be a supplement underneath it. You can download the questions and answers to that. So we're pretty current.

MEMBER SHACK: Now is Supplement 1 still a co-development?

MR. SALLEY: Yes.

MEMBER SHACK: Okay.

MR. SALLEY: Yes, we worked together on this. And I kind of skipped over my slide about partnerships in there, but the ability to work with industry under the MOU is really valuable. I'm a very big believer in that. It allows us a number of things. It allows me access to talent that they have that I don't. One who comes to mind is Dan Fong. In an electrical space Dan is excellent and just EPRI bringing him to the table and allowing us to talk with him and how we do our testing and that is hugely valuable. With the DESIREE test I'll talk a lot about the ability for them to get things for us and to help us. Really, it takes the quality of the product, which is what I'm worried about, and it really increases the quality. So it's a very good thing.

If you talk to my folks, obviously it's much easier to do it your way and not have to deal with anybody else. It's kind of like being single versus being married. But in the end it's the good thing to go with.

CHAIRMAN STETKAR: Mark, you mentioned earlier that the research programs are user need driven.

MR. SALLEY: Yes.

CHAIRMAN STETKAR: And that your primary customer is NRR.

MR. SALLEY: Yes.

CHAIRMAN STETKAR: How through this collaborative process with industry does industry's user needs -- how are they reflected in terms of your research priorities and budget? So for example, if industry identified a particular issue, which they have in the past and still continue to do, is there a process that that achieves some sort of elevated recognition in your user needs requests that eventually get filtered down to your budgets and schedules in terms of organizing, you know, your limited resources, whether it's testing or, you know, going out for validation of computer codes, or whatever it is, you know, you do under your program?

MR. SALLEY: At the highest level the office director, Dr. Sheron, about annually he will have a meeting with the CEO-type of EPRI and they'll go through all the programs. And fire is just one addendum of many that are in there. And they'll generally hit the high points to make sure that, you know, these are the top three that we're working on, same top three, and can we work together on these? So they'll do that at a very high level.

For years Ken and I; and Rick is picking that up that Ken's been promoted, we'll discuss, try to look a little bit ahead of where the troops are working and say, okay, what are we thinking about next and, you know, what's high priority for you? What's high priority for us?

We don't do everything together. And I was, you know, listening to their presentation, and I wanted to make that clear, that there are certain testing programs that EPRI thinks are important and they're going their way about it, and an example being the heat release rate in cabinets. To be truthful, I'm going to talk about that in a little bit, I had a program to kick off. And we were starting to get it, but we were looking much more experimental. We were looking at, okay, we've looked at this test, this test and this test. Where are the holes at? You know, where do we need to go do some experiments and pick that out?

But when EPRI said, no, we've got a big program going on this, okay, I'll back that one off. You go and do your work and, you know, we will -- big program and the fact they're not doing experiments, but they're looking at --

CHAIRMAN STETKAR: Yes. Okay. You're going to get to cabinets, I'm sure.

MR. SALLEY: So, yes.

CHAIRMAN STETKAR: So we'll talk more about that --

MR. SALLEY: So, you know, that was one where --

CHAIRMAN STETKAR: -- when you get to cabinets.

MR. SALLEY: -- EPRI is working --

CHAIRMAN STETKAR: But that's a good example in terms of what at least I think we heard this morning as an issue that seems to be a source of, you know, uncertainty or consternation about perhaps excessive conservatism where there were allegations that the available test information might not at all be relevant to a real world situation. But kind of when pressed, you know, the industry says, well, we're sort of looking to research to do that testing. And if you're saying, well, we're not going to do that type of testing, I'm not sure how this process really works.

MR. SALLEY: To be truthful, with that program we've looked at it. We have a user need line item on that. It's not a very high priority as some of the others --

CHAIRMAN STETKAR: Okay.

MR. SALLEY: -- within NRR. But we do have a lot of data, but there are holes in the data. And we were going to go and start, if you will, plugging the holes. But before we go and charge and do that, I want to give industry the benefit of the doubt and let's see what they come up with.

CHAIRMAN STETKAR: All right.

MR. SALLEY: And then we'll do it. Likewise, with our cable tray program, I'm going to talk to you about CHRISTIFIRE. You know, that's one that we're strictly going alone. That's something that -- it actually was a long-term need a few years ago that we saw from our PIRT that, you know, hey, we need better data here. Let's start thinking about this. As we discussed it with NRR they said, hey, that's a user need item. Let's get it in there. So that was a nice one that matured into a real program. And again, that's one we're going alone.

So I just wanted to make the point that industry and NRC do have independence. There are a lot of things we work on together when we can and there are things that they think are priority they work on and I have other priorities. So that's the point I wanted to make.

CHAIRMAN STETKAR: Thanks.

MR. SALLEY: Big question with 6850, and this is the one that I've been wrestling with for about a year now. We're going to talk a little bit about 6850 as how and when do we revise this? When do you say the state of the art has significantly advanced; it's now time to come out with revision? You know, does the state of the art change in six months, six years, 60 years? When does that occur? How does that occur? You know, that's the hard one for me to put my finger on, and I'm working with that right now.

Just look at 6850 for a second. Look at the document. You know, you got 18 specific chapters in there which are all unique tasks. You got 23 separate appendices which again tie back and support the chapters and the tasks. So you're covering a lot of things from human factors to circuit analysis to fire dynamics. You know, you've got a very broad brush of the Fire PRA that compromises 6850. When do you revise it? How do you revise it?

What I'm kicking around or what I've been proposing to industry now and we're in the discussion phases is that I'd like to go with a modular-type update where we can take a piece of it, a certain subject area that we've done tests, we've got better data, it's now time for -- it's matured further. Let's update it. But again, I need to work very closely with this because you have to remember this is a jointly-owned document. I can't just take 6850 and revise it. Ken and Rick, they just can't run and revise it. That's not success. We developed it together; we need to continue to work on it together with that collaboration. So that's kind of where we're at, and this in the discussion phases right now.

Next slide I'll give you just an example.

MEMBER ABDEL-KHALIK: Chapters are sufficiently stand alone with limited impact on other chapters that you can --

MR. SALLEY: That's part of the challenge. That's a part of the challenge. I don't think that the authors originally ever intended it to be a modular replacement. They wrote a document. They wrote a report. And you got to remember too, 805 it was used for, but it actually had a different meaning when it was started out. It was a fire re-quantification, which led to the SEP, which is how the inspectors do it. So it's a very interesting document.

CHAIRMAN STETKAR: An example, Said; and I'm a bit familiar with, and we heard a little bit about it this morning, the criteria that you use under the current data collection process for determining whether a fire is challenging, presuming that you know everything there is to know about that fire, so you have perfect knowledge, you then determine whether it's a challenging fire or not a challenging fire. That determination in principle effects parametric values that you would use for detection and suppression. Because essentially you've already screened out some events as being non-challenging so that, for example, some parameters that you use for detection and suppression efficiency might change depending on how you do that data sorting. So those two essentially talk to one another in a sense, or, you know, in human reliability --

MEMBER ABDEL-KHALIK: I'm sure there are a lot of --

CHAIRMAN STETKAR: -- in terms of, you know, available time versus time required to perform a detection suppression capability.

MR. SALLEY: There is no easy answer.

CHAIRMAN STETKAR: It's not --

MEMBER ABDEL-KHALIK: There are a lot of cross links between the chapters.

MR. SALLEY: Yes, if you take a look on the next slide, supporting my modular theory or concept, there are two examples. When we look at chapter 9 it deals with the circuit failure analysis. Okay? We've just completed the DC testing that I'm going to talk to you about. Tomorrow we kick off an electric circuit PIRT panel and we also then will follow that up with a PRA group that follows the electricals and say, okay, what's my probability? So the bottom line is we're going to refine and come up with some more information and a lot more data sets on how to do circuit analysis.

When we have that program completed; say a year from now that program should be compete, we've got that information, but you still have the old information in 6850. Do I take that and say, okay, we're going to start revising 6850 and we'll use this information in five years when 6850 is revised, or can I say reality 2012 I can have this on the street and 6850, the people can start using it?

The same is true of the Appendix R. No pun intended, but Appendix R of 6850 is cable fires. I heard from industry meetings that, you know, folks we were doing some fire modeling with the cable trays early on said this is way too conservative. And I looked just a little bit at what was going on and the fires were big. And we said, you know, why is the fire so big? How is this happening? When we looked at the methods that were developed in 6850, they didn't account for the fuel being consumed. So the fires tend to go on infinitum.

As we now look at the CHRISTIFIRE Program, we can characterize, okay, here's show the fire burns.

Here's how it, you know, consumes the fuel. Here's how it reaches a steady state. Well, we can now get to that steady state. They're always on an incline, so in that one, yes, they're conservative.

So how can I best get that information into the PRA practitioners' hands is the question that Rick and I are discussing right now with the NRC and with industry.

CHAIRMAN STETKAR: During this process, you know, we hear a lot of concerns about excessive conservatism, and you just brought up an example where the most recent testing may confirm some sources of conservatism in the current models. To simply say that something is conservative doesn't leave me feeling very well because, you know, there are a lot of sources of conservatism.

The question is is the conservatism enough that it makes a pragmatic difference in either the level of effort that's required to do the PRA; which is a resource issue, I'll admit, or the overall technical conclusions from those analyses, which is, you know, more along the lines of what we're concerned with here? Do you think about that?

MR. SALLEY: All the time.

CHAIRMAN STETKAR: Okay. Glad to hear you think about it. How is that determination factored back into, for example, this idea of, well, do we update the guidance today or do we wait, you know, for a different process, update it five years from now? Nice to know information, but not necessarily critical for me to do my job today. That's the degree of, gee, we've learned something that's really important, that what we're doing today is either really conservative and that conservatism really makes a difference. Or conversely, what we're doing today is really optimistic and that optimism makes a difference, which we've learned also in the past. That obviously needs to be reflected to the users as soon as possible compared to something that, well, maybe we're, you know, 15 percent conservative.

MR. SALLEY: I really see things as refinement. What I'm saying is I really don't see any eurekas coming out of here.

CHAIRMAN STETKAR: Okay.

MR. SALLEY: Case in point -- and I was thinking about some of the --

CHAIRMAN STETKAR: That's important information, by the way.

MR. SALLEY: I don't see the eurekas. I mean, let's go back to 1997, okay, when the whole circuit thing and the multiple spurious was all just like a -- it was like a storm and it was brewing. And we had RIC presentations. And we sat in the ACRS room back there in '98; I was in NRR, and you know, pounded on tables and circuits don't fail. You can't have multiple spurious, you know? They don't fail this way. They short to ground. You don't see all this. And we had all those heated debates until the tests were run and then all of a sudden there was like a eureka moment here. No, this really does happen and, no, we can see percentage of this and we can understand thermoset and thermoplastic, and cables feel differently. And since then we've been refining that. And so we've been on a continuous refining method from a this can never happen to no, it does happen and now we need to understand what and why and how it happens. So we've been continually refining it. DESIREE is our latest one that goes from an AC to an DC and we continue to refine it. So I see us really on the refining role.

The second part with this conservatism, the sword cuts both ways. I would love in a perfect world that everything I had in research and everything that was done in 6850 was guaranteed 100 percent conservative and I spend the rest of my career with research in my branch. And we just pick a topic at a time and we whittle it out. And we just keep whittling out, you know, here's a percent here and here's a percent there, and we're going to get all this conservatism out of here and get it down to reality, whatever reality is. That's not going to happen.

And I think we can see that, too -- case in point, I'm going to talk a little bit about high-energy arcing faults, is when the team put 6850 together, they used the best information they had available at the time. If you remember San Onofre had the nice high-energy arcing faults. And, wow, lot of good data, lot of good photographs. And if you look at the appendix in 6850, it's pretty much San Onofre.

Now, say there's an engineer looks at it and says if it's 480-volt or 4,160, does it make a difference? Well, intuitively I want to say yes, but then we've now said all high-energy arcing faults are San Onofre. This past year, right, Robinson. Whole different event here. Wait a minute. Wait a minute. This happened in a conduit? No, no, no, no. This happens in switchgear. Well, no it happened in conduit. And it talked about zones influences. Well, they're too conservative. Well, what the regions are telling me is, hey, we're taking your method. We're applying it to Robinson. You're not conservative. As a matter of fact, it goes out further. Okay?

So the conservatism, that sword is two-edged. I mean, anytime we open anything up and look at it, we'll say yes it's conservative. We're going to go in there and grab that conservatism and rip it out of there. Not always. So, I mean, that's why we continue to research. But I really see it as refinement. Like I said, I don't see this eureka moment that's going to come down. And I'll show you some of the DC stuff, and it's pretty exciting, but it's not eureka.

CHAIRMAN STETKAR: We're going to run short on time here, and I want to keep you moving, but in many cases listening to what you say is I tend to translate it back into something that people aren't doing in the fire analyses and that's quantifying the uncertainties. In other words, if the information that we have today has a certain amount of uncertainty in it, indeed I can put some sort of distribution to that, calculate, you know, some mean value or something like that. Refinements later on theoretically should reduce the uncertainty, one would hope that. From what I hear you saying is that as we become more refined our uncertainties might be growing, which to me says maybe we're not really thinking about those uncertainties either from the parametric specification, you know, the data in point, or from the users of that information to say, well, this is our estimate of the risk today, but we're not certain within a factor of; pick a number, 200.

In any of the stuff that you've done have you characterized the uncertainties, the variability from what you see?

MR. SALLEY: Uncertainty is always going to be the bogeyman under the bed. I mean, I'm firmly convinced of that and there's never going to be anything that's going to be that guaranteed certain. The closest one that I watch is probably a simpler one, and that's the fire model team as they deal with the parameters inside the fire models. And I'm watching them wrestle with uncertainty, and boy, that is a job. I mean, to really -- when you look at the fire models and the different parameters as what's going in, you know? Do I use the right K-RO-C? Was that the correct density? You know, at what point do you get to -- what's the classic -- if a butterfly flaps its wings in Brazil does it cause a tornado in Texas? You know, where is the butterfly effect, the uncertainty and how does that migrate through? You know, that is the challenge and I think it's always going to be there.

You know, in fire modeling, from my own experience, if I'm not sure of the K-RO-C, I'll pick the high, I'll pick the low, I'll run the model and I'll roll it into the world of sensitivity. And so, okay, from a sensitivity standpoint, eh, little bit, or you know, high or low. But that uncertainty is always going to be the challenge. You know, Commissioner Apostolakis just did a paper or gave a talk at the NEI Fire Forum as a matter of fact on the uncertainty of uncertainties and --

PARTICIPANT: Unknown of unknowns.

MR. SALLEY: -- unknown of unknowns. Thank you. That's why he's here. Keep me honest.

But the unknown of unknowns. And that's always going to be a part of it.

CHAIRMAN STETKAR: Okay. Thanks. I know you want to get through some of the --

MR. SALLEY: Yes, and I will try to move quick and like I said, I want to give you a high-level view. But please the main thing is to answer your questions, so stop me whenever.

HRA, another one. And you want to talk

about uncertainty? I mean, that's a hard subject. We have a joint team going with NRC and EPRI. They have completed a NUREG. NUREG's out for public comment. I think it's pretty well-received. Got a lot of comment. And I'll say the same thing: Any time we put a NUREG out, whether the people praise it or hate it, either way is good as long as they're reading it and giving us comments. The problem is when you put a NUREG out and you get zero comments. Then you know you've missed the mark. So this one had a lot of comments and I'll take that as a compliment of the team. And they're working them through. So we look at the spring of next year of hopefully getting that issued final. You'll see that we've included it in some of the training.

But with the HRA, there's the SRM project. And fire is a part of that project, so we need to work in with the larger community. And I know Susan Cooper is working very close with her colleagues up in research and we'll see that happen.

CHAIRMAN STETKAR: Yes, and we have a subcommittee that's been following that pretty closely. We just recently had a meeting on it. That again, that issue will not be solved universally in the immediate future.

MR. SALLEY: No. Fire had a real need though, and I really credit Susan and her team and the EPRI effort because they're the 805, and HRA is a very important factor. So I think they may have got a little ahead of the wave and tried to give us some tools to use, and that's where that's at.

Next slide? Fire modeling. We're starting to pick up some momentum here. You know, we've got the internal document we use for our inspectors, 1805, to get them into the fire dynamics. We've got some time for a refresh, if you will. There has been new models developed. The THIEF model that came out of CAROLFIRE to predict cable damage, which is one of the keys things, so that's being incorporated. And you'll be seeing that coming out here. Dave Stroop has got that going to publishing here hopefully before the end of the year. So we're continuing to keep that alive and move that forward.

CHAIRMAN STETKAR: Here again, is there a substantial difference -- you have to remind what THIEF does, Mark, because I can't remember, but it's the conditional probability of cable damage given a fire? Is that it's primary --

MR. SALLEY: Yes.

CHAIRMAN STETKAR: Okay.

MR. SALLEY: That's the best example, John, to use in this, if you want to see state of the art and progression over time. When we went to the SDP back around 2000 and started working with the inspectors on it, when they would do a calculation, a simple hand calculation, if they knew that a cable failed at say 700 degrees Fahrenheit and the cable was in the hot gas layer, they did a hand calc and they got 700 degrees, as soon as they got 700 degrees, they said I got 700. Immediate cable failure. I've got the circuit doing a hot short, whatever. THIEF came along and says wait a minute, you know, cables have mass. We looked at this, said yes, they don't instantly fail as soon as they see 700 degrees Fahrenheit. It isn't like an off/on switch. There's thermal inertia they've got to overcome. The cable's got to fail. And we did some of that work. THIEF was the one that came along and did a 1D heat transfer. So now we can take it from an instant failure to, okay, what is the heat flux over the period of time on that cable to get to the failure?

CHAIRMAN STETKAR: As a practical standpoint, do you see substantial increases in time to cable failure? Because that's the whole key of, you know, when I start doing my detection suppression analysis.

MR. SALLEY: From going to the temperature turns 700 degrees? Until that? Yes, there's going to be -- it's a good refinement. That takes a good chunk of conservatism out.

CHAIRMAN STETKAR: Okay. But are we talking about, you know, the difference between zero time and two minutes, or are we talking about zero time and an hour?

MR. SALLEY: Depends on the fire. No, I mean, look at Appendix R space. Appendix R told you that, okay, when you go -- you have the fire started at T0 in the compartment. At T0-plus all cables are damaged. That was like, wow. You know, that's conservative.

CHAIRMAN STETKAR: Yes.

MR. SALLEY: And then we said no, we got to wait now with the SDP and, you know, when do you get the realistic fire that actually give the temperature that does that? So, you know, some of that conservatism was taken away from Appendix R. THIEF again takes it to the next level. And THIEF is modeled much like the RTI on how does a sprinkler head -- I mean, that's where we stole the idea. You know, how does a sprinkler head operate? That sprinkler head is 160 degrees Fahrenheit. As soon as it sees 165, does it immediately do this? No, it takes a little time to heat up. You got to heat the element. That's why the elements have gone from being so fat to being so skinny, because now they heat up. They're quicker. And NIST did that back in the early '80s. We basically stole that and move that over to cables. We didn't invent anything. That's again just refinement. You know, we continue to refine things.

So 1805 should be coming out this fall with fire modeling. Again we've done a lot of work here. Again, a project that I would hesitate to say that industry would have had a hell of a time doing it by themselves or we would have had again a hell of a time doing it by ourselves was doing a V&V. V&Vs are intense. I mean, that's seven volumes of work. And this is a good one where we collaborated. We picked the five most useful models to the NRC and the industry and we've got a V&V.

You know, my goal is to -- now that we have it and we've used it a little bit, we've learned a little bit more about it, I want to go back and do it again. And we've got some more fire tests. And again, here comes the uncertainty. You know, we can tighten some things up. We found some additional tests and NIST did none. So we can go back in, and again it's that fine tuning piece that I see us doing.

We ran a PIRT. And again, the PIRT, one of the big items that came out of the PIRT was the cables, that, you know, you really don't understand a lot of things. You really need to focus in. And the cable burning was the one that clearly came to the top, which was why we started that work from the PIRT.

The last piece there, NUREG 1934. Again a joint document between industry, EPRI and NRC research, is the application guide. You know, fire model is nothing new. NIST has been doing this for 30 years. And, you know, it's interesting talking with some of the stuff they do. The forest fires in California, they're over there modeling that. When the *Valdez* had the spill in Alaska, one of the things was is it better to burn the oil off on the water or try to, you know, contain it? And they did fire modeling work in that. World Trade Center, they did a lot of experiments and fire modeling on that. So it's used pretty much everywhere.

Now the nuclear community. Nuclear plants are very different than any other building, we all know that. Design's different. What we worry about. You know, life safety for us to protect the reactor.

For the rest of the world it's get everybody out of the building. So there are unique things about what we do and what our targets are. Our targets aren't people. Our targets tend to be cables. Our constructions tend to be different than a room like this with a nice flat ceiling versus the congestion we see in a power plant.

So we need an applications guide to get people to be doing quality models. So that's the piece we're working on right now. And again, you can take that to some uncertainty.

When you try to run V&V, what we did the V&V, we asked the question how good are the models? What does the model do with good input? Now the question is with the applications guide is how good is the modeler, because he's the one that -- you know, garbage-in-garbage-out-kind of thing. So we broke that problem into two pieces and now we're working on the second piece.

And it was refreshing; well, it didn't make my day, but we put that out in January for review and we had a lot of comments. Problem was they were all very good comments. And I had originally been way over zealous and I wanted this document to be the end-all, be-all for fire modeling. You can't do that. So the team basically had to reel me in a lot and calibrate me and say people know, they have to know how to run a model. We're not going to teach them how to run a model. They need to know the basics. Now, we need to take them into the nuclear environment, and that's where that document's going to go.

So we look for that to be hopefully here near the end of the year. That's going to come out again and we want to run it for public comment again because we had so many last time. So just to be fair to everyone, we're going to put it out again for 30 days. So that's where fire modeling is at.

Next slide? Okay. Now into the good stuff. CHRISTIFIRE. This is an experimental program that we're running right now. It's just starting up.

You know, an odd thing, since Browns Ferry '75 we've been burning cables. If you go back and look at some of the earliest stuff we've done, we were burning cables. And one of the things that happened here, which again is so important having a partner like NIST, is the measurement system. How do you measure fire? And there was a lot of stuff that came out in the '80s after we had burned all those cables that said now this is how you measure. You know, you can do this. You know, oxygen consumption and ctelemtry working off the load cells. This is how you can come up with heat release rates and terms that had kind of come up after we had done our burning.

So it's now important for us to use our fire models. One of the key drivers, probably the most important thing you're going to load in that fire model is that heat release rate. How big is the fire? And this is what we want to get off the cable tray. So this is something we're studying now with these cable tray fires. Again, ignition. Ignition is hard. On solid combustibles ignition can be very complex. It's not as easy as a flammable liquid where you can, you know, do a Cleveland cup-type test and say, okay, at this temperature gasoline ignites at minus 34 and we can get that data. Solids tend to be a little more complex. But we're looking at the ignition. And the key here is the flame spread, too. How fast does the flame travel down the cables?

We look for there to be multiple phases in this project. We just wanted to get the first one in to see if we could do what we wanted to do. We look for this to really advance Appendix R, Section 6850 when we have it completed. The document is out right now for public comment, so you may have seen this. We've put it out for public comment in fact because we're inventing actually new models in here. FLASH-CAT is a new model and it's a model that's designed to predict how a flame will travel down a cable tray.

Next slide? Again, this first phase is just to get the basics, to get our understandings. There's a lot of complexity that gets into the cable routing in a plant. You know, how the cables are orientated. We focused on flat horizontals here. You know, whether they're 45 or vertical that's going to make a difference. We all understand that.

A big one, fire-retardant coatings. What are they going to do to this? And this is one that, you know, you look at this industry; and I've been around a little bit now, you go to things like fire-retardant coatings and say what is the standard for fire-retardant coatings? Well, you kind of fail open because they're kind of -- we can't find one. It's not like I can take UL XXX And this is how you do a test for a fire-retardant coating and we grade them A, B, C and D, or 1, 2 and 3, but we don't. So what you see post-Browns Ferry in '75 was people took stuff that basically had come out of the coal mine industry, was where the cable coatings were used. And they put everything on from grade A to grade Z, and it makes the problem a lot more complex. So we need to start looking and seeing just how complex.

Cable tray covers. Lot of people use those for Reg Guide 175 compliance. We were just up at Susquehanna a little bit ago and I noticed that, man, they got cable tray covers everywhere. I think that's going to make a very significant thing as to the how the flame spreads with those covers on there, as well as the heat release rate.

And then we can get into the finer fire dynamics things now, like if you look at a cable tunnel, for example, in a BWR where you're going down to an intake pumping station. You get a nice cable, which is almost like a mine shaft, and you start getting a nice ventilation flow through there. Then you can say, wow, this is really going to impact it. So one of the finer things in the later stages we'll look at is the wind-aided flame spread in the fire dynamics.

Next slide? We did three different levels of testing from a small scale that we would do in a standard cone-type apparatus to what NIST invented here, if you will, is an intermediate scale where we're using radiant panels to heat up the cables, to our favorite of all fire tests, which is the full-scaled. We did 75 small scale on the cables, 32 like this of the intermediate scale and 26 of the full scale. And again, the variables are very interesting, and you'll see that in the report. It's not as simple as the most massive cable gives you the biggest fire, because it didn't work that way.

Now, if you can think about something simple. Gabe here was an Eagle Scout, so we'll get into the Boy Scout stuff. If you take a two-by- four, you know, if I build a fire in the woods, if I cut it up into small pieces, twigs, I can start it very nice and easy and I can get a fire. But if I try to take the solid mass of that two-by-four and ignite it, it's very difficult.

The same is true of your cable trays. If we have a cable tray that's extremely loaded and packed solid such that it's a solid block of polymers versus one where the cables are kind of spaced out and we now get air, so air can entrain through it, you know, we tend to get some different burning rates.

Just to give you a flavor here, here's one of the 26 full-scale tests in super high speed. So this is typically what we were doing in NIST.
It's kind of worth seeing here what these tests look like, and it will give you a feel for again where this conservatism comes on.

Well,our videos, I'm sorry, are not going to work.

CHAIRMAN STETKAR: All right.

MR. SALLEY: But we can give these to you. But we have 26 full-scale. And again, you can see the -- we'll have to go with the still pictures.

CHAIRMAN STETKAR: On CHRISTIFIRE; I haven't had a chance to read the report yet, Mark, did you load these trays up to like 40 percent full or so?

MR. SALLEY: That's what we were trying.

CHAIRMAN STETKAR: Okay.

MR. SALLEY: And again, when you start a project like this, where do you begin?

CHAIRMAN STETKAR: No, that's -- I was just curious what sort of --

MR. SALLEY: Yes, and that's kind of what we were seeing. I mean, what we're looking at too is at the fundamental level; and that's the key here is the fundamental level. I like the world when it's thermoset and thermoplastic because it gives me kind of nice end zones to work with, and we're going to talk about a cable called kerite here that doesn't want to play in either one.

But what we did was we did a series of tests where we did thermoset and then thermoplastic, and then said, okay, what kind of different results are we getting? It's very clear as to how we get the different combustions.

DESIREE. These are the videos I'm sorry you're going to miss, because they're quite exciting. But this is the DC testing program, and this is just a still out of there.

Next slide? Again, refinement. When industry started their testing program, what we were looking at was the AC circuits. We followed up when the industry program completed. There were a number of unanswered questions which led to RISK 2004-03 that basically said there was a number of unanswered questions. Research responded to that by doing the CAROLFIRE Program to answer those questions. And again, we were looking at AC source for power.

2006, Harry, when he was still at Duke, they had done some DC testing. And they had some things that didn't fall within how the AC worked, and it was some different looking things happened. So that was laying on the table. We picked it up with DESIREE, which is the DC testing.

Next slide? And the approach was very similar to CAROLFIRE. This program we started off on our own. And talking with Ken there was an interest from industry to contribute with this, to be a part of it. And we said sure, we can work something out. We had modified the MOU. And it was a very good move for I think NRC and industry, because it opened a lot of doors to things, and I'll show you some of that here. Again, the key here is to better understand how the DC circuits respond to fire damage. That's the whole role of this.

Next slide? We followed the CAROLFIRE format where we used the penlight apparatus, which is this device. Never work when you want them to. I'm having all kind of technical difficulties. It is a cylinder device, which is the old sketch device from the EQ days. We have a nice controlled radiant heat flux that we can load down onto the cable so it's a very controlled environment and we can understand the cable response.

And then we go to the good old intermediate scale, which is actually an ASTM standard room-size burn. We built the top of it and we can put the cable trays either in the plume region or in the hot gas layer to see how they respond.

We did 59 small scale tests and 16 of the intermediate scale tests as DESIREE.

Next slide? This is really valuable and I got to take my hat off to Ken Canavan, because he really put the time helping us here and doing this. When we started this out, this program -- and it's I guess what, about $800,000 in testing on this one?

Gabe's the project manager for this.

You know, one of the things is going to be buying the batteries for DC. So basically we'd clear out every Wal-mart within a 50-mile radius of Albuquerque, New Mexico to assemble a battery bank, which we were in the process of getting ready to do. But talking with Ken and some of the experts in industry, they said you really want to use station batteries and you really need to find a set. And it was lucky here that Ken located a -- North Anna's Technical Support Center was getting ready to a battery change on the old batteries. They had gone through their life cycle and were timed to be changed out. So it was wonderful that he was able to pick those up. Now, shipping those wet from North Anna to Albuquerque, New Mexico, Ken can write a little book on that, because if anything could go wrong, it did go wrong.

But nevertheless, we got them there and we tested with realistic batteries. And so this gives us a test now that we have real power source, you know, not a bunch of DieHards strung together. But that's what the test configure looked like. It's basically a shipping container and we built a battery rack inside, much like you'd find.

Next slide? Again, looked at the common things to be looking for in a plant. DC motor starters, small solenoid-operated valves, a control for a circuit breaker, another solenoid valve and then a large coil to try to represent a PORV. Again working with industry saying, okay, what do you got in DC space that you're worried about from a risk significance? Again, it aided us here.

Next slide? It's also too for me to recognize that we worked very close with NRR on that to answer their questions. This is where the user need piece comes in. Harry Barrett was extremely instrumental working with us to make sure that we had realistic testing.

We preformed the testing. It's interesting, the DC circuits in the plants tend to be ungrounded, so you don't have that nice ground plane that you have in the AC circuits. That's going to come into play here.

And then we also -- because we were set up, we could do some additional testing. And the key one here is the kerite. Again, the biggest champion for this is Harry Barrett, who I have to take my hat off to him, to get us -- re-prioritized a bunch of work to get that kerite testing in here. The kerite testing is being performed right now as we speak.

Next slide? It's not a eureka moment, but it's a little bit of an eye-opener here, is a difference between the AC failure and the DC failure. One key difference. After all the AC testing that industry had done and we had done, we never really saw an open circuit. Okay? We'd see the cables get damaged. The jacket's clearly gone. the insulation's burned. If it's thermoplastic, it's dripped down to the bottom of the tray. If it's thermoset, it tends to be there and charred, but it's there. The copper's almost always -- every test the copper always survived the fire.

And here with the energetic fault, we actually saw open circuits. So if you can think of somebody arc welding in the cable tray, that's kind of what it looked like if the video would have worked. And we literally saw a lot of the copper get blown away and you can see the copper slag. This is the bottom of the penlight facility. So that was a difference, a big difference between the AC and DC.

Next slide? Here's the video that won't run. I apologize. My bad for not bringing a separate copy.

Failure is much more energetic in DC than AC. So if you had to ask me today would AC bound DC, the answer I'd probably give you is I don't think so. DC is probably going to be more of a bounding case than the AC consideration.

The arcing tended to act like a pilot. Remember I was saying about the combustion phenomena that we're studying in this. You know, for the solids to be there they have to get volatile. They start giving off their gas, getting volatile. You mix with the oxygen. You now need some form of heat, some spark, if you will, to ignite that and to give you combustion. The shoring of the cables, something Steve Nolan saw 20 years ago in Sandia tests, we tend to show that again. Yes, those arcs tend to be the ignition, the sparkplug, if you will, to get the cables to burn.

Fuse sizing was important and it often dictated with the arcing and the hot shorts.

Next slide? Obviously, and this is kind of an obvious one, that the larger fuses take longer to clear than the smaller fuses. You know, the breakers kind of had us spoiled in the AC testing, because the breakers tend to be quick. You know, they tend to pick faults up very quick and to clear the circuit. We didn't see that with the fuses. As a matter of fact, in some of the larger fuses we didn't see the fuses clear. We saw the cable actually become an open circuit before that fuse cleared. So that was kind of --

CHAIRMAN STETKAR: Is that right? You actually --

MR. SALLEY: Yes. Next slide? Un-grounding. You know, you could theoretically say that the cable tray itself could form now a nice path for one circuit to short to the cable tray, the other one short to it and now the plus, for example, would come across, and lo and behold, we saw that. So you do see the raceway actually become a path to conduct the electricity in the end-grounded system. So the end-grounded system does bring some unique things in.

Next slide. The key here is I've kind of given you my off-the-cuff look at, you know, what we saw or what I saw the actual guys doing the work do. That's kind of meaningless. It's just nice. The key here now is the real work is beginning. Tomorrow actually the first panel comes in. We have Brookhaven

National Labs coming in. They're going to run a PIRT. Actually it's going to be a PIRT and an expert elicitation. Here again we've tried to work very close within industry. Both panels will be eight people. Four we've picked from the NRC National Lab side and we've had four come from the industry experts. So we wanted a nice balanced panel. So it's not going to be lopsided in any way. It will be a truly balanced panel.

The first one, the PIRT meeting, again Brookhaven is running the PIRT for us. It will be a formal PIRT and it is going to be the electrical experts. And the question's going to be -- and I kind of want to get out of the tail-wagging-the-dog mode of testing circuits and what I want this panel to tell me, is there anything left on the table that I need to be looking at?

If you remember the original NEI testing, NUMARC back then, halfway through the test program all of sudden CPTs came up, control power transformers. And that was the silver bullet that prevented the hot short. And for one that was tuned so tight, it greatly cut down on the number of them. But when we did subsequent testing it didn't come out to be that silver of a bullet, if you will. Here we are into the third phase and DC coming up.

So what I'm saying is I feel that I'm being reactive rather than being proactive and that PIRT allows me to be proactive. That's what I learned from the fire modeling PIRT. So this electrical group is going to go there and see is there anything else on the table? Did we miss anything? Let them look at this data. You know, they're the experts. We've given them all the data sets. They've got the full DC data set. We haven't published it final yet. We're giving it to them in draft. They have everything. They've got the earlier CAROLFIRE work and they've got the original NEI work and that's going to be their basis to look at it and say, okay, is there anything else we need to look at in cable space? We've looked at AC, we've looked at DC. We understand intra-cable failure versus inter-cable failure. We understand end devices and how that matters to do a pull-in on a coil. We understand the role of the CPT and how closely that can be and how it affects, and to basically ask all the electrical engineering questions.

Upon the completion of that panel, we immediately go into the second panel, and this one will be structured more as an expert elicitation. And this one will bring in the PRA experts and say, okay, the electrical experts have looked at this. Here's what they've come up with. Here's what they've concluded from all this test series. Now the question becomes for 805 space what are the probabilities of this type of cable and this configuration giving you that short? And we'll let the PRA community bring that. So we'll get the physics part done and then we'll go into the PRA community.

So hopefully that will be about a year from now that will be completing. Starting tomorrow is the first panel and these panels will run through the winter, into the spring and I would hope they'll conclude up in the summer of next year and we can get the reports finalized. Again, it will be a full structured elicitation with Brookhaven leading it.

Next slide? You heard a bit about training. Training is kind of an interesting role for research. I mean, I really enjoy the training part of this that we get to do. It's funny, you just can't take 6850, mail it to Chattanooga and say come up with a class. I think that would be a disaster. So we have to bring the experts to bear to actually do the training. And we've had some very good experts. And the beauty of this right now at this point is very many of the people who are the authors of 6850 are the ones who are giving the training. So you really can't ask for too much more than to have a class from a textbook from the person who wrote the textbook. So we've been very lucky with that.

We do it again with EPRI and we do alternating years. This year was the NRC's year. We just completed the two classes. I don't want this program ever to go static. It needs to grow and develop. A big addition this year was to add a full track or a full class, if you will, on HRA. So we've gone from three classes to four classes.

We've also done something very interesting. NRC hosted in 2008 and we videotaped both sessions and we saved all the slides. And I had a number of college students over the summer and they basically got to learn a little bit about Fire PRA by going through all the presentations. And we basically created an early form of a distance learning class. If you remember how distance learning started with the universities, they would often send you the VHS tapes and the book and you'd watch the tapes and the professor would lecture and go through it. We've kind of tuned that up a little bit.

But that's the MARIAFIRE. It's a CP,

which is a conference proceeding. And it fills that need right now today if you needed to say I need, you know, some -- my goal from the NRC was we hire some new folks, they go into the region. They're going to start doing Fire PRA. And the old answer was, well, gee, make sure you get signed up for next year when EPRI and NRC put on the training. So that person goes into this nine-month I'll go do something else. Well, right now you can take this off the shelf and you can start learning on your own. And it also gives you ability of some of the industry presentations and what Donnie was saying, that if you haven't done it for awhile, you had the training two years ago and today all of a sudden you need to exercise it, it gives you a good refresher.

MEMBER ABDEL-KHALIK: I have a question about your previous slide.

MR. SALLEY: Yes? Sure.

MEMBER ABDEL-KHALIK: If the members of these panels were to listen to the talk we listened to this morning about road map for obtaining realism in Fire PRAs, would the outcome of these expert elicitations be any different?

MR. SALLEY: I don't know. I would like to say no. I would like to say if the industry guys will bring some of that knowledge to the PIRT panel for discussions, you know, some of their priorities or things they want to discuss among the experts and try to get some ideas. That's what I'd like to say.

MEMBER ABDEL-KHALIK: Well, we're not really sure.

MR. SALLEY: As in what the questions are as far as --

MEMBER ABDEL-KHALIK: With the outcome of this process.

MR. SALLEY: I missed some of this morning, so I'm speaking from ignorance.

MEMBER ABDEL-KHALIK: Okay.

MR. SALLEY: So I'll pass on that, if I could.

MEMBER ABDEL-KHALIK: All right. Let's proceed.

MR. SALLEY: Next slide? Currently in the training, and again it's offered twice a year, we have the four tracks. We've put the fourth track in, which is the human reliability analysis. Upon completion of this year one of the things we looked at was the fire modeling, that we need to start getting into a detailed fire modeling program. And we're considering developing for next year a fifth track, if you will.

The basic fire analysis is more of a hand calculation fire dynamic-type analysis for the PRA. Let's start moving into the detailed fire modeling, which this would be a good forum to do it.

And it's interesting talking to the people who are taking it. We're getting a good mix of both industry and NRC. I think the people really look forward to it. Mostly what I've heard has been very positive on the training. And people are looking at it that, boy, even if I do just -- if I'm an electrical engineer and all I do is circuit analysis, okay, and I know how to take the cables and I know how to take the PNIDs and I can run the circuits down and I can run the cables down, they find it very interesting to look at the PRA piece and learn, you know, what are the PRA guys doing with this information once I develop it? Or how are the fire guys telling me that I get damage? So the word that used is cross-training. People are seeing a lot of value in that as to understanding the big picture by the whole Fire PRA. So I've noticed a number of positive comments on that. I know the HRA, it was new this year and it was well-received, and the team did a very good job. Hopefully we'll have the same success with fire modeling.

Next slide? Which you get to the fire modeling slide, and this is one that EPRI has been doing for about 10 years. And it's kind of gotten saturated where everybody who is going to do it has done it and it got a little stagnant. So the attendance is somewhat down. So I think by kind of fluffing it up, getting that applications guide out and then incorporating it into the bigger program we can get an interest going in fire modeling. Because quite truthfully, fire modeling is a very powerful tool. I think if I was back in industry what I would be doing with fire models -- and I'm really not seeing, you know -- or when I talk to the NRR guys, I'm not seeing all these, you know, what I would be bringing in, a lot of high-powered fire modeling stuff or things I would be trying to do. So I think fire modeling is under-utilized and I'd really like to get it a lot more utilized. So that's something we're working on.

Next slide? Knowledge management is an area that we picked up on. We had a lot of information. We've done a lot of things that -- esoteric at the time, like, gee, make sure all the NUREGs are in ADAMS. Was a program that I used summer students for three years ago and it was amazing how many NUREGS were never in ADAMS, that we had one paper copy of a document. And it's like, my goodness, after all this work and time, if you lose that one paper copy, wow, or who even knows, you know, from 1978 that this was done? So we've done a lot of work with that. Of course Browns Ferry was the high water mark for us and, you know, we've captured everything we can. As a matter of fact, I've even gone and found some more stuff. We had Jack Lewis come up and give a seminar. Jack was a TVA operator at the time, so beautiful insights he gave us. You know, he left TVA in '86 and went to our COC Training Center where he spent the rest of his career down in COC in Chattanooga training. That's a TVA term, COC. I'm losing it.

PARTICIPANT: PDC?

MR. SALLEY: Our PDC. Too many acronyms. Our PDC. And he was an instructor there for a number of years and he recently retired. But before he really got to the house, we grabbed him and he kind of gave us a seminar, which is very interesting and we want to get that on there as to what he felt and what he saw that day of the fire.

The "History of Fire Research." Wow, there was a lot more, a lot more than I even realized, especially things like old generic issues and stuff.

So we've captured that and we've got the history of where we are, fire research up through 2009.

The "Fire Protection Knowledge Management Digest" is we kind of ripped off the NRC's information digest and did one for fire protection. And there we've captured basically every generic letter, information notice, SECY paper, anything to do with fire protection. And again, that was built for the inspectors. And when the inspectors go out and say, you know, wasn't there something on an information notice about heat collectors? You know, where's the list of INs for fire that I can quickly page through and say, yes, here it is. There was. Or wasn't there something about hydrogen gas storage on the control room roof? Or don't I remember reading something? Or generic letter 8610 is the one that everybody likes to bring out and beat, because that was the big Q&A. So we've assembled all that. And again, it's publicly available to anybody who's interested. We share it with industry.

Next slide? Okay. Looking ahead. You know, what are we going with? And how are we looking on time here? We okay?

CHAIRMAN STETKAR: Yes, if you can get through it.

MR. SALLEY: Okay. Five Events Data Base. Very important project. Very, very important project. On this one, my hands in research are tied. Okay? I don't see this data. I can't get this data. If I went to Alex and said, Alex, I'm going to have you write a generic letter to have every plant turn in every fire that ever went, you want to talk about a non-starter. So this one I'm at the mercy of industry.

For years we used the NEIL data base, and it was good to a point, but I understand that there's actually -- Ken's told me that there are better things out there they can do than the NEIL, which was the insurance data base. This is one we need to pick up, guys, and really do. I mean, if you look at 6850, this is where we are a little dated. When 6850 was done and the team was together, they says, okay, a lot of times you would have an EPRI piece and you would have an NRC piece. It's a joint project. Okay. Who got the better piece? Okay. If it's a better piece from the NRC, let's use that. If the industry piece is better, let's use that because we want the best document at the end of the day.

The Fire Events Data Base, clearly the better one was the EPRI data base. So the NRC, we stopped. We got out of the data collection business and we went with the EPRI data base. That was clearly the better tool at the time. But it was current through 2000. So the data that you're using now is good through 2000. There's been 10 more years of operating experience that we have not picked on that we need to get in there.

And, John, I listened to your question this morning and I echo many of those same concerns as to how that older data comes up and in. And I've been a little bit of a thorn in Rick's side trying to say, you know, for example, one I got caught cold on was when we had the new commissioners come in. And the new commissioners came in and they wanted some briefings on it. And finally we got the standard briefing material and I believe it was Commissioner Magwood, we briefed him on this is what we're doing in fire research. And he hit with ne with a question. What percentage of the fires were electrical in nature? Now this is something I should have went bam, right? And I went let me get back to you on that one because I don't want to give you a bad number.

So I immediately had to scurry over, you know, back to Church Street and wind my people up and say, okay, let's start going. And now here's where the fun begins, because well, if we look at this data that's good through 2000, we get, you know, 29 percent. But if we look at the LERs, which are the official reporting, we get 42 percent. And this should have been a question that I should have answered so simply, you know? You know, I'll call you back in five minutes with the answer. Here's the pie chart, like NFPA or somebody would do, and we need to do that.

And another problem it presented, J.S. had an effort where the reactor vendors are doing some work and they find the data base that's currently on our Web site, which is an old NRC one from the AEOD days. It's horribly out of date and I need to sunset that and get a unified data base. So again, we're trying to work with EPRI. And at the end of this we would love to have a data base that we could both work out of, that we could share as a joint project and would come from the same numbers. So big project, but like I say, my hands are kind of tied on that.

We do do some metric monitoring. And this is one the Commission directed NRR and we picked up and used. And this one we use the LERs. And basically we're looking at three things from the Commissions direction. How many fires are we having?

In LER space we're seeing about seven. On average roughly seven LERs are reported a year for fires.

Second question was how about inspection findings? What are you seeing? I'm sorry I don't have that number off the top of my head, but we have the inspection findings. We track, you know, whether they're green or white or yellow type of findings.

And the third one is the long-term compensatory measures. Again, we're working under the MOU with EPRI to get that information from NEI.

So those are the three that the Commission has asked us I guess about two or three years ago to start tracking for them.

CHAIRMAN STETKAR: Mark, how do you respond to what we heard this morning, that if indeed the PRAs have some fidelity, numerical fidelity, we should be seeing many more damaging fires per year than indeed we seem to be seeing as measured from, you know, some metric. You mentioned metric monitoring here. Some metric in terms of, you know, a white or yellow or red finding from the inspection process, CCPD, however you want to monitor that. Do you agree with the industry that indeed the numerical results that seem to be coming out of the Fire PRAs are not consistent with what we're really seeing, if that's the appropriate way to measure frequency of severity, if you will?

MR. SALLEY: I'm not a PRA expert, so I hesitate. I mean, my background is more the classical design experimental fire protection that I come from. And so as a fire protection engineer looking at it, and you say, you know, for this event the chances of a core damage from a fire is one times ten to the sixth. Okay. That's one in a million. That's a lot of operation to get to that. Even if you take it down to ten to the minus third. Now we start getting itchy, but we haven't had ten to the third operating experience.

And to do the old Wash 1400, let's take 100 reactors, let's operate them for one year and now all of a sudden we have 100 reactor years of operation, that discounts a lot of things like bathtub curves and start up versus -- you know, stable operation versus the aging effect. So that's not my forté. I wouldn't look --

CHAIRMAN STETKAR: Sunil will come up at the end. I'll hit him with that one.

MR. SALLEY: Yes. I mean, I personally, in research I would look to a Nathan Su to help me with a question like that, because I see it as a much simpler world --

CHAIRMAN STETKAR: Okay.

MR. SALLEY: -- and where I come from.

CHAIRMAN STETKAR: I'm sorry.

MR. SALLEY: No problem.

CHAIRMAN STETKAR: Hit the wrong guy, but you had the bullet up there.

MR. SALLEY: I'm not the PRA expert.

Incipient detection. There's one that again we want to hopefully work with industry. And I started laying the groundworks with getting things set up. I visited NASA and talked with the guys at Kennedy Space Flight Center and such, and they swear by incipient detection and they think this is the greatest thing since sliced bread. And they told me the stories of the relays getting ready to burn out before a launch and they caught it and successfully. So, you know, Kennedy Space Flight thinks that's the greatest thing since canned beer.

Talked with guys from DOE and they tell me that this is junk and if you want some, they're out back in the dumpster. So go take them if you want them because they don't work in our environment.

MEMBER ABDEL-KHALIK: You know, you said that you get roughly seven LERs per year.

MR. SALLEY: Okay.

MEMBER ABDEL-KHALIK: These cover everything from a trash can fire to --

MR. SALLEY: Anything. The metric that we used was what is a fire that meets the threshold to be reportable to the NRC, like declaring an unusual event for a fire and filing the LER? That's what we used. That's the metric that we will get a response from the industry.

MEMBER ABDEL-KHALIK: Okay.

MR. SALLEY: And that's what we've used. And I can share the report I believe with you, and I'll be happy to do that. We're about at our third update. We like to do a six-month update is our agreement with NRR. We'll be happy to share that with you. Again we're looking for the trend. And the fire trend tends to want to be pretty flat, that we have around seven --

MEMBER ABDEL-KHALIK: Okay.

MR. SALLEY: -- or, you know, some years there will be four and some years there will be ten. But, you know, seven is the number from me reviewing the reports last time. J.S., help me there, but I believe seven was the LER, or roughly seven LERs.

CHAIRMAN STETKAR: Mark, let me interrupt you for just a second.

MR. SALLEY: Yes.

CHAIRMAN STETKAR: Because 33 percent of our member complement here is going to be leaving and not returning, and I'd like to ask that 33 percent -- Bill, do you have any particular comments that you'd like to --

MEMBER SHACK: No. No.

CHAIRMAN STETKAR: Okay. We usually go around the room and --

MEMBER SHACK: Sitting here absorbing information all day, but I just sort of sit back and think.

CHAIRMAN STETKAR: I just wanted to check.

MEMBER SHACK: Yes.

CHAIRMAN STETKAR: We usually do that right at the end, but wanted to give you the opportunity. Thank you. Sorry.

MR. SALLEY: Okay. So incipient detection is a program that it was an FAQ. There's been an answer. And we clearly need to do some follow-on research and confirmatory research on that.

Low-power shutdown is a program that -- this was an interesting one. We originally set out to do -- this was a joint project. As the project developed, this was one that kind of broke down a little bit and EPRI said, no, we can't put our resources on this. We have other things right now. Tell you what, if you want to go with it, you either going to go this one alone, however, we can offer a peer review for you. And we said, fine, that's understandable. Had to divert some resources. So we completed this out and they peer reviewed it, and we're closing up the final comments. And hopefully this is going to be out before Christmas for public comment. And again, it's a quantitative method to do a low-power shutdown risk for fire. So that will be coming out in a NUREG/CR for comment.

The heat release rate, we've talked about that. Basically, we've got that on hold to see what EPRI does before we go -- you know, we don't want to replicate activities. So that one's on hold.

Next slide? Kerite. You know, what's it, you know, I before E except after C, or what's that rule? There's always an exception to the rule, right? You know, like I said, my world I wanted the cables to be thermoset and thermoplastic. And from that we can now say, okay, we can understand failure temperatures and failure modes and now they start failing. There's always one cable that ain't going to play. Cable that ain't going to play is kerite. And I've had some experience with kerite way back in my NRR days. I can remember kerite being an interesting cable in the fact that it was one of the ones that self-healed itself, where when it was hot, it would fail, but once it cooled down, like after a hose stream in a fire barrier test, all of a sudden it became functional. Okay? So it was doing that self-healing. You say, wait a minute, it's a thermoset. Thermosets don't self-heal. Thermoplastic self-heals. Yes? Well, this one did. I saw it. So it's that one that always wants to break the rules.

The kerite cable tends to be used more I understand out there in medium-voltage power. The key for us of course is the control circuits. It is a control cable though. And when we started down the little road, we thought that, you know, it was a handful of plants. There was a couple, three that had bought it in the control. As we see though, there is more and more of it out there than we thought.

CHAIRMAN STETKAR: That's what we heard this morning, that it's sort of an issue on -- we heard numbers, five to ten percent of the plants. So we're talking round numbers.

MR. SALLEY: Right. You know, we had

it --

CHAIRMAN STETKAR: Five to ten units.

MR. SALLEY: We had this originally, it was a couple, three. And the number seems to have grown. With testing something like kerite, it's hard because it's not manufactured anymore. So you're going to have to get it from somebody who's got it. And this is, you know, somebody who has left overs, if you will, in their power stores warehouse from when the plant was built. Again, this was one that it was good. You know, we want an answer. We want to get this off the table, that industry was able to go and some of the utilities donate some material for testing. So we just want to get an answer.

And like I said, Harry Barrett is one of the guys who really worked out priorities. He wants to clear that -- you have an FAQ hanging out there. Well, nobody wants these FAQs. This one you need a little bit of experimental work on. It's nice in the fact the experiments are running right now. They're going to be done here in a few weeks and we're going to have that data. So the timing is nice for me when we go to that PIRT panel and say, oh, by the way, here's the kerite data. Is it a thermoset? Is it a thermoplastic? Does this one have its own class all by itself? What did the experts deduct from the tests? So hopefully we can bring a successful closure to kerite and get it off the table and move onto the next issue.

Smoke damage to electrical circuits and components is one we want to look at. And this is one that it's a lower priority. But if we ever get into the digital INC world, this is one that I think we'll want to have some information on. So this is one that's -- it's a medium-type priority that's behind this cable testing that I would see Gabe looking at. We've got some ideas and some plans and we're kind of banging some ideas with some laboratories on how we'd do this.

Gaseous extinguishing agents. This has always been a little bit of a thorn in the side. Cable fires tend to be deep-seated fires. Deep-seated fires tend to take lot higher concentrations than a surface-type fire. It's very difficult to design systems that will do that. As the systems age their concentrations and their hold times if they were tested today would be lower. There's been some research on this. We want to do a little bit more research.

Also, another thing, if you remember back in the '70s and '80s the miracle agent was halon. And, boy, halon was the Cadillac of agents. And today, you know, post-Montreal protocol, it's an ozone eater and you can't buy it. And if you can buy it, it's grossly expensive. So you're seeing the halons phase out and you're seeing new agents come in, new clean agents. So now the question becomes, okay, how are they going to work for our applications? So we're looking at doing a little bit of work here again in the gaseous extinguishing agent.

Another things just to tag with that too a little bit is the water mist, too. You're seeing, you know, instead of the standard sprinkler that we use to -- you know, based on the cruise ship fires, you've seen a lot of the water mist systems coming into popularity in buildings.

Next slide? International, just to touch on; and I'm just about done here, there is a fire events data base program internationally and we have been a member of this. It's an OECD program since its inception. And this is a nice little metric because it gives you -- the main thing it gives us is a conduit to talk with the other fire research organizations internationally as to what happened. So if they have a fire, you can kind of call them up and

-- you know, you're going to read what the press says, but when you talk to them at the meeting, they're going to say, well, here's what really happened. So it kind of gives us a little bit of an insight like that.

And also it gives us a data point to say, okay, if we're looking at the fires we're having and the rest of the world are having, are we having all electrical fires and they're having all pump fires? Why are we so different? What are they doing different than us? We're not seeing that. But it gives us that metric to watch with.

Again, for our reporting here the NRC's contribution to this is LER fires. So we're tracking LER fires, because that's what we have. Now, obviously some countries are putting everything in. If you're a small country that has four reactors, you can keep a pretty good eye on things. If you're larger, that's a weakness of this program is the reporting criteria. You know, our threshold is very high, so you're seeing a lower number from the U.S.

An interesting program that we've talked about, and this data base has given us a venue to talk to people, is the high-energy arcing faults. Like I say, if you look at what's in 6850 today, no surprise.

It's basically San Onofre. These events have happened all over the world. Germany's had a number of them. Belgium, I know talking with them, have had it. France has had it. And this is a hard one. You know, we have the best method of putting in the PRA, which in 6850, if you talk to the other countries, they'll say that's about the best that you can do for PRA. How do we refine this? How do we learn some more? Well, we've got to do some experiments.

And this is going to be an interesting experimental program, because running the experiments is not going to be the big cost. The big cost is going to be getting this equipment, to get the switchgear to blow up and to -- that's where the money of this is going to be.

Now, in the business of doing research, I can say, you know, Chris, let me have $X million and, you know, we'll go buy all kind of switchgears and all kind of cabinets and we'll go and do this. Or can we work smarter? And the working smarter piece would be, okay, the NRC -- we have a laboratory. Sandia has a nice facility. They're a cross-wind facility for DOE. They have the power supply there. We can do the testing in Sandia quite nicely. But we need the equipment. So on the international thing we've talked to folks and we've said, you know, price of admission, like an OECD program, instead of giving us money, what are you interested in? You're interest in 40-volt switchgear? Send me one. I'll blow it up for you. Okay? You know, Japan, what are you interested in? You're interested in, you know, 4160 breaker cubicles. Send me them and we'll blow them up for you.

So we've put a metric together. And what's going to be integral about this it's much like, you know, what I learned with working with EPRI for that battery bank is what you've got to have is you've got to have the contacts out there and you've got to know what's going on to know that there's a plant out there who just so happens to be recycling their batteries, so basically you can have them versus going and spending $X million buying them. And again, you know, once I get this rolling and started up I'm going to go to EPRI and say, okay, here's another program. How would you like to contribute? And the price of admission both internationally and nationally is can you find some old switchgear?

It's interesting because J.S. talked it up at the last meeting in Paris and already I've had Korea say, okay, hey, I got this switchgear. Where do I mail it to? And I was like, whoa, whoa, whoa.

Little too quick. So it's good that we are being -- you know, people are receiving our ideas and we can have a very nice international program here. And I've asked Gabriel to draw up a matrix as to, you know, what we're looking for. And hopefully I'll be calling you, Rick, and saying can you do some shopping here and see who's got some stuff from abandoned plants or changing equipment out that we can go here and get a better understanding of the high-energy arcing faults.

And the last one is PRISME. PRISME is a French program that is very detailed looking into fire models. They're trying to do a lot of qualitative work with the fire models. A lot of the work replicated what we're doing here like the cable trays and that. So it was hard for us to join it, but we have finally reached an agreement where we'll do some in-kind contribution where there won't be a cash contribution from us, but we'll do some data exchange from some of our experiments and they'll allow us the data. But the OEC data brings its own set of restrictions too in the fact that I can't openly share the data. So it's very limited to me that I can't just, you know, openly share the data from the exchange. But nevertheless it's something nice that we could stay with the international community.

And I believe with that, that is the full research presentation.

CHAIRMAN STETKAR: Excellent. Thank you.

Any members have any --

MR. SALLEY: Did I lull you to sleep?

CHAIRMAN STETKAR: Seeing none, thank you.

Yes?

MR. CANAVAN: Can I just have one quick clarification on the low-power shutdown fires? We sent you some comments, but we never thought that that was a peer review. But we look forward to seeing it on the public --

MR. SALLEY: I'm sorry, Ken, I understood that as -- that was, you know, we had drafted it early. We had gotten the input from EPRI. We'd adjusted that and we've talked of course with NRR; got some input. And we're going to put it out for public comment.

MR. CANAVAN: Well, no. We'll weigh in during the public comment period.

MR. SALLEY: Please do.

MR. CANAVAN: The comments that we sent you were sort of, you know, me and a couple other people were just taking a quick look at it and giving you some feedback.

MR. SALLEY: Oh.

MR. CANAVAN: I just didn't want to cast that as a peer review because all the stakeholders didn't get an opportunity to see it on our side.

MR. SALLEY: My misuse of the word.

MR. CANAVAN: Oh, and there isn't a lot of extra 4160-volt switchgear out there.

CHAIRMAN STETKAR: You got a big back yard? You can start stockpiling. I'm sure you can work a deal out.

MR. SALLEY: No, it's interesting though that -- you know, like I say, the key here on this is going to be that you'll break the budget.

CHAIRMAN STETKAR: I got a bunch of old relays sitting in my basement if you want them.

MR. SALLEY: And you need to just find the right people at the right time. As a matter of fact, it was interesting doing the DC testing that we changed equipment in there. Again, Ken bringing a lot of the industry experts. There's a place up in New England that actually refurbishes old switchgear that, you know, us being researchers or not owning a nuclear power they really didn't know about, but you know, that's a contact where we can find things maybe that aren't going to be refurbished that we can go and let's do a cross-phase experiment here and see how big a bang we can make.

CHAIRMAN STETKAR: Sunil, did you run away?

MR. WEERAKKODY: No, I'm here.

CHAIRMAN STETKAR: You're on the agenda for some closing comments, and I'm not going to forget to ask you the question about the significance of -- I assume you've had enough time to get an answer together.

MR. WEERAKKODY: After you said that I told several people in the staff not to leave.

CHAIRMAN STETKAR: I know the room cleared.

MR. WEERAKKODY: Thank you. For the record I'm Sunil Weerakkody. I'm the Deputy Director, Fire Protection in NRR.

I had some concluding remarks that I have come prepared, but after listening to the subcommittee chairman's comments and introduction this morning, I thought I'll share some of the other facts on the NRR side with the audience.

John said that, you know, the Commission directed that we, you know, the ACRS do the study and then you're going to get the report out in February.

For NRR the Commission has directed us to provide them lessons learned from pilot study in June. So in the big picture of things what we are planning to do is we really look forward to getting the ACRS study as an input as terms of the study that we plan to do, the lessons learned when we send it to the Commissions. I mean it in a very complimentary way, John.

PARTICIPANT: We took it that way.

CHAIRMAN STETKAR: We did.

MR. WEERAKKODY: You took it that way?

CHAIRMAN STETKAR: We'll issue our report at the end of February. Do with it what you will.

MR. WEERAKKODY: Our due date is June 30th of 2011, so we have the luxury of waiting for that report and factoring that into our lessons learned letter to the Commission.

One of the things that -- before I answer the questions, you know, from the members, I do want to put some context on the old, old question or the issue that we are discussing. John, you said that in terms of what ACRS looks at, you're looking at the; I'm using my own words, you know, adequacy of methods, data and that sort of thing as related to Fire PRAs. And in terms of determining data adequacy, and obviously you'll have some standards, and against those standards you will make certain determination as to whether it's adequate or not.

As a regulator, you know, who's got an OECD fire safety, when I look at the number of issues that we discuss here today with respect to Fire PRA, I do have a very clear standards that we hold in NRR with respect to is it adequate? In other words, with all of the things that we talk about, you know, problems with data or heat release rates and all that, are the Fire PRA methods adequate? And our standard is simply this: Are they adequate where when a licensee determines that I'm not meeting a particular well-founded deterministic code, such as a separation issue, are these methods adequate to make a determination as to whether or not I can live with that situation? Okay? And even though I can have multiple opinions with respect to the realism of Fire PRAs, with respect to that particular question I'm pretty confident that we are at a stage where we can say, yes, they are adequate.

And then I'm saying this based on some of the things we learned from Harris. Like for example Shearon Harris maybe before they even did the Fire PRA; I don't know the timing for sure, they chose to replace a number of their cables that were running across different areas with e hour measured cables. Okay? Now, perhaps hindsight that licensee might find when they make their Fire PRA very, very realistic that maybe they didn't need that. Okay? But as a regulator, when I know that the fundamental fire safety depends on good separation, okay, I know with all of the issues with Fire PRAs, if I did an analysis, conservative or uncertain, I have that tool adequate to make a judgment on whether or not that particular mod is necessary or not.

So in terms of adequacy, you know, I really look at this whole issue from the context of are the methods adequate to support a deviation from a well-founded deterministic requirements that we are requiring through Appendix R regulation and that we are imposed on new reactors?

MEMBER ABDEL-KHALIK: No, but the point was made I think several times this morning; and let me read exactly the comment, that Fire PRA that is biased can mask important events and components or can drive plant changes that do not improve safety. So from what you just said, are you saying that this is not a real concern?

MR. WEERAKKODY: To me, when I look at a plant that's transitioning from Appendix R program to

805 and, you know, uses a Fire PRA to make a determination as to do or not do mods, I have yet to see an example where they made a mod that made the plant unsafe. So, you know, somebody's got to give me an actual example and say, oh, I made this mod, but because of Fire PRA conservatism I find that it to be lessening my safety. You know, I'm very suspicious about that statement.

Did you want to say something, Donnie?

MR. HARRISON: This is Donnie Harrison. In the context of the comment, I think when you're looking at importance measures, relative importance measures over conservatism can influence where all of a sudden you start masking the importance of something that should be important but it's coming out less important because you've made something else much more important than it really is.

So if you're in an application that's using that type of a relative ranking process, that would probably be a bigger issue. For 805 application it's not a significant issue. And again, depending on how you do that delta risk calculation, it can be a non-issue.

MEMBER ABDEL-KHALIK: But this is not a hypothetical state. This is a statement that's made in the context of 805.

MR. HARRISON: Well, I think actually that's Doug's comment. I've got a wall blocking me from seeing that Doug's still here. Or if it's Rick's comment. I think that he was making a more general comment.

But again, in a relative ranking system that can be a masking issue.

The other thing is I think they're talking about, in the past the industry has mentioned making modifications today that if you had refined models five years from now you may have looked back and said I don't need that modification, or I didn't need that modification to be an acceptable 805 application. My rebuttal to that is I can't predict the future. I can only deal with where I am today.

MR. WACHOWIAK: This is Rick Wachowiak from EPRI. Just to amplify what was just said, the statement doesn't say we make a modification that's unsafe. It's a modification that's unnecessary. So I think if all you were doing with these PRAs was saying I have a deviation from some deterministic practice and do I need to make a modification to make it safe enough, a conservative or biased high PRA could give you an upper-bound solution to that and say I don't know whether or not I need to make this mod. But if I do make the mod, it doesn't make things any worse other than it used up the resources that we could have spent on making something else actually better. Okay? So if that's all you were using the PRA for, it's a matter of resources at that point.

I don't see that happening with these PRAs that were used for 805 then are now the official fire PRAs that are going to be used for STPs. And you're going to get white, yellow, red findings all over the place because you've got these things in there that you've used for an application that was just is it a good idea to make a mod? So we have to be careful about the application and clear about the statement. The statement isn't saying we're making unsafe mods. We're saying we're making mods that may not provide any benefit and using resources that could have been used elsewhere to make mods that do have benefit or other program changes that do have benefit.

MEMBER ABDEL-KHALIK: No, but there is another part of this --

MR. WACHOWIAK: Yes.

MEMBER ABDEL-KHALIK: -- other than making modifications that --

MR. WACHOWIAK: Right.

MEMBER ABDEL-KHALIK: -- may incremently improve safety, albeit not cost-effective.

The other component, the other part of this statement is that they can mask important events.

MR. WACHOWIAK: They can.

MEMBER ABDEL-KHALIK: So how do you address that?

MR. WACHOWIAK: That was the point of our morning's discussion, was that we need to be able to address that. In the context here --

MR. WEERAKKODY: One of the fundamental statements that I want to make is that when you look at the adequacy of Fire PRAs, with all of the issues you're putting on the table with respect to plant transitioning to 805, okay, we look at what are the fundamental good requirements that Appendix R tried to install, which is separation. Okay? So I think where I could directly say is if there are situations where use of Fire PRA could result in modifications that are unsafe or less safe, I don't think I can agree with that. But like you said, when you're going to other applications, or like Donnie said, you know, when you go to the relative ranking, obviously there could be certain misunderstandings coming out of that.

MEMBER ABDEL-KHALIK: I think you missed

the point that I'm trying to make.

MR. WEERAKKODY: Yes?

MEMBER ABDEL-KHALIK: Okay? And I fully understand the point that you make that none of these modifications would decrease the level of safety. Right? But the point is there may be changes that you need to make that you don't see because they're being masked. And I haven't heard the answer to that.

MR. WEERAKKODY: Okay. Yes, I can't see that happening, but go ahead, Donnie.

MR. HARRISON: This is not an 805 transition, but it's one where there's relative ranking.

MEMBER ABDEL-KHALIK: Right.

MR. HARRISON: And it's where you've got 10 CFR 50.69, which is special treatment requirements. And that's a risk-informed application that uses the importance measures as part of the process. And the way we dealt with that issue is you don't just look at everything together. You do what I call a both/and approach, which is you look at the individual hazards. So you'd look at the Fire PRA hazards and how things ranked out, but then you individually look at the internal hazards, the flooding hazards, all the different hazard groups and you treat them individually as well as collectively.

So I find out what's important for my internal events model, and that way if there's some issue in the Fire PRA model that would have masked that if you looked at it collectively, it will actually show up on its own in the internal events ranking. And so then you know what's important for each of the hazard groups and you can address that.

The masking within the hazard group would still be there, but --

PARTICIPANT: That's the point of this.

MR. HARRISON: -- that within the total risk part of it by knowing that the total risk is acceptable. And it's a matter of conservatism. Obviously the more conservative, the more drastic that impact is.

CHAIRMAN STETKAR: Rick, do you have --

MR. WACHOWIAK: Yes, I was just going to finish with it all depends on what the use of the tool is. If you're using the tool for things that involve relative ranking, then the first part of the statement applies and you may get the wrong answers if you do that. And I think Doug mentioned a couple this morning. If you were to use your Fire PRA for an A4 evaluation, as done with this process, you may not get the right answer; his example was in that, or for some other risk-informed application.

CHAIRMAN STETKAR: My sense is what I'm hearing here is on the part -- and correct me if I'm wrong; as I said, I'm allowed to be wrong -- on the part of the staff, and to some extent maybe even on the part of the industry, is that the degree of realism, if you will, in the PRA, that bar to justify the transition to NFPA 805, in other words, to justify the adoption of a risk-informed fire protection program, without ever planning to ever do anything else is different from the level of realism that you would desire for a variety of particular applications within that framework. Once you've established the fact that you're within that framework, whatever those applications are, whether they're risk-informed changes to the plant itself, you know, physical equipment changes or whether they're significant determination under the ROP process that now, you know, would take benefit of that risk information.

We should think about that, because in practice -- I'm not an attorney and I don't have enough brain cells left to go back to school to become one, but part of the Commission's concern, you know, in our direction was things that impede the transition. There's a concern at the Commission level in terms of why aren't more plants signing on for this process? Why are plants dropping out? Why are people saying that indeed the applications, you know, should be delayed until we have some of these important issues, whatever they are?

And perhaps some of what we're hearing is kind of a mixture of those two issues. What does it take to transition? What inherent benefit is there from simply transitioning and saying I'm never going to use this thing for anything else versus what do I need for actual applications? I don't think we'll get an answer to that, but it might be something worth discussing in December. I'm not sure that it's as easy as I've just characterized it to separate those, because obviously you're developing a --

MR. WEERAKKODY: The same model, yes.

CHAIRMAN STETKAR: -- the same model --

MR. WEERAKKODY: No, I --

CHAIRMAN STETKAR: -- you know, that you'd like to use in the future, but --

MR. WEERAKKODY: I deliberately couched my wording because I knew the Commission was directed to what are the issues impeding transition to 805? I don't think Rick said anything that I would disagree with. In fact, when I think some of the other applications that are coming down the line such as; I don't know whether the members have heard, Tech Spec 4B, which gives the licensees the operational flexibility to change their allowable outage time without regulatory intervention, I myself concerned with, you know, things like that, you know, because there are conservatisms, un-conservatisms. I'm not personally concerned with respect to the current status for 805, but I really do want to be able to defend to any member of the public that we have a great tool that I can rely on before I turn over that flexibility on self-adjusting the AOT to the industry. So I think that is a great point, John.

CHAIRMAN STETKAR: I am now officially starting to get a bit concerned about the time, only because I have to worry about the rest of you.

MR. WEERAKKODY: My rest of my presentation is simply three statements of what the staff has saw. It might take me like --

CHAIRMAN STETKAR: If you could do that.

MR. WEERAKKODY: Yes.

CHAIRMAN STETKAR: And again, I'm going to only interrupt in terms of trying to get --

MR. WEERAKKODY: The whole purpose was to repeat some of the key messages of the staff. I wasn't going to add anything that they haven't said.

CHAIRMAN STETKAR: If that's the case, maybe we can --

MR. WEERAKKODY: Just go ahead and ask me questions there.

CHAIRMAN STETKAR: I would only like to ask one question, and you've now had enough time to think about it, and that is how do you address the industry's statement, and backed up by their presentation this morning, that if indeed the methods and the supporting data are applied we should be seeing many more damaging fires? And I'm not talking about core damage frequency, because they've eliminated that absolute measure of a frequency of damage, but a frequency of damaging fires, a frequency of fires that damage equipment such that my conditional core damage probability is a measurable event in the same way as we do that sort of significance determination process for, you know, the Internal Events PRA? Are we not seeing those fires? Is there something -- you know, why isn't the staff in the reactor oversight process issuing more white and yellow findings for fire events? Because, you know, it's been stated that indeed fire events in a generic sense are not events. They're happening out there. There are countable numbers of events. If they weren't, we wouldn't worry about counting up many more events over the last 10 years.

So the question is if the fires are happening, why isn't the agency, the staff identifying a reasonable countable number of either, you know, white or yellow? I'm not even going to be up into red area fires.

MR. WEERAKKODY: I have seen that statement made in a number of industry presentations and I see that and I go back and ask the staff and they give me a number of reasons as to why that is not so. But what I want to do is take a commitment on that. It is such an important question.

CHAIRMAN STETKAR: That's fair. Take it away.

MR. WEERAKKODY: I want to discuss with the staff and I want to give you written input, because we should get beyond that. If that is the case, then there's something wrong.

CHAIRMAN STETKAR: Well, that's -- yes. Okay.

MR. WEERAKKODY: And so I'm going to take a --

CHAIRMAN STETKAR: And we'll certainly bring it up in December, you know, so that's a decent take-away. But it certainly is --

MR. WEERAKKODY: Yes.

CHAIRMAN STETKAR: You can't argue with actual observed operating experience. There can be differences of opinion over --

MR. WEERAKKODY: We should be able --

CHAIRMAN STETKAR: -- you know, an individual event, but not at the level at which we've heard this morning. You know, we're not talking about ten to the minus five events per year. We're talking about countable numbers of events if over nothing else, a decade.

MR. WEERAKKODY: No. Well, Donnie wants -- go ahead. And I'm going to ask the staff to answer. But if you don't get a satisfactory answer, I want to make sure that that point is well addressed.

CHAIRMAN STETKAR: Yes.

MR. WEERAKKODY: If not today, within a week or so.

MR. HARRISON: And I agree with Sunil. What we'll need to do though is get with the industry to actually get their calculation. Because I recall an ACRS subcommittee meeting many, many months ago;

maybe it was the last one or the one before on this topic, and someone asked a question about the frequency of fires and how many we should be seeing. And the question came back of, well, what's that include? Is it the self-extinguishing ones? And they said yes. And the person from the ACRS, if I recall right, said, well, that seems like a reasonable number then. It all depends on what's in the calculation.

CHAIRMAN STETKAR: That's why it's probably appropriate not to try to answer today because we want to make sure that we're counting eggs and eggs and we understand hat those eggs are. But if indeed you understand what they're counting and indeed there is a substantive basis for that, that means there's something wrong, you know, and that we need to understand what that is in terms of the PRA.

MR. WEERAKKODY: No, I fully agree. We have to get beyond that kind of argument in order to --

CHAIRMAN STETKAR: Because you're never going to solve that argument.

MR. WEERAKKODY: Yes.

CHAIRMAN STETKAR: And if there's not another standard at that level, you'll never be able to answer the question.

MR. WEERAKKODY: You've been very clear with respect to what you're trying to do. You want to basically get to a point where we understand the technical issues and come up with a way to solve them. So I think the only statement that I really want to make is the last bullet there. We are very glad that EPRI research, and we have a lot of momentum behind us, to do research and address these issues. So that's all. You know, how we got to this point is not important to me because all of us are supportive of use of Fire PRA in the regulatory framework.

CHAIRMAN STETKAR: Thank you.

MR. WEERAKKODY: Any other questions for me?

CHAIRMAN STETKAR: Any of the other members have any questions?

(No audible response.)

CHAIRMAN STETKAR: With that, thanks a lot, Sunil.

We do have a presentation from Mardy Kazarians. While he's getting set up, I think I mentioned this morning; I don't remember whether Mardy was here when I talked about it, Mardy is a consultant to the committee. And his scope of work has been to -- I would characterize it as flying under the radar a bit, although the radar picked him up pretty early, to go out and perform a fact finding first exercise for us whereby he went out and talked to practitioners primarily.

And I will be the first to admit that if I were a PRA practitioner and came to an ACRS subcommittee or an ACRS full committee meeting, what I said in this public forum with whoever the audience might be, could be a bit different than if I sat down over a glass of beer with somebody that I could speak to on a one to one technical basis in terms of the problems that I've been finding. So given that experience, that was one of the reasons why we set Mardy loose on a variety of stakeholders to see what information he could gather.

And then Mardy, as you're probably all well aware, is one of the most experienced and well-respected fire modeling people in the industry, so he has street credibility to talk to people also, which is important. And I will now let Mardy tell us what he's been up to.

MR. KAZARIANS: Okay. Well, I'm the oldest, I can say that. I don't know if I'm the most experienced one, but definitely I've been around for a long time. I was just thinking that maybe -- it's interesting that we're still talking about the same topics as 30 years ago.

All right.

CHAIRMAN STETKAR: We haven't redone the same Fire PRAs three times though.

MR. KAZARIANS: Yes, that's true. I guess my presentation will be very anti-climactic for all the things we've heard and discussed this morning and this afternoon.

So this is basically my marching orders. Two questions: Are there limitations in current Fire PRA methods, models and the data that lead to inappropriate conclusions during the transition to NFPA 805? That's one, the key question. And also a side question which is, are there other issues impeding or discouraging the transition process? So those are the things that I'm after.

And as John put it, I'm gathering oral information mostly and some, you know, documents, as much as I can. So I have to say that this is not a very scientific process.

So I've been contacting a variety of stakeholders. And if I were to categorize them it would be people from the NRC staff, utilities themselves and the consultants; I do recognize the difference between the two of them, public stakeholders, and NIST, NEI and EPRI perhaps. Whoever would like to talk to me, I'll talk to them for sure. So what I'm doing is I'm collecting information, organizing it and I will interpret it according to my understanding of the phenomenons and the models and so on.

This is a short list of some of the topics that I typically bring up with the people I talk to. First of all I would like to know their experience with the Fire PRA. You know, in other words for me to gauge what part of the Fire PRA they're experienced with, the type of involvement that they had, especially NFPA 805 transition- related. And the key question I ask all of them is the difficulties in applying the NUREG/CR 6850, including the FAQs obviously, and have they been forced into taking deviations from 6850 and FAQs? So those are one of the key topics that I dwell on and have a long discussion about it.

Then of course some of the things that I think in my opinion has some bearing on the overall picture is the information that is available to people who do the Fire PRA and how much before and after the start up of the Fire PRA, and especially cable information, circuit information. And also I was curious about the multiple spurious operations and if that had a huge impact on the level of effort. Then for me to gain some measure of where they are and whether the contributors -- and what are the issues actually is I talk with interviewees about the core damage frequency and CCDPs and the contributors. That gives me a good feel for, a relatively good feel for what the issues are.

And of course the peer review process is an integral part of this whole thing, so sometimes I go through that with them, especially those people who have been on the peer review panels and I get the peer reviewers' viewpoint on what they think of what they've seen.

CHAIRMAN STETKAR: How many, Mardy -- and I recognize that, you know, everyone that you've spoken with shall remain completely anonymous.

MR. KAZARIANS: Yes.

CHAIRMAN STETKAR: Can you give us an idea of approximately how many folks you've spoken with who have been on those peer reviews? I mean, is it two or three? Five?

MR. KAZARIANS: It's in that order.

CHAIRMAN STETKAR: Okay.

MR. KAZARIANS: Yes.

CHAIRMAN STETKAR: Okay.

MR. KAZARIANS: It's in that order, yes.

CHAIRMAN STETKAR: More than one, less than 100?

MR. KAZARIANS: Yes, actually here it is.

CHAIRMAN STETKAR: Oh?

MR. KAZARIANS: Okay. People that I've talked to. Consultants, utility people and NRC staff.

CHAIRMAN STETKAR: So out of the 10 from consultants and utilities there have been --

MR. KAZARIANS: Half of them probably were --

CHAIRMAN STETKAR: -- have participated in peer --

MR. KAZARIANS: Yes, because --

CHAIRMAN STETKAR: Okay. Good. Good.

MR. KAZARIANS: And there is a reason behind it, is because they're all senior people, they're well-experienced with Fire PRA, so they've been drawn into that process.

CHAIRMAN STETKAR: So in a sense if they've participated in peer reviews, they may have some experience broader than their own particular PRAs?

MR. KAZARIANS: Yes. Yes.

CHAIRMAN STETKAR: Okay. Good.

MR. KAZARIANS: And I hear behind the scenes comments, which is fine for me, you know?

CHAIRMAN STETKAR: We all do.

MR. KAZARIANS: I'm planning to talk to a couple more people. There are a couple people I've missed so far and I need to definitely talk to them. And I'll be speaking in front of this panel in December and I'll be presenting my results at that time. All right?

CHAIRMAN STETKAR: Okay. Just for public disclosure, I've asked Mardy before the meeting; we haven't set a firm date yet, to at least give us a few -- you know, like a bullet hit list of some of the bigger issues that he's identified, you know, before we have his actual written report. The only reason for that is if there's anything on his preliminary list that might affect the content of what we're going to discuss in that subcommittee meeting in December, I want to make sure we're aware of it, that our staff is aware of it and we're able to communicate that to both NRC staff and the industry so that there aren't any surprises, at least in terms of, you know, potentially significant issues that might have been overlooked from some of the other discussions that we've had here.

And that's it? Any other questions for Mardy? Any questions for Mardy?

(No audible response.)

CHAIRMAN STETKAR: That's one of the benefits of having to sit up here all day is everybody's out of gas.

With that, I guess what I should do, I have absolutely no idea whether the bridge line is still open, so, John, could you find out whether it is?

And if it is, if there's anyone on there who would like to make any comments or add any information, I'd really appreciate hearing from you. And also I admire your stamina if you're out there.

We'll wait a couple of minutes until you confirm what's going on out there.

MR. LAI: Mr. Chairman, the line is still open.

CHAIRMAN STETKAR: It is still open?

MR. LAI: Yes.

CHAIRMAN STETKAR: Has it been unblocked? Can we get it unblocked?

MR. LAI: Yes, you can. You can talk,

yes.

CHAIRMAN STETKAR: Okay. Now, it's the only way to find this out. If there's anyone out there listening, could you please just say something so that (a) we know you're alive; and (b) we know that indeed there's two-way communications possible? Just anybody.

(No audible response.)

CHAIRMAN STETKAR: Don't all speak up at once.

(No audible response.)

CHAIRMAN STETKAR: Hearing nothing, I'm going to assume that either there's people listening who don't feel necessary to add anything or indeed everybody has given up. So, we'll close the line back off again.

MR. LAI: From the public?

CHAIRMAN STETKAR: Is there any member of the public here who would like to say anything?

(No audible response.)

CHAIRMAN STETKAR: Thank you for reminding me. I always forget that.

Before we close what I would like to do is, I've been trying to keep a short hit list here of topics that I feel will warrant particular attention during the December subcommittee meeting, because as I said in December I would like if possible to focus on the real thorny issues, if there are some. I think we've had, you know, excellent presentations and I've tried to distill a little bit of what I've heard from them. And the reason I'd like to mention this is to give forewarning to people and also to get feedback from you. If you think something else should be on the list, please let us know and we will make sure that it's on the list so that we can plan for it.

The five items that I've sort of listed here; and they're not necessarily in any prioritized order, just stream of consciousness, I'll combine the issue of electrical cabinet fires into a single issue at the moment, although there are probably several facets of that issue. One is the frequency of fire ignition as a function of cabinet type. Another is the data or models supporting the fire growth rate, the time to peak heat release rate within those cabinets. And also the absolute measured maximum heat release rate on a per cabinet basis.

The reason I'll put all of those together is that when you're thinking risk space, it's the integration of all of those things that we care about. So however we want to address those, but the cabinet fires seem to be an issue and things again that I've heard peripherally, cabinet fires seem to be an important topic. If nothing else, you know, we saw the ridge line there.

Second one is; and I think I mentioned this earlier, there seemed to be some disagreement, and I'm not going to characterize it any more than that, over the degree to which the current status of the FAQs actually resolves technical issues that seem to be a concern to the industry. And I think I mentioned it earlier, what I'd like to really understand, if indeed there is that disagreement, which particular FAQs are the concern? Why are they of concern? Now if indeed we can get communications going; you know, I'd like to hear both sides of the story, but since the industry primarily raised the issue, you know, I need to hear from the industry to elaborate what that list is and what the real concerns are. Now, I don't know how long your list is. That's up to you.

The next three are less clear in my mind and that's why I think I'd like some input from all the participants here. One that I wrote down is are there still concerns about the methods and models for incipient fire detection? I don't know. There is an

FAQ out there that provides a model. We heard that Shearon Harris used a different model that was deemed acceptable for the transition but not acceptable for any post-transition applications essentially. You know, so this gets into the issue of the fidelity of the PRA for uses other than simply transitioning to the risk-informed framework.

Is it worth in December to discuss anything about that issue or is there general agreement that it's not a very significant technical problem? I'll let you think about that. You know, I pretty much know the staff's response, so I'm looking at the industry to say is it worth addressing?

MR. BRADLEY: Yes.

CHAIRMAN STETKAR: Okay. I hear a yes. It's on the table.

I hate to say this, but I'll bring it up because it was mentioned a couple of times. Human reliability analysis. Is that a topic? And I'm honestly looking for input. I have my own opinion here, but --

MR. CHAPMAN: Put it on the list. I think only with regards to underestimating the time available to take an action with regard to time and damage.

CHAIRMAN STETKAR: That's more of a fire modeling issue.

MR. CHAPMAN: I understand that.

CHAIRMAN STETKAR: Okay.

MR. CHAPMAN: I just wanted to --

CHAIRMAN STETKAR: What I don't want to do is drag this out into another discussion about how -- you know, where is your unified field theory on human reliability analysis?

MR. CHAPMAN: Right.

CHAIRMAN STETKAR: Because that's a non-productive discussion.

MR. CANAVAN: Dennis isn't here, but I'll reiterate what he had said.

CHAIRMAN STETKAR: Yes, Ken, we are indeed still on the record. I haven't closed this out, because I want to make sure that all of this information is available for any other public stakeholders who might want to --

MR. CANAVAN: Ken Canavan, and I'm always very nervous doing this, because I'm actually speaking for Dennis Henneke who left, but I believe his issue was on control room abandonment.

CHAIRMAN STETKAR: Yes.

MR. CANAVAN: And he had certain concerns about the HRA around that.

CHAIRMAN STETKAR: If that's an issue. I mean, what we heard this morning was that to me seemed to be the only HRA issue, at least what Dennis highlighted. He seemed to indicate that it may not be necessarily a very significant across the board issue for overall risk, certainly not, you know, the ridge line of the cabinet fire significance, but --

MR. CANAVAN: Yes, he said 10 percent contributor on average.

CHAIRMAN STETKAR: Okay. If we want to discuss it, I'd like to keep it then in that context of control room abandonment.

MEMBER ABDEL-KHALIK: Is it HRA or safety culture?

CHAIRMAN STETKAR: No, it's HRA. It's HRA.

Jim, I think your issue is more toward the fire modeling and what's the available time versus required --

MR. CHAPMAN: Yes, but I just wanted to introduce it.

CHAIRMAN STETKAR: Yes. Thanks.

The last one that I had on my list, and this one is a bit hazy, is the presentations I heard this morning about, or it might have been early this afternoon about EPRI's research program, ad certainly the presentations we heard this afternoon about the staff's research program, to me sounds like there's some communication but that it's not necessarily directly at the same purpose. The question basically would be what are EPRI's research priorities? You know, and we'll know those once we get something that is legible. I had to get the dig in. It's a small table.

PARTICIPANT: A picture of a small table.

CHAIRMAN STETKAR: It's a picture of a small table.

And you know, we have Memoranda of Understanding set up. If indeed the NRC's research program is not being responsive to the industry, (a) is that a problem? And I certainly can't answer that. But if the industry is looking for the NRC, our staff to do a certain type of -- whether it's fire testing or fire model validation, or you know, you name it, and that's viewed as a significant source of uncertainty or conservatism, the lack of that information in the PRAs that are being produced today; not 10 years from now, but today, if the industry feels that that type of research is important today, then you know, should it be performed, should it be given high priority in terms of NRC research? Again, ACRS does not set research priorities. We can't do that. And certainly we'll not try to do that. But it's important for us to understand if there is indeed a disconnect between things that an industry user says they need and things that the NRC research program is producing, I'd like to understand that.

So that's sort of a gray area, but it speaks to this notion of we need better data, we need better models, we need this, we need this, we need this. Who's going to supply it and when? You know, just saying that we want everything all the time from the other guys is not necessarily conducive to solving the overall problem. So I'll throw that out there.

Mark's got to come up and say something.

MR. SALLEY: Yes, I just wanted to touch on that. NEI at the last fire forum, one of the things we did, John, was we did a joint presentation like we do. I kind of asked basically for what you're saying is customer feedback.

CHAIRMAN STETKAR: Yes.

MR. SALLEY: And I opened it up to industry. Could we dig out the feedback forms that -- we had Tom Gorman, if you remember, from PPL put that together, Tom? And if we could supply that. Tom Gorman from PPL came in and we basically asked him to do kind of a customer survey. You had a mixed audience of NRC and industry and we asked those questions. Tom had a form, you know, what are we doing that's right? What are we doing that's wrong? What are we doing that you need? What do you wish we were doing more of? What do you wish we were doing less of? So I believe we had that at that the last forum.

CHAIRMAN STETKAR: That would be --

MR. SALLEY: And that may help you.

CHAIRMAN STETKAR: Yes, if there was reasonable feedback on that, that might be useful.

MEMBER ABDEL-KHALIK: Well, I asked explicitly this morning or this afternoon as to whether or not you're doing any experiments as a part of this matrix that you presented, and you indicated no you're not. You're relying on NRC to produce that data. And listening to the research program this afternoon do you think that all the data that you need will actually be available?

PARTICIPANT: That's a good question.

MEMBER ABDEL-KHALIK: I didn't see the answer in the presentation.

CHAIRMAN STETKAR: No, and I think it's something that's worth discussing on the table, because I have no idea honestly what our conclusions or recommendations might be. But one thing that I think might be useful, if indeed there are areas where the collected wisdom agrees are difficult technical areas that indeed, because of either individual sources of conservatism where this accumulated, you know, two-to-the-fourth-type of factor, they are driving the unrealism of current PRA results. Then you know, I think the Commission might appreciate the ACRS' recommendation about how does that get result, recognizing that we don't do anything on process. But I think we could say that we feel more research or experiments or testing in this particular area seems to be well-focused. You know, It's up to the collected world to figure out who does that and when, but at least saying that it might be an area where a certain type of testing or a certain type of modeling-type research might help. Right now, you know, I'm not sure I can identify that, but that might help.

Now with that, does anybody else have any good items to put on the agenda? Because the reason I want to go through this exercise obviously is the 13th and 14th of December are now less than a month away and people need time. You know, we have Thanksgiving and, you know, people have lives. So the more that we can settle on what should be on that agenda, the better it is for everyone.

MR. TRUE: Okay. This is Doug True. Two things that I think may deserve some discussion are manual suppression and control of fires. It kind of ties in with the growth rate and heat release rates, but it's an intervention by personnel. To prevent the growth of the fire is a significant area that we think needs some enhancement.

CHAIRMAN STETKAR: Let me see if I can understand a little more specificity. Is the issue more in the area of the fire analyses underestimating the amount of time that's available to perform those actions, or is it that the available information for the performance of those actions is inadequate? Follow me? In other words, am I looking at a fire modeling time window issue, time available to perform whatever it is, put out the fire or de-energize the circuit or whatever, or is it an issue that the information for the time required and the effectiveness of those activities is lacking?

MR. TRUE: I think it's the latter, but it's not that it's lacking. I think it's just we still think it's got a fair amount of conservatism.

CHAIRMAN STETKAR: Okay.

MR. TRUE: Having more realistic growth rates would give us more time, which would give us more credit. But for example, the curves are set based on experience. Well, anecdotally; this is not fair, but it gets my point across, there's one fire that lasted 90 minutes that never damaged anything because the operators or the fire brigade took the decision to control that fire rather than trying to extinguish it, for whatever reason.

CHAIRMAN STETKAR: Okay.

MR. TRUE: That's treated as it took 90 minutes for us to do anything about it.

CHAIRMAN STETKAR: So your issue is on those curves on --

MR. TRUE: In fact made some progress on that, but we think there's more that could be done. We also think the data base will help us get more information to able to help support that also.

CHAIRMAN STETKAR: Okay.

MR. TRUE: The second thing, which is a segue from that, is the data base. I know you kind of lumped ignition frequencies and venting for electrical cabinets into one category. Earlier on I got the impression you'd like us to come and specifically talk about what's going on with the Fire Events Data Base and how we're going to handle the historical data and --

CHAIRMAN STETKAR: I think that's important. And I think you're right, I probably didn't mention that. And in that sense those types of generic issues I think are important.

MR. TRUE: Okay.

CHAIRMAN STETKAR: But again, I'm still trying to focus on if I'm doing a PRA today, what are the biggest issues that I'm struggling with? You know, why don't I necessarily believe the numerical results from my PRA, if that's the assertion? And what do I need, what tools or what data, what information do I need in a practical sense to make me at least believe the numbers better? I'm never going to believe them perfectly.

MR. TRUE: I don't believe internal is perfectly --

CHAIRMAN STETKAR: There you go. So, you know, when we start talking about data, we can talk all day about data obviously.

MR. TRUE: Right.

CHAIRMAN STETKAR: But, yes, I think

you're right there.

MR. TRUE: Just trying of give you and overview of that process.

CHAIRMAN STETKAR: Yes. Yes. Yes. Yes. Yes.

MR. TRUE: So, but I know you're looking for a short list. I know you're looking for a targeted list, but I --

CHAIRMAN STETKAR: No, we have two days and, you know, on our schedule we can consume the entire two-day period, or we can decide to quit at the middle of the morning on the first day. So I want to make sure that people walk away from the December subcommittee meeting, at whatever time that ends, saying that indeed everybody has had their opportunity to provide technical input to us and don't feel that there are lingering, you know, trails that need to be followed up on. Because quite honestly, we as a committee don't have the time to follow up on those.

MR. TRUE: I understand that, but in the context of your saying that as a PRA analyst, you know, what things do I need to know, and I just can't leave this conversation without having said it really depends which one of those rows in that chart you're on. Because once you've addressed electrical cabinets, which I believe we can probably make progress on, you're going to rapidly run into something else you don't believe. And the diesel generator blip on there is one good example of that.

And so I realize you can't tackle the world, but it really is a plant-specific challenge and we can't just narrowly focus on a couple of things. They may be symptomatic of other problems, but I don't think we're going to resolve it with just focusing for example on electrical cabinets.

CHAIRMAN STETKAR: That's a good point and I think we're all aware that these -- first of all, regardless of that ridge line there, the most important contributors and the amount of effort to address those certainly as you go through this iterative process do vary from plant to plant.

At the first cut I'm obviously trying to keep us focused on what are the big-ticket issues, because those are being thrown up as a major impediment to this whole transition process. And obviously once you dynamite the biggest boulders, the next larger rocks show up, you know, and finally get to the pebbles. On internal events risk assessment, we tend to say, well fine, if we get to the point where we have 100 one percent equal contributors, it's not worth blowing up another pebble. You know, if you have five 20 percent contributors, it might be worth bring out a little bit of dynamite.

We talked about cabinet fires. You mentioned diesel fires. If there are one or two or three other ones that in your experience looking at, you know, what you've seen done so far, that merit additional discussion, then that's probably a good idea. I don't want to dredge it out into sort of the esoteric thing that, yes, eventually we're going to get to, you know --

MR. TRUE: Right.

CHAIRMAN STETKAR: -- 15 seven percent contributors and after that we're going to have, you know, 40 two-and-a-half percent contributors.

MR. TRUE: Okay. We'll try get to you quickly a list of those other bins.

CHAIRMAN STETKAR: Okay.

MR. TRUE: And some of the issues related to that.

CHAIRMAN STETKAR: Okay. Good. Good.

Anything else?

MR. WEERAKKODY: I had just one thing to say. I took notes on the five issues you mentioned. We are going to sit down with John Lai either Thursday or Friday because what I want to make sure is that we take these issues, turn them into some actionable items for the staff and make sure we give you what you need as soon as possible. Because like you said, December 14th is the next subcommittee meeting.

CHAIRMAN STETKAR: Thirteenth.

MR. WEERAKKODY: No, I won't be here because --

CHAIRMAN STETKAR: That's okay. You guys can work out --

MR. WEERAKKODY: Yes, we'll work it out.

CHAIRMAN STETKAR: -- who to talk to when once we're off line.

Anything else as far as topics that we need to think about? I mean, things may come up in the interim. I just want to make sure that nobody says, well gee, I was blindsided or surprised by this issue.

(No audible response.)

CHAIRMAN STETKAR: As I mentioned, Mardy Kazarians has indicated that he will give us a preliminary kind of hit list from his activities. If something else comes up from his activity that is in addition to what we just discussed, we'll make sure through John Lai that that's transmitted to all of you interested parties here so again that there isn't any surprise there.

Anything else? Questions?

(No audible response.)

CHAIRMAN STETKAR: I thank you all very, very, very much. I think that this was I think a very, very useful discussion. I appreciate all of the effort that industry and the staff put into their presentations. I think I certainly learned a lot and I think it's very, very helpful. So I thank you all for your presentations.

And with that, we are adjourned.

(Whereupon, the meeting was adjourned at 6:07 p.m.)

Fire PRA Impacts to NPFA 805 Transitions

ACRS Reliability and
PRA Subcommittee Meeting
November 16, 2010

Biff Bradley, NEI
reb@nei.org

NEI
NUCLEAR
ENERGY
INSTITUTE

Overview of Industry Presentations

- NEI - Fire PRA issues impacting NFPA 805 (Bradley)
- EPRI Perspectives (Canavan)
- Insights from Industry FPRAs (Chapman/True)
- Important Technical Areas (True)
- EPRI Fire PRA Action Matrix (Wachowiak)
- NEI - non PRA issues impacting NFPA 805 (Basso)

Background

- Industry very supportive of achieving closure of fire protection issues
  - Goal: Achieve stable regulatory state
- Adoption of 50.48(c) is a major undertaking
  - Nearly half of the industry well on their way
- A number of important process and technical issues persist

NEI

Realism of Fire PRAs

- NEI first identified lack of realism in January 2008
  - Letter to NRC staff outlining specific technical concerns, requesting collaboration on resolution
- FAQ process for Fire PRA
  - Over two years, some technical progress made, but process was slow and ineffective in achieving realism, even for the topics addressed
  - By late 2009, industry stopped submitting FPRA-related FAQs

NEI

Realism in Fire PRAs (Cont.)

- In December 2009, NEI notified the Commission of industry's continued concerns and initiation of EPRI FPRA Action Matrix
- Industry committed to improving FPRA methods for use in risk-informed decision-making in NFPA-805 and other risk-informed applications

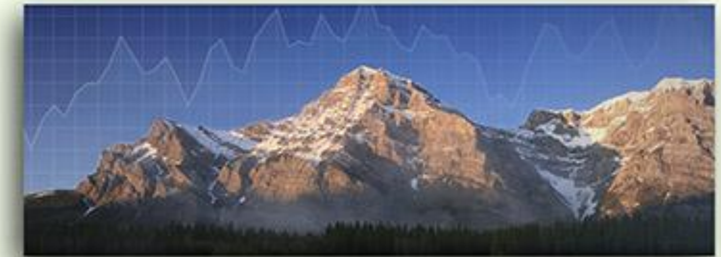
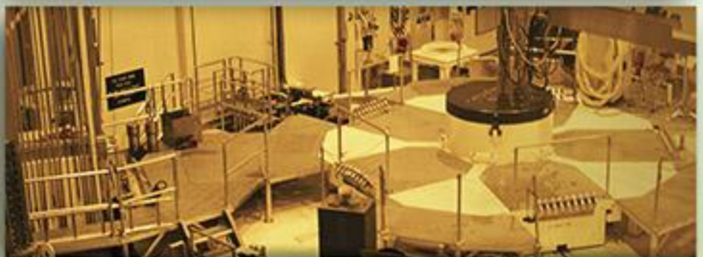
Key FPRA Concerns

- Major concerns to be illuminated today:
  - The manner in which fires are characterized does not appear to conform with operating experience,
  - The level of quantified risk using current methods appears to be overstated, as compared to operating experience, and
  - Uneven level of conservatism may mask key risk insights and confound decision-making

NEI

Implications for Submittals

- The Enforcement Discretion timeline for 50.48(c) submittals does not support resolution of all FPRA technical issues
  - Large number of licensees submittals due 6 months after 2nd pilot SER
  - Current process would require re-submittal of LAR with new information
  - Changing FPRA basis not conducive to stable regulatory condition
- Industry November 15 letter to NRC requests consideration of staggered submittal schedule; however this alone does not provide sufficient time to address FPRA issues



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EPRI Perspectives on Current Fire PRA Methods

Ken Canavan
Director, Plant Technology

ACRS PRASC
November 16, 2010

Background on EPRI 1011989-NUREG/CR-6850

- FPRA methodology developed jointly between EPRI and NRC RES

- Landmark study that reset the standards for fire PRA
  - Succeeded in providing a standard framework for FPRA
  - Provided consistency in many inputs, missing in IPEEE-era FPRAs

- Development process included piloting activities
  - Failed to obtain industry support for a full pilot
  - Individual tasks tested instead

The Fire PRA Challenge

- Fire PRA is a complex analysis
- IPEEE methods were inconsistent, relied on judgment, and were focused on identifying vulnerabilities
- NUREG/CR-6850 aimed to address this by
  - Defining discrete tasks
  - Applying simplifications in boundary conditions, e.g.,:
    - Fire events binned
    - HRRs binned
    - Suppression/control binned
  - Bounding assumptions employed on bins

EPRI Perspective on FPRA related FAQs

- A total of 15 FPRA-related FAQs processed
- EPRI 1019259/NUREG/CR-6850, Supplement 1 published
- Each FAQ improved the understanding of the technical issues involved in the scope of the FAQ. (Most resulted in risk reductions)
- FAQ process slow and ineffective in establishing realistic FPRA methods

Published FAQs are interim solutions on a handful of technical issues.

Much more work to be done.

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Implications

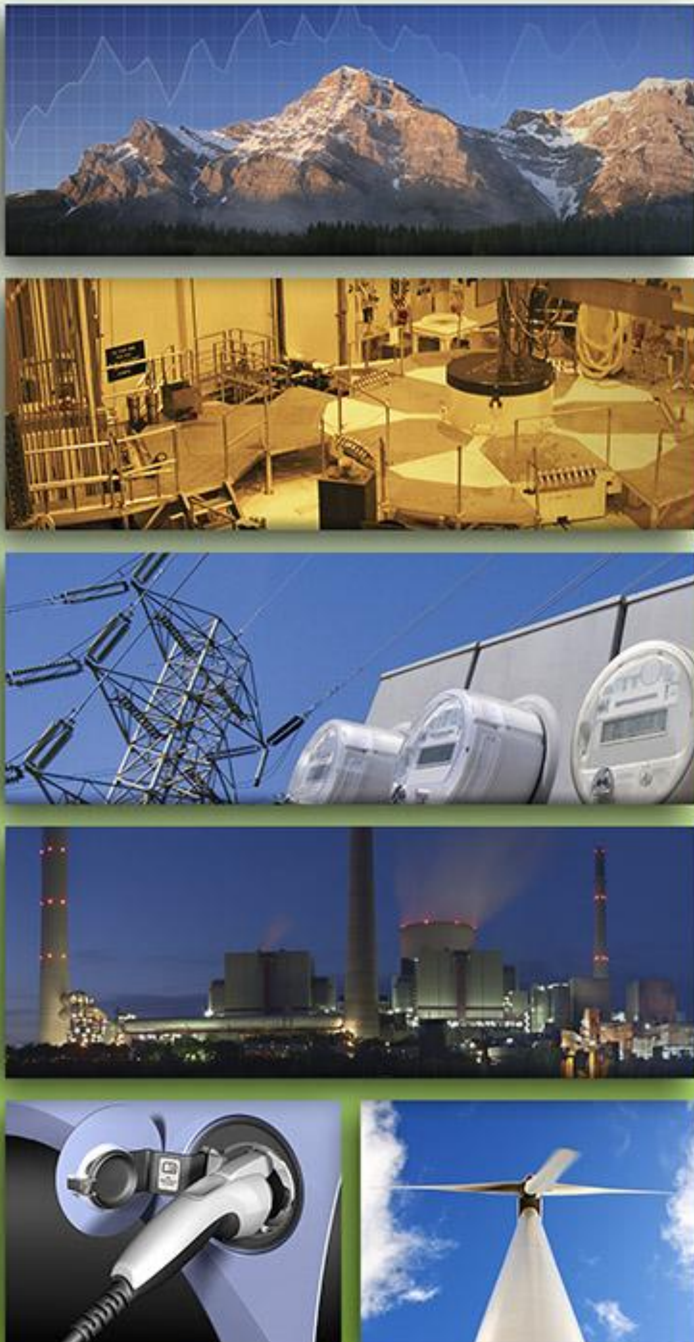
- Original method simplifications and conservatisms
  - Expeditious
  - Erode the level of realism in the analysis
- EPRI 1011989/NUREG/CR-6850 methods were not piloted in an integrated manner
- Integrated implications of the simplifications and conservatisms were not known until the NFPA-805 pilots and a few other FPRAs progressed to quantification (late 2007)

Implications

- Getting realistic risk results and insights will require additional refinement to the methods

This should not be surprising for a fledgling method

- EPRI committed to supporting methods enhancement



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Insights from Industry Fire PRAs

Jim Chapman, Scientech
Doug True, ERIN Engineering & Research

ACRS PRASC
November 16, 2010

Purpose

- Provide insights from industry PRAs performed using NUREG/CR-6850 with FAQs that support industry's claims that :
  – The manner in which fires are characterized in NUREG/CR-6850 does not appear to conform with operating experience,
  – The level of quantified risk appears to be overstated, as compared to operating experience, and
  – The uneven level of conservatism may mask key risk insights and confound decision-making

Background

- Basic methodology for constructing a fire scenario:
  - Individual ignition source bins assigned a plant-wide frequency derived from industry operating experience
    - e.g., pumps, electrical cabinets, transient sources, diesel generators, etc.
  - Ignition frequency for a specific source based on an allocation process
  - Fire growth rates are assigned to bin
  - Fire peak heat release rate distributions are assigned to bin
  - Credit for manual suppression based on broad class of fire (i.e., electrical, oil, welding, transients, etc.)
  - Fire modeling defines damage footprint (i.e., zone of influence)
  - Damage translated into PRA model for computation of conditional core damage probability (CCDP)

Computation of Fire CDF

- In the simplest form, the risk from an individual fire scenario is a function of:
  - The frequency of the fire event (F_{fire})
  - The fire severity characteristics as a function of time (S(t))
  - The probability of suppressing the fire event as a function of time (NSP(t))
  - The conditional core damage probability given the damage caused by the postulated fire ($CCDP_{damage}$)

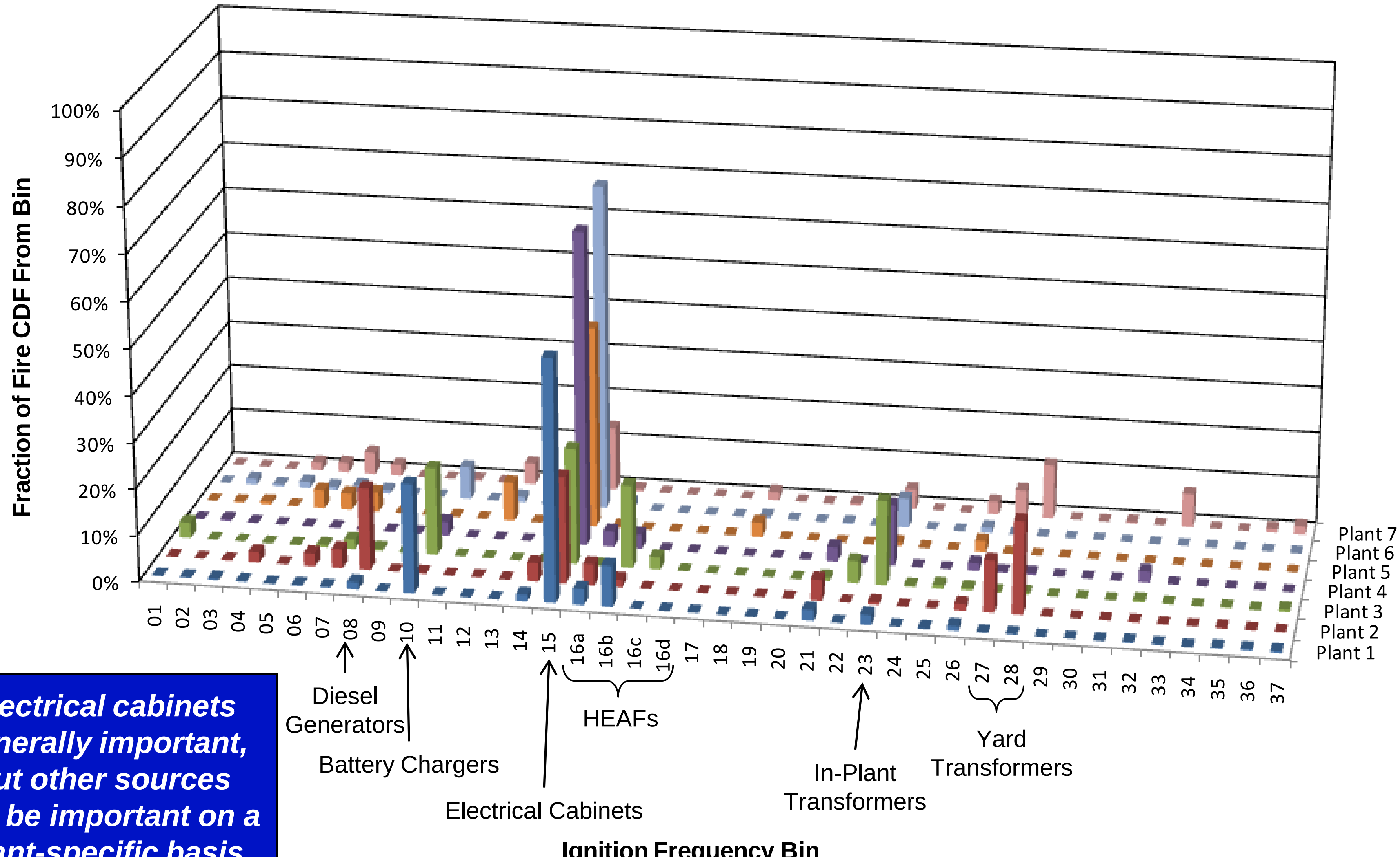
$$\text{Scenario CDF} = f\,(F_{fire}, S(t)_{fire}, NSP(t), CCDP_{damage})$$

Computation of Fire CDF (Cont.)

$$\text{Scenario CDF} = f\,(F_{fire}, S(t)_{fire}, NSP(t), CCDP_{damage})$$

- Conservatisms exist in each of these components
  - Some fire frequencies overstated
  - Fire severities overstated
  - Suppression under-credited
  - Resulting CCDPs overstated
- No single factor causing the unrealistic results
- Results are very scenario specific, i.e., plant, location, ignition source

Fire CDF Contribution by Ignition Source



Electrical cabinets generally important, but other sources can be important on a plant-specific basis

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Conformance with Operating Experience

- Use of ignition source bins is a useful simplification, but has led to the introduction of conservatisms that lead to
  - Departure from operating experience
  - Overstatement of the consequences for the assigned frequency

- Walkthrough a simple example:
  - Diesel generator fires

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Example: Diesel Generator Fires

- Ignition Source: Bin 8 – Diesel Generator Fires
  - Applies to Diesel Generator Rooms
  - Bin 8 Plant-wide Frequency
    - Original Frequency = 2.1E-2/yr (based on 49.5 events)
      - 60 actual events
        - 39 events fully counted
        - 21 events counted as "Indeterminate" with weight of 0.5
    - FAQ-048 Updated = 5.04E-3/yr (based on EPRI report)
      - 53 of the 60 fires occurred prior to 1990

Example: Diesel Generator Fires (Cont.)

- Plant-wide Frequency of 5E-3/yr allocated:
  - Plant with 2 diesels, Frequency ~ 2.5E-3/diesel-yr
  - Plant with 4 diesels, Frequency ~ 1.3E-3/diesel-yr
- Characterization of diesel fires based on events:
    - 16% electrical fires
    - 84% oil fires
  - Electrical fires characterized by electrical components identified in inventory
  - Oil fires characterized by distribution
    - 2% of oil fires involve 100% of oil inventory
    - 98% of fires involve 10% of oil inventory
    - HRR computed based on spread of oil

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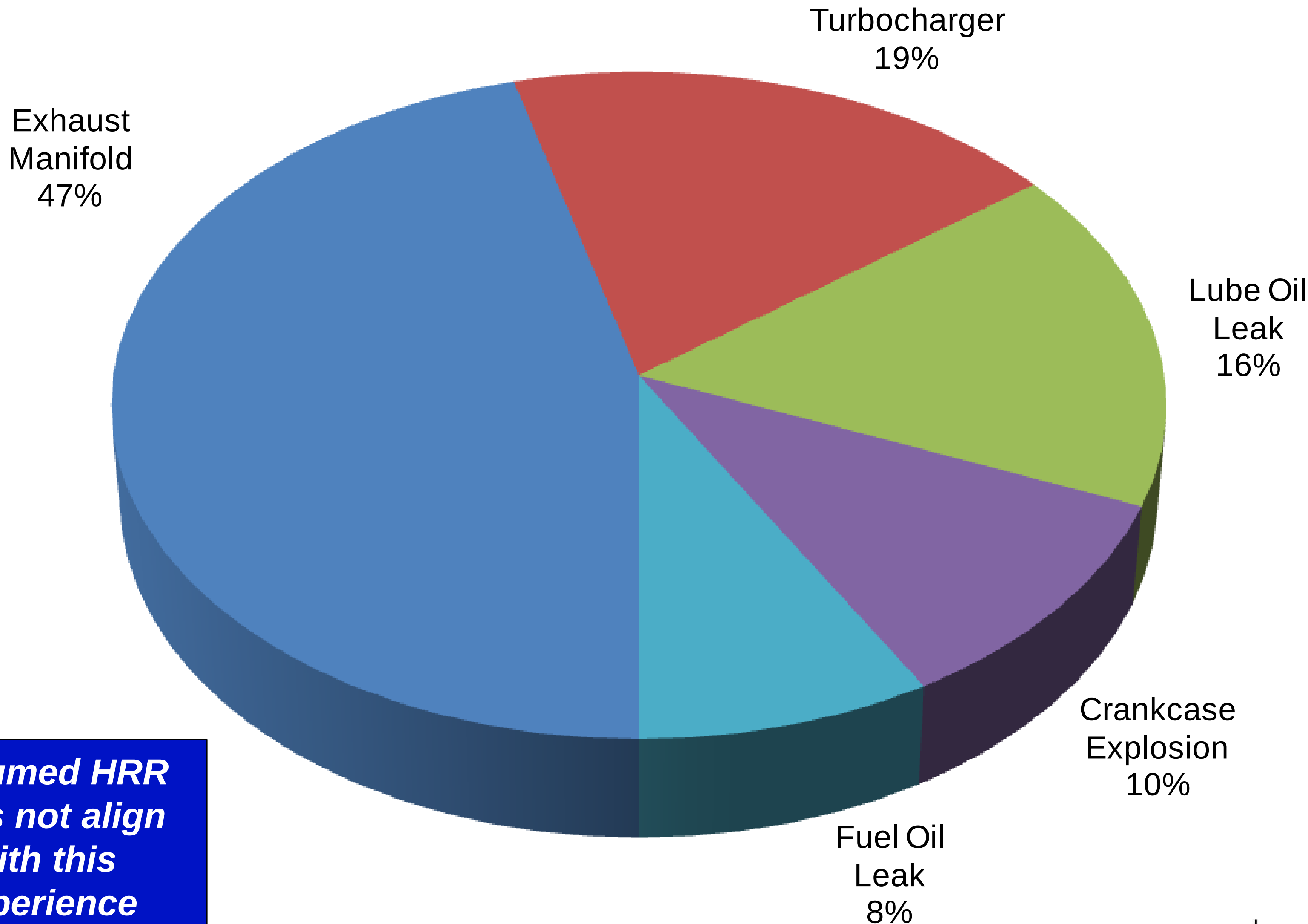
Operating Experience: Diesel Generator "Oil Fires"



Assumed HRR does not align with this experience

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Conformance with Operating Experience: Diesel Generator Fires

- FAQ-048 resulted in significant decrease in ignition frequency
- Allocation of plant-wide frequency can distort results
  - Plant with more diesels has lower per room frequency
- Oil fire HRR not consistent with actual fires
  - Most actual fires very localized, not spills of oil
  - None of the actual fires involve 10% of total oil inventory
  - Assumed HRR likely results in full room damage, unless automatic suppression is available
  - Most fires did not even involve actuation of automatic suppression
- A review of events indicates that plant shutdown was not required in many cases
  - All FPRA fires assumed to lead to plant shutdown

Severity of assumed fires significantly overstated versus operating experience

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Conformance with Operating Experience: Spurious Operations

- Addressing spurious operations is an important element of a comprehensive FPRA
  - Essential part of 50.48(c)
- Operating experience has not indicated spurious operations have occurred in real fire events (except Browns Ferry)
- Investigation of FPRA results shows over-prediction of spurious operations
- Sampling of PRAs investigated to compute the predicted frequency of one or more spurious operations

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Conformance with Operating Experience: Spurious Operations (Cont.)

- FPRA focuses on computation of CDF
- However, the FPRA model scenarios include spurious operations (SOs) caused by assumed fires
- Fire scenario damage "vectors" identify those with one or more SOs
- Plant-wide SO frequency (one or more SOs):

$$\Sigma \text{ Frequency of Scenarios involving one or more SOs}$$

- Results:
  - Plant X: 0.0041/yr
  - Plant Y: 0.0043/yr
- If extrapolated to entire U.S. industry (100 plants):
  - Expect to see a fire involving SO every 2 or 3 years
- None observed since Browns Ferry fire in 1975

Likelihood of spurious operations significantly overstated in FPRAs versus operating experience

Over-Prediction of Fire Risk

- Difficult to use CDF values for comparison with industry performance
- However, it is straightforward to identify scenarios involving a high conditional core damage probability (CCDP) for comparison to industry experience
- CCDPs are routinely assessed by:
  - NRC's Accident Sequence Precursor (ASP) Program
  - Reactor Oversight Process (ROP)
- Approach:
  - Review set of representative FPRAs to identify the frequency of fires involving high CCDPs

Over-Prediction of Fire Risk: Industry Experience with Fire CCDPs (Cont.)

- ASP Program
  - Maintains a list of "significant precursor" events
    - CCDP $\geq$ 1E-3
  - Trends high CCDP events
    - CCDP $\geq$ 1E-4
- "Significant precursor" events are relatively rare in recent operating experience:
  - No "significant precursor" events have occurred in the industry since 2002
- Of the 34 "significant precursor" events, only one involves a fire (1975 Browns Ferry)

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FPRA Model Prediction of High CCDP Damage Conditions

FPRA Model	Predicted Frequency of "Significant Precursor" Events (CCDP > 1E-3)	Predicted Frequency of High CCDP Events (CCDP > 1E-4)
Plant A	1.0E-3/yr	1.0E-2/yr
Plant B	9.9E-3/yr	2.0E-2/yr
Plant C	3.3E-3/yr	1.4E-2/yr
Plant D	1.3E-3/yr	3.2E-2/yr
Plant E	4.7E-3/yr	3.2E-2/yr
Range	1.0E-3/yr to 9.9E-3/yr	1.0E-2/yr to 3.2E-2/yr
Industry-wide Recurrence Interval	Every 1 to 10 yrs	1 to 3 per year
Actual Experience	None since Browns Ferry (1975)	None from 2001-2009 based on SECY-10-0125

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SECY 10-0125 Results for CCDP >1E-4

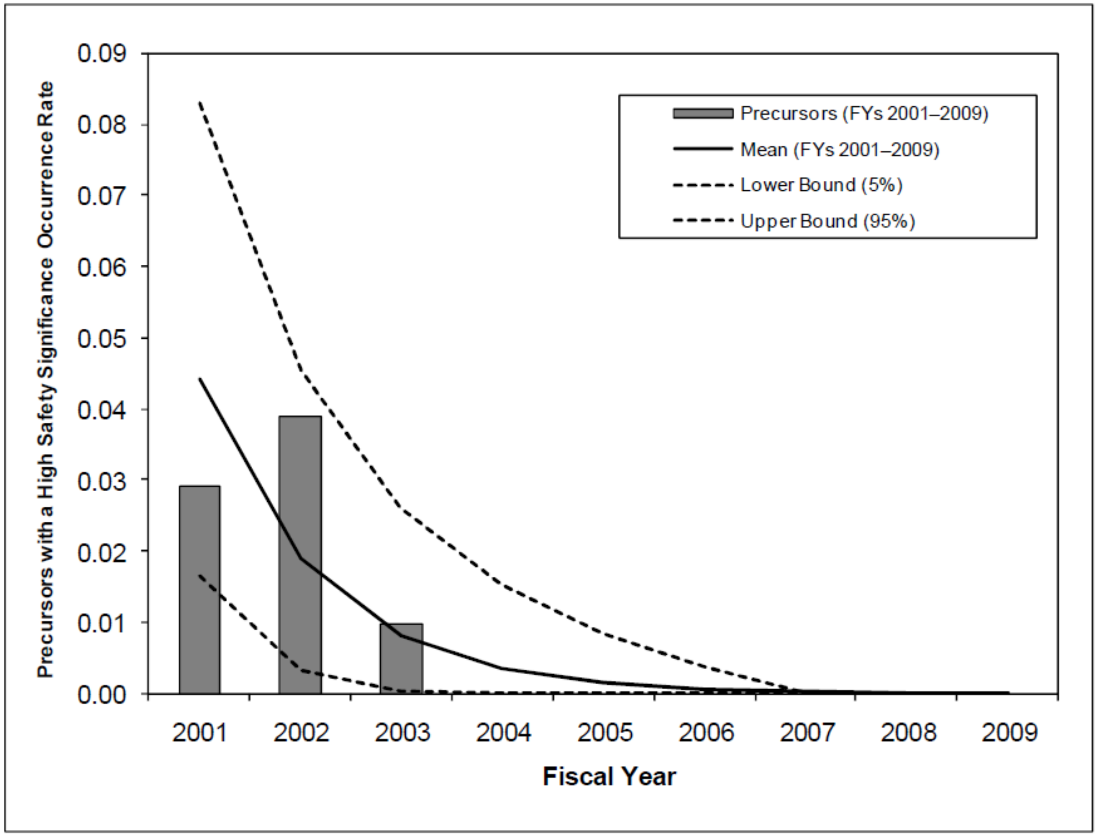

Figure 2. Precursors with High Safety Significance.

- Total of 8 events
- None involved fires
- FPRAs would have predicted ~9 to ~30 fire events, industry-wide for same period

FPRA prediction of high CCDP conditions does not comport with actual operating experience

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ROP Experience

- ROP routinely evaluates CCDP of events and conditions
  - Based on actual plant condition
- ROP Criteria:
  - Green: CDP/CCDP < 1E-6
  - White: CDP/CCDP 1E-6 to 1E-5
  - Yellow: CDP/CCDP 1E-5 to 1E-4
  - Red: CDP/CCDP >1E-4
- To date, no <u>actual fire events</u> have been considered Red or Yellow (CCDP >1E-5)
- Fire PRA models would have predicted many each year across the industry

Over-Prediction of Fire Risk: Conclusions

- Evidence that FPRA methods are significantly over-predicting the frequency of:
  - Spurious Operations
  - High CCDP conditions

  as compared to actual industry experience
- This directly contributes to the over-prediction of computed Fire CDF

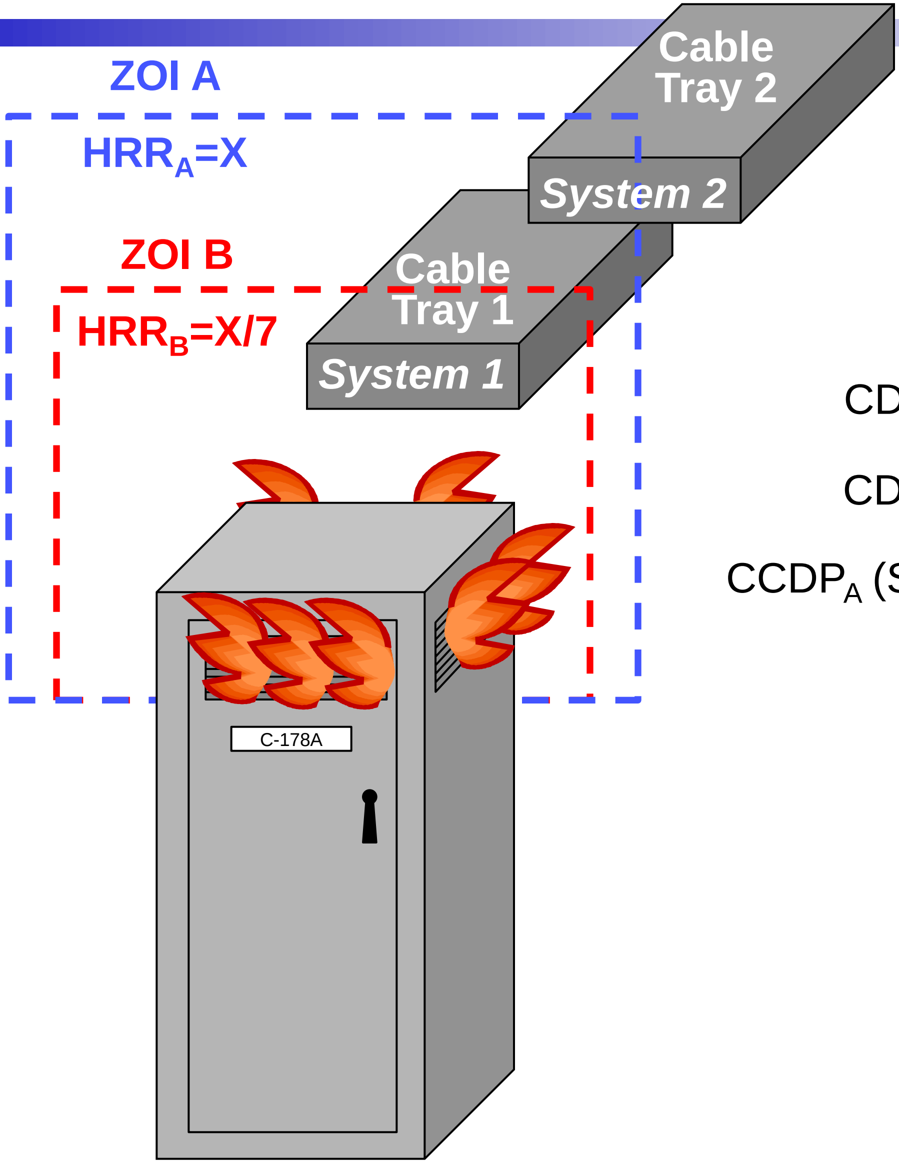
Masking of Risk Insights

- PRA Policy Statement says:

  PRA evaluations in support of regulatory decisions should be as realistic as practicable and appropriate supporting data should be publicly available for review

- One of the reasons realism is important is to minimize the potential to mask important insights
  - Realism particularly important for significant contributors
- Likelihood conservatisms have different implications than damage conservatisms

Baseline Risk from Differing ZOIs



Plant Baseline Risk

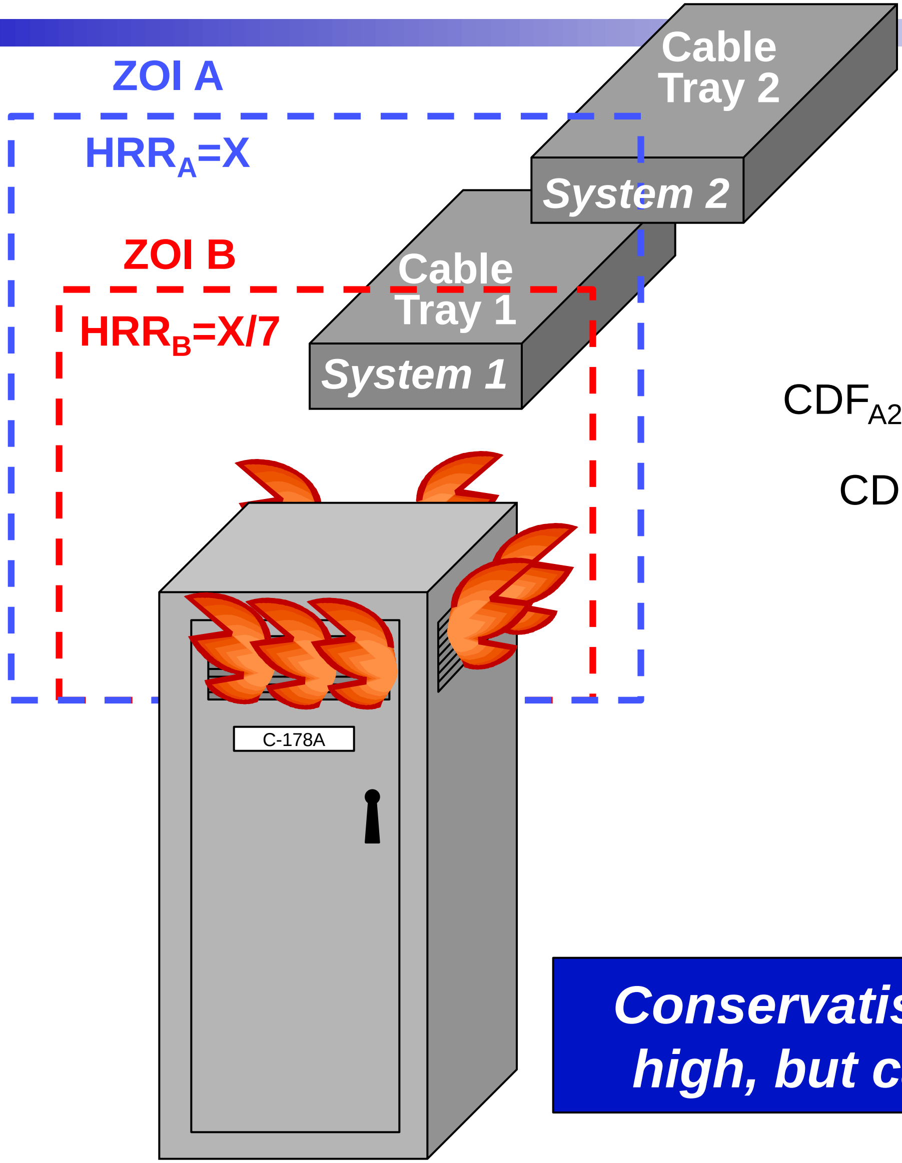
CDF_A = Freq(S_i) * $CCDP_A$ (Sys1,Sys2 failed)

CDF_B = Freq(S_i) * $CCDP_B$ (Sys1 Only failed)

$CCDP_A$ (Sys1,Sys2 failed) >> $CCDP_B$ (Sys1 Only failed)

CDF_A >> CDF_B

Conditional Risk from Differing ZOIs



Case with 'System 2' Out of Service

$CDF_{A2} = CDF_A = Freq(S_i) * CCDP_A$ (Sys1,Sys2 failed)

$CDF_{B2} = Freq(S_i) * CCDP_{B2}$ (Sys1, Sys2 failed)

$CCDP_A = CCDP_{B2}$

$CDF_{A2} = CDF_A = CDF_{B2}$

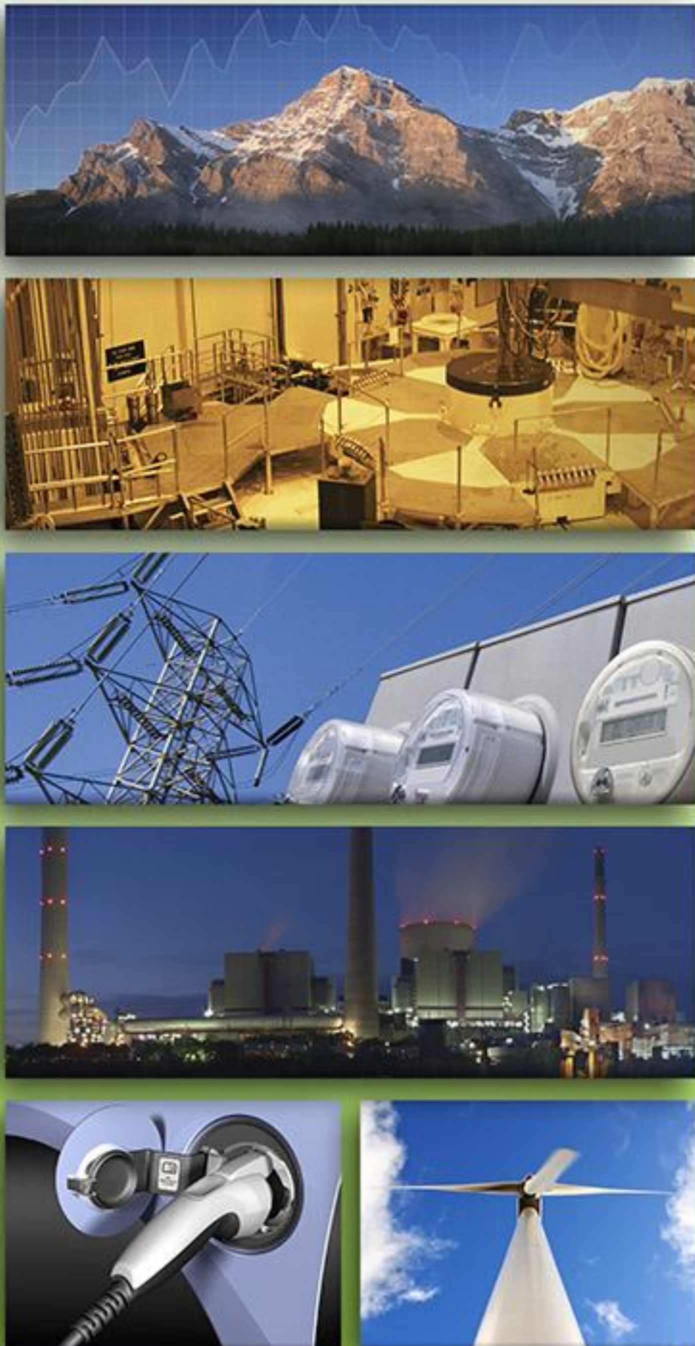
ZOI A = No Change in Risk

ZOI B = Potentially Significant Change in Risk

Conservatism biases the baseline results high, but can lead to understated deltas

Summary

- Simplifications/bounding assumptions driving the results
- Problem is compounded conservatisms: No simple fix
- Computed risks don't comport with risk experience (CCDP/ASP)
- Prediction of spurious operations inconsistent with operating experience
- Conservatisms can confound good risk-informed decision-making (805 & beyond)



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Roadmap For Attaining Realism In Fire PRAs

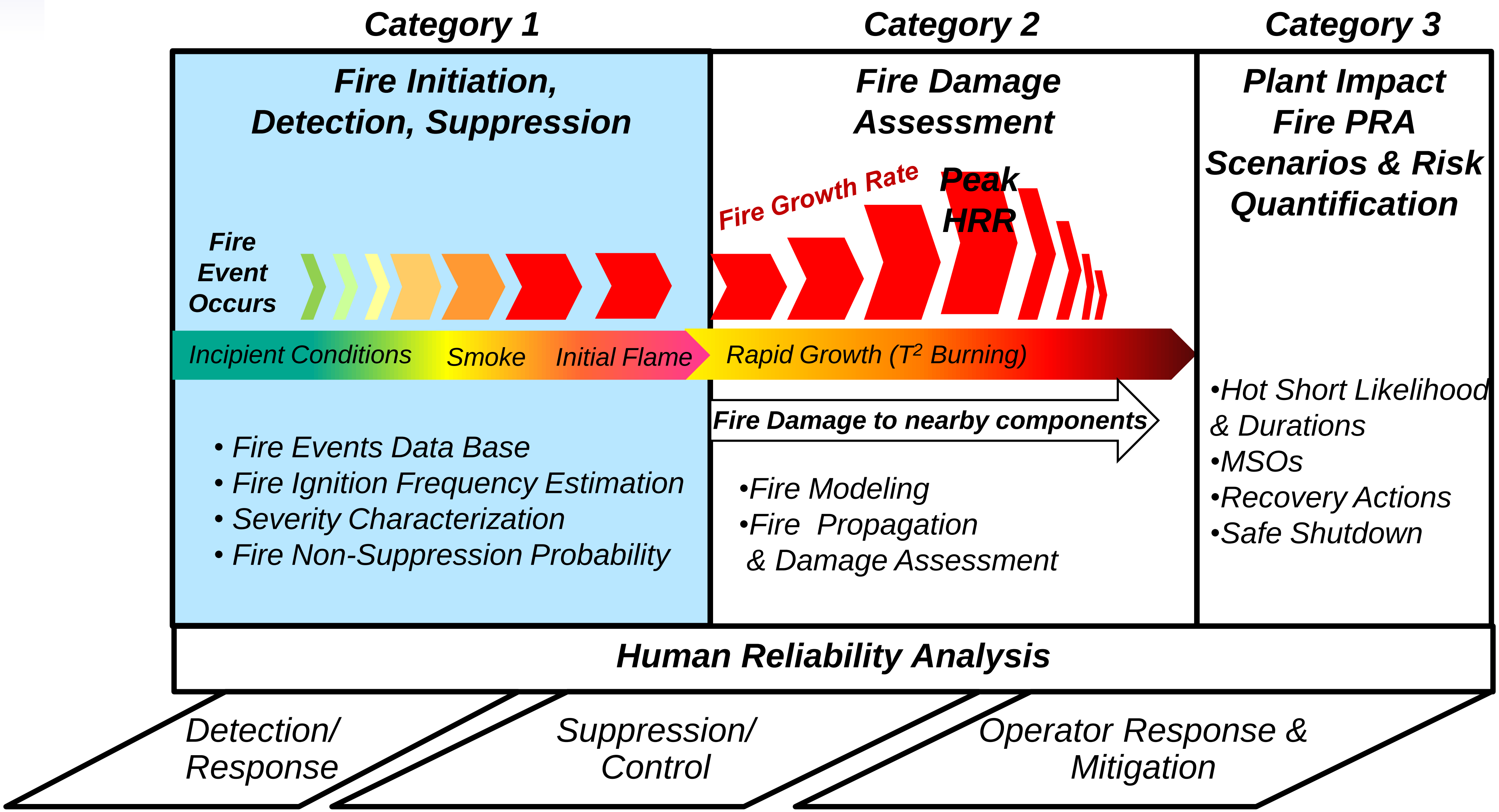
Doug True, ERIN Engineering & Research

ACRS PRASC
November 16, 2010

Purpose

- Develop a report that uses insights from industry fire PRAs to identify the important areas of EPRI 1019189/ NUREG/CR-6850 where bounding assumptions/ simplifications are unduly influencing FPRA results
- Report Objectives:
  - Identify key areas needing additional realism
  - Illuminate causes
  - Identify and organize a set of reasonable near-term research activities (next ~3 years)
  - Inform & update the EPRI FPRA Action Matrix

FPRA Issues Framework



Category 1: Fire Initiation, Detection, Suppression

Areas In Need of Additional Realism:

- Fire Event Data Characterization
  - Fire Events Database
  - Fire Ignition Frequency
- Fire Severity Characterization
  - Incipient Fire Growth in Electrical Cabinets
  - Oil Fire Severity
- Incipient Detection
  - Credit for Incipient Detection
- Fire Suppression & Control
  - Credit for Fire Suppression & Control

Fire Event Data Characterization

- Fire Events Database
  - The events in the current FEDB do not align well with the manner in which they are used.
    - Assumptions are used to make links that could be supported by data
  - The current FEDB only includes data through 2000
  - The current FEDB relies on weak event descriptions and a less than traceable categorization scheme
  - Risk-informed, Performance-based Fire Protection will require a long-term fire event data collection & analysis program

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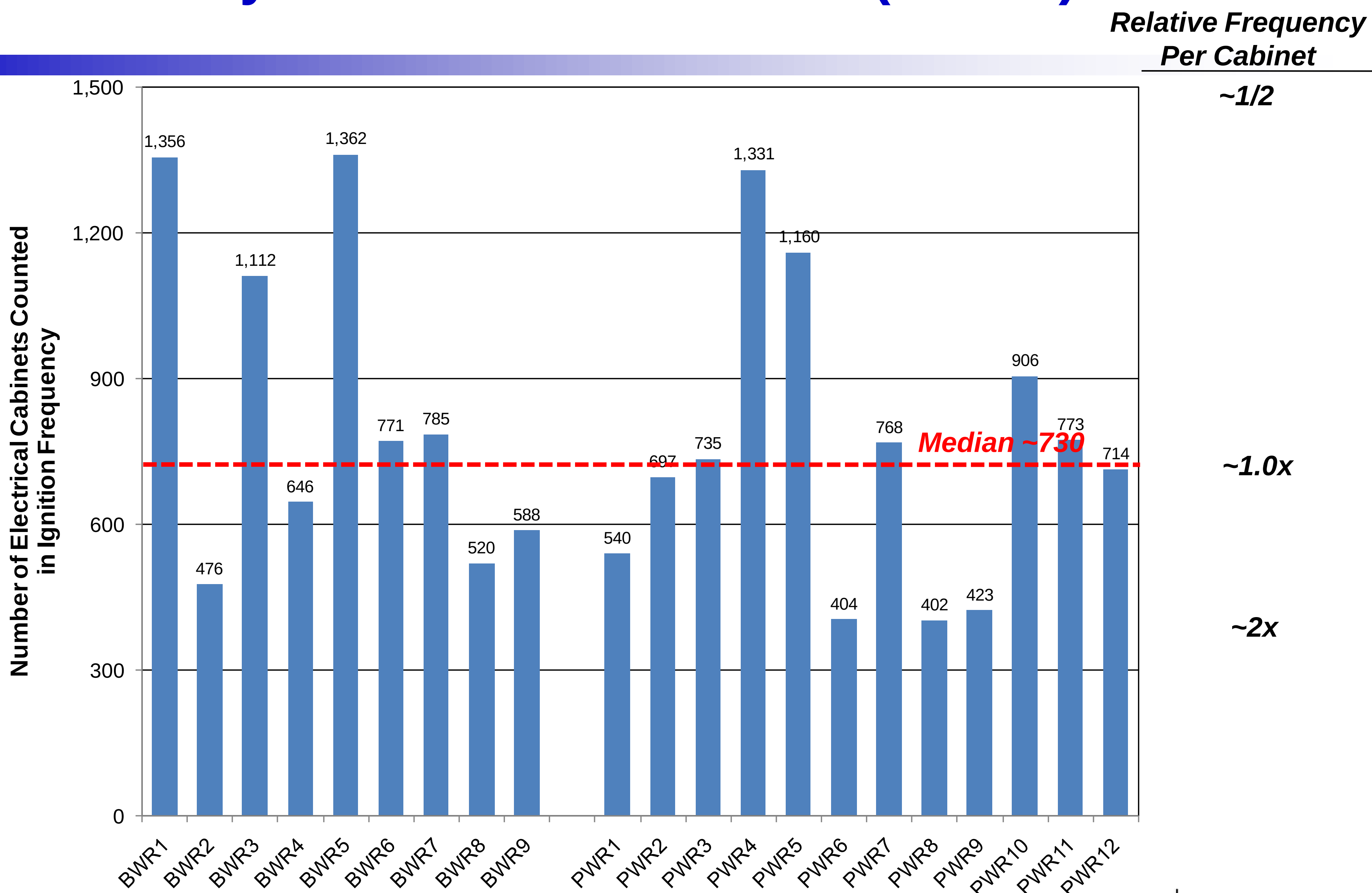
Fire Event Data Characterization

- Fire Ignition Frequency
  - Current approach to component-based ignition frequencies relies upon an allocation technique rather than component-specific ignition frequencies
  - Current approach to the calculation of ignition frequencies is simplistic, does not comport with current data analysis techniques, and does not account well for plant-to-plant variability
  - Treatment of transient ignition frequencies does not address administrative controls
    - No credit for control of transient combustibles

Inventory of Electrical Cabinets (Bin 15)



* *Draft information (unverified)*

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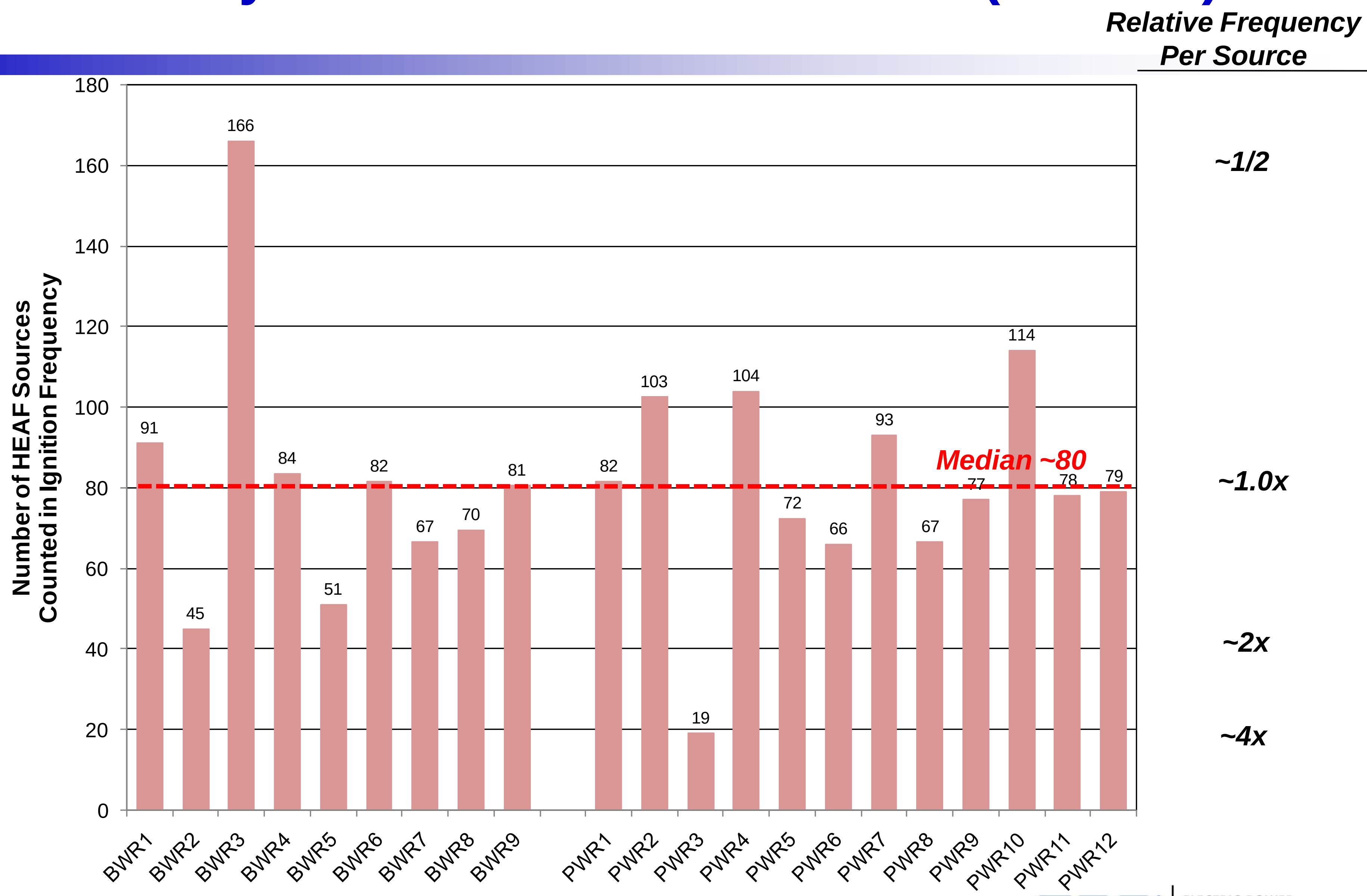
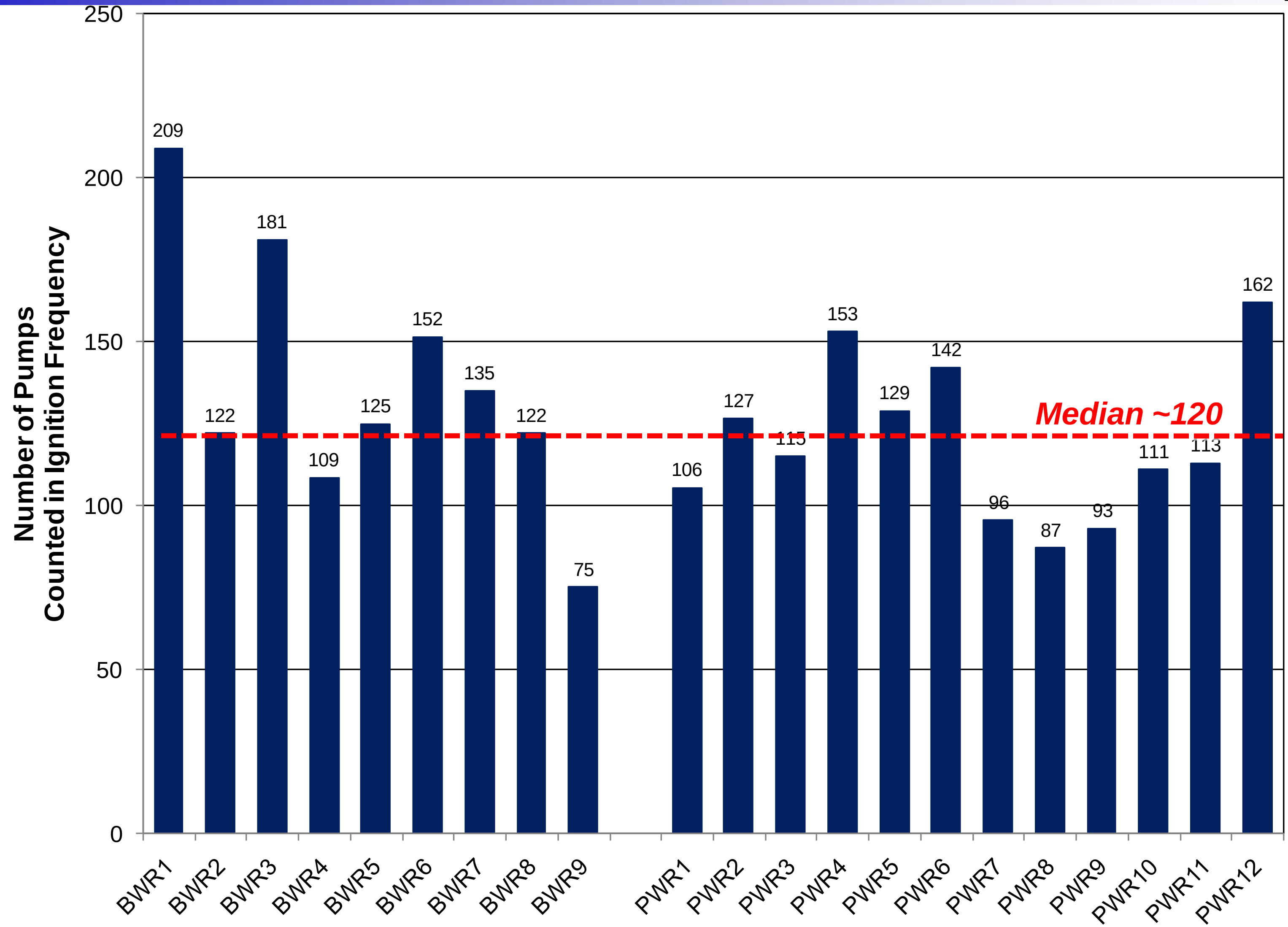
Inventory of HEAF Sources > 1000V (Bin 16b)



* *Draft information (unverified)*

Plant-wide Inventory of Pumps (Bin 21)

Relative Frequency Per Pump



~1/2

~1.0x

~2x

** Draft information (unverified)*

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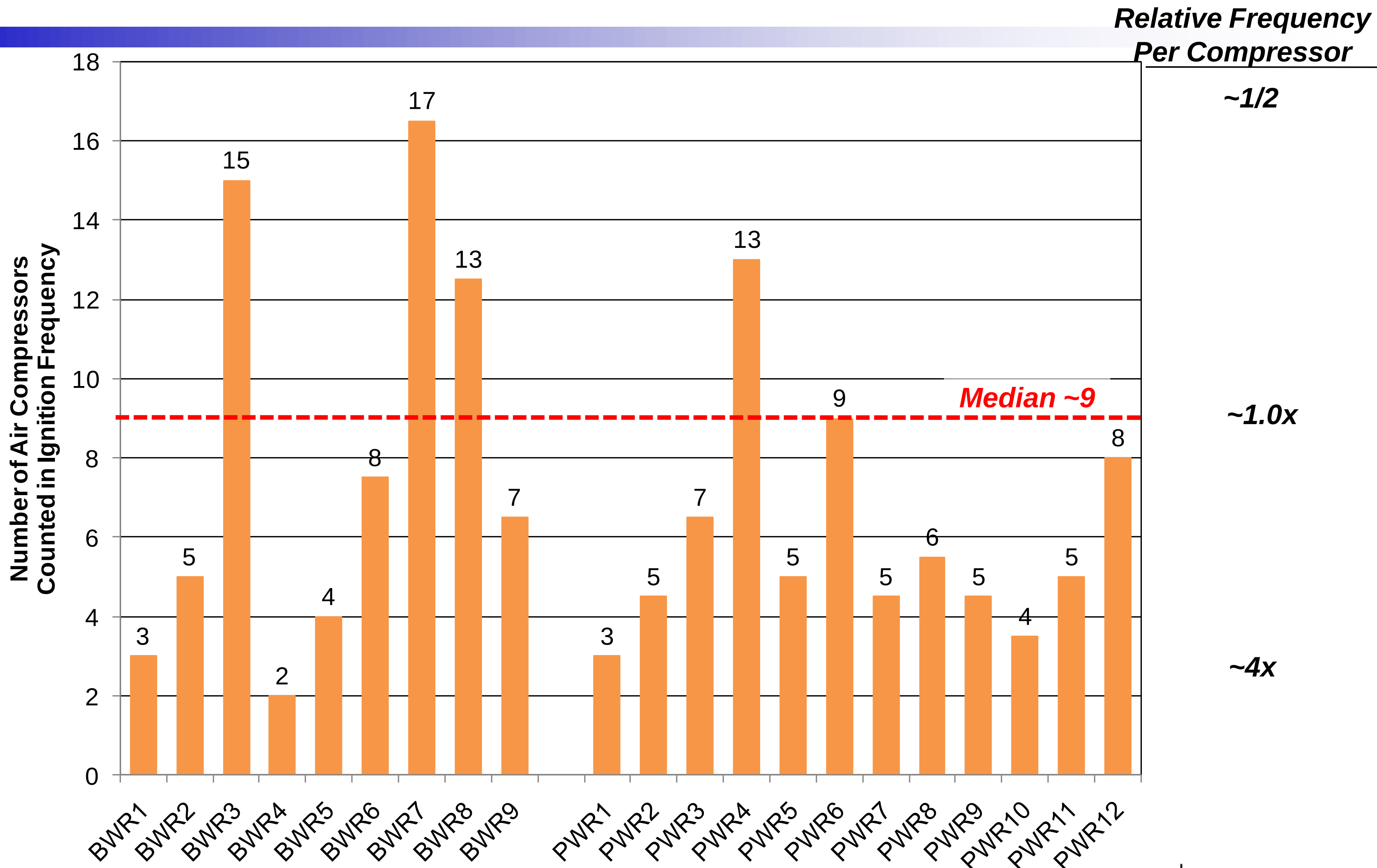
Plant-wide Inventory of Air Compressors (Bin 9)



** Draft information (unverified)*

Database & Ignition Frequencies

- Implications for FPRA
  - Current FAQ requires reliance on old data
  - Current database has non-negligible frequency contribution from “indeterminate” events
  - All fire events treated as entering the t^2 growth phase
    - Experience does not support this

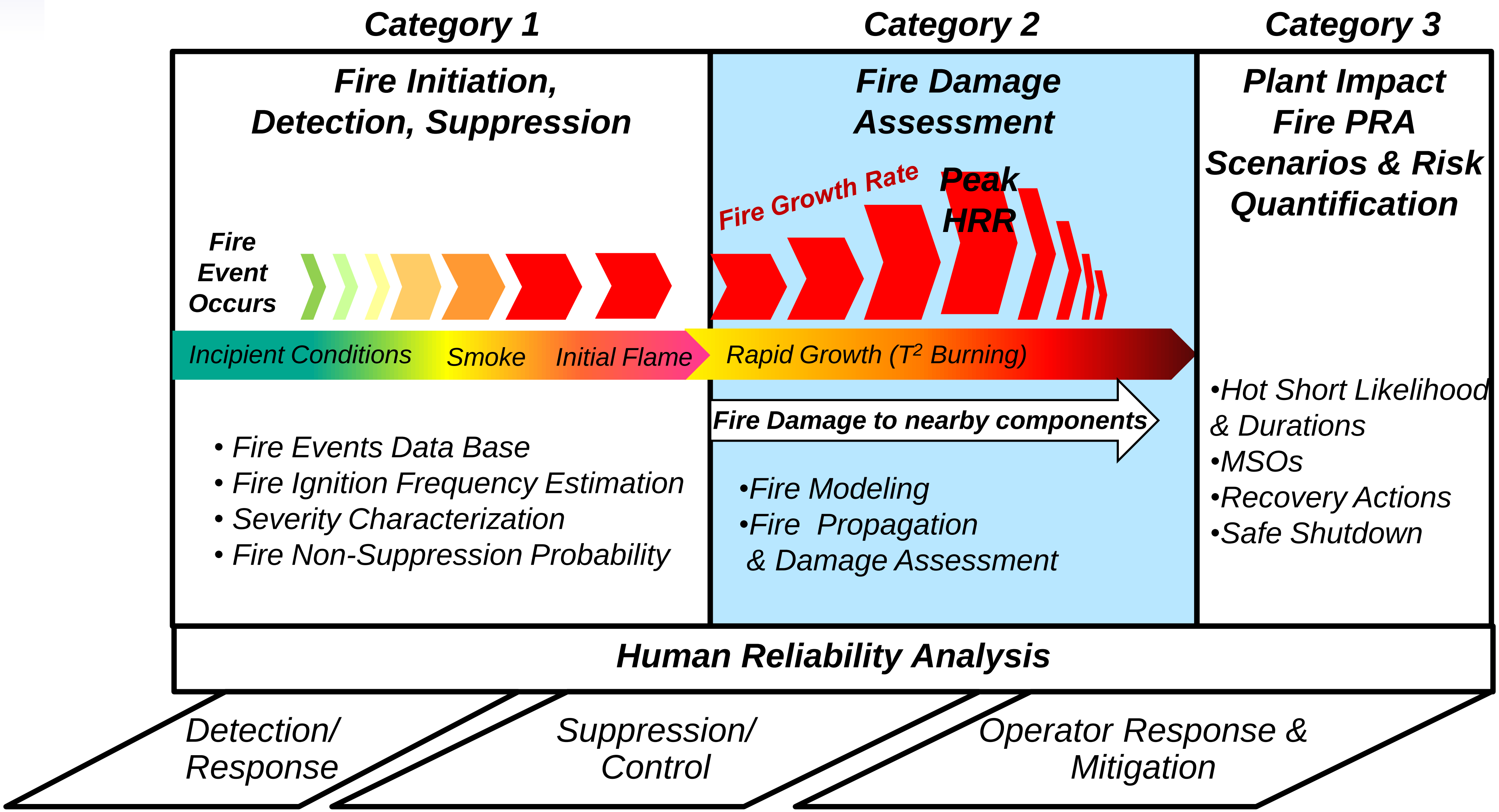
Could easily overstate likelihood of true fires by a factor of 2-5 for key bins

Insights from enhanced database will provide valuable input to other tasks

Fire Severity Characterization

- Incipient Fire Growth in Electrical Cabinets
  - Events from Fire Events Database (FEDB) are treated as in the t^2 growth phase even though vast majority are suppressed or controlled before external damage occurs
- Oil Fire Severity
  - Treatment of oil fires severity is simplistic and over-predicts fire severity vs. events in current FEDB
  - FAQ-44 adjusted treatment for MFW pump oil fires, but other components need a similar update:
    - Pumps
    - Transformers
    - Diesel generators

FPRA Issues Framework



Category 2: Fire Damage Assessment

Areas In Need of Additional Realism :

- Fire Growth Assumptions
  - Fire growth and comparison with data
- Peak Heat Release Rates
  - Electrical cabinet peak heat release rate (HRR)
  - Transient Ignition Source HRR
  - Hot Work HRR
  - Other HRRs
- Damage Assessment
  - Switchgear High Energy Arcing Faults
  - Bus Duct High Energy Arcing Faults
  - Damage to Sensitive Electronic Equipment
- Fire Propagation
  - Electrical cabinet propagation
- Fire Modeling
  - Fire Modeling Guidance

Fire Growth Assumptions

- Fire growth and comparison with data
  - The treatment of electrical fire growth rates is very coarse and does not address condition-specific factors
    - Ventilation-limited conditions
- Fires in the database do not appear to evolve in the t^2 development phase for some time
- Current assumptions has artificially assigned fire growth rates
  - e.g., 12 minute fire growth timing for electrical cabinets
- Artificially limits benefit of intervention actions
- Improved database should provide better basis for fire growth assumptions

NUREG/CR-4527

- Primary basis for 12 minute fire growth rate assumption
- To ignite cables, utilized ignition source comprised of a polyethylene bucket containing:
  - 1 quart of acetone
  - 1 lb of kimwipes
- Flame height of ~3ft
- Duration of source burn ~35 min

- Source insufficient to sustain burn unless cable bundles were physically separated

NUREG/CR-4527 – HRR of ignition source only

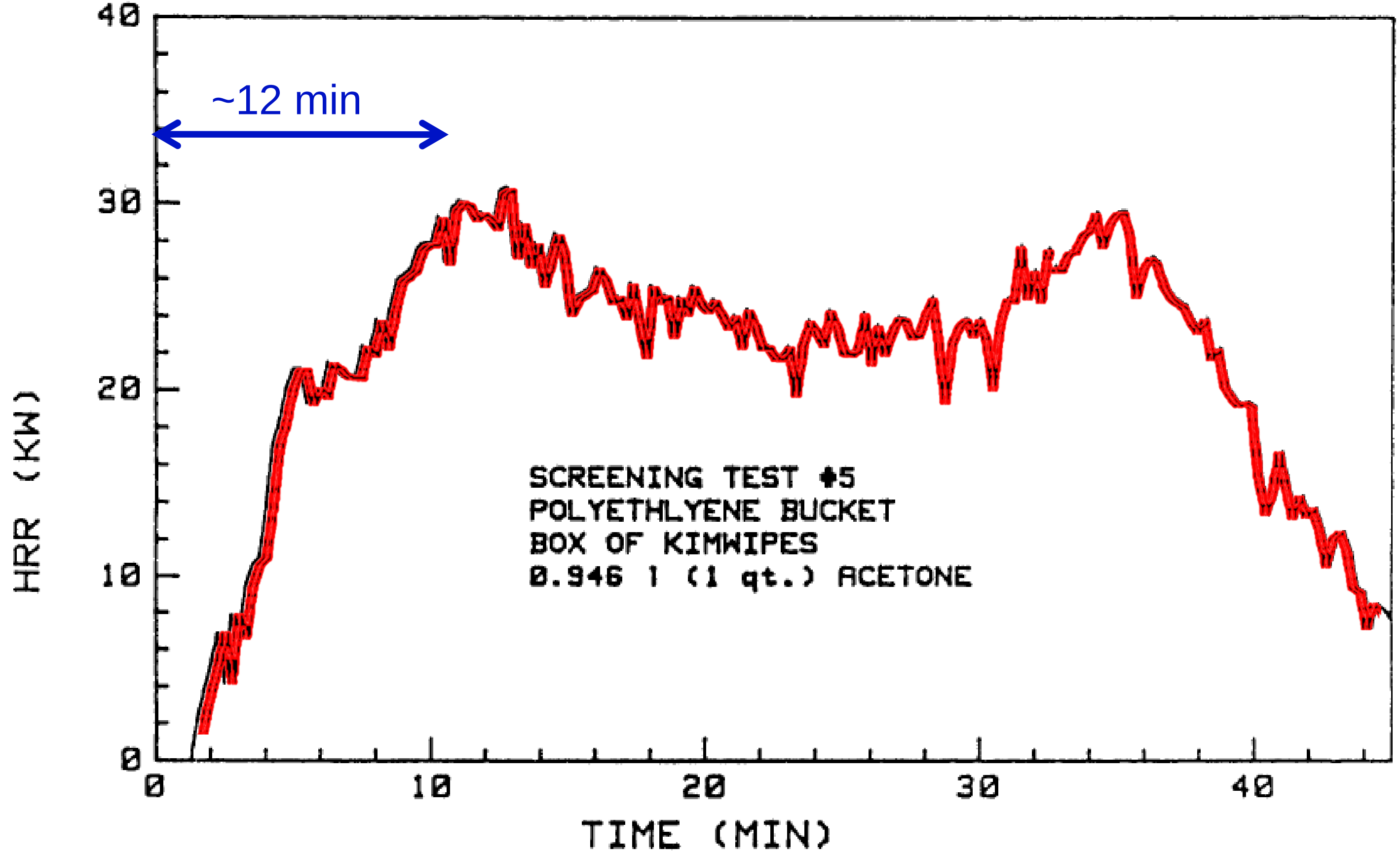


Figure 6. Heat Release Rate for the Transient Ignition Source; Screening Test #5

NUREG/CR-4527 – Screening Test Results

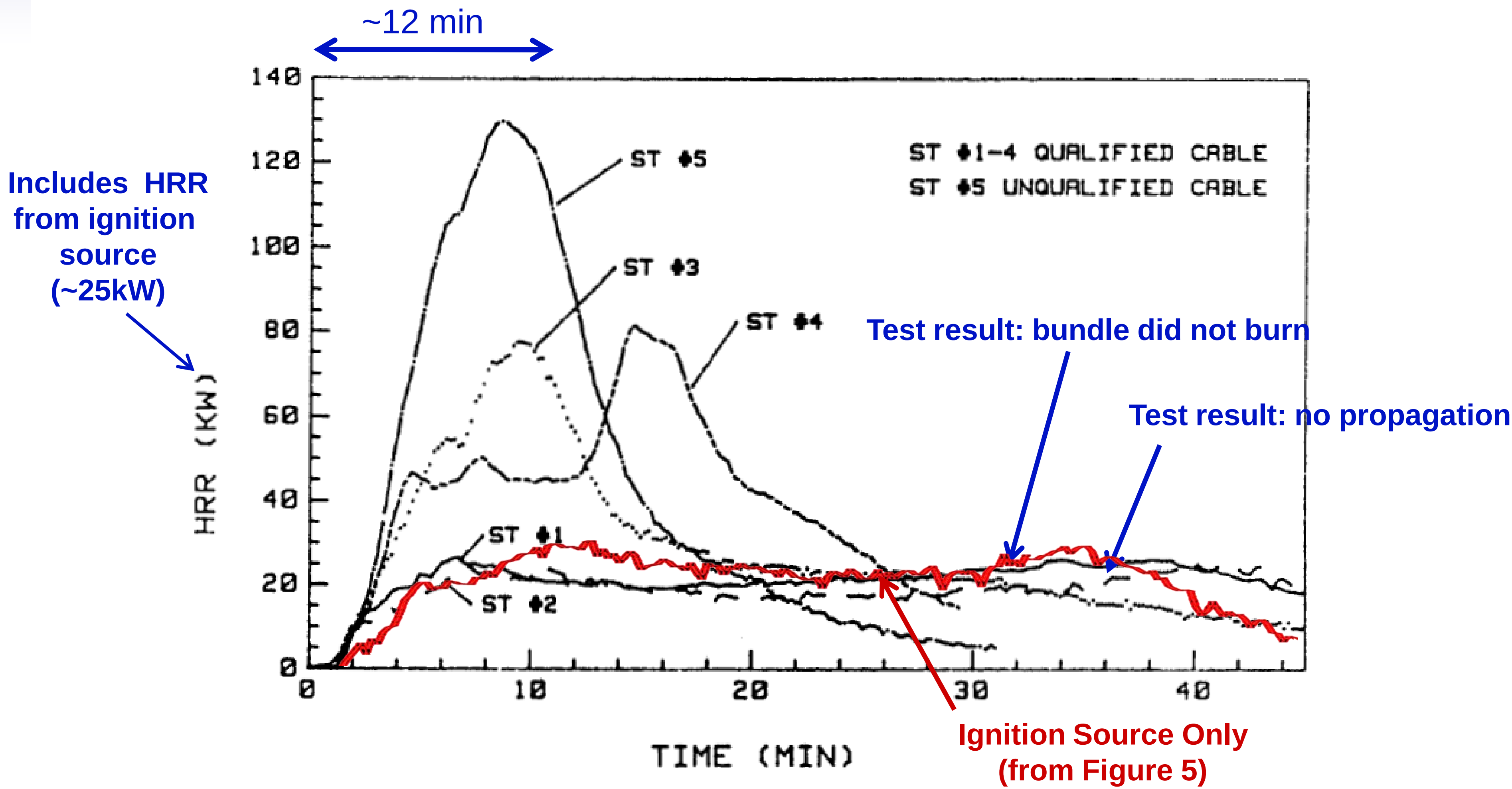


Figure 8. Heat Release Rate Plots for Scoping Tests #1 through 5

-22-

NUREG/CR-4527 Scoping Test Results

Test #[a]	Cable Type	Amount of In Situ Fuels[b,c] (KJ)	Cabinet[d] Ventilation Method	Peak HRR (KW)	Intense Burn Duration (min)	Test Result
ST1	Q	117,000	No doors	24	15	Bundle did not burn
ST2	Q	117,000	No doors	27	17	No propagation
ST3	Q	117,000	No doors	77	18	Entire bundle consumed
ST4	Q	117,000	No doors	82	17	Almost entire bundle consumed
ST5	UQ	117,000	No doors	132	17	Entire bundle consumed
ST6	Q	348,500	No doors	82	25	No propagation
ST7	Q	348,500	Doors closed	95	25	No propagation
ST8	Q	582,875	Doors closed	93	30	No propagation
ST9 barriers	Q	234,990	Doors open	74	20	No propagation
ST10	UQ	611,530	Doors closed	280	30	Propagated All burned
ST11	UQ	611,530	Door open	506	20	Propagated All burned

No significant damage

NUREG/CR-4527 – "Preliminary Cabinet Tests"

Table 4

Matrix of Preliminary Cabinet Tests

TEST #	IGNITION FUEL	CABINET TYPE	CABINET VENTILATION	IN SITU FUEL TYPE	IN SITU FUEL AMOUNT (KJ) [BTU]
PCT 1	Transient	Vertical	Vent Grills on Doors	UQ	7.283×10^5 [6.90×10^5]
PCT 2	Transient	Vertical	Doors Open	UQ	1.051×10^6 [1×10^6]
PCT 3	Transient	Vertical	Doors Open	Q	1.055×10^6 [1×10^6]
PCT 4	Heptane	Vertical	Doors Open	Heptane	56.78 ℓ (.929 m^2 pan) [15 gal (10 ft^2 pan)]
PCT 5	Electrical	Benchboard	Door Open Front Grill	UQ	1.519×10^6 [1.44×10^6]
PCT 6	Transient	Benchboard	Door Open Front Grill	Q	1.551×10^6 [1.47×10^6]

Fire Growth Rate Data – Electrical Cabinets

Test	Time to Peak	Steady Burning	Time to Decay	Ignition Source	Cable	Ventilation
ST1	7	8	15	Transient	Qualified	Open
ST2	6	11	17	Transient	Qualified	Open
ST3	10	8	18	Transient	Qualified	Open
ST4	14	3	17	Transient	Qualified	Open
ST5	8	9	17	Transient	Unqualified	Open
ST6	8	17	25	Transient	Qualified	Open
ST7	18	7	25	Transient	Qualified	Closed
ST8	10	20	30	Transient	Qualified	Closed
ST9	10	10	20	Transient	Qualified	Open
ST10	10	20	30	Transient	Unqualified	Closed
ST11	18	2	20	Transient	Unqualified	Open
PCT1	11	10	21	Transient	Unqualified	Closed
PCT2	12	2	14	Transient	Unqualified	Open
PCT3	13	14	27	Transient	Qualified	Open
PCT4a	16	0	16	Heptane Pool	Unqualified	Open
PCT4c	16	0	16	Heptane Pool	Unqualified	Open
PCT5	17	0	17	Electrical	Unqualified	Open
PCT6	11	0	11	Transient	Qualified	Open
Test 21	4	14	18	Gas Burner	Unqualified	Open
Test 22	9	2	11	Gas Burner	Unqualified	Open
Test 23	10	0	10	Transient	Qualified	Open
Test 24	12	0	12	Electrical	Qualified	Open
Average	**11.4**	**7.1**	**19**			

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NUREG/CR-4527 – Scoping Test Conclusions

- "A number of conclusions can be made as a result of the Scoping Tasks that give insight into cabinet fire development and input into the Preliminary Cabinet Tests. The conclusions are as follows:
  - There is a "critical" amount of "ignition source fuel" that is necessary to ignite a cable bundle, particularly qualified cable.
  - Qualified cable fires (with the selected cable and ignition source) in vertical cabinets do not spread throughout the cabinet.
  - Unqualified cable in vertical cabinets will easily ignite (with the selected ignition source) and propagate a fire in a single cabinet.
  - Burning rate (as measured by the HRR) is affected by the ventilation method (i.e., closed or open cabinet door) in tests using unqualified cable. Closed cabinet doors appear to result in higher cabinet temperature but also cause oxygen deprivation that appears to limit the burning rate.
  - Smoke obscuration in the test enclosure occurs within eight minutes in unqualified cable cabinet fires in the configurations tested.
  - The thermal environment in the enclosure does not become severe enough to cause melting of components or result in flashover.

- Furthermore, an important observation made during the tests was that when comparing the test cabinets loaded with in situ fuel (loadings are based on survey information) to pictures of actual nuclear power plant cabinets, the fuel load appears to be small. As a result of the Scoping Tests, it appears that cabinet fires with qualified cable do not propagate significantly. However, cabinet fires with unqualified cable may be a real threat to the safety of a nuclear power plant, from the standpoint of fire spread, and control room habitability, given the "critical" conditions and configurations."

Ramifications for FPRA

- Simplification in NUREG/CR-6850 leads to potential overstatement of fire growth rate and heat release rate (HRR):
  - Tests designed to cause damage
  - All fires treated as if propagation is possible
  - Fire growth rate set by “transient” ignition source (acetone & kimwipes)
  - Included tests with 10-15 gal of heptane as ignition source
  - Most tests were with open or no doors
  - Many tests were with unqualified cables
  - Benchboard and vertical cabinets treated the same

Ramifications for FPRA (Cont.)

- Damage rate and damage potential appears overstated
- Short time reduces potential for intervention by plant personnel, e.g., operations or brigade
- Needs to be informed by better experience data & more mechanistic treatment of cabinet parameters, e.g., ventilation limited fires

Could easily overstate likelihood of fully involved fire by a factor of 2-5

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Peak Heat Release Rates – Electrical Cabinets

- Electrical cabinet peak heat release rate (HRR)
  - HRRs for electrical cabinets are binned very simply
  - Mix and match of test results to assign peak HRRs
  - Assignment of distribution appears to have little connection to experience
  - Expert judgment inscrutable – does not meet PRA Standard requirements
- Simplified scheme for designating peak HRR
  - Qualified/unqualified & number of bundles
  - Ignores ventilation limited cases
  - Applies test results that may not be applicable

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Peak Heat Release Rates – Electrical Cabinets (Cont.)

- Major contributor to all current FPRAs
- Not aligned with actual operating experience
- Overstates effects of fires
- Has potential to confound risk-informed decision-making:
  - Assumption of damage that may not occur is not always “conservative”
    - Could mask risk increases from plant changes/ conditions, out-of-service equipment, etc.

Could lead to identification of wrong dominant contributors and misguided decision-making

Fixed Ignition Source HRRs

Tests of Cabinets with Unqualified Cables

Average of Benchboard Tests with Open Doors

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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Peak Heat Release Rates - Transient Ignition Sources

- Transient ignition sources, e.g., Bins 7, 25, 37
- Source peak HRR data from tests performed on trash bags
- FEDB events are primarily events involving transient ignition sources:
  - Space heaters, extension cords, scaffolding, etc.
  - Only one FEDB event involved a trash receptacle

Overstatement of threat from transient combustibles could skew results and mask important contributors

Quantitative impact on PRA is very plant/ scenario-specific, but could be significant

Peak Heat Release Rates – Hot Work

- Majority of events in FEDB are pre-Appendix R
- New FEDB needs to inform with the type of events that actually occur
- HRR should be tied to the types of hot work that has involved fires, rather than an arbitrary HRR from a transient source

Peak Heat Release Rates – Other Sources

- As other refinements are made to FPRA methods, it is expected that additional simplifications/assumptions on peak HRRs will be identified for improvement
- One example involves electrical fires from pumps and fans
- NUREG/CR-6850, Table G-1 says that the data used is from electrical cabinet fire tests and it is “considered conservative”

Fixed Ignition Source HRRs

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)
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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)
Pumps (electrical fires) [8]	69 (65)	211 [2] (200)	0.84 (0.83)	59.3 (56.6)
Motors [8]	32 (30)	69 (65)	2.0 (2.0)	11.7 (11.1)
Transient Combustibles [9]	142 (135)	317 (300)	1.8 (1.9)	57.4 (53.7)

See Note 8: No basis

Note 2: Vertical Cabinet Test

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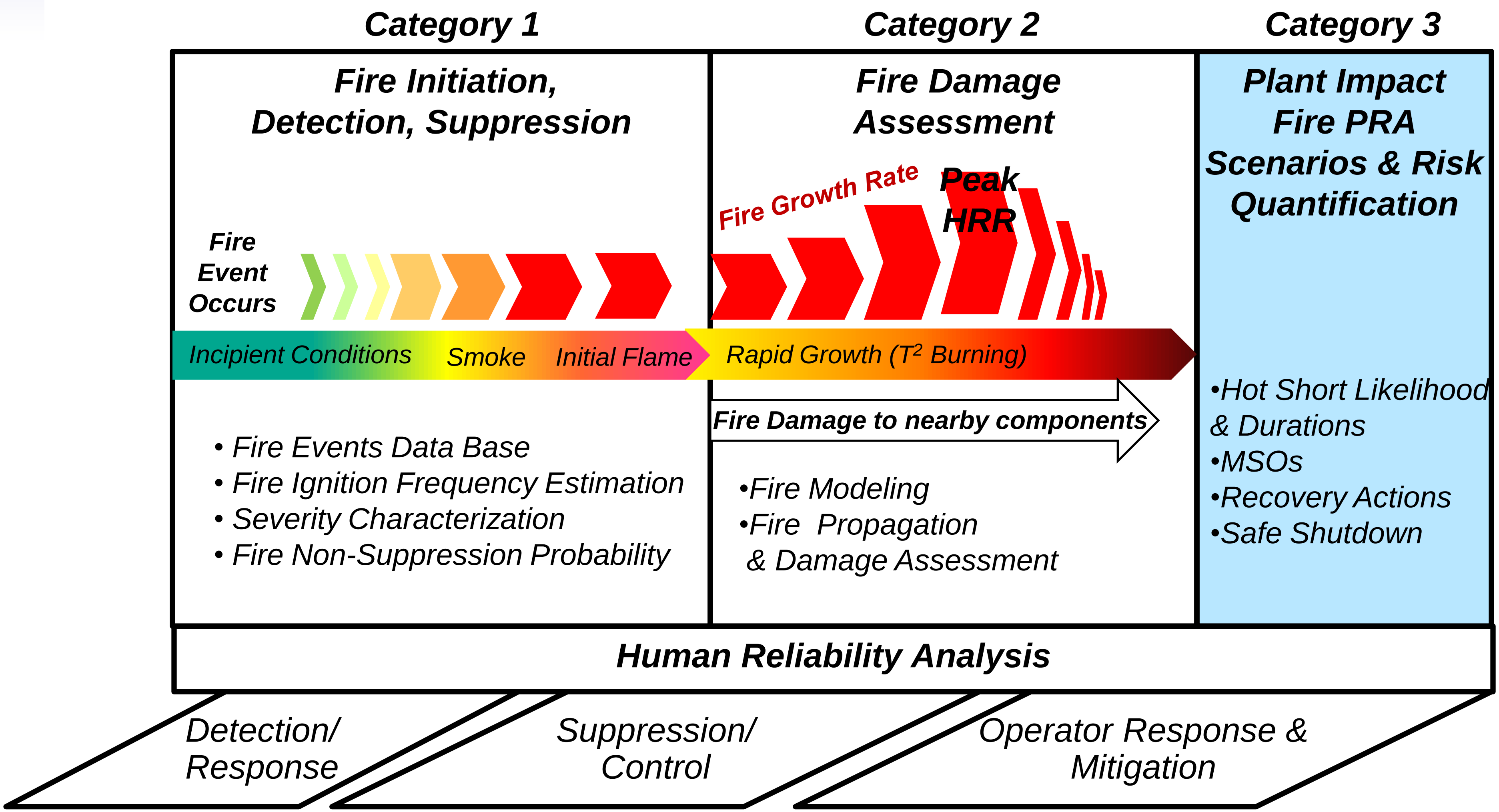
Fixed Ignition Source HRRs (Cont.)

Notes for Table G-2

1. Ref. G.2: Sandia experiments, average of vertical cabinet fire intensities with qualified cable.
2. Ref. G.3: VTT experiments with control cabinets.
3. Ref. G.2: Sandia experiments, average of two bench-board cabinet experiments with qualified cable.
4. The value is based on expert judgment. The expert panel assumes that the type of cable will only affect the ability of the cable to ignite. Therefore, once ignited, a single cable bundle is assumed to burn with similar intensity regardless of the cable qualification. A value of 85 BTU/s was selected as a conservative estimate for unqualified cables to represent a higher intensity at the 75^{th} percentile when compared to qualified cable.
5. Ref. G.2: Sandia experiments, average of two vertical cabinet experiments with unqualified cable and closed doors.
6. Twice the intensity selected for the 75^{th} percentile.
7. Ref. G.2: Sandia experiments, the highest heat release rate observed in cabinets with open door and unqualified cable.
8. No experimental evidence is available for assessing fire intensities for electrical fires in equipment other than electrical cabinets (or panels). Recommended values are considered conservative and are based on electrical cabinet (panel) fires experiments.
9. Distribution estimated based on the range of the tested transient fuel packages summarized in table G-7.

FPRA Issues Framework



Category 3: Plant Impact, Fire PRA Scenarios & Quantification

<u>Areas In Need of Additional Realism</u>:

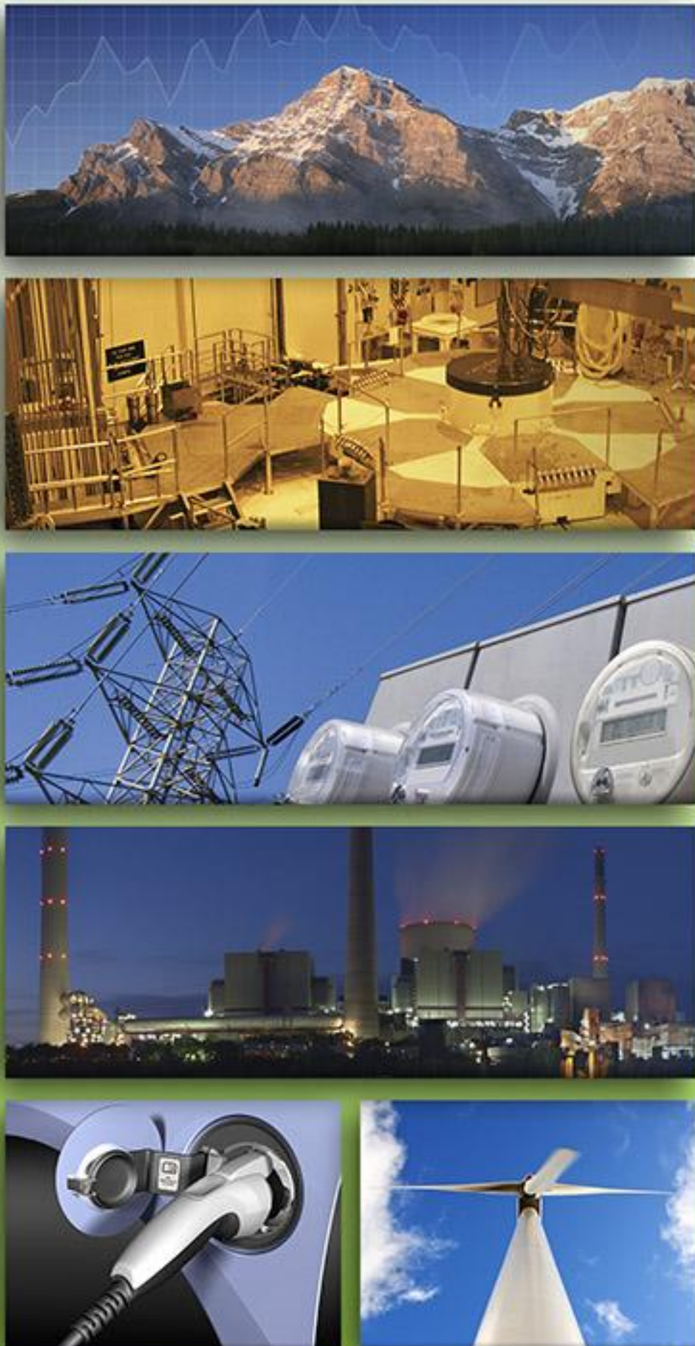
- Treatment of Hot Shorts
  - AC Circuits Hot Short Probability and Duration
  - DC Circuits Hot Short Probability and Duration
- Human Reliability
  - Human Reliability Methods (HRA) methods and performance shaping factors for fire PRAs
- Modeling of Control Room Fires
  - Control Room Modeling and Treatment in the Fire PRA
- PRA Model Advancement
  - Address unrealistic model simplifications

Summary of Roadmap Conclusions

Conclusion	Primary Bases
Fire characterization does not appear to conform with operating experience	• Over-prediction of number of severe fires • Assumed rate of fire growth & severity, e.g., 12 mins in electrical cabinets, oil fire severity • No credit for control of fires
The level of quantified risk appears to be overstated	• FPRAs predict high frequency of fires with high CCDPs, but NRC's ASP &ROP have not observed • Predicted frequency of spurious operations not consistent with operating experience
Uneven level of conservatism may mask key risk insights and lead to inappropriate decision-making	• Simplifications result in bounding treatment of "bin" • Overstated fire damage can lead to underestimation of risk increases from plant changes • Assumes plant challenge for all fires, e.g., plant trip • No credit for administrative controls

Many areas of expedited research needed to provide enhanced methods

Together…Shaping the Future of Electricity



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EPRI Fire PRA Action Plan

Rick Wachowiak

ACRS PRA Subcommittee
November 16, 2010

EPRI Fire PRA Action Plan

Initiated in late 2009 as a means to clarify and coordinate industry activities related to fire PRA methods

- Updated as new issues are identified

Includes activities led by EPRI, NEI, PWROG, BWROG

Roadmap used to align and help establish priorities

Reports to NSIAC via an Executive Oversight Group

Technical tasks coordinated within the NEI FPRATF

Focus of Research Activities

Fire PRA that is biased can mask important events and components or can drive plant changes that do not improve safety

Increase level of realism in fire PRA

- Support risk informed applications
- Reduce large departures from realism where possible
- Compatibility with internal events PRA

Fire PRA Action Matrix outlines and tracks the research activities needed to increase realism

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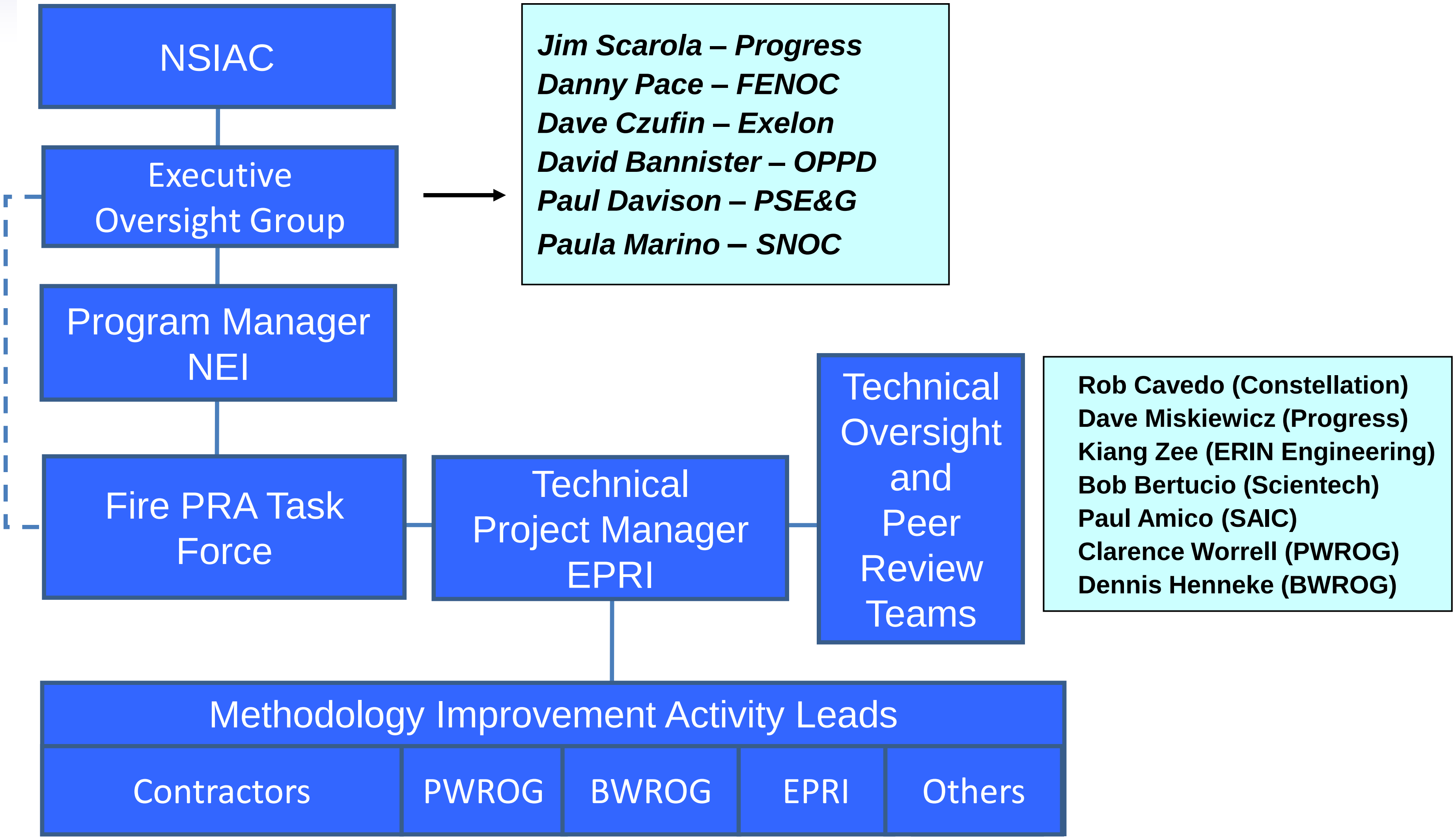
Fire PRA Industry Organization



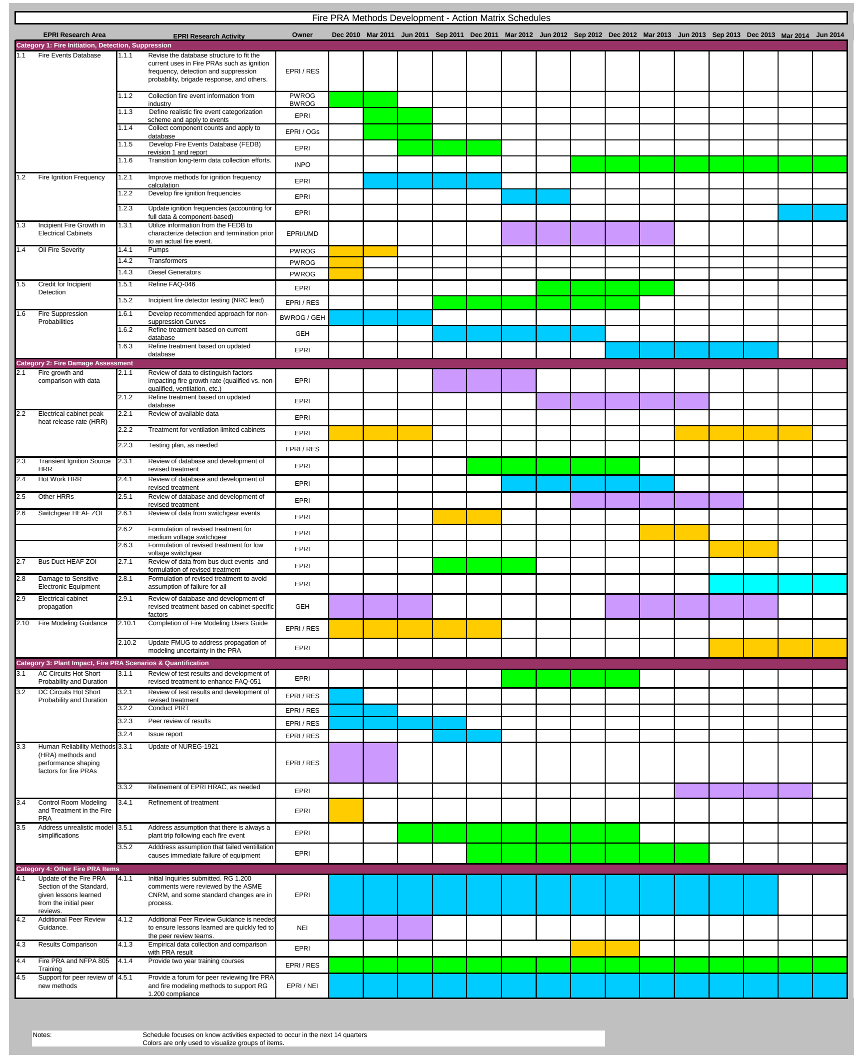
Fire PRA Action Matrix

Provides schedule for resolving key issues through mid-2014

For each activity there are: Owners, Schedules, Products

Categories of fire PRA activities

- Initiation, detection and suppression
- Damage assessment
- Plant impact, PRA scenarios, and quantification
- Ongoing base-load activities



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Action Matrix Example

Updated Fire Events Database

Fire PRA Methods Development - Action Matrix					
Area of Needed Realism	**EPRI Research Area**	**EPRI Research Activity**	**Priority**	**Owner**	**Status**
Category 1: Fire Initiation, Detection, Suppression					
Fire event data characterization	1.1 Fire Events Database	1.1.1 Revise the database structure to fit the current uses in Fire PRAs such as ignition frequency, detection and suppression probability, brigade response, and others	High	EPRI / RES	Revision to the database complete. Interim Report 1019198 issued that describes the database specification. Obtained agreement with NRC on the structure of the database.
		1.1.2 Collection fire event information from industry	High	PWROG BWROG	All plants have supplied raw data. PWROG and BWROG are doing the initial screen. PWROG batch is done. BWROG will likely finish in 2010. EPRI will do final screen and data entry
		1.1.3 Define realistic fire event categorization scheme and apply to events	High	EPRI / RES	Categorization scheme has been defined and the NRC concurs. Implementation can start once the owners groups finish the initial data screening.
		1.1.4 Collect component counts and apply to database	High	EPRI / OGs	PWROG and BWROG are developing the component counts. PWROG has had a strong response. Expect to issue a report early in 2011. Currently they have the raw data and explanations of outliers. BWROG is not expecting significant amount of data until late 2010.
		1.1.5 Develop Fire Events Database (FEDB) revision 1 and report	High	EPRI	This will include the description of the classification and the further data collection. A hard copy report of the data will be made public. The database itself is proprietary and will be retained by EPRI. It will provided to the NRC under the MOU without plant names.
		1.1.6 Transition long-term data collection efforts	High	INPO	Current agreement for INPO to take on data collection effort. INPO evaluating approach to long-term data collection. EPRI will retain responsibility for classification and application to FPRA.

Conclusions

Many important Fire PRA activities are under way

Focused on increasing the level of realism in Fire PRA

Fire Events Database is a key element to understanding the issues

EPRI is working with NRC RES

- Fire Events Database
- DC Testing
- Fire HRA

Roadmap report, including the full EPRI Action Matrix, will be provided to ACRS in the coming weeks

Together…Shaping the Future of Electricity

Non-FPA Issues Impacting Transition to NPFA 805

ACRS Reliability and PRA Subcommittee Meeting

November 16, 2010

NUCLEAR ENERGY INSTITUTE

Late Emerging Issues with Potential Impact on NFPA 805 Transition

- Impractical and evolving expectations to demonstrate “Safe and Stable” for an indefinite period
- Resolution of pilot issues being deferred by the issuance of implementation actions or license conditions
- Additional technical justification for continued acceptance of Pre-Transitional Licensing Bases

NEI

Example: Safe and Stable

Definition of Safe and Stable

- **NFPA 805, 1.6.56:** "For fuel in the reactor vessel, head on and tensioned, safe and stable conditions are defined as the ability to maintain Keff<0.99, with a reactor coolant temperature at or below the requirements for hot shutdown for a BWR and hot standby for a PWR."
  - 1.3.1 Nuclear Safety Goal: The nuclear goal of NFPA 805 is to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the fuel in a "safe and stable condition."

NEI

Example: Safe and Stable

Treatment of Safe and Stable

- **HNP SE:** **"The licensee stated that the NFPA 805 licensing basis for HNP will be to achieve and maintain safe and stable hot standby conditions. However, ...analyses previously performed ... included actions and equipment to achieve cold shutdown. NRC staff finds this acceptable because these actions are not required to meet the nuclear safety performance criteria..."**

- **ONS RAI 3-49:** **"Demonstrating the ability to maintain safe and stable conditions for only the first 72 hours following a fire does not, by itself, provide adequate assurance that the nuclear safety goal of NFPA 805 is met. The licensee should be able to demonstrate that safe and stable conditions can be maintained indefinitely, once achieved."**

NEI

Example: Safe and Stable

- Impact
  - ONS Re-analysis of All Components and Cables Associated with going to HSD
  - Non-pilot plants evaluations aligned with pilot/ONS LAR will require significant changes late in the process that will challenge meeting June 2011 submittal
  - Drive plants to a more restrictive condition than Appendix R

Closing Remarks

- Criteria and Guidance established by Staff and Industry must be consistently applied
- Changes in Requirements through the Review Process create instability and will significantly impact non-pilot transitions
- Deferral of the resolution of pilot issues by issuing Implementation Actions or License Conditions increases uncertainty in non-pilots applying the guidance consistently
- Expedient Resolution and Alignment on treatment of Safe and Stable needs to be reached through FAQ 08-0054

NEI

Alexander Klein, P.E.

Branch Chief, Fire Protection

Division of Risk Assessment

Office of Nuclear Reactor Regulation

Status of Transition to NFPA 805
Methodology and Issues Impacting the Transition

Advisory Committee on Reactor Safeguards

November 16, 2010

Objectives

Provide an Overview of the Status of Licensees Transition to NFPA 805 in Accordance to 10 CFR 50.48(c)

- Pilot plants – Shearon Harris and Oconee
- Other plants transitioning to NFPA 805
- NFPA 805 Infrastructure
- The FAQ process and its impact on the transition process
- Lessons learned

Shearon Harris and Oconee Transition to NFPA 805

- 6/05 – Progress submits a Letter of Intent to adopt NFPA 805 for Shearon Harris
  - 5/08 – Progress submits the license amendment request
  - 8/09 – 3/10 – Staff issues major rounds of requests for additional information
  - 6/10 – Staff issues the safety evaluation
- 2/05 – Duke submits a Letter of Intent to adopt NFPA 805 for Oconee (3 units)
  - 5/08 – Duke submits the license amendment request
  - 4/10 – Duke submits a revised license amendment request
  - 11/09 – 9/10 – Staff issues major rounds of requests for additional information
  - 12/10 (tentative)– Staff issues the safety evaluation

Other Plants Transitioning to NFPA 805

- 47 Units (non-pilot) have sent a Letter of Intent to adopt NFPA 805
- Most Units plan to submit license amendment requests in 2011
- Some Units plan to submit license amendment requests in 2012
- 1 Unit has not started transition
- 1 Unit has withdrawn

NFPA 805 Infrastructure Products

- Regulatory Guidance and other documents
  - Regulatory Guide 1.205
    - NEI 04-02, Revision 1 issued September 2005
    - RG 1.205 issued May 2006
    - NEI 04-02, Revision 2 issued April 2008
    - RG 1.205, Revision 1 issued December 2009
  - SRP 9.5.1.2 issued December 2009
- NUREG/CR 6850 issued September 2005
  - Supplement 1 issued September 2010
- Frequently Asked Questions
- NFPA 805 inspection procedure

NFPA 805 Infrastructure Development Activities

- Pilot Observation Meetings – periodic meetings held throughout NFPA 805 pilot process between pilot plant technical staff and NRC staff
- Pilot Workshops – public meetings held to communicate NFPA 805 pilot lessons learned to industry
- FAQ monthly public meetings – held to communicate technical/regulatory issues addressed through FAQ process

NFPA 805 Infrastructure Development Activities

- Issues resolved during pilot transition
  - Minimum information required at Acceptance Review
  - Recovery Actions
  - Alternative/Dedicated Shutdown under NFPA 805
  - Fire PRA quality
  - Radioactive Release transition
  - Non-power Operations transition
  - NFPA 805 Monitoring Program

NFPA 805 Infrastructure Development Activities

- Pilot plant observations and meetings
  - Shearon Harris/Oconee
    - 2005 - 2008
- NFPA 805 workshops
- Frequently Asked Questions monthly meetings
- License Amendment Request and Safety Evaluation template meetings
- Pilot plant site visits

Frequently Asked Question (FAQ) Process and Impact on Transition

- As lessons were learned through the pilot process, licensees asked for a semi-formal process to address guidance document changes
- FAQ process established to provide interim staff approval of changes to NEI 04-02 guidance
- Process has had substantial impact on transition
  - Facilitated resolution of over 30 significant technical/regulatory issues related to NFPA 805 transition

Resolved FAQs and their Potential Impact

- FAQ 07-0008 – Fire Protection Engineering Evaluations
- FAQ 07-0040 – Non-Power Operations
- FAQ 09-0046 – Incipient Detection

Lessons Learned Regarding Non-PRA Implementation Issues

- Licensees still needed a qualitative review process for minor plant changes
- Significant guidance was required to properly establish those recovery actions that require the evaluation of risk
- Implementation of the “safe and stable” concept under NFPA 805 required significant dialog with the pilots
- Monitoring program needs to be more mature at time of submittal to allow the staff to properly review and approve the process

Fire PRA Related Methodological and Other Issues Impeding the Transition Process

Presentation to ACRS Subcommittee on PRA and Reliability

November 16, 2010

Donnie Harrison, Chief
PRA Licensing Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

General Discussion Topics

- Selected Issues that impact Fire PRA Applications
  - Internal Events PRA/Fire PRA Carry-Over Issues
  - Risk-Informed Applications
  - Fire PRA Peer Reviews
  - Scope of 10 CFR 50.48(c) (NFPA 805) Transition
- Path Forward

Internal Events/Fire PRA Carry-Over Issues

- Internal events PRA may have been peer reviewed many years prior to application
- Unresolved internal events PRA peer review findings can affect fire PRA application
- Subsequent internal events PRA method changes/upgrades require focus-scope peer reviews
  - Results in subsequent impacts on fire PRA model

Risk-Informed Applications

- Some licensees have limited experience with risk-informed applications or no experience with applications of this scale
- Though fire PRA methods have been around for about 30 years, most licensees have dated experience in developing fire PRAs
- Impact of nearly simultaneous development of three items:
  - New fire PRA methodology guidance (NUREG/CR-6850)
  - New fire PRA standard (ASME/ANS-RA-Sa-2009)
  - New fire risk-informed application (10 CFR 50.48(c))

Fire PRA Peer Reviews

- New methods/approaches (beyond NUREG/CR-6850) being implemented impacts peer reviews
- Industry responded to early peer reviews by revising peer review guidance
  - Peer reviews may have initially used NUREG/CR-6850 as the only acceptable methods
  - New peer review guidance impacts the information needed to be provided by an applicant
- Incomplete fire PRAs submitted for peer review to meet scheduling needs may result in follow-on peer reviews of the completed elements

Fire PRA Peer Reviews

- Industry created Fire PRA methods task force to address new methods
  - Adds another layer of review of fire PRA model
  - Addressing new methods and providing task force feedback to the licensee takes time
  - Task force may modify or reject method resulting in further changes to a licensee's PRA; potentially requiring another peer review

Scope of 10 CFR 50.48(c) (NFPA 805) Transition

- Licensee decides on level of detail and realism in fire PRA modeling to support their application
- Fire PRA methods use a progressive screening approach
  - Focuses licensee resources on areas of highest fire risk contribution
  - Results in screened areas being conservative

Scope of 10 CFR 50.48(c) (NFPA 805) Transition

- Licensee may retain conservative screening approach if results are acceptable or implement plant modifications instead of using refined fire PRA models
  - Time, effort, level of justification, and cost considerations
- Plant modifications can reduce risk, not only for fires, but also for other risk contributors
  - Many to be implemented after staff evaluation
  - Ensuring credited performance achieved by actual installation
  - Limitations on the use of the plant change evaluation process until installation completed and confirmed

Scope of 10 CFR 50.48(c) (NFPA 805) Transition

- Creation of an entirely new licensing basis for fire protection that merges two disciplines
  - Must re-verify feasibility of operator manual actions
  - May need to designate some operator manual actions as recovery actions needing change in risk calculations
- New basis may include variations from deterministic requirements (VFDRs)
  - Results in potentially numerous change in risk calculations
  - Cumulative impact must be acceptable, as well as individual VFDR impacts
  - Fire PRA method simplifications can create conservative change in risk calculations

Path Forward

- Continue to engage external stakeholders to address Fire PRA concerns
- Identify and address conservatisms in the Fire PRA methods
  - Fire PRA methods or NUREG/CR-6850 FAQs
  - Fire PRA Methods Enhancements issued (Supplement 1 to NUREG/CR-6850)
  - Interact with the Fire PRA Methods Task Force
- Develop and train more industry and NRC staff

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

ACRS Reliability and PRA Subcommittee Meeting - Fire PRA Research in Support of NFPA 805

Mark Henry Salley P.E., Branch Chief

November 16, 2010

Rockville, Maryland

Office of Nuclear Regulatory Research

Fire Research Branch

Overview of NRC RES Activities

- Provide a High-Level Overview of NRC RES Fire Research Activities
- NRC's Research Partners
  - Electric Power Research Institute (EPRI)
  - National Institute of Standards and Technology (NIST)
  - Sandia National Laboratories (SNL)
  - Brookhaven National Laboratories (BNL)

Overview of NRC RES Activities

- Continue to Advance the Science and Understanding
  - – Improve the State-of-the-Art
  - – Expand the Knowledge Base
- Reduce Uncertainty
  - – Continue to refine/improve
    - Methods
    - Data

How Fire Research Activities Are Determined

- User Need Request
  - Formal Office Request for work
    - Close Interaction with Requesting Office
    - A Number of Different Tasks with NRR
    - Agree on Priority of Task
  - Agency Mandated Programs
  - Long Term Research

Fire PRA Methodology

- NUREG/CR-6850 EPRI 1011989
- State-of-the-Art
- Initial Issue: September 2005
- NFPA 805
- Frequently Asked Questions (FAQ)
  - Issued Supplement 1 September 2010
- How do we revise/update?

Fire PRA Methodology Update

- 18 Specific Chapters (Tasks) + Glossary
- 23 Appendix (A – W)
  - State-of-the-Art does not advance uniformly
- NRC Proposal “Modular Update”
  - Revise and Issue Chapters/Appendix as the Research advances State-of-the-Art
- Work closely with EPRI under MOU

Fire PRA Methodology Update

- Two Examples:
  - Chapter 9 “Circuit Failure Analysis”
    - NRC DESIREE-FIRE Program
      - Electrical PIRT
      - PRA Failure Probabilities
  - Appendix R “ Cable Fires”
    - NRC CHRISTIEFIRE Program

Fire HRA Update

- EPRI/NRC-RES Fire Human Reliability Analysis Guidelines"
  - Draft for Public Comment November 2009
  - Team has addressed major comments
  - Incorporated as a separate class in Fire PRA Training
- To be discussed along with the HRA SRM project Spring 2011

Fire Modeling

- NUREG-1805 “Fire Dynamic Tools”
  - Initial Issue: December 2004
- New Chapter “THIEF Model”
  - Developed as a part of CAROLFIRE
- New Look to Spreadsheets
  - Update/correct errors
- NUREG-1805 Supplement 1
  - Issue Fall/Winter 2010

Fire Modeling (cont.)

- NUREG-1824 EPRI-1011999 V&V
  - Initial Issue: May 2007
  - Future Expansion
- NUREG/CR-6978 PIRT
  - Initial Issue: November 2008
- NUREG-1934 EPRI-1019195 Application Guide
  - Draft for Comment January 2010
  - Team working the comments expect a second draft for comment Winter/Spring 2011
  - Discuss with ACRS subcommittee Spring/Summer 2011

CHRISTIFIRE

CHRISTIFIRE

- Better Understanding Cable Tray Fires
  - Heat Release Rate (HRR)
  - Ignition
  - Flame Spread
- Multiple Phase Project
  - NIST Performing the Experiments
- Significantly Advances the Science
  - Revise NUREG/CR-6850 Appendix R
- Draft for Comment issued October, 2010
  - Plan to discuss with ACRS Subcommittee after public comment period

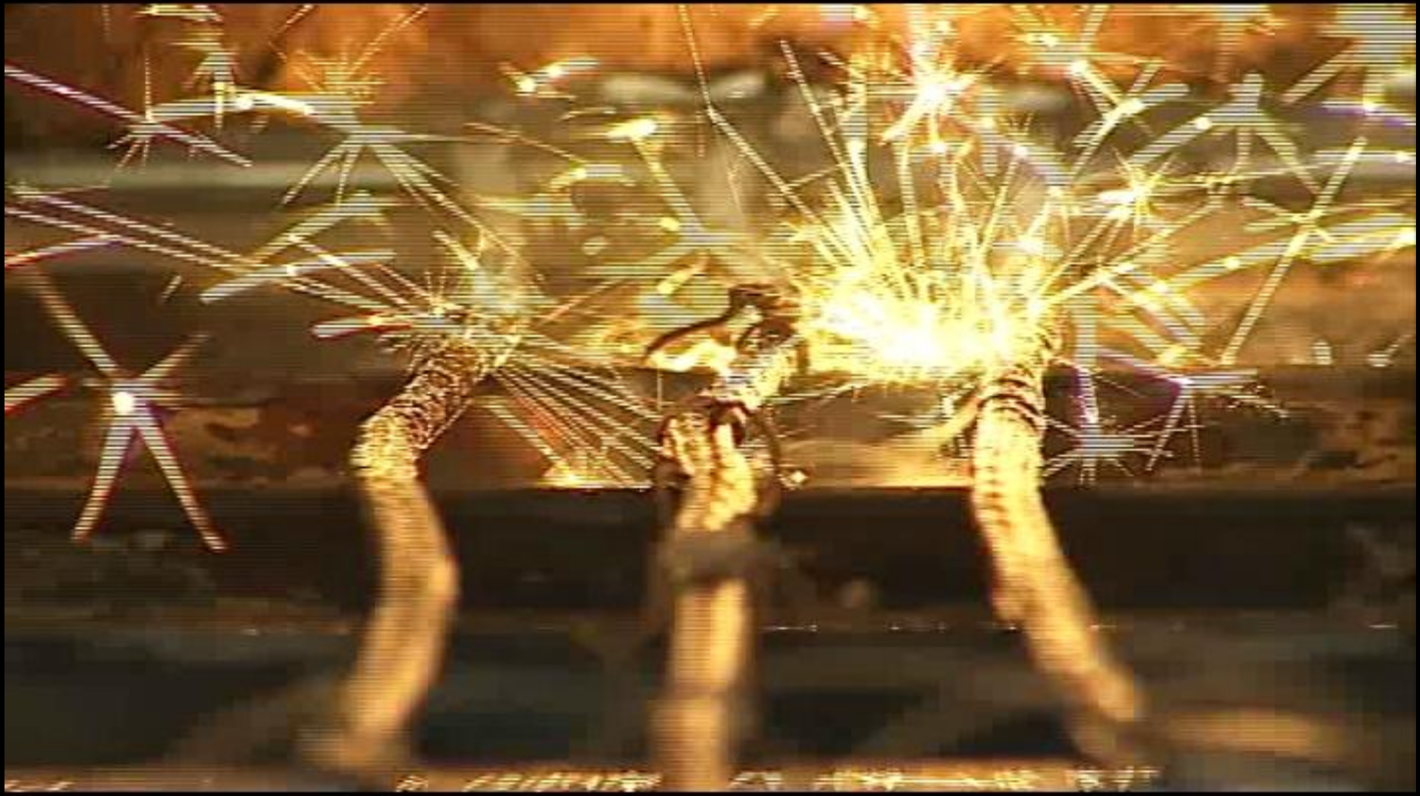
CHRISTIFIRE (continued)

- Next Phases address variables such as:
  – Cable Orientation
  – Fire Retardant Coatings
  – Cable Tray Covers
  – Wind Aided Flame Spread

CHRISTIFIRE

CHRISTIFIRE

DESIREE-FIRE



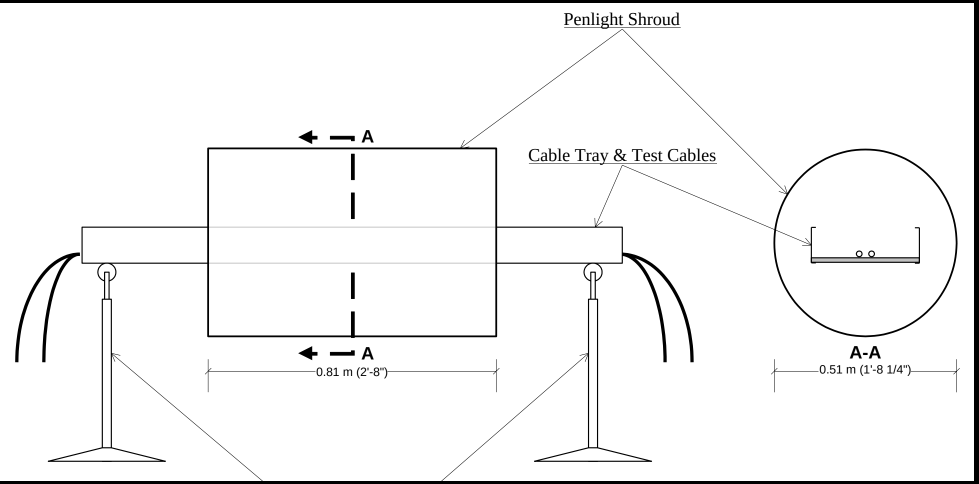
Testing for Further Refinements

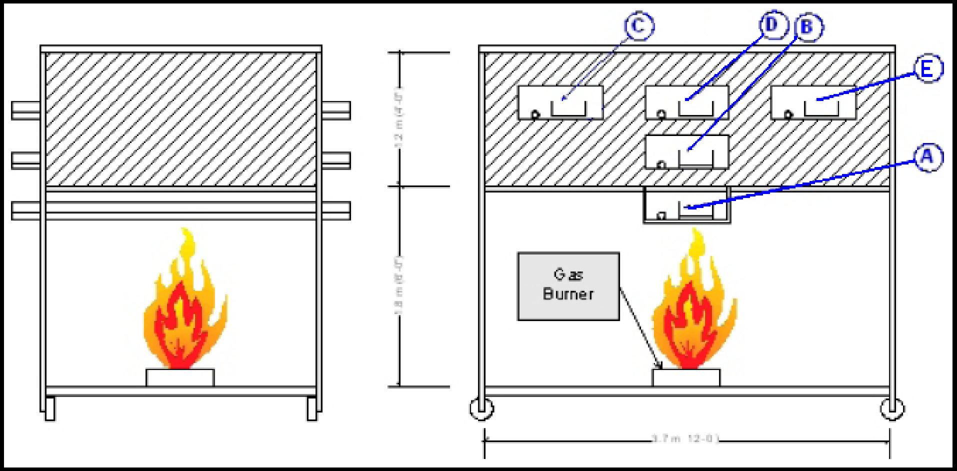
- To Better Understand the differences between alternating current (ac) and direct current (dc) circuit response
- Supports NFPA 805 and Appendix R Analysis
- Numerous safety related systems commonly powered with dc
- Duke testing in 2006 indicated that dc circuits may react differently than ac circuits to fire-induced failures

DESIREE-FIRE

- Approach
- - Similar to CAROL-FIRE Program
  - Industry collaboration through EPRI MOU
  - Test numerous dc circuits
  - Conduct tests and report results
- Objective
  - Provide data to characterize DC circuits
  - Provides additional Data on other issues

- Small-Scale
  - 59 tests
  - 1 circuit type per test





- Intermediate-Scale
  - 16 tests
  - Every circuit per test

Battery Bank

Nominal 125Vdc
Batteries from North Anna TSC

Circuit Evaluated

- dc motor starter (MOV)
- Small pilot dc SOV (ASCO red-hat)
- 15kV & 4.16kV circuit breaker control
- 1” SOV valve assembly
- Large Coil (representative of PORV)

Key Test Objectives

Characterize DC

- Realistic circuits and configuration
- Inter-cable shorting
- Interactions with ground plane
- Multiple proper-polarity, coincident hot shorting
- Ground detection circuit

Follow up testing

- Kerite cable characteristics
- Instrument circuits
- Testing planned Fall/Winter 2010

Results

- Open Circuits
- Energetic faults

Open Circuit

Copper Slag

Results

Results (2)

- Arcing & Cable Ignition
  - Electrical failure are more energetic than in AC testing
  - In most cases arcing appears to act as the pilot for cable ignition
  - Arching and hot short durations are linked to fuse sizing

Results (3)

- Fuse sizing
  - Larger fuses (15-35A) take longer to clear then small 5-10A fuses
  - In some tests the 25A & 35A fuses did not clear, instead electrical arching caused an open circuit in cable conductors

Results (4)

- Grounding
  - DC battery bank is ungrounded
    - Requires both positive & negative circuit conductors to short to ground to clear fuses
    - Several instances where inter-cable shorts through cable raceway

Follow-on Work

- DESIREE FIRE Draft complete August 2010
  - Draft report to be made Publically Available
- Phenomena Identification and Ranking Table (PIRT) and Expert Elicitation
  - Underway now with two separate Expert Groups
  - Identify and rank electrical fire phenomena
  - Provide best estimate probabilities for use in fire PRA
  - Panel Meetings Beginning Fall 2010 through Summer 2011
  - Final Reports Fall 2011

Training – Fire PRA

- Fire PRA Training with EPRI
  - Rockville, MD.
    - September 27 thru October 1, 2010
    - October 25 thru 29, 2010
  - Updated Program
    - Added Track for Fire HRA
  - Methods for Applying Risk Analysis to Fire Scenarios (MARIAFIRES-2008)

    NUREG/CP-0194 August 2010

Training – Topics

- Based on NUREG/CR-6850 (EPRI1011989)
- Currently 4 Separate Classes
  - Fire PRA
  - Fire Analysis
  - Electrical Circuit Analysis
  - Fire HRA
- Fifth Class in Planning Stages
  - Detailed Fire Modeling

Training – Fire Modeling

- Program currently under development
  - Supported EPRI program past 10+ years
  - Reassessing the users needs
  - NUREG-1934 should form basis for training
  - Expect work to be performed in 2011
  - Currently considering adding it as the 5th Class in the Joint RES/EPRI Fire PRA Training

Fire Research Knowledge Management

- NUREG/BR-0361 Browns Ferry Fire
  - Issued February 2009
  - Plan Revision in 2011
- NUREG/BR-0364 NRC History of Fire Research Activities
  - Issued June 2009
- NUREG/BR-0465 Fire Protection and Research Knowledge Management Digest
  - Issued January 2010

Other Planned Fire Research 2011-2012

- Updating Fire Events Data Base
  - EPRI currently collecting the data
    - Sunset current NRC Data Base
  - Metric Monitoring
    - LER/Inspection Findings/Long Term Compensatory Measures
- Incipient Detection Systems
- Low Power Shutdown Fire PRA
  - Draft Report Public Comment Winter 2010
- Electrical Cabinet HRR
  - Review EPRI project

Other Planned Fire Research 2011-2012 (Continued)

- Kerite Cable
  - Sandia currently testing
- Smoke Damage to Electrical Circuits/Components
- Effectiveness of Gaseous Fire Extinguishing Agents

Other Planned Fire Research 2011-2012 (Continued)

- International Projects
  - Fire Event Data Base
  - Proposing High Energy Arc Fault Test Program
    - NRC supply Test Laboratory
    - Foreign Countries supply Electrical Equipment
    - Discuss with EPRI for US Utility Participation
  - PRISME
    - In-Kind Contribution with OECD/IRSN

Current state of licensee efforts to transition to 10 CFR 50.48(c), NFPA Standard 805 Concluding Remarks

Presentation to ACRS Subcommittee on PRA and Reliability

November 16, 2010

Sunil D. Weerakkody, Ph.D
Deputy Director – Fire Protection
Division of Risk Assessment
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

Closing Remarks

- NFPA 805 is a national consensus standard; NRC incorporated it to NRC regulations via 10 CFR 50.48(c) with limited exceptions.
- NRC's Office of Nuclear Reactor Research (RES) worked with Electrical Power Research Institute (RES) using best available data methods at the time to publish NUREG/CR-6850.
- Licensees may deviate from methods provided in NUREG/CR-6850; deviations must be substantiated.
- When licensees identified and proposed new or enhanced methods, NRC staff invested significant resources to review them and develop consensus.

Closing Remarks (contd.)

- RES is continuing to invest significant resources to enhance the state-of-the-art of fire PRAs.

- Risk-informed licensing processes (e.g., Regulatory Guide 1.174) provides staff capability to make risk-informed decisions with due consideration of fire PRA uncertainties.

- NRC licensing processes provides licensees capability to change commitments if and when new information emerges.

- Staff remains open to collaborating with stakeholders to continue to improve the state-of-the-art of fire PRAs.

Limitations in Fire PRA Application for NFPA 805 Transition

Presented by

Mardy Kazarians

Kazarians & Associates, Inc.

Presented at

ACRS Subcommittee Meeting

November 16, 2010

Purpose / Key Questions

1. **Could the limitations in current fire PRA analysis methods, models, or data lead to inappropriate conclusions during the transition to NFPA 805?**

2. **Are there other issues impeding or discouraging the transition process?**

Overall Approach

Information is being collected from interested stakeholders.

- NRC Staff
- Members of Utilities
- Consultants
- Public Stakeholders
- Others (e.g., NIST and NEI)

Collected information will be organized and interpreted.

Overall Approach

Topics discussed with interviewees:

- Level of experience with Fire PRA
- Type of involvement with Fire PRA and NFPA 805 transition
- Difficulties in applying NUREG/CR 6850
- Deviations from NUREG/CR 6850 and FAQs
- Status of cable information
- Impact of MSO
- Patterns in CDF contributors
- Peer review process

Progress

Have interviewed the following entities:

- Consultants (5)
- Utilities (5)
- NRC Staff (6)

Will contact additional stakeholders.

Results to be summarized and presented during the December Subcommittee meeting.