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(HEAF) Involving Aluminum

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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INFORMATIONAL UPDATE ON HIGH ENERGY ARC FAULTS

(HEAF) INVOLVING ALUMINUM

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WEDNESDAY,

JANUARY 23, 2019

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ROCKVILLE, MARYLAND

The public meeting convened in the Commissioners' Hearing Room at the Nuclear Regulatory Commission, One White Flint North, 11555 Rockville Pike, at 9:00 a.m., Ken Hamburger, Facilitator, presiding.

PRESENT:

KEN HAMBURGER, RES/DRA/FXHAB, Facilitator

MICHAEL CHEOK, RES/DRA

TOM BOYCE, RES/DE/RGGIB

MICHAEL FRANOVICH, NRR/DRA

STANLEY GARDOCKI, RES/DE/RGGIB

NICK MELLY, RES/DRA/FXHAB

KENN MILLER, RES/DE/ICEEB/EET

MARK HENRY SALLEY, RES/DRA/FXHAB

GABE TAYLOR, RES/DRA/FXHAB

C O N T E N T S

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

Page

Opening Remarks 3

Introduction & Meeting Objectives 6

Generic Issue Program Status for PRE-GI-018 6

Preliminary Observations of Sep 2018 Full-Scale
 Confirmatory Tests on Aluminum HEAFs 44

Future Test Planning and Equipment Selection 87

NRC/EPRI Working Group Charter 99

Public Question and Comment 116

Concluding Remarks 169

Adjourn 169

P R O C E E D I N G S

9:01 a.m.

MR. HAMBURGER: Good morning, everybody.
It's nine o'clock, so we're going to get started.

My name is Ken Hamburger. I work in the
Office of Nuclear Regulatory Research. I'm an NRC
Facilitator, and I'm here today in that capacity.

Mostly just to keep us on time and on
schedule. And make sure everybody has a chance to say
what they came here to say.

A couple of logistical notes. For
visitors, while you're here, please keep your visitor
badges visible. Keep them on you. You shouldn't need
an escort wherever you are today.

This room is fine. The hallway out here
is fine. The cafeterias are fine. You don't need an
escort for any of that.

If you need to access any of the other
floors, please find an NRC staff member to escort you.
The bathrooms are through this door, make a left.
Women's bathrooms are on the left. Men's bathrooms
are on the right. Again, don't need an escort.

The cafeteria is also open to you if you'd
like to grab coffee or a snack. It's out that door to
the left. Follow the hallway down, and the cafeteria

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1 is on the left.

2 If there is any sort of fire or emergency,
3 you have emergency exists in the rear of the room.
4 And we have the two exits in the front of the room.

5 We are transcribing today's meetings. We
6 have our Court Reporter in the back there. So, a
7 couple of things for those in the room.

8 Please identify yourself when speaking.
9 Use your name so he can capture that in the
10 transcript.

11 Please speak into the microphones. He has
12 an audio feed, so he can only hear what's said over
13 the microphones.

14 And we have webinar participants. So they
15 can only hear what's said into the microphones. So
16 please don't forget.

17 I'll try to remind you. Even if you're
18 right up here in the front and you're speaking to
19 somebody over here, the webinar hears silence if you
20 don't have one of the mics.

21 So, we have an aisle mic over here and
22 over here. I have two wireless mics. If you have any
23 trouble getting to the aisles, you can just raise your
24 hand, I'll bring over a wireless mic to you.

25 And for those on the webinar, best way to

1 ask a question or make a comment is to use the raise
2 hands' feature on the webinar. Or use the chat
3 feature and you can ask Tom. Tom is manning our
4 webinar.

5 And he will either relay the question to
6 us. Or open up the phone lines. We do have a phone
7 line in the room so you can ask the question yourself.

8 And we have you muted at the moment, but
9 periodically we'll open up the phone lines. Anybody
10 has a comment or question.

11 So I suggest that you keep yourself muted
12 until you're ready to speak in case we open up the
13 phone lines.

14 We have a public comment period scheduled
15 for the last two hours of today. That's open for
16 anybody to present or say anything they would like to
17 say.

18 I do think we're pretty lightly loaded in
19 terms of the agenda. I expect to have two hours plus
20 for that public comment period.

21 But just so that we can get through all
22 the items on the agenda and make sure that everyone
23 has a chance to speak, I may ask you to hold certain
24 comments or questions until that public comment
25 period.

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1 Just to make sure we get through
2 everything we have to get through. Again, I expect
3 more than enough time for that public comment period.

4 If anybody has any questions or issues
5 with today's meeting or with the webinar, you can
6 reach out to me, Ken Hamburger. I'll put my contact
7 information up on the board during the breaks.

8 And with that, I would like to introduce
9 our Division Director, Mr. Michael Cheok.

10 MR. CHEOK: So thank you Ken. And good
11 morning. Welcome. And thank you for participating in
12 this public meeting on the Pre-Generic Issue on High
13 Energy Arching Faults involving aluminum.

14 Again, my name is Mike Cheok. I am the
15 Director for the Division of Risk Assessment in the
16 Office of Nuclear Regulatory Research.

17 Today we will provide a brief status of
18 where we are in the generic issue. We will also talk
19 about our proposed next steps.

20 But most importantly, we would like to
21 hear your comments, questions, or feedback on the
22 process.

23 As Ken said, I would like to welcome those
24 on the Webinar. And I would like to say that we would
25 also love to hear from you. For those of -- for those

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1 people who are not available today, this meeting is
2 being transcribed.

3 So, today you will hear two main teams
4 throughout the meeting. First, you know, we will
5 follow the GI Process, the Generic Issue Process,
6 which has several well-defined steps.

7 The first step that you'll hear about is
8 the screening process. And you will hear about the
9 results of that screening process.

10 We are now in the assessment phase of the
11 process. And you know you will again hear about what
12 we have done so far and where we plan to go.

13 We will have a methodical process. We
14 will be methodical in getting to the most realistic
15 and the most applicable offering experienced data and
16 information.

17 We will also have to be methodical in
18 terms of defining our tests going forward. We will
19 have to have realistic and applicable tests to get the
20 best information on how we can characterize the HEAF
21 phenomenon.

22 We will -- we will have to do this so
23 that, you know, when they come up with our
24 recommendation, the recommendation will be robust. It
25 will be supportable. And it will be defendable.

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1 Also, you know, I would like to say that
2 not all HEAFs are the same. We have to characterize
3 the different classifications or categories of HEAFs
4 correctly.

5 We have to determine the corresponding
6 frequencies of these classes of HEAFs correctly. We
7 have to model the effects of these HEAFs on plants
8 correctly.

9 Also, not all plants are the same. Not
10 all plants have aluminum. Plant configurations and
11 plant equipment are different.

12 Plant procedures and plant practices are
13 different. So, you know, we have to get this right in
14 terms of the generic issue.

15 A single solution for all plants may not
16 be applicable. We may have to have solutions that
17 maybe different for different plants.

18 So the second thing you will hear today is
19 that we will need to continue to improve on our
20 communications. We will need to involve all the
21 public stakeholders throughout the process, early and
22 often.

23 We plan to hold as many public meetings as
24 needed. And we hope that you will show up and provide
25 us with the feedback.

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1 So with that, I would like to go ahead and
2 turn the meeting over to Mark Salley for his --
3 bringing us through the Agenda.

4 MR. SALLEY: Thanks Mike. To pick up
5 where Mike left off there, this is about
6 communications today.

7 And as a part of the Generic Issue, the
8 Generic Safety Issue process, there is a requirement
9 that they have periodic updates.

10 And this fulfills the periodic update.
11 But more importantly, when we talk to Tom Boyce and
12 Stan, there was additional information that we wanted
13 to share today. So, we wanted to share as much
14 information as possible.

15 You know, also with communications, good
16 communications are very important. We've done a lot
17 of internal briefings inside the NRC through the
18 Commissioner assistants, up through the DEDOs.

19 And it's surprising some of the questions
20 and information we hear that's floating around in the
21 industry.

22 Without getting into that, we'd like to
23 take the high road here and to answer any questions
24 you have. And to communicate anything we can with
25 you.

1 Also, with good communications is a two-
2 way street. We need dialog. So, at the request of
3 the stakeholders and industry, we've allowed two hours
4 this afternoon as Kenny said, for any open discussion.

5 So again, we want to hear from you. So
6 today is about communication.

7 I want to give you a quick overview of
8 what we're going to try to accomplish today. And then
9 we'll get right into it.

10 Again, this is part of the Generic Issue
11 Program. We're doing this update. We've also
12 performed some testing in September.

13 And we'll refer to this as confirmatory
14 testing. If you remember the first phase of testing
15 we did with the Internationals, the OECD NEA Program,
16 we had two tests, Test 23 and Test 26 that kind of
17 stuck out a little bit.

18 And we had some ideas and some thoughts
19 that aluminum could be the issue. But we wanted to be
20 -- we don't want to cycle industry.

21 We want to be sure. We want to be
22 thoughtful in how we move forward. And we wanted to
23 do some confirmatory testing.

24 We did some in September. We did the
25 medium voltage. It's basically broken up into three

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1 pieces, medium voltage, low voltage, and the bus
2 ducts.

3 We did four tests with the medium voltage.
4 Frank Cielo is here from KEMA. If anyone has any
5 questions about the testing lab, you can grab Frank at
6 a break and talk with him.

7 But we did the confirmatory testing, and
8 Nick's going to give a presentation. And we're going
9 to share some of the insights.

10 There's a lot of data. And it's going to
11 take time for us to analyze the data and go through
12 it.

13 But I think at this point we can share
14 some observations and let you know what we see.
15 Again, it's about giving you the information and
16 sharing what we have.

17 We'll also be moving into the next series
18 of tests. We hope to run the low voltage and the bus
19 ducts this summer.

20 So again, we'll talk about that. If you
21 remember the meeting back in April, we had two and a
22 half days, very good discussion with everyone. We're
23 moving along with that matrix and some of the testing
24 there.

25 And finally, the last thing that we'll

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1 talk about after lunch is, NRC has an MOU with EPRI to
2 work on technical matters in a number of areas. One
3 of them is fire risk.

4 Under the fire risk we've put together a
5 working group and a charter with EPRI that we'll look
6 at the data and do some of the technical analysis.
7 We'll discuss that this afternoon.

8 So that's the basic overview of what we're
9 going to have today. Again, this afternoon I want to
10 emphasize that we've got a two-hour slot for any of
11 your questions and open discussion.

12 I see that Victoria, you've got a
13 presentation from NEI, which we'll put up first. And
14 Kelly, I believe you have one too that we'll have.

15 So, with that, I'll turn it back to you
16 Kenny and get started.

17 MR. GARDOCKI: Well good morning. My name
18 is Stan Gardocki. I work with the Generic Issues
19 Program in the Department of Research here at the NRC.

20 If you have any questions dealing with the
21 generic issue process, you can always give me a call
22 anytime. Or send me an email.

23 I want to first step back a little bit for
24 those people that weren't here at the last public
25 meeting, and introduce the Generic Issues Program and

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1 how it -- the generic issue processes through the
2 program.

3 It basically has three stages, as you can
4 see on the slide there. Now the first time we see the
5 GI, it comes into what they call the screening stage.

6 And we take a first cut at it to see if it
7 meets the seven criteria. If it does not meet all
8 seven criteria, it doesn't proceed forward.

9 We spend as much time on this screening
10 stage as necessary to make a good evaluation. Because
11 we don't want to waste, you know, resources, time and
12 personnel doing something that's not necessary.

13 So, we've revamped the program several
14 years ago and came up with these seven criteria. And
15 we think it's a pretty good screen to go to the next
16 stage.

17 After it goes through the screening stage,
18 we go to what they call the assessment stage. And we
19 spend about one to two, maybe possibly, you know, two
20 years on the issue to determine the risk and the
21 safety significance of the issue.

22 This is important for us here to determine
23 whether it goes to the next stage, call the Regulatory
24 Office of Mutation Stage. Which, you know, we have
25 the applicable NRC office that's working on the issue.

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1 This particular issue would go like to
2 NRR. So we don't want to waste NRR's time. So, we do
3 what they call an assessment.

4 We do the testing up front. We do the
5 modeling up front. And we do what they call an
6 assessment report at the very final part of it.

7 And we put it out to the public. We have
8 meetings with ACRS and we discuss what they call the
9 regulatory analysis. We'll get into that a little bit
10 later on.

11 And then if it passes the screen -- the
12 assessment stage, it goes into a regulatory office
13 stage. And this is where the regulatory office here
14 would be like NRR.

15 It develops generic communications. They
16 might send out generic letters, bulletins, INs. They
17 meet with the industry. Develop an action plan if
18 there's any necessary actions that industry has to
19 take.

20 That process could take several years.
21 Once you get into a regulatory office, depending on
22 how quickly the industry reacts.

23 And we stay in the regulatory office stage
24 until all actions have been implemented for all plants
25 affected. And that the NRC has verified that all

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1 actions have been taken.

2 The next slide here is a generic process
3 overview. It's a very encompassing slide. But it
4 captures everything from the screening to the
5 regulatory office.

6 And it shows who's responsible. Who's
7 working on it. And at the bottom you can see all the
8 notices and the public involvement and ACRS
9 involvement.

10 So it's a pretty good slide. It gives you
11 an overview of the entire process.

12 Where we are now, is we went through the
13 screening process. And we're in the assessment stage.
14 You can see there the drop downs that we put out the
15 necessary reports.

16 And during the assessment stage, you can
17 see the research still has the issue. So we're still
18 in charge of the research office.

19 And we have what they call an assessment
20 team working on it. These personnel are just, you
21 know, working on it.

22 And they go back and report to the generic
23 issues, you know, group. And put out an assessment
24 report at the end. Okay. Next side.

25 Specifically where we are on this generic

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1 issue is, when we first get the generic issue into the
2 NRC, we screen it out to see if it's an immediate
3 safety concern. We ask the regulatory office to
4 document that.

5 And we don't want to procrastinate through
6 a process if there's an immediate safety concern in
7 the plants.

8 NRR has the LIC-504. And I don't know if
9 anyone's been introduced to that process. But it's
10 pretty quick.

11 You know, they can say, you know, we have
12 a problem with a valve, or a valve stem or whatever it
13 is. And the plants need to go out there and replace
14 immediately.

15 But, if the NRR comes back with immediate
16 safety concerns and says it's not an immediate safety
17 concern, we don't know how much of a safety concern it
18 is, so put it in the generic issues process.

19 Do the entire process. The in depth
20 development and the assessments. And see how much
21 risk and safety importance it has.

22 So they've done that. You can see that
23 back in March 2016. In May 2016 we put it in the
24 program.

25 You can see the mark -- the ML numbers at

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1 the end there. If you ever want to go into the ADAMS,
2 and you can see all these documents.

3 We also have a generic issues' dashboard.
4 It's on the public website. You can follow the issue.
5 It can show you where we are.

6 All these information documents are tabbed
7 at the bottom there under documents. And then once
8 you get into regulatory office space, you can see
9 which plants are affected.

10 You know, how they're progressing. What
11 actions they need to take. What steps need to be
12 taken to take the generic issue to completion. It's
13 a pretty good tool.

14 All right. Once we get through this
15 screening process, you can see May 2016 we did a
16 generic issues program staff screening. Which is just
17 myself and my department and my supervisor and
18 division director signing off to see if there's any
19 specific screening criteria not being met. I can
20 screen it out.

21 So if this only applies to one plant in
22 the United States, it doesn't meet the criteria of two
23 or more plants. It's not a generic issue.

24 So, I or my supervisor at that point
25 cannot waste putting together a committee. Review

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1 panel, they call it G-I-R-P, GIRP to waste time and
2 effort.

3 So it's very economical this program. We
4 take various steps to say push it forward or step
5 back, depending on the criteria.

6 So, we took a look at it. And we said, we
7 think it meets all seven criteria. We formed a review
8 panel.

9 We did form a review panel. And you can
10 see the screen report produced by the GIRP was on July
11 2017.

12 So you can see we've gone through about a
13 year to get the screening report done. And now we're
14 progressing into the assessment stage.

15 We issued an assessment plan. And you can
16 see up there. The -- if you want to take a look at
17 that.

18 It pretty much highlights what the
19 activities are going to be done during the assessment
20 stage. And it gives it kind of a time line so we can
21 kind of hold people, you know, responsible to get
22 something done at a certain time.

23 If we think it's going to be protracted
24 and go beyond two, three, four or five years, then we
25 might pull back and say we might take it out of the

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1 program. Put it in a study. And then come back in.

2 So that's what the assessment stage does.

3 We try to put a time. And we put milestones. And we

4 try to meet those and keep people to those milestones.

5 Okay, next.

6 What you can look forward with this

7 generic issue coming up. We're going to put out -- or

8 hope to put out an assessment report near the end of

9 the year.

10 We should get all the tasks and milestones

11 done. And if it meets the risk and safety criteria to

12 go on into the regulatory office, we think it's a

13 safety or risk important item, then we formally call

14 a transition team.

15 We don't want to just hand it over to

16 another department without a smooth transition. So we

17 do a transition team.

18 We put members on the team that are on the

19 GIRP review panel. And then we put people from the

20 office it's going to on the team.

21 And we hand over all the information. And

22 the Office Director will send a letter to the other

23 Office Directors saying, you have it. And you have

24 sufficient resources, you know, knowledge about the

25 issue.

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1 So we just don't want to hand it over to
2 -- across the fence and say it's now -- it's yours.
3 So, it's a very smooth transition.

4 Once it's transitioned to the regulatory
5 office, the regulatory offices, like I said before,
6 will determine what regulatory actions need to be
7 taken.

8 It could be, like I said, INs, GLs,
9 generic letters. It could be even orders issued by
10 the Commission.

11 They're looking forward to see if there's
12 anything that the industry needs to do. To look and
13 see if there's any, not loopholes, but missing
14 regulatory items and regulations that need to be
15 adjusted.

16 And once they've determined that, they put
17 out that information to the industry. They could put
18 it out in a 54F letters to say industry, here it is.
19 And you know, respond back as appropriate.

20 And one industry has taken all the
21 actions, we review them. We verify them. And then we
22 close out the generic issue.

23 I think that's the last slide, right? Oh,
24 one more. Okay.

25 All right. The assessment plan. This was

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1 a -- you can find this inside the assessment plan.
2 And this is a very good overview of what milestones
3 and actions are being taken during the assessment.

4 You can see which parts have actually been
5 completed. And you can see what actions we plan on
6 going forward.

7 I will ask Nick to chime in a little bit
8 on what activities he foresees and adjustments to the
9 schedule.

10 MR. MELLY: This is Nick Melly in the
11 Office of Research. I just wanted to kind of key in
12 on some of the important things that you're seeing up
13 here in terms of the time line.

14 And in terms of some of the things that
15 Stan was talking about in terms of the risk numbers
16 that are used in the assessment plan. And what causes
17 things to move forward. And what causes things to
18 fall out of the generic issue plan.

19 So, currently right now, we're looking up
20 there, and we're right around the first of the year
21 we're looking at the Phase Two, large scale test plan.
22 Right now we've finished four tests since September on
23 the medium voltage.

24 And we're looking to also get low voltage
25 testing done and bus duct testing done so that we can

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1 have the information we need in order to create a zone
2 of influence model for aluminum moving forward for
3 these risk studies.

4 That's very important that we have all the
5 data we need. So that we're not cycling the industry.
6 Or we're not creating overly conservative models for
7 the damage states.

8 To accomplish that, the NRC is working
9 with EPRI to create the zone of influence. And we're
10 going to have discussions here about a charter that's
11 in the process so that the NRC can look at all the
12 data with EPRI, and create a zone of influence that's
13 appropriate for aluminum taking into account many
14 different factors.

15 We want to look at the frequency of the
16 event occurrence. Couple that with plant
17 configurations such as a unit connected design and
18 things like that, in order to create a good picture of
19 what the zone of influence is.

20 We do not want to move forward in the
21 generic issue with a conservative model giving us
22 conservative risk estimates, because it's just not
23 realistic.

24 That's where the pilot plant selection,
25 the pilot plant studies come into play. We really

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1 need help from industry because if we use our in-house
2 modeling techniques such as the SPAR to move things
3 forward as we have done for quick assessments, it may
4 be conservative because there are a lot of large
5 assumptions that have to be made.

6 If we can leverage the plant design, the
7 plant PRA models when we move forward using pilot
8 plants, we can get a better picture of what the risk
9 is at the plants.

10 And we want to link that with moving
11 forward through the generic issue, so that we can
12 adequately assess the risk at plants.

13 It's an aggressive schedule right now.
14 And we believe that we can accomplish these. We have
15 a lot of things moving in parallel in terms of the
16 testing, the data analysis with the working group.

17 We believe we are close to being able to
18 select pilots, or hope to get pilot plants in this
19 process, so we can start figuring out what needs to be
20 done in order to adequately assess the risk. Which is
21 necessary for the assessment plan right now.

22 MS. ANDERSON: Are we -- are we taking
23 questions?

24 MR. GARDOCKI: One last comment. Like I
25 said, the dashboard has all the information as -- in

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1 regards to this generic issue.

2 You can always refer to that on the NRC
3 public website. And in the future, we try to hear
4 periodic meetings, you can probably expect another
5 meeting right before we start the assessment report.

6 And we're going to have a public meeting
7 with ACRS if they want to have a meeting to introduce
8 this. And they kind of get involved with the
9 regulatory analysis part of the assessment report.

10 So he can expect those as future
11 activities as far as generic issues program public
12 involvement. That concludes my presentation.

13 MR. HAMBURGER: Yes. So we will welcome
14 questions from those in the room first.

15 MS. ANDERSON: Victoria Anderson from NEI.
16 Nick, you mentioned that one of the things you'll be
17 doing is working on making sure you have all the data
18 you need to develop an aluminum zone of influence.

19 Are you looking at developing a single
20 zone of influence? Or a spectrum of ZOIs based on
21 different physical conditions?

22 MR. MELLY: A spectrum.

23 MS. ANDERSON: A spectrum?

24 MR. MELLY: We're not trying to just do a
25 one worst case zone of influence approach for

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1 aluminum. We're trying to link it in more a
2 probabilistic manner so that we can look at the
3 potential at the plant in order to get a more dynamic
4 zone of influence based on important parameters such
5 as the current, the voltage, plant design.

6 We don't want one conservative zone of
7 influence that would be used for the study. We're
8 really trying to get a -- to move the method forward.

9 MS. ANDERSON: Okay.

10 MR. TAYLOR: And if I could -- this is
11 Gabe Taylor from the NRC. If I could just add to
12 that.

13 At the workshop last April we talked about
14 different approaches that we could do. And I think
15 the idealized approach would be the dynamic ZOI that
16 Nick alluded to.

17 It's similar to what the IEEE does for
18 their arc flash calculations. So if we could get
19 there, that would be great.

20 If we can't, there's other fall back
21 options where we basically bin different categories
22 based on the hazard and the frequencies. And have a
23 ZOI for each individual bin.

24 And then, you know, the lease detail would
25 be something like we have today. Which is, you know,

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1 a one size fits all, which is kind of not where we
2 want to go.

3 But what path we go hasn't been determined
4 yet.

5 MR. MELLY: And it's actually very
6 important to understand that when even looking at the
7 test program that we have developed. Because we are
8 testing at two seconds and four seconds.

9 And for the low voltage cases, we're going
10 to be doing minimal tests at eight seconds. But we're
11 not doing -- we're doing that for various reasons just
12 so we can look at the spectrum of possible fall cases
13 in the plant.

14 We're not trying to say, the four second
15 test had this damage state. So now we're going to
16 link all zones of influence to that four second test,
17 which was the worst case.

18 That is not what we're trying to do with
19 the test program.

20 MS. ANDERSON: Okay. Are we going to be
21 talking more later about the considerations that go --
22 that will go into that development of the ZOI
23 spectrum?

24 MR. MELLY: Right now I believe we're
25 trying to work that through the EPRI working group --

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1 MS. ANDERSON: Okay.

2 MR. MELLY: Charter. In that that is
3 essentially what the whole conversation of the charter
4 is going to be.

5 MS. ANDERSON: Right.

6 MR. MELLY: Is that -- we're going to be
7 looking at the data that we have in-house, and coming
8 up with a method to develop that.

9 MS. ANDERSON: All right. If we don't get
10 into it in detail today, I think it may be useful to
11 have another public interaction on that topic. Even
12 if it's outside of the generic issue process. I think
13 there may be some substantial technical input that
14 stakeholders may have.

15 MR. MELLY: I agree. And we've had
16 initial discussions already that we're -- we're
17 looking at the data now. And we've just developed
18 this charter.

19 We do plan on having several more
20 interactions with the public when we move a little
21 more forward in the process of developing an initial
22 method. Looking at the data.

23 We plan on sharing the working group
24 conclusions or the working group assessment with the
25 public before any finalized method is developed.

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1 MS. ANDERSON: Okay. Thank you.

2 MR. HAMBURGER: Thanks Victoria.

3 MS. UHLE: Hi. This is Jennifer Uhle from
4 NEI. So, my question here is talking about this
5 approach, which is great to hear.

6 However, the amount of test data you would
7 need to really develop that doesn't seem to jive well
8 with the, you know, having the, you know, four tests.

9 So, -- or then I would ask in reverse, if
10 you plan on developing these zones of influence, then
11 shouldn't that inform your method in how you develop
12 them?

13 Shouldn't that inform the tests that you
14 do run? So it -- you know, where are we in likelihood
15 of getting to this state?

16 MR. MELLY: So to respond to that, we did
17 hold a PIRT panel to discuss the test results of the
18 Phase One testing.

19 And that was really to inform the Phase
20 Two of testing of what we would need to do in order to
21 create this spectrum of zone of influence, and what
22 data we would need.

23 That's really what went into the
24 development of the test matrix that is in the current
25 test plan.

1 And while there have only been four tests
2 performed right now on the medium voltage at two and
3 four seconds and various currents, we're really trying
4 to isolate parameters in this test series so that we
5 can look parameter to parameter differences as we move
6 forward.

7 Also, we are looking at the next series of
8 testing this summer to have four additional tests at
9 low voltage, various parameters. As well as four
10 tests looking at the bus ducts.

11 Additionally, we're trying to look at when
12 we can perform decrement curve testing, which I'll get
13 into a little bit later, in order that we can have
14 enough information to supplement the operating
15 experience data that we do currently have in-house, as
16 well as a wealth of information from previous testing
17 at shorter durations using the IEEE 1584 data and
18 things like that.

19 So we're trying to bring all of that
20 together to create this. But as you say, it is a
21 limited number of tests, but it is a resource issue.

22 Testing is fairly expensive, fairly slow,
23 and there's a lot that goes into the testing itself.

24 MR. SALLEY: Yeah, Jennifer, and just to
25 put the final piece on that, as a researcher you know

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1 you can never have too much data. The more data the
2 better.

3 I think we've -- from what we've worked in
4 the April workshop, we have a pretty good matrix.
5 Which we'll talk about in a little bit, as to how we
6 parse this out.

7 And at the end of this afternoon's session
8 on the working group, you'll see how that it fits into
9 the NRC's scheme with the OECD NEA and how we bring
10 that to bear too, with it.

11 So, we have parts long presentation. And
12 I think it will provide you more information.

13 MR. MELLY: Yeah. And this was also one
14 of the main issues that was brought up by the GIRP
15 panel for the generic issue.

16 Is that we didn't want to come out with a
17 conservative zone of influence for aluminum before we
18 did this assessment plan. So, the real discussion by
19 the members was, what test do we need to accomplish in
20 order to create a realistic zone of influence?

21 And it was decided that we needed medium
22 voltage tests, both low voltage and bus duct testing
23 if we wanted a whole picture of what was going to be
24 necessary for the working group to establish
25 something.

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1 MS. UHLE: Okay. And then you're, I would
2 expect working with EPRI to plan these tests and
3 ensure that they are prototypic in their set up?

4 MR. SALLEY: Yes. Like I said, we -- in
5 April we've done that. And as a matter of fact for
6 the September tests, we had members from EPRI, witness
7 the testing with us.

8 And that and we plan to do the same in the
9 spring and fall. That we have the working group that
10 will be there to see the tests and get the information
11 first hand.

12 MS. UHLE: Yeah. It's not so much the
13 witnessing the test as is, you know, taking the
14 comments that are proposed and factoring them in then,
15 rather than dispositioning.

16 You know, going forward I think that would
17 have to be done to really get to the point that we
18 would, I think, all like, with the multiple zones of
19 influence.

20 MR. SALLEY: Yeah. And I agree. And it's
21 one of the reasons we made all the public comments and
22 how we changed the test plan as a public document.

23 So you can -- the ML number is out there.
24 You can see the effects it had from the meeting. And
25 the changes it made.

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1 You know also, one of the things is, we
2 never really were looking at the decrement curve. And
3 that was something that Ken brought up in the -- in
4 the April meeting.

5 And we've expanded our test program to
6 include that for the value we hope to bring to the
7 testing. So we are listening.

8 MS. UHLE: Thanks.

9 MR. HAMBURGER: Thanks Jennifer. I know
10 we have a question on the webinar. Do we have any
11 more questions from those in the room before we jump
12 over to the webinar?

13 (No response.)

14 MR. HAMBURGER: Okay. And just before we
15 go to the webinar, both Nick and Stan will be here all
16 day.

17 So if any questions occur to you as we
18 move forward, please you can jump in and ask them or
19 find them at one of the breaks. Yes. You may.

20 MR. AIRD: We have one question from the
21 webinar from Mohammad Mustafa. He asks, did the GIRP
22 review include existing codes and standards?

23 For example, National Electric Code,
24 IEEE's et cetera, related to aluminum? Are they
25 inadequate?

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1 MR. SALLEY: I'll start the answer and
2 I'll let me guys finish. You know, one of the things
3 that we did when we were doing internal briefings,
4 when Fred Brown was the DEDO and we first started
5 going through the internal briefings with this, you
6 know, Fred made the comment to us that the high energy
7 arc faults are not unique to nuclear power plants.

8 You know, this is an electrical
9 phenomenon, you know, it's not unique. Now granted in
10 a nuclear power plant, you're all familiar we do move
11 a lot of electricity around. We've got a lot of
12 things happening.

13 So, it may amplify a little bit, or we've
14 picked up on it. But, one of the things again with
15 Fred, was to reach out and to see that very question.

16 If you remember the April workshop, we had
17 the chief electrical engineer from the NFPA come down.
18 And of course in the common vernacular in the industry
19 is arc flash.

20 You know, you'll hear this referred to a
21 lot as arc flash and arc flash events. So, we are
22 working with the NFPA.

23 And again, I think too, with the test lab,
24 the different scenes that we're taking it a little
25 further then the arc flash events that commonly occur.

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1 And you see them here.

2 We see them in the Metro in D.C. We've
3 lost it. The Atlanta airport has had the one a couple
4 of years ago.

5 Around Christmas you just saw it in New
6 York City with the blue in the sky again. So, these
7 events are happening out there.

8 We're going to talk a little bit about the
9 differences in how we bin them in '16 with that. So
10 that will be part of the discussion with looking
11 between an arc flash, an arc blast, and a HEAF.

12 And again, working with the NFPA, one of
13 the things Ken Miller and us have worked on, is
14 definitions. To clearly define which of the different
15 phenomenon.

16 So, that's kind of where we're at.
17 Anything you guys want to add?

18 MR. TAYLOR: This is Gabe Taylor, Office
19 of Research. So, I was on the GIRP panel.

20 And the information that we looked at was
21 the operating experience that we communicated in the
22 Information Notice 2017-04. As well as other
23 international operating experience that was documented
24 in the OECD reports.

25 In addition to that, Nick mentioned, we

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1 looked at the SPAR models, SPAR all hazards model to
2 see what the potential risk increase could be.
3 Understanding that they are somewhat course, and not
4 as detailed as the plant's PRA models.

5 We also looked into the NFP 805 transition
6 plants, into their SEs and information available there
7 to see what the potential HEAF contributions were.

8 And that's not -- that's using the
9 existing models, so it wouldn't include the
10 increasing, if there is an increase for the aluminum
11 type HEAF.

12 So that was kind of the core information
13 that we looked at to evaluate the HEAF and the
14 screening, the aluminum HEAF and the screening phase.

15 As far as the NEC, that's more of a
16 utility specific, whether they follow that code or
17 not. And I really can't make any comment to whether
18 it's adequate.

19 MR. MELLY: This is Nick Melly in the
20 Office of Research. Yeah, as far as the NEC codes and
21 the IEEE, they did a lot of the wealth of their data
22 collection on copper.

23 They haven't specifically looked at
24 aluminum. They do have some theoretical comparisons
25 between copper and aluminum.

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1 But their main focus is on personnel
2 protection. Whereas we are looking a little beyond
3 that for extended duration faults.

4 They are following closely what we're
5 doing in terms of definition space. And they're --
6 we're going to be looking at their data in a little
7 bit more detail as we move forward.

8 But in terms of saying whether their
9 regulations are inadequate based on what we've seen,
10 we can't really make that determination.

11 MR. SALLEY: And I guess a final thing on
12 the aluminum, Frank Cielo is here. Frank, if I could
13 ask on you, you do testing every day.

14 Is there any insights or anything you can
15 provide to that?

16 MR. CIELO: Yeah, this is Frank Cielo from
17 KEMA labs. I was just talking to my colleague Alex
18 Feldman.

19 We do arc flash testing on a regular basis
20 for lots of manufacturers. And it is absolutely for
21 personnel protection.

22 And we've done your testing of course.
23 And we've done high energy arch fault testing for some
24 other customers.

25 It's just completely -- the consequences

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1 are just -- they're completely different. In orders
2 of magnitude different.

3 So, and one of the things you may want to
4 think about is showing somebody a video of a regular
5 arc fault test for, you know, to comply with the IEEE
6 standard versus the HEAF. It's just like, pfft. I
7 mean, it's so obvious, the amount of destruction. The
8 amount -- the impact on our laboratory, the physical
9 impact on our laboratory and what actually happens,
10 it's just -- it's just absolutely incredible.

11 And you know, we test for every -- we're
12 an independent test lab, all right. We're ISO/IEC
13 17025 certified.

14 We have no affiliation with any
15 manufacturer, anybody. And we test for every
16 manufacturer basically on the planet between our three
17 laboratories.

18 And most of the arc fault testing, we do
19 in the U.S. against the IEEE standard. And you really
20 have to see it to kind of appreciate what this is.

21 Because the first time we did this for the
22 NRC, we weren't sure we were going to continue,
23 because of just the amount of destruction that we
24 experienced at our lab. And the damage that we
25 experienced at our lab.

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1 But it's important testing. And it needs
2 to be done. And we, you know, we just continue to
3 work through it. Hope that helps.

4 MR. GARDOCKI: And this is Stan Gardocki.
5 Back to your original question about the generic
6 issues program involvement with industry standards.

7 We do look at the NRC endorses the
8 industry standards to the regulations. So we'll find
9 out if there's any adjustments that need to be made in
10 the industry standard.

11 And then they have to go back and re-
12 endorse it for the regulations.

13 MR. HAMBURGER: Before we get to you, we
14 have a follow up question from the webinar.

15 MR. AIRD: Yeah. We have one follow up
16 question. It goes, is this an electrical circuit
17 protection issue? Or an aluminum conductor issue?

18 There are fast acting devices to preclude
19 arc flash and protection schemes.

20 MR. TAYLOR: So at this stage we're trying
21 to understand the hazard. We are aware that there are
22 some protection schemes out there that are available
23 commercially that could be use to fastly open up a
24 protective device and clear the fault and the cycle,
25 a few cycles.

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1 So, we're aware of that. And you know,
2 once we understand what the hazard is, and the
3 frequency is, and understand what -- where the risk
4 falls out in the delta risk, then we'll be able to
5 have a clearer picture of where it goes moving
6 forward.

7 And if it does make it into the regulatory
8 office limitation stage. At that point there would
9 likely be a lot of involvement between the NRC and
10 industry in understanding the ways to protect the
11 plant from the type of hazard, whether that be
12 prevention, protection, or mitigation features.

13 So, we are aware of those technologies.
14 But as far as this program, we're not trying to
15 evaluate the adequacy of those feature devices.

16 And then regarding the comment on
17 aluminum, you know, we did see the two tests in the
18 first phase that showed some much larger damage areas.
19 There were a few aluminum tests that didn't create
20 any, you know, additional hazard, then what we're
21 seeing in the copper.

22 They actually didn't even hold the fault
23 in. So, not all aluminum type events may lead to some
24 type of larger damage footprint than what we're seeing
25 from the copper.

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1 But from the September tests, when we ran
2 those, the four tests that we ran, and Nick will talk
3 about those in the next presentation, all four -- they
4 were medium voltage. But all four did last for the
5 entire duration.

6 And we did see, you know, a much larger
7 damage footprint. And more so the energy release,
8 because the energy is related to the duration of the
9 arc.

10 And when you're running them for two to
11 four seconds, there is a difference between that.

12 MR. MILLER: This is Ken Miller,
13 Electrical Research. As Gabe said, we've about
14 recognized that protection schemes in fact are
15 supposed to clear these kinds of faults within very
16 short periods of time.

17 We understand that. And but of course
18 operating experiences has shown that sometimes that
19 doesn't occur. There's failures that occur. And
20 these kinds of HEAFs, you know, occur as a result of
21 that.

22 And again, the important point here is to
23 study and understand how destructive those can be as
24 far as effecting the zone of influence.

25 So, again, we understand that protection

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1 normally would take case of something like this. But,
2 we're seeing cases where it doesn't.

3 MR. MELLY: Yeah. And to the second part
4 of your question as well, this is Nick Melly from the
5 Office of Research.

6 In terms of aluminum, we're also not
7 saying at this moment in time that the -- if you have
8 aluminum as part of your conductive pathway that it's
9 more prevalent to have a higher G arching fault.

10 In terms of frequency, we're not seeing
11 that from the data yet. It is an issue that we're
12 going to be looking at when we take a deeper dive into
13 the data.

14 But the frequency of occurrence from
15 aluminum versus copper, right now we're not seeing as
16 a change.

17 MR. HAMBURGER: Okay. Let's take the next
18 question from the room, please.

19 MR. FLEISCHER: This is Ken Fleischer from
20 EPRI. Not so much a question, but I did want to share
21 some OE of one major U.S. manufacturer of switch gear
22 in regards to type testing of copper bus bar switch
23 gear versus aluminum bus bar switch gear back in the
24 '70s.

25 Now again, to reemphasize that these were

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1 two second tests, because the IEEE standard requires
2 switch gear to be rated to two seconds. They noticed
3 no discernable difference between the two tests.

4 The only thing that the test did to
5 demonstrate was that the aluminum bus bar would have
6 to be a little larger than the copper bus bar with a
7 little bit of different spacing. But they did not see
8 any of the extra aluminum byproduct from those two
9 second tests.

10 We are also working to contact a few more
11 additional manufacturers. But we did get one that
12 actually told us they did the type tests with
13 aluminum.

14 MR. HAMBURGER: Thank you Ken.

15 MS. VOELSING: Hi, this is Kelli Voelsing,
16 also from EPRI. So, I think we need to clarify so
17 that we're not mixing an apples and oranges
18 discussion.

19 The reason that Ken shared that
20 information that we received from a manufacturer
21 regarding the difference between aluminum and copper
22 type testing, is because from the comments from the
23 gentleman from KEMA, we assumed when he said the
24 testing is completely different, that he was referring
25 to testing between copper and aluminum.

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1 In offline discussions, he clarified that
2 he was talking about the difference between flash
3 testing and arc fault testing. So the duration of
4 testing.

5 So I did want to clarify that apparently
6 he was intending to communicate a difference in the
7 duration of tests. Not a difference between copper
8 and aluminum, which is the generic issue that we're
9 supposed to be talking about here today.

10 And I'd also like to clarify that I think
11 we have to be careful about referring to the damage
12 footprint. Because we haven't necessarily validated
13 any damage.

14 What we've validated is, you know,
15 byproducts being deposited at a certain radius. Not
16 damage.

17 MR. TAYLOR: Thank you Kelli. And that's
18 a -- that's a good point. I was searching for the
19 right words.

20 And it's really the observations from what
21 we saw between the copper and the aluminum, where at
22 the two aluminum tests, well, six aluminum tests now
23 showed the larger area.

24 MR. CIELO: Yeah. This is Frank Cielo.
25 Thank you for clarifying that. I didn't intend to

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1 cause any confusion there.

2 It was the difference between the regular
3 arc fault testing and this testing. Thank you for
4 clarifying that.

5 MR. HAMBURGER: Okay. Any more comments
6 from anyone in the room?

7 (No response.)

8 MR. HAMBURGER: Tom, do we have anything
9 else on the webinar?

10 (No response.)

11 MR. HAMBURGER: Okay. We are ahead of
12 schedule. So Nick, if you're ready to go, we'll talk
13 about those preliminary observations.

14 MR. MELLY: All right, next slide. Again,
15 this is Nick Melly from the Office of Research. I'm
16 going to be discussing the testing that was performed
17 in September.

18 Kind of a big picture look at some of the
19 observations, some of the preliminary insights and the
20 project goals.

21 I'm also going to be talking about some of
22 the challenges, the measurement devices that we're
23 using, and the general observations.

24 I also want to discuss the future testing
25 parameters and schedules and some important milestones

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1 as we move forward. Next slide.

2 So to start this all off, we did share the
3 draft test plan to our OECD NEA members, as this
4 initially started as an international project on June
5 30 of 2017.

6 We also put this out for public comment in
7 the Federal Register in August for a month long public
8 comment period. That closed on September 1, 2017.
9 Next slide.

10 As part of that initial test plan, we did
11 receive five comments from NEI. And we had 32
12 comments from our OECD members.

13 Since then we have received numerous
14 comments both from NEI, EPRI, as well as some of the
15 industry itself. Which we have discussed at the
16 public workshop that we held in April 2018.

17 And we've addressed all of these comments
18 and dispositioned them. Formally put that into our
19 public document system, ADAMS, essentially addressing
20 all comments and how the NRC planned to address them.

21 Whether they were going to be put into and
22 incorporated into the test plan. And if any physical
23 changes were made to the test plan, both parameter and
24 testing method. We have the ML link that is up there.

25 So right here on the screen you're seeing

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1 the Phase Two HEAF test program. This is the matrix
2 that we discussed earlier.

3 This came about after the PIRT panel
4 phenomenon ranking table -- parameter identification
5 and ranking table exercise that we held in January
6 2017.

7 This was our best guess of, these are the
8 amounts of tests that need to be conducted in order to
9 answer the question and get the data that we need.

10 What you're seeing on the screen here is
11 four box tests. Test 2-19, 2-21, 2-22, and 2-24.
12 These are the tests that were performed in September
13 that I'm going to be discussing today.

14 These were all medium voltage, 6.9 kV
15 tests at 25 kA and 35 kA for two seconds and four
16 seconds respectively.

17 Another aspect that you're going to see on
18 the slide here, you see the two tests that are on the
19 far right-hand side with Xs. These were identified
20 that we may need to do additional testing.

21 And we wanted to be budget ourselves to be
22 able to perform tests as things came up.

23 MR. TAYLOR: Nick, just to clarify. This
24 is the -- showing 35 kA for the 6.9 kV test. We
25 actually tested at 32 kA.

1 So this was from the original test plan.

2 MR. MELLY: And that is because the test
3 facility itself, there are some limitations on the
4 capabilities of the generator. So we actually had to
5 reduce the current in order to achieve the duration of
6 testing that we wanted to achieve.

7 The two tests that I was discussing
8 earlier, the SPAR tests on the right-hand side, we
9 have allocated those for the decrement curve testing
10 that was a direct result of the comments from EPRI.

11 These are going to be tests where we're
12 actually going to be simulating actual operating
13 experience event at a unit connect design plant where
14 the generator essentially fed the fault.

15 This is not a trivial exercise. We have
16 a separate contracting action with the laboratory in
17 order to develop the capabilities needed to do this
18 test.

19 KEMA has never done a test like this
20 before. So, getting their generators ready to
21 simulate this, is a separate effort. Which is why we
22 did not do them in September.

23 And we're currently pushing that forward
24 right now, working with EPRI to establish what needs
25 to happen. And the KEMA test engineers.

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1 Another thing that you'll notice on this
2 test matrix is that there are some tests in blue and
3 some tests in orange. We're doing this as part of an
4 international program.

5 The tests in blue represent tests that are
6 going to be funded through the OECD NEA test program.
7 And largely these are copper tests versus the ones in
8 orange, which are the aluminum tests.

9 We're performing the orange tests first,
10 because they're associated with the need of the
11 generic issue program itself. So we are prioritizing
12 the generic issue and performing the test that you see
13 in orange before we do any OECD NEA tests.

14 Next. I'll take questions during the
15 presentation. So, sure.

16 MR. HAMBURGER: Sure. This is a long
17 presentation. So if you --

18 MS. UHLE: Okay. Thanks. Jennifer Uhle
19 from NEI. So, I want to go back to a question that I
20 previously asked.

21 And I think in your discussions about this
22 test -- particular test series -- excuse me, I have a
23 cold. You indicated that the industry comments, the
24 EPRI comments, you dispositioned.

25 And this is the point about that we really

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1 want to make or get across so that it's clear to
2 everybody. The industry comments that were given to
3 NRC, they were, I agree, dispositioned.

4 But that does not mean addressed in a
5 substantial manner. There were numerous comments that
6 the industry felt essentially affected the proto-
7 typicality of the tests that were -- we got the
8 answer, we'll deal with this in a next test series.

9 And so, we've been saying that industry
10 has -- comments have been addressed. But, that's not
11 our opinion with regard to the test series.

12 And that's why when we want -- we want to
13 highlight the importance of truly listening to the
14 comments. And not dispositioning, meaning, I heard
15 you. I don't agree with you. And I'm not changing
16 the test set up.

17 MR. MELLY: Do you have any specifics in
18 terms of which comments were not addressed?

19 MS. UHLE: Yeah. And I'm going to --

20 MR. HAMBURGER: Well, let's -- if we're
21 going to discuss those, I suggest we wait for the
22 public comment period. Because that might be a
23 detailed discussion.

24 And so it's --

25 MS. UHLE: Well, I just -- if you don't

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1 mind, this can be very quick if we just -- and then
2 maybe we discuss it later.

3 MR. HAMBURGER: Okay. Sure.

4 MR. FLEISCHER: Ken Fleischer from EPRI.
5 One particular comment that actually we also
6 verbalized during the April workshop, is we still
7 didn't really see the benefit or -- really the benefit
8 for the low voltage eight second test.

9 Unless that test could be justified by
10 some means. And I know that it was originally
11 mentioned at the April workshop that it was probably
12 going to be discontinued and go back to the four
13 seconds.

14 But we see that it's still considered as
15 eight seconds. I don't know if that ever really got
16 finally dispositioned as one example.

17 MR. MELLY: So this has been
18 dispositioned. And the final test plan has not been
19 released, because it is part of the OECD agreement.

20 However, you still see the eight second
21 test as part of the low voltage. We did reduce the
22 number of eight second tests.

23 However, we've added to the test plan that
24 the eight second tests are not going to be used to
25 inform the eight second or the low voltage zone of

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1 influence spectrum.

2 However, we are trying to still do an
3 eight second test only in term -- so we can draw
4 comparisons between the low voltage and medium voltage
5 tests where we might see a medium voltage case hold
6 for longer than four seconds.

7 So the eight voltage second test is kind
8 of just a place holder, because we are at the limits
9 of the capabilities of the KEMA facility. So we
10 cannot do an eight second test at KEMA for a medium
11 voltage case.

12 MR. FLEISCHER: That's interesting.

13 MR. MELLY: However, we're trying to draw
14 some comparison of what we see from the low voltage to
15 what we can maybe expect to see in a medium voltage
16 case where it does last for potentially longer then
17 four seconds.

18 So, we have made that distinction in the
19 test plan which we plan on releasing very shortly.
20 That is the only reason that you see that eight
21 seconds on the low voltage case currently.

22 MS. VOELSING: Kelli Voelsing from EPRI.
23 And Ken can probably speak to this a lot more
24 eloquently.

25 But, I'm not -- we see in the OE very

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1 different situations that lead to potentially high
2 energy arc faults in low voltage versus medium voltage
3 equipment. So very different set of conditions that
4 lead to those.

5 And so I'm not sure that there's a solid
6 technical basis for extrapolating the results of an
7 eight second low voltage test and saying that that's
8 somehow applicable or representative to what you might
9 see for medium voltage if the facility had the
10 capability to do that.

11 And I would say that the generator voltage
12 to k curve is another example of a comment. And I
13 realize, you know, you're planning to address that in
14 the future.

15 But, it's not going to be particularly
16 relevant to the low voltage testing that's up coming.
17 And so, is there a time line when those two reserve
18 testing places are planned?

19 Because it would seem that the results of
20 those tests might be critical to the resolution of
21 this issue. And I'm wondering how those are going to
22 happen before the planned time line for the first
23 presentation of resolving that by December.

24 MR. TAYLOR: Okay, Gabe Taylor from
25 Research. So, I'll touch on the last part of your

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1 comment first.

2 The two orange boxes on the far right, the
3 optional tests, as Nick mentioned, we're going to save
4 those for the decrement curve evaluation. And later
5 in the presentation we're going to talk about the
6 decrement curve.

7 One thing that -- that's the type of
8 experiment that hasn't been done at KEMA, trying to
9 match that type of decay response from the generators.
10 Typically they use super excitation to maintain a
11 constant power source.

12 So because of that, there's a lot involved
13 on their end analytically. And also validating that
14 they'll be able to perform that type of testing.

15 So because it's not in our current
16 contract, and there's the work involved that it
17 requires us to go into our contracting process to make
18 changes that are new. A new contract to get the work
19 done.

20 So, through that process, it's not a --
21 it's going to take some time to get that in place.

22 MS. VOELSING: I think the complexity is
23 understood, I'm just asking about the time line, with
24 respect to the resolution of the GI that you propose
25 by the end of December.

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1 MR. TAYLOR: Yes, I apologize for the long-
2 winded explanation, I was trying to provide as much
3 detail as possible. So, when we get that process
4 completed, we'll be able to perform the testing.

5 So, because where we're at in the
6 contracting process phase, I don't have an exact time
7 frame for you. But if I were to guess, it would be
8 sometime later this year.

9 MS. VOELSING: Do we want to talk about the
10 extrapolation of eight-second?

11 MR. TAYLOR: Yes, that was the next place
12 that I was going to pick up. So, you remember from
13 our April workshop, we talked about some small-scale
14 testing and modeling. And over time, that has -- we
15 have changed directions and the process that we're
16 going through, because of some subject matter expert
17 changes.

18 So, currently, the plan is to work with
19 Sandia, using their area model, and basically, be able
20 to develop that to run simulations to estimate
21 different physical parameters, such as heat fluxes,
22 pressures, particle ejecta, that sort of thing.

23 And by being able to perform these small-
24 scale, as well as medium-scale, tests, we could have
25 models and simulations that could -- basically, the

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1 data would validate the models and then, you could use
2 the simulations to develop ZOIs or that sort of type
3 of information that would be useful in informing the
4 eventual model that's used in the PRA risk
5 assessments.

6 MS. VOELSING: So, obviously, modeling and
7 simulation is always a valuable part of the process,
8 but developing models and validating them based on an
9 extrapolation, I'm not sure that that provides solid
10 technical basis for the models.

11 MR. TAYLOR: They actually already have the
12 model in use out there, and I believe EPRI is actually
13 using it for some of their DC work.

14 So, what we really need to do is provide
15 some changes to the sub-model, to accurately represent
16 what we're trying to characterize. So, it's a multi-
17 pronged approach, to try to understand this hazard.

18 We see some value in performing the small-
19 scale work, but also, regardless of that pronged
20 approach, there's also some value in having more than
21 two points and you're trying to extrapolate for low
22 and medium voltage.

23 So, while we did reduce the number of
24 eight-second tests that were originally planned in the
25 small-scale test, or in the full-scale test plan, we

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1 still see value in performing that type of duration.

2 And in addition, we're seeing some
3 operating experience that shows longer duration low
4 voltage OpE. However, I think we are in agreement
5 that the frequency of low voltage versus medium
6 voltage and the hazard that it contributes are
7 different between the two.

8 MR. HAMBURGER: If we have more questions
9 about the small-scale testing or about the resolution
10 of specific technical comments, let's hold those and
11 let Nick --

12 MR. MELLY: I'd like to answer one thing.
13 The extrapolation is important, we think, because we
14 just simply don't have the ability to do an eight-
15 second test at the KEMA facility.

16 We are trying to match, we would like a
17 data point, so that we can develop this spectrum type
18 approach to the zone of influence models.

19 We did see some OpE, such as Robinson,
20 where it was between an eight-second to 11-second arc,
21 in medium voltage. We do not have the capability at
22 the KEMA facility to replicate this event.

23 So, we are looking at how we can make
24 comparisons between the low voltage energy release
25 versus the medium voltage energy release, in terms of

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1 duration. We do see that as a key important factor.

2 The PIRT documented duration as one of the
3 most important factors for the high energy arcing
4 fault and we're, again, seeing that from testing. So,
5 we do see limited number of low voltage tests as an
6 extrapolation point, an important test parameter.
7 Okay, moving forward.

8 I want to discuss some of the challenges
9 that we saw with the Phase 1 testing, and some the
10 measurement limitations that we're running into. We
11 had been testing with plate thermocouples, essentially
12 using an Inconel plate to measure the heat flux and
13 the temperature.

14 And you can see the picture on the left,
15 the before image, versus the picture on the right,
16 after it was subjected to Test 23, where we completely
17 melted the Inconel plate and were not able to record
18 any data at the three-foot location.

19 This was a limitation that we had not
20 anticipated and we were not able to get any data from
21 that test, because we damaged our instrumentation.
22 This was a main issue that we were trying to deal with
23 as we went towards Phase 2, is how are we going to
24 collect the data that we need to inform the model?
25 Next slide.

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1 So, what we came up with with NIST was a
2 tungsten slug calorimeter, essentially, a more robust
3 measurement device using one-inch diameter tungsten
4 slug.

5 It was very durable and the hope was that
6 it would survive a direct impact from the high energy
7 arcing fault at the three-foot location and beyond, or
8 wherever we put these devices.

9 We were using a calcium silicate
10 insulating board, a Marinite type board, around the
11 tungsten slug, to essentially protect the device and
12 get the data that we needed.

13 You see a picture on the left there, that
14 is a picture of it under the heat release rate hood at
15 NIST itself, cone calorimetry, testing the principles
16 and developing that tool, so that we can use it in
17 Phase 2 testing. Next slide.

18 Another challenge that we faced with the
19 Phase 1 testing was, how to get the pressure results
20 from the events themselves.

21 We had a lot of interference with
22 electromagnetic interference for our pressure devices
23 that we were using in the Phase 1 testing, so we
24 didn't fully believe the results that we were getting,
25 because of this large interference.

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1 Pressure is a very important aspect of
2 these high energy arcing faults. As we said, we can
3 have blast effects with these, where we can create
4 pressure waves within a compartments and potentially
5 damage boundaries between fire barriers, or between
6 fire areas, or have pressure effects on other
7 equipment.

8 A good example of this is the event that
9 occurred at Turkey Point in 2017, where we did breach
10 a fire barrier and damage a fire door between two
11 adjacent switch gear rooms.

12 This is one area that we're looking at and
13 we really needed to dial in on how we were performing
14 these pressure measurements, so that we can get a
15 better picture of what is going on. Next slide.

16 So, as we move forward to Phase 2, we
17 decided to move to a fiber optic measurement device.
18 KEMA has upgraded, essentially, their facility and
19 we're getting much cleaner results.

20 All the pressure measurements that we have
21 received in the Phase 2, the first four confirmatory
22 tests, do appear to have worked adequately and just as
23 we expected and things are looking good in that area.
24 Next slide.

25 We are also looking at video as data, as

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1 part of these test series. It's a very fast event.
2 We're using a lot of different videography tools, such
3 as our infrared cameras, essentially to look at the
4 temperature of the event as a whole.

5 We are -- there are some challenges with
6 this, because it is such a quick event, and we're
7 seeing temperature ranges going from ambient to 35,000
8 degrees at the initiation of the arc itself.

9 So, there are some compromises that we
10 needed to look at, in terms of our infrared cameras,
11 such as the field of view, the speed, and the
12 temperature ranges that we can achieve. Next slide.

13 We have improved the infrared camera
14 technologies that we're using, both through NIST and
15 Sandia, trying to look at a dynamic picture of what is
16 going on during the test itself.

17 For our Phase 2 camera capabilities, we
18 have a greater temperature range and higher
19 resolution.

20 And all of these infrared techniques that
21 we're using will be shared, potentially, in a separate
22 NUREG report, that our colleague Dave Stroup is
23 working on currently, and we're going to be pushing
24 that forward to our Phase 2 test program. Next slide.

25 Another important tool that we're using

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1 and that we have recently developed for this test
2 program is our data acquisition system.

3 Right now, we're using an isolated data
4 acquisition system with an independent power supply.
5 We've seen in other test programs that the arc itself
6 can short out the data acquisition.

7 And like we said, these are fairly slow
8 tests, we can only perform a few a week, and if we
9 lose a data acquisition system and all the data, it's
10 a complete waste of a test.

11 So, we have spent a lot of effort in how
12 we can create redundant systems in order to collect
13 all the data that we need. Our current system has 72
14 channels, we're only using about half of those
15 channels currently.

16 And I'll discuss different ways that we're
17 adding capability to this data acquisition system to
18 potentially collect more information, as we move
19 forward. Next slide.

20 So, what you're currently seeing on the
21 screen is our test setup for the Phase 2. We have
22 different instrumentation racks, located at three-foot
23 on all sides of the cabinet and above.

24 And additionally, we have a six-foot rack
25 located in the direction where we believe the arc is

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1 going to travel. We've had fair success in the past
2 with predicting the arc path, based on the electrical
3 setup of the cabinet itself and where we're initiating
4 the arc.

5 However, it's not an exact approximation
6 for every test case. Sometimes, the arc will tend to
7 migrate, as we've seen done in previous tests, so we
8 really need to have a way to collect information on
9 all sides of the cabinet itself, so that we do not
10 miss the arc ejecta and all the energy release, to
11 have a useful test in all cases.

12 Some of the challenges with this is that
13 it's a lot of instrumentation, it's a lot of data, and
14 it's a lot of time to set up the tests. Next slide.

15 What you're looking at on the screen here
16 is what one of those typical racks looks like and the
17 types of instrumentation that is on each rack. We
18 have ASTM E thermocouples that we're using, that link
19 to the IEEE standards.

20 We have plate thermocouples. We have the
21 tungsten slugs that we discussed. We also have a lot
22 of passive instrumentation on these test racks, such
23 as cable coupons, aerogels, and carbon tape, that
24 we're using to measure the ejecta from the event
25 itself, looking at the byproducts that are created at

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1 different distances away from the arc.

2 We're hoping that all of this will feed
3 into the model that we select, as we move forward with
4 the working group.

5 You can see here, this is a lot of data.
6 So, we're trying to spend our resources wisely, we
7 want to work with our modeler and figure out what data
8 exactly they need before we go and post-process all
9 data and all collection points that we took during the
10 test. Next slide.

11 Additionally, we're working with Sandia,
12 trying to leverage a lot of their DOE advancements and
13 their camera capabilities, high speed capabilities,
14 leveraging that, so that we can use it for this test
15 program. We have various cameras located away from in
16 front of the test cell itself.

17 And additionally, we've developed a system
18 to put a camera inside the test cell, using mirrors
19 and, essentially, to look at the arc location without
20 damaging their expensive cameras.

21 Worked fairly well in the first series of
22 tests and we hope to continue that as we move forward,
23 because, again, the video data is very important as we
24 try and assess what happened during the event, both
25 the infrared, as well as the high speed. We're able

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1 to understand things now that we were not able to see
2 in the first series of testing. Next slide.

3 Another thing that we're doing in this
4 test series is, we're doing the full weights and
5 measurement of all of the test equipment before we
6 test and after we test.

7 We want to get a picture of how much
8 material was vaporized, both in the conductive
9 pathways, the aluminum in the different phases of
10 power, as well as how much was vaporized of the
11 cabinet itself, if we had cabinet breach.

12 This is something that was not done in the
13 first series of testing and does take considerable
14 resources post-test arrangement. Next slide.

15 This is the piece of equipment that we
16 used in the first four tests that were conducted in
17 September. It was a single compartment GE-Magne-Blast
18 Metal-Clad Switchgear, where aluminum busbar was
19 located in the rear of the compartment that you're
20 seeing there.

21 This was the equipment that was discussed
22 in the April workshop and was selected with some
23 interaction with the industry. It was deemed to be a
24 typical cabinet that we would see in the U.S.
25 operating plants. Next slide.

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1 This is the actual in-KEMA design setup
2 before one of the tests. You're looking at the
3 cabinet. The front door of the cabinet is located on
4 your left-hand side. You see pressure transducers
5 located on the sides of the cabinet, under that 219
6 symbol.

7 As well as, you're seeing our protected
8 instrumentation racks located, again, at the three-
9 foot and six-foot locations, in order to collect the
10 information that we needed from the ejected arc.

11 This was a -- for each one of these test
12 series, you see the racks there, themselves, we could
13 not reuse a single instrumentation rack, because of
14 the damage from the event itself.

15 There is a considerable amount, about a
16 week of prep time that went into building these
17 instrumentation devices at the KEMA facility before
18 they are used.

19 So, it is a considerable amount of work
20 that goes into a single test and they're not reusable,
21 so that kind of explains why these test take as long
22 as they do to prepare for, as well as to run a single
23 test. Next slide.

24 What you're seeing here, and I'm not sure
25 if you can make it out clearly, is the arcing wire

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1 that we're using to initiate the arc itself across
2 three phases of power. It's a thin -- Ken, can you go
3 over that with the mouse by any chance?

4 MR. TAYLOR: Yes, it's a 24-gauge single-
5 strand tin-copper wire, per the C37.27 standard, IEEE.

6 MR. MELLY: And this was a change that we
7 made based on some of the comments we received during
8 the public workshop. We initially had been initiating
9 these arcs using the low voltage standard, because
10 they had a rationale for the ionization of the wire
11 that was created itself.

12 However, from one of the comments, we
13 decided to change that to the medium voltage case that
14 was used, and we went with a thinner gauge wire. That
15 wire was able to maintain and hold the arc in all
16 cases during the test week. Next slide.

17 So, here are the four tests that we did
18 perform. These are pictures of the rear of the
19 cabinet itself, post-test. The first upper left-hand
20 picture you see there is our Test 219. This was a
21 two-second arc at our 25kA.

22 And moving across, you have our two-second
23 arc at 35kA. On the bottom left, you have our four-
24 second arc at the 25kA. And the bottom right is our
25 four-second arc at the 35kA, 32kA, I'm sorry.

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1 You can see the progression in damage
2 states, however, we did breach the cabinet in all
3 cases. We do see this linking up with operating
4 experience, where an arc occurs in the rear of the
5 cabinet itself, it does create a cabinet breach.

6 From the video itself, we can actually
7 witness the metal in the back of the cabinet
8 essentially vaporizing and ejecting the energy towards
9 our instrumentation devices.

10 One thing to note here is that we do see
11 fairly repeatable results. That was a challenge when
12 we had equipment donated from a ton of other
13 countries, where we essentially didn't have the same
14 piece of equipment.

15 Which is why, in the second phase of
16 testing, we're trying to use the same make, model, and
17 initiate the arc in a similar location, so that we can
18 have comparable data as we move forward.

19 We were successful in locating our
20 instrumentation and we're using the arc initiation
21 point as our main parameter to decide where we
22 locating things.

23 In all four tests, we did see the door in
24 the front of the compartment open, due to pressure
25 effects. It was a single-latching door. We were able

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1 to re-close the cabinets after the experiment itself.
2 We saw minimal bending, but we didn't see many thermal
3 effects at the front facing of the cabinet itself.
4 Next slide.

5 Another aspect of this I want to discuss
6 is some of the observations we're seeing from our
7 measurement devices themselves. We were again using
8 that calcium silicate Marinite board for our ASTM E
9 slugs, as well as our tungsten slugs. And we saw some
10 unusual effects occurred during the test series. Next
11 slide.

12 What you're seeing there is a before and
13 after picture of one of our tungsten slugs that was
14 located on the three-foot rack. On the right-hand
15 side, you see this green silicate glass-like material,
16 that has bubbled up from the Marinite itself.

17 And we're looking into trying to match
18 material property characteristics for the Marinite to
19 the temperatures of the exposed surface, with the data
20 that we've collected from that tungsten slug.

21 We have -- those devices did survive and
22 we were able to actually collect valuable temperature,
23 as well as heat flux information from the majority of
24 our tungsten slug devices.

25 So, we do see that as a success moving

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1 forward in the ability to capture these high energy
2 cases at a close proximity to the cabinet. Next
3 slide.

4 Again, our plate thermocouples did not
5 survive the highest heat fluxes that we saw there,
6 which did expose us to a new problem that we had not
7 anticipated, which was once the plate thermocouple
8 vaporizes, the wires and the wire pathway that is
9 behind that device becomes exposed, which damages all
10 the other wires behind it.

11 So, there were some cases where we still
12 lost data because of the high energy that's released
13 from the cabinet, and we're currently working at ways
14 to enhance the protections, so that we do not lose any
15 of the valuable data. Next slide.

16 Again, another thing that we're looking at
17 to improve our cost-efficiency of the test program is,
18 we have been using the ASTM E slugs.

19 That is largely so that we can have a
20 direct comparison between testing that was done as
21 part of the IEEE work, as well as ASTM work. However,
22 we may see this as a redundant testing device, which
23 we do not need to use moving forward.

24 It's one area that we hope to bring up
25 with the working group, after we can look at all of

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1 the data for these devices, to see if we even need to
2 use these moving forward and maybe make each test a
3 little bit more cost-effective. They're fairly
4 robust, however, they did not survive the high
5 intensity arc itself. Next slide.

6 Another big ticket item that we're looking
7 at for this test program is the deposition of ejected
8 byproducts, as we move away from the cabinet itself
9 for these aluminum tests.

10 What you're seeing here in these two
11 pictures is some of that ejected material, which is
12 the white powder coating that is on the wall of the
13 test cell itself.

14 We did take black carbon tape samples of
15 this material and we're going to be performing post-
16 test analysis at Sandia to look at exactly what that
17 byproduct was, both at the wall, on the three-foot
18 test stand, and the six-foot test stand.

19 One important note is that we didn't
20 really see this type of ejecta during the two-second
21 arcs that we had in this test program. The majority
22 or the bulk of the material was during the four-second
23 test.

24 So, that's another issue that we're
25 looking at, that these aluminum tests might not have

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1 the amount of byproduct material ejected, depending on
2 the duration of the arc itself.

3 So, this was a question that came up just
4 recently in this series of testing that we're going to
5 be evaluating. We have a question?

6 MS. VOELSING: Yes, sorry, this is Kelli
7 Voelsing from EPRI, again. I'm sorry, I may have been
8 confused, but I thought the latest information I
9 received was that, although you took samples with the
10 carbon tape, you did not plan to have Sandia analyze
11 them, because of resources, and you were counting on
12 the small-scale test results to do the material
13 characterization. Did I misunderstand what I was
14 previously told?

15 MR. TAYLOR: Yes, there must have been some
16 misunderstanding. So, we put samples in a number of
17 locations. On every rack, we had a number of
18 different types of samples, aerogel, black carbon
19 tape, PVC samples, and we have hundreds of samples to
20 analyze.

21 There's probably five or six different
22 ways that can analyze each sample. And really,
23 putting the samples in the testing is not the
24 expensive part, the expensive part is the post-test
25 analysis.

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1 So, what we're trying to do right now is
2 understand exactly what the model needs and what
3 samples need to be analyzed and how they need to be
4 analyzed, before we move forward and expend the
5 resources to analyze the samples.

6 So, they've done some preliminary, picking
7 off one on each rack and analyzing it for different
8 parameters.

9 But as far as analyzing the samples that
10 are needed to inform the working group's work or the
11 modeling work, we haven't initiated that type of
12 resource expenditure. So, we're trying to be as
13 efficient and as effective as we can to get the
14 information that's needed.

15 MS. VOELSING: So, to date, either from the
16 small-scale or from this testing, there's no material
17 characterization results available?

18 MR. TAYLOR: Not to the public, no.

19 MS. VOELSING: Or to the working group?

20 MR. TAYLOR: Or to the working group, yes.
21 They have done some preliminary analysis, but even on
22 the small-scale, the small-scale is really focusing on
23 the modeling.

24 And until they have -- because the changes
25 in direction on the modeling and the approaches, until

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1 we have the modeling approach nailed down, we didn't
2 want to analyze the samples yet.

3 So, all the samples are still out at
4 Sandia, there's some preliminary information that was
5 provided to the NRC, as just a quick look, but as far
6 as a comprehensive analysis of the samples, we don't
7 even have that yet.

8 MS. VOELSING: It might be helpful to the
9 -- even to have the quick look, to know what the
10 material was characterized at. And will there be any
11 potential for stakeholder engagement on these models
12 that you're working on with Sandia? Because that
13 doesn't seem to be a part of any of the discussions.

14 MR. TAYLOR: I'll let -- do you want to
15 answer that or -- okay. So, yes, when we get far
16 enough down the line, I think that's, as Victoria made
17 mention, it would be very valuable to have feedback on
18 the modeling and what we're getting out of that.

19 MS. VOELSING: It might be helpful to have
20 feedback on the front-end, to make sure that what
21 comes out the back-end is appropriate.

22 MR. TAYLOR: Agreed.

23 MR. MELLY: And we do see this as a very
24 important piece, as we move forward. Again, the
25 material composition, as well as the conductivity that

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1 we're talking about affecting equipment is a big part
2 of the aluminum issue.

3 And we recognize that and we have been
4 working towards ways of improving the data that we've
5 collected, so that we can draw this conclusion. We do
6 see this as an important aspect. Next slide.

7 And again, this is a picture of some of
8 the metal ejecta that we did take samples of at
9 various distances from the cabinet itself, that's what
10 you're seeing on the ground here. Next slide.

11 And to even push that forward, we have
12 looked into new ways to actually address, actively,
13 conductivity measurements within the room itself,
14 during the test that we do conduct.

15 We're going to be using a developed tool,
16 instrument, in order to look at the conductivity
17 during a test cell, as we do these four low voltage
18 and four medium or bus duct tests in the summer.

19 These are essentially resistant devices,
20 where their initial intent was to measure the
21 corrosion effects in smoke environments, to look at
22 how they affect conductivity changes in real-time.

23 And we're hoping that, if we do use these
24 as we move forward, as we coat these in byproducts, we
25 can get a real-time estimate of conductivity changes

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1 within the test cell itself at various distances.

2 This is a new device that we've not tested
3 before, we're currently working with NIST, not right
4 now, because they're furloughed, but we're working
5 with NIST to add these into the test program itself
6 and put these in the future tests that we're running.

7 We're doing some shake-out tests right now
8 to see if these will be useful and the type of data
9 that we can collect using these.

10 As I said earlier, the next four tests
11 that we have planned, or the next eight tests that we
12 have planned, include four low voltage tests, at 15kA
13 and 25kA, the tests that are identified here. A two-
14 second test and eight-second test is slated for the
15 next series of testing. Next slide.

16 And additionally, we have our bus duct
17 tests. We're going to be doing a copper bus duct with
18 an aluminum enclosure, which is typical that we see
19 and that we saw from a survey of how much aluminum is
20 out there, that was performed by NEI.

21 As well as, we're going to be looking at
22 aluminum bus in an aluminum enclosure. So, these are
23 the tests that we have slated for the spring/summer.
24 Next slide.

25 Some of the important OECD, the next phase

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1 actions and some of the important milestones that we
2 have upcoming. We've completed most to this date. We
3 also are going to be getting some international
4 equipment for the OECD NEA tests. We have just
5 received that in-house.

6 And the next big milestone is the second
7 series of tests that we're going to be performing in
8 the spring, May, summer time frame. We have not
9 established a firm date yet, we're going to be working
10 with KEMA, as well as NIST, when they're off furlough,
11 to establish the dates for the upcoming test series.

12 Any questions on anything that I've went
13 over in the last portion of this presentation?

14 MR. HAMBURGER: We'll take any questions
15 from the room first.

16 MR. SCHAIRER: Yes, this is Mark Schairer
17 with EPM. Can you elaborate a little bit more on how
18 the data you're collecting will support the zone of
19 influence spectrum?

20 In particular, are you going to
21 differentiate between ignition and damage of cables
22 and different cable types, like thermoplastic,
23 thermoset, Kerite? So, is the data you're collecting,
24 will that be sufficient to support that spectrum?

25 MR. TAYLOR: So, we're -- Gabe Taylor,

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1 Office of Research. So, that's one thing that we've
2 been trying to get a grasp around is, we're doing a
3 lot of work to understand the hazard, but on the back-
4 end, the fragility that you're speaking to, does
5 equipment or cables become damaged or do they ignite?

6 That's an area where -- the applicability
7 of the current data, that's more thermal fires and
8 damage via these high energy short duration exposures.
9 We're trying to get a grasp of how we would go about
10 doing that.

11 So, again, we're looking at possible heat
12 conduction type modeling, similar to the THIEF model
13 that we have in FDTs, to try to characterize what the
14 thermal fragilities, from a function standpoint and
15 from an ignition standpoint, are.

16 But if there's -- it's an area where we're
17 definitely seeking feedback from anybody that has
18 expertise in this area, to help inform the process
19 going forward, because that's a very important concept
20 of determining what the ZOI is, is what those
21 thresholds or fragilities are.

22 MR. SHUDAK: This is Tom Shudak with
23 Nebraska Public Power. As far as your other testing
24 that you're going to do on copper buses, were you
25 anticipating doing those before you released your

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1 report or are you going to do some comparison between
2 the copper and aluminum from just a zone of influence
3 from these control tests?

4 MR. TAYLOR: So, we have the original
5 testing program for the Phase 1 OECD test. So, they
6 potentially provide us, for a comparison. But as far
7 the GI Program, that test data from Phase 1 and
8 anything else that we can come up with from either
9 NFPA or IEEE to compare it from, we will.

10 As far as the other tests in this matrix,
11 we don't envision those testing being performed before
12 the assessment phase would need to be completed. So,
13 the comparison of those wouldn't be available for the
14 GI Program.

15 However, later on, when we complete all
16 the testing and we work with EPRI through the working
17 group and come up with kind of the updated guidance
18 for 6850 Appendix M replacement, that obviously would
19 be a very valuable comparison.

20 MR. PRAGMAN: Chris Pragman, Exelon
21 Nuclear. I just want to follow up on Tom's question,
22 because my understanding of the GI process is that the
23 decision is based on a change in CDF, or delta CDF.
24 So, if you don't have the base model involving copper,
25 how do you quantify the delta CDF for aluminum?

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1 MR. MELLY: So, the CDF or the delta that
2 we're going to be using right now is compared to the
3 current 6850 Appendix M zone of influence model. So,
4 we're not changing that.

5 However, if we need to look at the zone of
6 influence as potentially greater, through the working
7 group or through the charter, that is how we would
8 establish a delta.

9 From the current modeling techniques that
10 are used, that three-foot, five-foot, with the
11 caveats, versus what we establish for the aluminum,
12 that would be the current delta that we're talking
13 about for the Generic Issue assessment phase.

14 MR. PRAGMAN: But it seems like to make an
15 apples-to-apples comparison, you'd have to compare
16 four-seconds copper to four-seconds aluminum. 6850
17 isn't four-seconds anything, it's more a empirical
18 number based on past experience.

19 MR. MELLY: And that's why we're not trying
20 to simply say, it's going to be a four-second model.
21 We're going to be developing a model specifically for
22 aluminum, using this data, and then, applying that to
23 the plant.

24 However, the current model that is in
25 regulatory use is that 6850 model, so that would be

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1 the baseline risk, what plants have currently modeled
2 to, versus what we come up with as a working group for
3 the generic assessment phase.

4 The eventual models, as we move forward
5 and complete the entire test program, will be looking
6 to change both the 6850 and the aluminum, so we may be
7 altering the copper zones of influence as we move
8 forward.

9 However, for the Generic Issue assessment
10 phase, the baseline is the current modeling techniques
11 that are part of the regulatory basis versus what the
12 working group comes up with for the zone of influence
13 of aluminum.

14 Again, not a single four-second
15 conservative model, but a spectrum that uses the
16 frequency of occurrence, plant design, as well as all
17 the data available, both the spectrum of two-second,
18 four-second tests.

19 MR. PRAGMAN: So, it sounds like we're
20 saying we're going to -- the baseline is 6850, which
21 is based on experience. The GI process, we'll use a
22 model -- I mean, when we're using models as licensees,
23 we're expected to benchmark them somehow.

24 So, I don't understand how you would
25 benchmark your model versus experience. I don't feel

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1 like you've explained that well enough yet.

2 MR. MELLY: And hopefully, that will be the
3 next meeting that we have, where the working group
4 establishes the basis for this new model that we've
5 created, using both data, operating experience from
6 the plants and the frequency to explain what we will
7 be using moving forward as a zone of influence for
8 these aluminum cases. Again, we're not changing the
9 baseline, which is the Appendix M of 6850, though.

10 MR. PRAGMAN: Thanks.

11 MR. TAYLOR: I just had one thing to add to
12 the previous comment from Mark. One thing I forgot to
13 mention, in our -- and Nick probably brought it up.
14 But on our instrument stands, we also place cable
15 samples, so we can look at those afterwards and see
16 the effects from the event or the test.

17 MR. MELLY: Yes.

18 MR. TAYLOR: Cable coupons, yes.

19 MR. MELLY: We use various materials of
20 cables as well on those. Tom, do we have questions on
21 the webinar?

22 MR. AIRD: We have one question on the
23 webinar, from Mark Hewlett, APS. He asks, are the
24 connectivity sensors mounted in a manner
25 representative of location inside a nearby cabinet or

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1 direct exposure?

2 MR. MELLY: Currently, the thought is that
3 we're going to put them direct exposure at various
4 distances away from the cabinet, such as on our
5 instrument racks at the three-foot, six-foot, and
6 maybe beyond, where we anticipate deposition of
7 materials.

8 However, the current test plan does have
9 adjacent cabinets as a potential. And if those tests
10 are performed, then we can put the conductivity
11 measurement inside of that cabinet, to see if we're
12 getting any influence inside the cabinet itself from
13 deposition of materials.

14 MR. TAYLOR: And from those sensors being
15 used in the smoke type testing, orientation plays an
16 impact on the measurement.

17 So, if there's feedback on -- we have a
18 solid state protection cabinet that's got circuit
19 cards in this orientation or we have this other
20 cabinet that has circuit cards in this orientation,
21 that would be useful information for us to incorporate
22 into the testing, to ensure that we're being
23 representative of the configurations.

24 MR. HAMBURGER: Any other questions from
25 those in the room? Anything on the webinar. Okay.

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1 And again, I think all of the staff here is going to
2 be here for the rest of the day, so if any questions
3 occur to you, don't hesitate to ask. And I think Mike
4 Cheok has a --

5 MR. CHEOK: So, Ken, before we go to the
6 next presentation, I would just want to revisit what
7 I said at the beginning and then, we can go from
8 there.

9 So, I think what I said at the beginning
10 was we are going to have to be very methodical in
11 doing our tests and evaluating this issue. And the
12 second thing was, improving our communications. So,
13 I will, I guess, say it again.

14 So, in being methodical, we have to do
15 things correctly. We have to do tests that are
16 realistic, that are in conformance to some standards.
17 We have to do tests that are practical.

18 So, what we heard this morning was some
19 discussion of the tests, but on the -- and the second
20 part of the Generic Issue is not just the testing, but
21 to look at operating experience. And we haven't got
22 to that part of the test yet. And that becomes a very
23 important part of resolving this Generic Issue.

24 So, we also need to be very realistic, in
25 terms of looking at OpE, operating experience, so that

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1 we can be realistic and so that we can be using
2 parameters that are plant-specific, that we see in our
3 plants.

4 So, what's going to happen -- what we
5 continue to have to do is to marry the results from
6 the testing with a frequency and a look at what we
7 have out in the plants.

8 So, what we are hearing this morning is
9 only a smaller part of the whole Generic Issue. We
10 will continue to have to involve all our stakeholders,
11 in terms of trying to be looking at operating
12 experience.

13 We have to be looking at plant-specific
14 information. Like I said this morning, we have to
15 look at the design, plant-specific designs,
16 configuration-specific designs. We have to look at
17 plant practices.

18 And so, on the other hand, on testing, we
19 also have to understand what the zone of influence is.
20 And we will continue to work with our testing partners
21 and with EPRI on, once we get the tests back, we will
22 have to look at what the results show us, how we look
23 at the raw data, and how we can interpret the raw data
24 into something that could be useful.

25 And so, yes, Sandia modeling on the data

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1 will be available to us, hopefully soon, and when we
2 get it, we'll be glad to share it with EPRI and the
3 rest of the industry: this is what the data is showing
4 us, this is what we will -- this is how we will use
5 it, in terms of modeling.

6 And at that point, we -- it's going to be
7 a public meeting, everyone's going to be asked for
8 feedback on how they think the data and the modeling
9 is going to match.

10 Again, so, we are a little bit ahead of
11 the schedule. I mean, off-the-cuff right now, we are
12 hoping to get some data soon. NIST being not in a
13 work status now kind of delayed some of our data
14 collection and analysis.

15 But once we get that also, obviously, we
16 will walk that through the work group, which you will
17 hear this afternoon, and then, with the rest of the
18 public in a forum where we will present the data for
19 everyone to analyze.

20 So, the second part of what I said this
21 morning was communications. And I would like to have
22 everyone's input, and I'm not sure I got that feeling,
23 and I'm not sure I want to be talking past some of the
24 questions and comments this morning.

25 So, I think what I heard was, we said we

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1 dispositioned a lot of the industry comments, but that
2 in dispositioning the comments, we may not have come
3 to a -- we did not address them, for lack of a better
4 term.

5 So, I think what we need to do, maybe this
6 afternoon or maybe after this meeting, we will sit
7 down with our staff and we'll -- if you all will
8 provide us with very, more specific comments on, this
9 is what we thought we gave you, we did not see the
10 resolutions to this, we'd be glad to discuss this
11 again in the next public meeting.

12 We'll be very specific as to, this is your
13 comments, this is how we will address this in the next
14 phase of testing or in the next task, in terms of
15 frequencies or in the characterization of the zone of
16 influence.

17 So, I think we can be more specific, in
18 terms of addressing comments in a public forum, so
19 that we understand your comments better and you can
20 understand our responses better.

21 So, let's see what else I've got in my
22 notes from the last two hours. I think I got it all.
23 I mean, so, we will talk about the decrement curve.
24 We will talk about using the need for an eight-second
25 duration test.

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1 I understand that there's some
2 sensitivities to test extrapolation. So, things like
3 that, I think we can address and we will address it
4 specifically in the public forum.

5 MR. HAMBURGER: Thank you, Mike. If we
6 don't have any more questions from the room, I think
7 we're overdue for a break. So, let's come back at
8 11:00. Come back at 11:00.

9 Again, bathrooms are out the door on this
10 side of the room, to the left. Cafeteria is open,
11 again, that's to the left, down the hallway, and that
12 will be on your left as well. My contact information
13 is up on the screen. If you have any issues, give me
14 a call, it's probably the best way to get a hold of me
15 at the moment.

16 (Whereupon, the above-entitled matter went
17 off the record at 10:42 a.m. and resumed at 11:07
18 a.m.)

19 MR. HAMBURGER: All right. So, we're going
20 to resume with Gabe Taylor.

21 MR. TAYLOR: Okay. Welcome back. So,
22 myself and Kenn Miller are going to go through future
23 test planning for the aluminum HEAF testing and the
24 equipment selection. Next slide.

25 So, during this presentation, we're really

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1 trying to communicate what we're planning on doing,
2 the upcoming tests, and also, receive feedback on
3 anything that we can do to improve how we go about
4 testing the equipment as we move forward.

5 Just as a refresh, I know Nick brought
6 this up in this past presentation, but if we look at
7 the overall test program, including the OECD test
8 report, you can see that we've completed the four
9 medium voltage 6.9kV tests, in the fall, September.
10 One clarification is that it was 32kA, not 35, as the
11 slide shows.

12 So, for the aluminum HEAF, we're really,
13 on this enclosure testing matrix, we're really looking
14 at the right portion of the matrix, and the individual
15 tests that are highlighted in the peach or orange
16 color are the ones that are NRC-sponsored.

17 So, that leaves us with four low voltage
18 tests, at 480 volts, two current levels, 15kA and
19 25kA, and durations of two and eight seconds. Note
20 that we also will be planning on running four-second
21 tests as part of the OECD program.

22 On the far right, you can also see two
23 tests that aren't connected to any part of the test
24 tree matrix.

25 And as we communicated previously, we plan

1 on using those two spare or optional tests to evaluate
2 the decrement curve. The decrement curve will be
3 evaluated at the 6.9kV, and it's yet to be determined
4 what current level we'll be testing that at.

5 But those are information that we're
6 trying to work with EPRI and understand the best way
7 to represent realistic plant decrement type
8 conditions. So, just -- and I have a later slide on
9 the decrement curve. So, that's low voltage.

10 If we look at the equipment that we're --
11 we haven't procured any equipment yet. We've put out
12 bids.

13 And right now, what we're look at for the
14 aluminum bus low voltage enclosures, either a
15 Westinghouse DS type switchgear or a General Electric
16 AK series switchgear. So, these are the low voltage
17 switchgear load centers that will be just downstream
18 of your step-down transformer.

19 As far as frame size, we're looking at
20 1600 amp or 200 amp continuous frame size rating. And
21 then, also, for interrupting capacity, we're looking
22 at anywhere between 42kA and 65kA.

23 And those numbers really came out of the
24 evaluation we did to support the workshop last April,
25 looking at what was common for plants out there. And

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1 although our sample size wasn't the entire fleet, it
2 was about a quarter of the fleet that we sampled from
3 the information that we had.

4 And as far as -- these were the common
5 ranges of equipment that was out there. So, if you
6 looked at an average, interrupting capacity was right
7 around 50kA for what we looked at. Next slide.

8 Okay, moving on to the medium voltage bus
9 ducts. For this type of testing, we're looking at a
10 combination of enclosure and busbar material types.
11 And also, there's a combination of NRC solely-
12 sponsored tests and OECD-sponsored tests. The voltage
13 level we chose for this was 4160 volts and a single
14 current at 25kA.

15 The combinations, as you can see, are
16 copper bus/steel enclosure, which is OECD only.
17 Copper bus/aluminum enclosure, which is similar to the
18 test we ran in Phase 1, the Zion bus duct experiment,
19 so we have two tests there at two and four seconds.

20 Then, we have an aluminum bus/steel
21 enclosure. In that case, we'll run one of the two-
22 second tests, there's an OECD test for four seconds.
23 And then, aluminum bus/aluminum enclosure, we have two
24 tests there for two and four seconds.

25 We do have two spares test, and at this

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1 time, we haven't determined a need for those yet. But
2 there could be a potential there to evaluate decrement
3 curve or some other type of configuration, as we see
4 fit.

5 So, if there's feedback to support those
6 optional tests, we'd be interested in learning that.
7 So, and one thing, just to be clear, these aren't the
8 iso phase bus ducts, these are typically non-
9 segregated phase bus ducts. Next slide.

10 As far as the general characteristics of
11 the medium voltage bus ducts, again, non-segregated
12 phase bus ducts. I gave you the voltage already.

13 As far as the rating, we're looking at
14 1200-2000 amps rating on the busbars and then, also
15 from a withstand rating anywhere from 31.5 to 63kA,
16 which that's typical out of the standard that's
17 identified there for medium voltage bus ducts.

18 One area that's still uncertain at this
19 time is, for our measurements, we need to stabilize
20 the arc in one location.

21 And if you're familiar, from the testing
22 that we did in the first phase, the OECD program
23 testing, because of electromagnetic effects, it
24 basically propelled the arc out the end of the bus
25 duct configuration.

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1 And if you look at the OpE, there's
2 typically some feature that stabilizes the arc,
3 whether it's a bolted connection or a grounding bar or
4 some other cause.

5 Recent OpE, there was an event that
6 happened exterior to the plant, they had an exterior
7 bus duct, and because of the coatings that they had on
8 the busbar, that acted to stabilize the arc in one
9 location.

10 So, right now, what our thought process is
11 is what's shown in the graphic there, is that if you
12 see the power supply from the laboratory, coming down
13 the left side of the image, the copper colored
14 conductors, it then runs horizontally into the bus
15 duct.

16 And in the bus duct, we make a physical
17 separation of the bus duct and, on the left side, we
18 place a shoring wire at that location to generate the
19 arc there. The idea there is that would stabilize it
20 in that general location, where we'd then have the
21 instruments located above and below.

22 Another option could be to use the epoxy
23 insulation that was used in the industry testing.
24 What we found in some communications with external
25 parties is that that type of insulation isn't common

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1 inside the plant. So, that's one non-conformity that
2 we would potentially introduce into the testing, if we
3 performed that.

4 Another option that we also had some
5 feedback from the Japanese experiments is that they
6 put a grounding bus perpendicular to the orientation
7 of the phases, the bus phases, and that helped to
8 stabilize the arc as well. But then again, that's
9 something that's not common to the types of
10 configurations that are in the plant.

11 So, just to kind of summarize, right now,
12 we're looking to put a gap in the bus ducts to
13 stabilize the arc, but if there's any feedback or
14 logic to support some other configuration that would
15 provide a more reliable means to maintain the arc in
16 one location, so that our instruments could capture
17 reasonable and usable data, we'd be very interested in
18 that type of feedback.

19 And then, from informal surveys of some of
20 the equipment vendors, common enclosure housing
21 thickness, looking at 11-gauge aluminum housing. The
22 conductor for aluminum, for the aluminum experiments,
23 to follow the ASTM standard that's specified there.

24 So, if there's any other types of design
25 considerations that are out there we should be

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1 considering, we're very interested in learning those.
2 If not, we'll work with our electrical contractor to
3 try to find and procure bus ducts that are
4 representative of the types of installations in the
5 field.

6 Okay, now it's moving on to the decrement
7 curve. And we talked about this a little bit earlier.
8 Last January of 2018, EPRI published some white
9 papers.

10 In the one white paper, they went through
11 a number of different scenarios. And one of the
12 scenarios they to be most common to exhibit a long-
13 duration arc was cases where it's a generator-fed
14 fault.

15 So, basically, you'd have a fault between
16 a generator and a protected device, so you wouldn't
17 have a main generator breaker to clear the fault. And
18 then, the generator would basically feed the fault
19 until the exciter voltage dropped out and stopped
20 providing energy to the fault.

21 So, we found that information very useful
22 and, as I mentioned earlier, we're trying to work with
23 our testing facility to be able to replicate some of
24 the field experience that was provided to us via EPRI.
25 It does require new contracting, which takes time.

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1 And also, it requires some analysis and
2 verification on the laboratory's part, to make sure
3 that they can run the experiment that meets our needs,
4 to replicate that type of exposure.

5 So, it's not a rudimentary process of
6 going out and doing this, this isn't very common or
7 we're not aware that it's been done in the past, but
8 we do have confidence that it can be done moving
9 forward.

10 And that's feedback we received from EPRI
11 and during the workshop and during the public
12 comments, and we're definitely taking that into
13 consideration and making changes to improve our test
14 program.

15 So, that's one example where we made
16 changes, but we're also looking for any other feedback
17 to improve our testing, because in the end, we have to
18 have something that's usable to make realistic methods
19 and models to inform our risk analysis.

20 So, just to summarize, our initial focus
21 here is to support the Generic Issue Program. We're
22 focusing on the NRC-sponsored aluminum type tests, to
23 support the GI Program in its assessment phase, to
24 provide useful information to determine what the ZOI
25 or the ZOI model is, to support the risk assessment.

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1 And although the decrement curve, the
2 process for getting all that is slow, we're trying to
3 expedite it as much as possible.

4 There could be possibilities, if they're
5 interested, for industry to perform that type of
6 testing. We could support it on the measurement side
7 as well, if that is a faster means of getting it done.

8 I think that's all I had. So, I really
9 appreciate any feedback on our planned approach this
10 coming year.

11 MR. HAMBURGER: Gabe, if people have
12 feedback that occurs to them after this meeting, can
13 they get in touch with you by email?

14 MR. TAYLOR: Right. You can email
15 gabriel.taylor@nrc.gov. My information's on the
16 meeting notice. As well as Nick Melly,
17 nicholas.melly@nrc.gov.

18 MR. HAMBURGER: Okay. Any questions from
19 those in the room? About any of the equipment Gabe's
20 presented?

21 MR. TAYLOR: I'll just make one additional
22 thing, while we're waiting. We'll run it no
23 differently than we've done previously.

24 In the first phase, we identified what
25 equipment was available and then, we worked with EPRI

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1 to make sure that was consistent with the type of
2 equipment that's found in the field.

3 So, we do have some initial leads on
4 equipment last week, but there's a few bids still out
5 there to see. And once we get that information, we'll
6 work with the working group to understand which
7 equipment is most applicable for the series of
8 aluminum tests.

9 MR. HAMBURGER: Okay. Any questions or
10 comments? Tom, anything on the webinar? Okay.

11 Well, I think the next presentation is
12 slated for an hour and I think there's going to be
13 some comments and questions on that, so I don't want
14 to get into that before lunch, because I have a
15 feeling that may delay lunch.

16 So, unless anyone objects strenuously, I
17 think we can go to lunch now and take a little
18 extended lunch. Come back at 12:45? 1:00? You okay
19 with 1:00? Mark, unless you think you can get it done
20 in -- okay, we'll come back at 1:00.

21 (Whereupon, the above-entitled matter went
22 off the record at 11:21 a.m. and resumed at 1:00 p.m.)

23 MR. HAMBURGER: All right. Thank you all
24 for returning promptly.

25 Just a reminder, for questions and

1 comments, please state your name before your comments,
2 so the court reporter can transcribe it properly, and
3 try to use the microphones for any comments or
4 questions, so other webinar participants can hear it.

5 Mark?

6 MR. SALLEY: All right. I take it
7 everybody had a good lunch. We've got a lot to cover
8 this afternoon. So, we'll pick it up.

9 Back on May 11th, 2017, in this room,
10 there was a briefing for the Commission. And one of
11 the industry execs was at the table and briefly
12 described the HEAF and the work that was going on.
13 And he made sure to make the point that the industry
14 really wants, speaking for the industry world, the
15 industry really wants to work with NRC research on
16 resolving this. The vehicle that we typically use in
17 research is the MOUs I described earlier with EPRI.
18 And we try to get the scientific arms together to do
19 that work.

20 For those of you that have been around
21 fire protection and have been here a while, if you
22 think back 20 years ago or so, again, in this room we
23 had a whole different topic in fire protection that we
24 were working, and that was multiple spurious --
25 everybody remember that? -- with the hot shorting of

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1 circuits and all that. It was a big issue in the late
2 nineties and at the turn of the millennium.

3 Today we don't talk too much about it. It
4 seems to be solved. Everybody's comfortable doing it.
5 The utilities know what they need to do. The
6 inspectors know how to inspect it. And we have done
7 a lot of work.

8 And as a part of the success of that, it
9 was that MOU between research and EPRI. If you
10 remember, we did a whole series of tests. The
11 CAROLFIRE program was the first one, and we worked
12 through it, again working together to get a good
13 scientific solution.

14 So, we've seen success with this before,
15 and it's worked quite well. I think we really
16 advanced the science, and it's good science. So,
17 again, with that in mind, we want to reach out and
18 work with EPRI on the technical solution to the HEAF.

19 Next slide.

20 So, what we did in the past few weeks,
21 working with Kelli and her folks and mine on this
22 side, is we had a number of calls and discussions, and
23 we thought we'd put together a Charter for what this
24 Working Group is going to attempt to do. We held it
25 out as a draft until today, again, for any feedback

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1 from stakeholders or industry on where we're looking
2 to move forward.

3 Again, the basic mission statement here,
4 I think it's quite obvious: to improve the
5 understanding of risk from electrical arcing fault
6 hazards in nuclear power plants. And you'll notice we
7 chose the words "arcing fault hazards" and not
8 directly to HEAFs. I think that's part of it and the
9 fact that we want to get the correct binning and get
10 the correct selection of the events. So, that's the
11 basic Charter for the group.

12 Next slide.

13 So, the goals of this Working Group:

14 Obviously, a better understanding of the
15 key factors contributing to the occurrence and
16 severity.

17 You can read them here.

18 Advancing the HEAF fire PRA modeling.
19 Again, we have the single model out of 6850 for the
20 zone of influence in Appendix M. We also have the one
21 FAQ for the bus ducts. We think we can do a lot
22 better with that.

23 And then, analyzing the plant impacts and
24 the risk implications. If you look at that, that
25 should look very familiar to everyone here. That's

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1 basically HEAF in the form of a risk triplet. So,
2 again, following the sound principles is how we want
3 this group to move forward.

4 Next slide.

5 So, this is where it kind of gets a little
6 interesting. There's a lot of famous quotes and a lot
7 of people have said things about, you know, getting
8 the right group of people together. I think one pops
9 into my mind, Lee Iacocca. If you remember Lee
10 Iacocca from the automotive world, this is the man,
11 basically, that came up with the Mustang in 1964, and
12 then, he saved Chrysler later. So, he was a pretty
13 heavy hitter in there.

14 He had a saying that kind of went
15 something like this: I hire people smarter than me,
16 and then, I get out of their way. So, that's kind of
17 the philosophy that I want to look at with this
18 Working Group, and this is the Working Group that
19 we've assembled between Kelli and myself working for
20 some of our best experts out there. You may of the
21 people. Some or a lot of them are in this room here
22 today. And again, they're very good people.

23 Also what's here, we put two levels of
24 management. The Project Managers, again, Kelli and
25 myself. If you have questions or want to talk to

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1 someone, we're there. And then, our sponsors that are
2 above it for the whole program, which is Mike Cheok,
3 my supervisor, and then, Tina Taylor.

4 A lot being said with putting the right
5 people together and getting out of their way. We've
6 talked a lot about zones of influence and things of
7 that nature, and how we want to do this. And I really
8 think that, as we're putting this group together --
9 and they're just starting out, by the way. So, we
10 want data, we want this, we want a lot of things. But
11 this group is just getting together. Like I said, the
12 Charter is a draft. Any input from anyone today was
13 welcome, and then, we'll get started with this.

14 But looking at HEAF -- and I'll set the
15 bar real high for this group -- don't just lock me
16 into a ZOI or something like that. I mean, the
17 sheet's clear. We're starting out.

18 If we look at HEAF and we talk about the
19 tests and why we're doing some of the tests and
20 different things, we basically have one equation with
21 six unknowns. Okay? And if you think back to college
22 and your early days in engineering, most of us went
23 through you could do one equation, two unknowns, and
24 work it through and substitute, and bring it back, and
25 all that.

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1 But this is a complex phenomena. I mean,
2 what effect does the voltage play? What effect does
3 the current play? And what effect does duration play?
4 What effect does the material play? What effect does
5 the enclosure do? We know there's a lot of variables
6 here.

7 And I think, as a part of this Working
8 Group, or what I challenge them to do is tell me this.
9 Does voltage matter? Does current matter? We've
10 fought a lot about duration. We're seeing the
11 material properties seem to matter between copper and
12 aluminum.

13 So, this group has a lot of work ahead of
14 them to do it. And I don't want to tie their hands,
15 but I want to let them do their thing.

16 In a perfect world, if this group was,
17 I'll say it as a manager, very successful, we would
18 have an equation where you could plug in the voltage,
19 you could plug in the current, the enclosure, and come
20 up with the zone of influence.

21 And maybe it's not a box like we've been
22 doing 3 foot x 5 foot. If you look at some of the
23 data we've gotten from video, it's more of a sphere.
24 Is that the correct thing?

25 Or the FAQ group, when they worked the bus

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1 duct out, I think, Industry, what do you call that,
2 "the cone of death," or something, for the cone that
3 comes down from the bus duct? Again, I don't want to
4 limit the group. I want to let the physics and the
5 science do what it needs to do.

6 So, these are the people that we've
7 selected. I think we've got a good group here, very
8 capable. And we want to let them get on with it.

9 Let me see what I've got. Next slide.

10 Again, deliverables. To improve the risk
11 models. The PRA stuff is driving it. That's what's
12 got us here. We want to look at the frequency and the
13 binning and the zone of influence. And again, I'll
14 zone of influence loosely. I think the group can come
15 up with what they need to for that. It may be a
16 sphere. It may be an equation. It may be different
17 things they can come up with.

18 Again, our goal was to look at the risk to
19 the plants. We talked a little bit about pilots, and
20 that's something, again, where we'll need some help
21 from industry. If you go back and look at 6850 and
22 the history of that, again, for the folks that have
23 been around since the 2000 timeframe -- we published
24 that in 2005 -- one thing that we constantly at the
25 end of AFP-805 we're hit with is, you know, we never

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1 really piloted it. We piloted it in pieces. We never
2 did a full pilot. If hindsight is 20/20, everyone
3 agrees back in 2000 we would have piloted 6850, and it
4 would have been a better tool for all to use.

5 So, here's an area, too, where we're
6 looking at pilots. Again, we're still in the
7 discussion phase as a part of the Working Group.
8 Remember, this is just starting up. But that the
9 Working Group would develop the models and the tools
10 and the data and how to do that, and then, let the
11 licensees or the consultants implement it in the plant
12 to do the pilot. So, that's kind of where we're at
13 with that right now.

14 Again, we really hope to advance the
15 science, to reduce uncertainty, to improve realism,
16 all the things we strive for, and to update the
17 current guidance. It is funny, when we started out in
18 the testing way back with the internationals, our goal
19 was to go and to provide the confirmatory test that
20 Appendix M, 6850, was a good model.

21 And for the most part, we were doing
22 really great and we were thinking, hey, this is a good
23 -- man, if you had to pick a one-size-fits-all HEAF
24 model, up until about that 22nd test, we're saying
25 this was right on. And we were, you know, Nick and I,

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1 patting each other on the back that this is really
2 going to be successful until those later tests came
3 and showed us that there's more to it than that.

4 So, again, we want to get that accuracy
5 and we want to get that fidelity in it; and again,
6 understand the variables and the parts they play,
7 which, again, will be the update to the guidance for
8 6850, Appendix M, and the supplemental, the FAQ -- I
9 think it's 37 or 47 -- for the bus duct.

10 Communications, we talked this morning is
11 important. We will strive to have open communications
12 with you. And I guess, as the Working Group, like I
13 said, the key is we've got to let them do a little
14 work. It's just getting together. And I think as
15 they get to key points in that, we can agree upon
16 things that we want to share with the larger group as
17 to how we're moving forward.

18 Next slide. So, I've got one more slide
19 here.

20 Priorities. And these are the NRC's
21 priorities as to how this Working Group moves forward.
22 I kind of want to give you the big picture of this.
23 This is not a short-term thing that we do in six
24 months or a year, but it's a little bigger.

25 Obviously, the first thing we want to look

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1 at is the aluminum HEAF. That's the driver for us in
2 the GSI program, and we want to solve that portion
3 first.

4 You saw the matrix that Gabe and Nick used
5 earlier this morning, how we laid all the testing out.
6 And we want to pick those aluminum pieces up first and
7 get this Working Group going.

8 Again, the decision from the GIRP was that
9 we want to go out with the most accurate model. We
10 don't want to go out with something that's very
11 conservative, do some more research, have it combine,
12 and have people do the work two and three times, but
13 to come out with the most accurate, realistic model as
14 possible. That's the goal that we're striving for.

15 It's a timely goal. If we get our testing
16 done, we get this group going, we believe we can
17 achieve it, and we have the schedule. So, that's our
18 first priority.

19 You also know that the way we originally
20 started this program was with an international
21 program. HEAF is not unique to the United States
22 nuclear plants. It's worldwide. We see these,
23 approximately 10 percent of the most significant
24 events, we see with our international partners are
25 HEAF. There's a lot to learn, and everybody pretty

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1 much understands that.

2 So, the OECD/NEA group, we're in the
3 process of signing out the agreement now, where we
4 want to go forward with the second form of testing.
5 And this will do a lot more of the copper and it will
6 be a lot more confirmatory, and again, bring a lot
7 more of the realism into the total understanding of
8 HEAF.

9 As a matter of fact, the German equipment
10 has already been shipped, and we have already received
11 equipment from Germany. So, there's a lot of interest
12 from our international partners to work on this.

13 Our goal with our international partners
14 was to keep this Working Group going because they
15 would have momentum, they would have understanding,
16 they would have experience, and to look at refining
17 the other models, again, the Appendix M, for the
18 copper and the different conditions.

19 We could, then, take that and put it out
20 for public comment and get our OECD partners, our
21 experts in the foreign countries, and let them do a
22 peer review of it, so that we could have a good, high-
23 quality product.

24 So, that's kind of the big picture looking
25 forward, that we go for the aluminum piece first, and

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1 then, we work into the second phase of testing with
2 the OECD and the NEA.

3 Again, the whole goal at the end of the
4 day is to improve the realism and fidelity of our
5 models.

6 Kelli worked very closely with us. Kelli,
7 that's kind of the end of my presentation. If you
8 have anything you'd like to say on the side of EPRI or
9 anything, this would be a good time.

10 MS. VOELSING: Are you saying you want me
11 to give my presentation now?

12 MR. SALLEY: If you're ready. Is it on
13 the Working Group?

14 MR. HAMBURGER: Sure. That's fine.

15 Before you give your presentation, does
16 anybody have any questions for Mark?

17 MS. ANDERSON: I have a question.

18 MR. HAMBURGER: Oh, okay.

19 MR. SALLEY: Okay.

20 MR. HAMBURGER: And, Mark, would you mind
21 just telling people where they can find the current
22 version of the Charter?

23 MR. SALLEY: Yes. If you look at the
24 meeting notice today, the one -- we updated it last
25 week. It's a two-page Charter. It's a link at the

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1 very bottom. You can just load it. It's an EPRI
2 Dropbox, is it?

3 MR. HAMBURGER: I believe it's a link to
4 the EPRI box.

5 MR. SALLEY: Box, and it's in there, a
6 copy. Again, it's a draft. So, we'll take any
7 comments/suggestions.

8 MR. HAMBURGER: Victoria?

9 MS. ANDERSON: So, this is Victoria
10 Anderson with NEI.

11 That was actually my first question. You
12 said that stakeholder input on the Charter was
13 welcome. And I checked out the meeting notice this
14 morning, and I don't think I noticed that link. So,
15 even if it is available, maybe there's a way we can
16 better publicize it. Maybe make it available in
17 ADAMS, if we really want to get as much public
18 feedback as possible. I mean, I was hunting for it
19 and I couldn't find it.

20 MR. HAMBURGER: I believe it's a link at
21 the bottom of the meeting description.

22 MS. ANDERSON: Right. But, I mean, again,
23 I was motivated --

24 MR. HAMBURGER: I'll put that down as --'

25 MS. ANDERSON: -- to try to find it, and

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1 I still struggled.

2 MR. HAMBURGER: Okay. So, I'll put that
3 down as an action item for NRC.

4 MS. ANDERSON: If we're really looking for
5 broad stakeholder input, that's not really going to
6 help it along.

7 MR. SALLEY: The millennials got me on
8 that one, Victoria.

9 MS. ANDERSON: What's got you?

10 MR. SALLEY: The millennials got me on
11 that.

12 MS. ANDERSON: I'm not a millennial. So,
13 I can't help you there.

14 MR. SALLEY: My millennials.

15 MS. ANDERSON: Okay. They'll help you.

16 MR. HAMBURGER: And of the documents,
17 including the Charter and the presentations from today
18 will be packaged up and placed into ADAMS and made
19 publicly available.

20 MS. ANDERSON: Okay. So, I think the
21 sooner that can be done with the Charter, the better
22 to help with soliciting feedback.

23 MR. GARDOCKI: And we'll try to put stuff
24 like that on the GI Dashboard.

25 MS. ANDERSON: Excellent. That's an

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1 outstanding idea.

2 MR. GARDOCKI: So, that's a great place
3 for all this information. Okay?

4 MS. ANDERSON: Outstanding idea.
5 Definitely fully support that.

6 How will other stakeholders and the public
7 be able to interact with this Working Group? Like
8 will information come out of this group? Will there
9 be draft reports put out? Will there be public
10 meetings on where they're going?

11 MR. SALLEY: Yes, we can decide that
12 however it's best for everyone. And again, I'll work
13 with EPRI and Kelli. I think that once we maybe get
14 a product that we think is far enough along would be
15 a good time to put a draft report out, give folks 30
16 days to comment on it, whatever. If we see
17 significant comments, we could hold a public meeting
18 and discuss it.

19 Or, again, how we talked with the pilots,
20 and I think that the Working Group itself could do
21 some presentations as to what their logic was, how
22 they came up with it, and what the intent was. So, we
23 can do that in a public forum, if you like.

24 MS. ANDERSON: Great. You mentioned
25 Kelli, and she showed up behind me.

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1 (Laughter.)

2 MS. VOELSING: Yes, I was going to say,
3 the names that are on the list for the Working Group
4 predate me or my involvement. And to your point,
5 Mark, if there's other industry stakeholders and
6 experts that have technical expertise to contribute to
7 the Work Group, I would think we would want to
8 consider their participation. So, there should be
9 room for that.

10 MS. ANDERSON: Okay. And just one other
11 question or I suppose a question/comment hybrid is:
12 you underscored the need to have the pilots to support
13 this Working Group and the pre-GI resolution. Right
14 now, I think plants would be hesitant to volunteer for
15 that because we heard this morning is we're not 100
16 percent sure what we're going to be evaluating or what
17 we're looking at, or how to deal with the fragilities,
18 or how to deal with this or how to deal with that.

19 The licensees in the audience can correct
20 me if I'm wrong, but, until some of that is better
21 defined, I don't think you're really going to get a
22 volunteer. So, I think the sooner we can better
23 define some of that, and we can get some realistic
24 inputs, the sooner we'll be able to get some pilots to
25 volunteer.

1 MR. MELLY: Yes, we absolutely understand
2 that. And the Working Group is currently also working
3 towards a pilot plant resource need or resource
4 allocation, what would be expected of the pilot
5 plants. We drafted that late at the end of last year,
6 and we're working that through the Working Group to
7 say, would this be the type of resources that any
8 pilot plant would need to allocate to doing this?
9 What type of information are we looking for? How it
10 would move through the process. So, we're still
11 fairly early in that step, and that draft is being
12 shared within this Working Group to see, is this the
13 type of information we need to collect and how would
14 it move forward?

15 MS. ANDERSON: So, I think you correctly
16 identified the resources as one specific concern the
17 pilot plants would have. I think another concern we
18 need to pay attention to is whether or not they're
19 going to be asked to consider information that they
20 believe, based on OE, to be unduly conservative.

21 I don't think a plant is going to
22 volunteer to put their information out there to be
23 evaluated with information or analysis based on
24 extremely conservative testing or results, to possibly
25 come up with erroneous conclusions. I just can't see

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1 a plant being willing to do that.

2 MR. TAYLOR: Yes, I agree. I think one
3 thing from other projects we worked on, such as the
4 spurious operation one, where they basically use data
5 from all the tests, we use operating configurations,
6 and then, the experts' judgment to modify or adjust
7 the data. So, I agree, we want to get a realistic
8 model to characterize the risk. And I think letting
9 the Working Group work through that process should be
10 able to get us there. But we're too early to --

11 MS. ANDERSON: And I think that
12 underscores the need to have continuing public
13 interactions, so that potential pilots have more
14 confidence in that. And then, there's potential for
15 them to volunteer.

16 MR. HAMBURGER: Thank you. Any more
17 questions for NRC staff about the NRC/EPRI MOU or the
18 Working Group?

19 (No response.)

20 MR. HAMBURGER: Any questions on the
21 webinar?

22 (No response.)

23 MR. HAMBURGER: Okay. And just a note for
24 those on the webinar. Before the end of the day, we
25 are going to open up the phone lines to make sure

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1 nobody has any questions that they haven't put down in
2 the chat.

3 All right. We are now officially in the
4 public question and comment session. We have two
5 prepared presentations.

6 Kelli, would you like to go first?

7 Okay. The first presentation was provided
8 to me by Kelli from EPRI.

9 And you can use the podium, and I can step
10 through. Or, if you want to take the buttons?

11 MS. VOELSING: First of all, thanks for
12 the opportunity to comment. My name is Kelli
13 Voelsing. I'm the RSM Program Manager at EPRI.

14 So, we have been participating and
15 following the development of what's going on with high
16 energy arcing faults and in preliminary discussions of
17 the Working Group Charter with Mark and his team, and
18 with Mike Cheek and Mark Thaggard as well.

19 I will say that at a high level I think we
20 are aligned on the tasks in the Working Group Charter,
21 the issues that need to be worked through in order to
22 have a realistic understanding of the risk and the
23 potential contribution to risk from aluminum. But I
24 think there's significant work and technical
25 challenges that we're going to have to work through in

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1 order to get to that answer.

2 So, maybe perhaps for those of you that
3 don't know, my technical lead on fire PRA is out right
4 now on a medical leave, having just had a baby. And
5 so, I have been given the opportunity to learn a whole
6 lot about high energy arcing fault in a very short
7 period of time. And the analogy that keeps coming in
8 my head, as I think about these, I thought it might
9 resonate with some of you all, which is, when we see
10 the videos, when we see the pictures, when we talk
11 about these enormous volted three-phase long-duration
12 faults, I absolutely understand how the first reaction
13 to seeing those is obviously one of concern. That
14 could be a significant issue with significant damage
15 at a nuclear plant.

16 But I think back to loved ones -- and
17 hopefully, none of you -- but if you've been given a
18 diagnosis and you hear the words "You have cancer"
19 from a doctor, the first thing that's going to go
20 through your head, oh, you know, invasive surgery.
21 We're going to cut out large portions of tissue and
22 poisonous chemotherapy and radiation, and obviously
23 the worst-case scenario. It's very easy to envision
24 that.

25 But I think very quickly you get into the

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1 details, and you start hearing from the doctor about
2 locations and size and phases and genetic markers of
3 the tumor, and all of the discriminating factors that
4 go into the appropriate treatment of a cancer. And I
5 think what I've learned about high energy arc fault is
6 that there's a lot of those discriminating factors in
7 not only what we see in the testing, but what we see
8 in the OE and in the experience of our plants as well.

9 And just like proceeding with a worst-case
10 cancer treatment, sometimes proceeding with a worst-
11 case treatment or a one-size-fits-all model or
12 approach to understanding HEAF would ultimately do a
13 disservice to the patient; and that for the best
14 outcomes, we have to understand those factors and we
15 have to take them into account, as we understand both
16 the risk and the mitigation plans for how we deal with
17 those.

18 So, I guess I was just saying, it keeps
19 coming into my head that I understand why the concern.
20 And obviously, these worst-case HEAFs would be a
21 significant or could be a significant safety impact,
22 depending on the configuration, the location of the
23 plant, the equipment that could in a zone of
24 influence. But there's a lot of other factors that we
25 have to consider before we get to that conclusion.

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1 So, if we could go to the next slide?

2 I'll start here, and I think we've already
3 heard this today. But I just wanted to put in context
4 that, currently, the Bin 16 treatment in NUREG-6840 or
5 EPRI 1011989, the Fire PRA Methodology in Appendix M,
6 that we've been referring to is a one-size-fits-all
7 for everything in Bin 16. There's one zone of
8 influence. There's one initiating event frequency.
9 And it's certainly easy to imagine that, if you double
10 or triple or quadruple the zone of influence, you're
11 talking about taking out entire rooms or large zones
12 of potentially impacted equipment. So, we have to
13 consider what all goes into Bin 16 and is it really a
14 some-size-fits-all approach that we should be
15 pursuing.

16 So, if we'll go to the next slide?

17 Some differentiating factors that may come
18 into play here. We do see distinct differences in the
19 types of events, the damage profiles of events between
20 medium voltage and low voltage equipment. I'll talk
21 some more about that.

22 The location. It's probably true that
23 there is aluminum out there in bus ducts, whether non-
24 segregated or iso phase bus ducts. But that equipment
25 is outside or in the turbine deck, and doesn't impact

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1 safety-significant equipment, it may not still be a
2 significant contributor to risk.

3 We see differences within Bin 16 between
4 switchgear and motor control centers, bus ducts, that
5 all of those have different probabilities in terms of
6 is this likely to be a long-duration or short-duration
7 event; is it likely to be a flash or a blast versus a
8 HEAF? And I think we can start to draw some insights
9 there.

10 Source of the fault may be another
11 important consideration that we haven't really talked
12 about yet. We saw a picture of the wire that was
13 being used to generate the fault on the aluminum
14 busbars, which would be, obviously, on the switchgear
15 on the load side of the breaker. Whereas, a good
16 portion, more than half of the industry experience is
17 that the fault is generally generated on either the
18 breaker side or at the stabs, which is generally not
19 where the aluminum is present. So, that may be an
20 important consideration in terms of testing, in terms
21 of where do we put the fault.

22 Electric configuration. At the time of
23 the white papers last year, we had reviewed a good
24 portion of the industry. We've now reviewed all 103-
25 104 units to determine which units have safety-related

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1 buses or buses that are subject to unit-connected
2 generator design without a generator breaker, such
3 that you would have a long-duration fault that has to
4 spin down. And that applies to some plants. It also
5 does not apply to a lot of plants. And so, I think we
6 need to consider that as well.

7 Material. Obviously, the reason we're
8 here today is the presence and location of aluminum.

9 And then, again, operational issues. We
10 would be remiss to not acknowledge that the best way
11 to prevent the risk of a HEAF is to not have a HEAF.
12 And although there are not one smoking gun, we do see
13 in the OE that a large majority of HEAFs have,
14 although not the same preventable cause, they do have
15 preventable causes that relate to cleanliness,
16 maintenance practices, human performance.

17 So, next slide.

18 Again, we are in alignment on the major
19 tasks of the Working Group Charter. We think those
20 are the right tasks that need to be worked through and
21 appreciate the commitment from Mike Cheok and Mark
22 Salley and their teams to work through that in a
23 methodical fashion that considers the spectrum of risk
24 and the probabilistic aspects of that spectrum of
25 events.

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1 So, the first task is to improve the risk
2 models, supported by all available information, be
3 that testing, data, whether type testing,
4 manufacturing data or manufacturers' data, or the
5 current test programs, or other testing.

6 OE from the industry as well as expert
7 engineering judgment because the bottom line is I
8 don't think we're ever going to have enough resources
9 to test all the configurations, all the possible
10 configurations that we might like to test.

11 And then, there are basically two tasks
12 that we've aligned on that support that. The first is
13 a realistic representation of the frequency of events
14 represented in Bin 16 and an appropriate modeling of
15 the various zones of influence for the events included
16 in Bin 16.

17 And then, following that, once we have
18 developed those methods and agreed and aligned on
19 those approaches, and tested them, and make sure that
20 we feel like they're practical and implementable,
21 then, obviously, that translates into updated
22 guidance. So, I think, in general, we are aligned on
23 the major tasks of the Working Group. Perhaps the
24 timeline and the ability to get through those tasks I
25 think will be an evolving issue, as we really start to

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1 dig into the technical details.

2 So, I have a slide with a lot of words for
3 kind of what -- and again, I don't have answers for
4 all of these or necessarily any of these, and
5 certainly some technical experts in the crowd who can
6 support, as necessary, but we wanted to identify some
7 of what we think, in working through these tasks in
8 the Working Group, what are some of the key insights
9 that we think we need to take into account as the
10 Working Group, as we work through these?

11 First, with respect to the frequency work,
12 you've heard about binning or sub-binning or this idea
13 that Bin 16 includes multiple different kinds of
14 events represented. And so, I just wanted to give you
15 a flavor of what we're talking about there.

16 So, right now, the total population in Bin
17 16 which is the frequency bin and the fire events
18 database that supports the arcing fault inputs into
19 the fire PRA. So, from 1964 to 2017, the total
20 population of that bin is 28 events across the U.S.
21 nuclear industry.

22 It does include a wide variety of
23 equipment. There's not a lot of events, but there's
24 a lot of potential sources that come into that bin.
25 So, it includes medium voltage, low voltage. It

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1 includes switchgear. It includes motor control
2 centers. It includes bus ducts, and it includes --
3 basically, in the Charter we refer to it as the
4 arcing fault hazard because it includes things that
5 would be characterized as flashes or blasts that
6 really didn't do damage outside the component and did
7 not, essentially, have a zone of influence or create
8 a post-event fire, as well as events that are
9 definitely high energy arcing faults and do have that
10 larger zone of influence and immediate damage or fire
11 or immediate damage to components.

12 The data includes events with and without
13 post-event fires and with and without post-event
14 damage. And perhaps it's obvious to say, but with
15 only 28 events, it may be that we have to use some
16 engineering judgment and for different types of
17 components or different aspects, what we actually know
18 about the probability of having a flash event or a
19 blast event versus a HEAF event. Because with 28
20 events, you can only break that out down into so many
21 sub-bins. And you've got 30 bins and three-quarters
22 of them have one event or zero events in it, I'm not
23 really sure how much that tells you from a statistical
24 perspective. So, we're going to have to be willing to
25 bring in other expertise and data and judgment into

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1 that consideration.

2 But I do think, nevertheless, the OE in
3 the ISAs database and the OE in Bin 16 does give us
4 some pointers about things that are critically
5 important. So, I'll highlight a few of those here.

6 First of all, medium voltage equipment, 84
7 percent of the events in Bin 16 that were damaging
8 occurred in medium voltage equipment. So, we're not
9 seeing large numbers of these events in low voltage or
10 high voltage equipment.

11 I'll also add that, for low voltage
12 equipment, there were two damaging events in low
13 voltage equipment in this population of 28 events. In
14 both of these cases, they were allowed to exist for a
15 prolonged period of time because there was not enough
16 energy to trip the protection features in the design.
17 So, they simply didn't have enough current to cause a
18 trip, and that's why they persisted for a long period
19 of time.

20 And so, although they're in the bin and
21 they do indicate post-event damage in some cases, we
22 need to do some more digging into what that damage
23 actually was. And it appears that the damage was due
24 to a post-event fire and not related to the HEAF
25 itself.

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1 And then, of the events with external
2 damage, the graph at the lower right of the slide
3 shows a breakdown of these events. In Bin 16, there
4 were 11 of them that caused external damage. Seven of
5 11 of those were in bus ducts, either iso phase or
6 non-segmented bus ducts.

7 And so, I would point out that our
8 experience in fire PRAs tells us that, generally, due
9 to the location of the bus ducts -- you know, they
10 tend to be outside or in the turbine building, and not
11 impacting safety-significant equipment -- so, they
12 tend to be lower contributors in the fire PRA. So,
13 more than half of those causing external damage would
14 have been in that type of application.

15 So, if I can go to the next slide?

16 Similarly, some early thoughts or insights
17 related to the zone of influence work that we've been
18 referencing. And I think we've pointed to this as
19 well. Currently, the zone of influence that is used
20 is based on one event that at the time it was created
21 was kind of the worst-case known event. It was a
22 SONGS event, and it's the basis for the 3x3x5 zone of
23 influence that's currently used.

24 So, just consideration of the test
25 protocol that we're involved in now and trying to come

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1 up with a zone of influence versus what has been done,
2 it's important to recognize the differences in those
3 approaches if you're trying to come up with a
4 reasonable delta CDF.

5 And then, secondly, to date, small-scale,
6 no large-scale, test results on HEAF or the byproduct
7 characterization have been available for analysis.
8 And so, to fully have a robust set of comments about
9 future test plans and the data that needs to be
10 collected to make sure that we can make good
11 decisions, we don't really feel like we can do that
12 until we've been able to analyze the existing data.

13 So, useful insights which might play into
14 that feedback on future testing related to zone of
15 influence work is, first of all, aluminum oxide is an
16 excellent insulator material with very low
17 conductivity. And aluminum in most situations will
18 oxidize almost immediately to aluminum oxide.

19 And so, one of the reasons we're
20 particularly interested in the small-scale or material
21 characterization properties is because, if the white
22 dust or very fine particles that we're observing at
23 distant locations are primarily aluminum oxide, and
24 they're not conductive, it may be that they don't
25 really -- you know, they may be very fine and spread

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1 easily like volcanic dust, but if they don't
2 contribute to damage, then that may not constitute a
3 zone of influence necessarily in a PRA.

4 Finally, we know from testing and OE that
5 the arc will travel away from the source. And so, in
6 the testing that's been done, as we said, we induced
7 the arc at the switchgear, at the busbars, and it's
8 going to immediately blow out the back of the cabinet.
9 And if you put cable coupons directly in front of
10 that, is that -- we've talked about the location of
11 the arc and the potential impact that that could have
12 on the testing. But also, when you're trying to
13 understand the fragility of components, it's important
14 to represent cables and cabinets and other SSEs in a
15 manner that's consistent with how they might be
16 configured in the plant.

17 Again, just the fourth bullet there is
18 kind of a similar concept. I know some of the OECD
19 testing on bus ducts, they, I believe, had the bus
20 duct on the ground. And so, if you're talking about
21 a conical zone of influence, which is what we
22 currently use in the fire PRAs for bus ducts, well, if
23 you did the testing on the ground, then you would,
24 obviously, not be able to get that downward zone of
25 influence that you would expect to see in the plant.

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1 And that wasn't part of the NRC's current
2 test plan, but I just point that out as indicative of
3 the kind of things we need to make sure that, when
4 we're configuring this equipment and collecting test
5 data, that the data we're collecting is representative
6 of the way the equipment would be installed and
7 operated in the field.

8 And then, we've alluded to this as well.
9 Bin 16 does include significant frequencies that
10 include arc blasts and arc flash events. Of those 28
11 events, we have looked at them, and at least 10 of
12 them -- there's a few that we want to understand more
13 about -- but at least 10 of them would be classified
14 as flashes or blasts, which, per the definitions
15 proposed by the NRC, would cause no damage external to
16 the component, and therefore, essentially, a
17 negligible zone of influence versus the one-size-fits-
18 all zone of influence.

19 Early insights on plant risk. I think
20 this is going to be a challenge for the Working Group.
21 Although EPRI is not involved in the generic issue
22 process, it's certainly something we're going to have
23 to be able to address as part of the generic issue.

24 This idea of an average plant risk is an
25 elusive concept, especially in this situation, because

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1 there are some drivers, some designs, some risk
2 factors that would certainly make you more susceptible
3 to this type of risk, the most obvious being, do you
4 have aluminum installed in these components or not?
5 A good fraction of the industry may not have aluminum
6 or may have aluminum only in bus ducts where it's not
7 particularly significant to risk.

8 A review of all of the U.S. units shows
9 that 70 percent of plants are not susceptible to a
10 long-duration generator-fed fault on a safety-related
11 bus. So, we've identified this as one of the primary
12 drivers. You know, where can you get a long-duration
13 fault? When there's only one breaker and that's where
14 the fault occurs, then you have to wait for the
15 generator to spin down while you're still feeding that
16 fault. But 70 percent of the U.S. industry would not
17 have a safety-related bus that is even susceptible to
18 that kind of fault.

19 Even when the long-duration generator-fed
20 fault can occur, the following factors must be
21 considered. So, we've talked about the voltage decay
22 as the generator spins down. And I'm glad to hear
23 that we're looking at how do we make that in future
24 tests reasonably represented.

25 The presence or absence of aluminum and

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1 the proximity of aluminum to the fault location, and
2 then, other equipment in the zone of influence, and
3 the actual fragility of that equipment.

4 With respect to the bus ducts, I will say
5 our not 100-percent survey of the U.S. industry, but
6 our reasonable survey of the industry suggests that
7 it's not rare to have aluminum in bus ducts, mostly
8 due to weight and cost. So, we probably are going to
9 find aluminum there, but the risk is dependent upon
10 the SSEs within the zone of influence. And aside from
11 some spatial considerations at very specific plants,
12 it's generally a low contributor to risk in most fire
13 PRAs. So, having a larger zone of influence in those
14 situations is probably not going to make much of a
15 difference.

16 Testing considerations. We talked at the
17 beginning about differentiating factors, the breaker-
18 initiated versus switchgear-initiated fault. And I
19 have a side views of a breaker, and in the NRC's
20 presentation they showed the shortening wire across
21 the switchgear busbars that they used to initiate the
22 fault.

23 I will say, we found that more than 50
24 percent of the experience in the industry is that it
25 is the moving parts where you rack breakers in and out

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1 where the fault is likely to initiate, either due to
2 maintenance or human performance, or other causes.
3 But it generally will tend to be on the breaker side
4 or at the breaker stabs or where those moving parts
5 come together.

6 And those parts of the breaker are made
7 out of copper, and they travel through some porcelain
8 bottles and through a torturous path, through some
9 more porcelain components before they move into the
10 segment of the cabinet where the switchgear busbars
11 would be.

12 And so, we don't know, but it could be
13 important to consider that because, you know, if the
14 fault initiates there, it has to sustain itself and
15 move far enough along, and continue to sustain energy
16 in order to make it to the aluminum busbars, and then,
17 still have enough energy to cause this larger-than-
18 expected oxidation. That may be important to
19 consider.

20 I think we've touched several times on the
21 data for evaluating damage. Just the mere observance
22 of damage to instruments at 3 feet or presence of
23 substance at a distance from the test does not, in and
24 of itself, dictate a zone of influence. To agree with
25 the NRC, that's not an easy question to answer. You

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1 know, how are we going to take these -- you know, what
2 instrumentation, what equipment? How are we going to
3 take measurements? How are we going to know what part
4 of that is due to aluminum versus everything else?
5 That's part of the switchgear. How are we going to
6 have a baseline to compare to in order to come up with
7 a zone of influence? I think we have to consider that
8 as part of the design of the future test program.

9 And I am personally not familiar with the
10 Sandia model. So, I don't have any comments on that
11 model or the fidelity of the model, or the ability of
12 the model to predict damage, and therefore, a
13 representative zone of influence.

14 So, target selection is critical to assure
15 the results are representative of plant equipment.
16 Usually, in a switchgear room you're going to have
17 multiple cabinets. And therefore, does the byproduct
18 penetrate through the cabinet? Does it cause damage
19 inside another cabinet? Does it move through the
20 louvers? That's a little different than just having
21 a rack directly in front of the blast.

22 Actual location and data collection to
23 assess impact on operation. To date, the OE does not
24 suggest large-scale deposition of byproducts or damage
25 outside the cubicle. So, when there has been

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1 byproducts, you know, in general, we have been able to
2 wipe them off and close the cabinet and everything
3 still works. So, we need to make sure that we're
4 using representative equipment to assess fragilities
5 and zones of influence.

6 And then, clarity on what conductivity and
7 what material is being measured will be a challenge
8 for the test program. And along with representative
9 conditions that lead to the longer-duration faults,
10 this is why I asked earlier about the extrapolation of
11 an 8-second fault in low voltage equipment to be
12 representative of high voltage equipment. And so,
13 this really gets to that point.

14 In medium voltage equipment, we see very
15 clearly in the OE that the dominant contributor there
16 is this unit-connected design where the generator has
17 to wind down as the voltage collapses and continues to
18 supply energy into the fault for a long-duration
19 period of time.

20 For low voltage equipment, what we see as
21 the contributor most frequently there is it's a long-
22 duration event simply because there's not enough
23 energy to trip the protection scheme. And therefore,
24 the current is just below what you need to cause a
25 trip in the circuit. And so, it just continues to

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1 propagate. So, there may be long-duration arcing
2 fault events, but they may not have the high energy,
3 because, by definition, if they did, the equipment or
4 the protection system would be expected to trip.

5 And so, I think you can see how what leads
6 to a long-duration fault in low voltage is a different
7 condition than leads to a long-duration fault in
8 medium voltage. And so, the extrapolation of one to
9 the other I think would have to be reviewed by the
10 Working Group to make sure that we're comparing apples
11 to apples in our extrapolation.

12 So, to kind of circle back to where we
13 started, at least our hope, like what the NRC said, is
14 that we come out of this with a refined Bin 16
15 treatment and supplemental guidance to update
16 NUREG-6850, and an acknowledgment that all arcing
17 fault events are not the same, and that risk should
18 consider the probability of various types of events
19 and associated zones of influence, neither of which
20 are probably a one-size-fits-all.

21 In the diagram there, maybe the cabinet in
22 the middle is a low voltage cabinet and probably is
23 most susceptible to high energy -- or not high energy
24 -- but an arcing fault with a relatively or non-
25 existent zone of influence. And maybe there's some

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1 probability of a larger zone of influence. And then,
2 maybe it's the bus duct with aluminum that has a
3 larger zone of influence because it does have a low
4 minimum. And we do see in the OE damaging types of
5 HEAFs occurring in that type of equipment.

6 So, this is by no means intended to
7 illustrate the answer. Just that we think that
8 there's a nuance in the answer, and that we hope what
9 we end up with at the end of this is a reasonable
10 representation based on all the input and the expert
11 judgment of the probability of the various types of
12 events represented in Bin 16. That's kind of
13 component- or application-specific. And then, also,
14 a representation that zones of influence for each of
15 those probabilities is also probably variable.

16 So, with that being said, we look forward
17 to continuing to work with the Working Group. As I
18 said, it's been a good collaboration on the Charter,
19 making sure that we had the right tasks identified in
20 order to get to a technically-solid basis for
21 improving our state of knowledge and our modeling of
22 the risk of high energy events or arcing fault events.

23 MR. HAMBURGER: Thank you, Kelli. Would
24 you be willing to answer any questions from the
25 audience, if they have any?

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1 MS. VOELSING: I'll try or --

2 MR. HAMBURGER: Okay.

3 MS. VOELSING: -- I'll defer to the
4 technical experts. But sure.

5 MR. HAMBURGER: Okay. Any questions for
6 Kelly from the room?

7 (No response.)

8 MR. HAMBURGER: From the webinar?

9 (No response.)

10 MR. HAMBURGER: Okay. Thank you.

11 And I have one more presentation that was
12 provided to me in advance by Victoria Anderson from
13 NEI.

14 And after this presentation, the floor is
15 open for any questions that anybody might like to ask.

16 MS. ANDERSON: All right. So, we wanted
17 to talk a little bit about the context of the
18 technical information that this effort is gathering
19 and the operating experience and the technical
20 information we have so far, and put that in the
21 context of the risk evaluations that are done as part
22 of the pre-GI process.

23 Because any decisions associated with the
24 generic issues process are designed to be risk-
25 informed, and really the specific thing we're looking

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1 at here, as I'll get onto in the next slide, is the
2 change in core damage frequency due to potential
3 aluminum HEAFs needs to be treated as the core damage
4 frequency due to aluminum HEAFs minus the core damage
5 frequency baseline. And I think one thing we talked
6 about a little bit this morning was that we aren't
7 really sure yet how we're defining that baseline, and
8 it's very important that we define it appropriately.

9 Next slide, please.

10 So, most past generic issues have been
11 dispositioned according to delta CDF instead of CDFs.
12 If you look at this chart here that talks about which
13 issues you exclude from further consideration and
14 which ones you continue, the X-axis is core damage
15 frequency and the Y-axis is change in CDF.

16 Based on our knowledge of the fire PRA
17 CDFs out there in the industry, which would really
18 tell us about our HEAF baseline, we believe the
19 results for this pre-GI evaluation would be in this
20 green region. We don't think anything would be over
21 $1E$ minus 4 on core damage frequency. So, therefore,
22 the determination is going to be based on delta CDF,
23 which really underscores the importance of properly
24 defining that CDF baseline.

25 In either factor in that determination of

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1 the delta CDF, any conservative assumptions could
2 result in an inappropriate decision. It could wind up
3 putting you in the incorrect region. And if we try to
4 make a decision based on a single assessment of the
5 baseline risk or we just use one specific event,
6 initiating event, frequency, or consequences, we'll
7 wind up with an inaccurate and unrepresentative
8 answer, which is not what you want in a generic issue
9 program.

10 Next slide, please.

11 So, this chart gives sort of a pictorial
12 of where we think we might be and what kind of
13 decisions we might be making. So, I'll just give an
14 explanation of what the different dots are for those
15 in the room.

16 The orange dots are perhaps guesses of
17 where we think we might be, based on some of the
18 initial bounding testing that's been done. The blue
19 dots are where we think perhaps realistically some of
20 the plants may lie in that delta CDF versus CDF region
21 if we applied some of the insights from the tests done
22 to date. And then, that green dot is perhaps what we
23 would decide our assessment would be, based on just
24 those orange dots, if we aren't really adequately
25 considering all the input from various plants.

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1 So, there's really two things to consider
2 from this chart. The first thing is, should we be
3 making determinations based on just a couple of small
4 samples interpreting data from bounding results so
5 far, when that may actually not be representative of
6 what we see in the industry? And the other
7 consideration is, are those orange dots themselves
8 based on conservative assumptions? And perhaps we
9 don't have anything outside of the excluded region.
10 I'm not saying that these are the answers, but this is
11 a stylized representation of where we may be finding
12 ourselves and underscores what it's very important to
13 make sure that we are accurately assessing both the
14 baseline risk and the potential delta risk from
15 including aluminum.

16 So, moving on to the next slide, we have
17 been talking about this in terms of, well, what have
18 we done with past GIs? It wound up being a matter of
19 delta CDF.

20 So, if you look at what we did with the
21 seismic GI, when that came out, we didn't even have
22 the amount of information relative to seismic PRAs
23 that we have relative to fire PRAs right now. But,
24 even with that limited risk-informed approach, there
25 was a pretty high variability in the decisionmaking

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1 that we came up with.

2 So, again, if you go back to that previous
3 chart, even without detailed information, we've found
4 a lot of variability. So, we anticipate that you
5 would find, with additional plant detail, you would
6 continue to find more variability.

7 So, we believe that it's extremely
8 important that we include realism in the assessment
9 and in resolution of the pre-GI. It's important to
10 make sure that we're really isolating the specific
11 impacts associated with the inclusion of aluminum
12 because that's a scope of this GI, and appropriately
13 shore up what that CDF for that baseline is, so that
14 we can accurately calculate a delta CDF and accurately
15 assess this issue.

16 We believe that a lot of plants may not
17 require action. We think a lot of plants will fall
18 into that region to exclude from further
19 consideration. If we have a properly-conducted pilot
20 with proper insights and proper consideration of OE
21 and properly-constructed tests, I don't think that
22 we'll find ourselves in that delta CDF region that has
23 us moving forward.

24 So, if we move on to our last slide, I
25 think what our priorities for the evaluations are

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1 -- and these are not just priorities in terms of what
2 we think is most important, although they are that,
3 too -- these steps really need to be taken
4 sequentially for us to get to a proper answer. So, we
5 need to make sure that we fully understand and
6 evaluate data from previous tests. I think we heard
7 a few times today that some of the previous test
8 results weren't fully understood; we didn't have full
9 material characterizations complete yet. And we think
10 that that's critical to get that done, so we can get
11 a better picture of what phenomena we're looking at.

12 We need to achieve consensus on the
13 technical approach for frequency and zone of influence
14 work. It sounds like the Working Group will be taking
15 that on. So, we fully support continuing with that.

16 Once that's complete, I think that would
17 be the appropriate time to move on to any additional
18 testing to resolve any identified gaps, so that we
19 make sure that our tests are carefully constructed to
20 close those gaps.

21 And finally, complete a realistic
22 evaluation of the plants using all that test data in
23 OE.

24 So, I think just one more thing I want to
25 underscore in my presentation is that it was mentioned

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1 earlier that the industry comments were dispositioned.
2 We turned in comments following the workshop last
3 April. I know that there still have been some changes
4 to the test plan made. But, based on the comment
5 resolution we saw, it doesn't look like the test plan
6 would really support a fully realistic evaluation of
7 this pre-GI. And we do think it's important to
8 perhaps look at those comments again before we proceed
9 with further testing. Because, right now, we don't
10 think that the testing plan fully aligns with what is
11 needed for a realistic evaluation.

12 MR. HAMBURGER: Would you be willing to
13 answer any questions?

14 MS. ANDERSON: I'll answer any questions.

15 MR. HAMBURGER: Okay. Anybody in the room
16 who has questions or comments for Victoria?

17 MR. HYSLOP: Hi, Victoria. J.S. Hyslop,
18 NRR.

19 You talked about the baseline and not
20 really having a baseline. I know we had some comments
21 earlier about 2 seconds versus a different model. Is
22 that what you're getting at when you say that?
23 Because there is a baseline, at least one that's been
24 used in regulatory analysis, and the NRC has accepted
25 it, and licensees have acted on it. So, can you

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1 clarify that for me?

2 MS. ANDERSON: What I mean is, if we're
3 trying to determine what the delta CDF is for the
4 specific impact of aluminum involvement in a high
5 energy arching fault event, our baseline needs to be
6 isolating out -- needs to be defined such that we're
7 isolating out the unique impacts of having aluminum
8 involved. And right now, I don't think that we have
9 the detailed information on the phenomena associated
10 with the testing results we have. That's not really
11 reflected in the baseline. If I understand, right now
12 the baseline is simply what we get from 6850 right
13 now, which is based on one event. So, we wouldn't
14 really be comparing an appropriate baseline to an
15 appropriate CDF from the aluminum impacts.

16 MR. HYSLOP: So, does that mean that, if
17 you feel that the testing and the analysis truly
18 represented aluminum, that you couldn't use the 6850
19 baseline? Is that what you're saying?

20 MS. ANDERSON: I don't think that you
21 would be able to just take the 6850 baseline by
22 itself. I think you need to do a more nuanced
23 evaluation once you have a better understanding of the
24 phenomena that we're observing in those HEAF tests
25 that involve aluminum.

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1 MR. HYSLOP: So, you're recommending,
2 after we understand the issue, just looking back at
3 6850 and verifying that's a suitable baseline or
4 making a decision --

5 MS. ANDERSON: Or adjusting it. I don't
6 think it's going to be a matter of verifying. I think
7 it's going to be a matter of adjusting it in some way
8 to make sure that you're uniquely reflecting just the
9 impacts of aluminum.

10 MR. HYSLOP: I guess that might be a
11 plant-specific analysis as well.

12 MS. ANDERSON: I think you could do it on
13 a generic basis or using representative plants.

14 MR. HYSLOP: Yes, that sort of gets to the
15 pilots --

16 MS. ANDERSON: Yes.

17 MR. HYSLOP: -- because, earlier in your
18 slide, you talked about having not just one PRA.

19 MS. ANDERSON: Correct.

20 MR. HYSLOP: And certainly we need several
21 pilots, so that we can look at this and not just have
22 to rely on one answer.

23 MS. ANDERSON: Yes, absolutely. But, as
24 I noted, I think we need to have a better idea of what
25 we're going to be asking the pilots to do before we

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1 get any volunteers.

2 MR. MELLY: Hi, Victoria. This is Nick
3 Melly in the Office of Research.

4 Can we go back to the slide with the dots,
5 the third slide?

6 MS. ANDERSON: Yes. Which, by the way,
7 are not representative of anything. This is a
8 pictorial -- yes, it's a cartoon.

9 MR. MELLY: All right. I was kind of
10 hoping that there were numbers behind them right now,
11 but --

12 MS. ANDERSON: No, no. It's a cartoon.
13 (Laughter.)

14 MR. MELLY: Okay.

15 MS. ANDERSON: I mean, aside from the fact
16 that we know that almost all the fire PRAs sit in that
17 CDF region.

18 MR. MELLY: Right. I wanted to speak to
19 this, just to reiterate the fact that the pilots are
20 really necessary as part of this process. The generic
21 issue assessment stage needs a risk evaluation. If we
22 do not have the pilots to do that, it falls back on
23 the NRC staff in order to make approximations, to make
24 assumptions on what that risk would be at various
25 plants.

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1 Some ways that we've done this in the past
2 are the SPAR model, and there are conservatisms within
3 and there's some limitations on the NRC staff at what
4 resources we have available to make our assessment.
5 For instance, spatially in the room it's very
6 difficult to tell what other CCDP targets would be
7 involved in a SPAR model versus the wealth of
8 information that the plant PRA models actually have.
9 So, that's just I wanted to stress that the pilots are
10 very important if we're looking to get a realistic
11 representation of the increase or the delta risk.

12 MS. ANDERSON: And I'll say it again, that
13 we're not really going to be able to in good faith
14 encourage a licensee to volunteer as a pilot until we
15 have confidence that the evaluation that's being done
16 is based on realistic evaluation of the operating
17 experience and realistic testing.

18 MR. MELLY: And I hope that, with the
19 products that the EPRI Charter and the NRC Working
20 Group come up with in terms of frequencies, zone of
21 influence, operational experience to support that,
22 will bolster some confidence in that approach.

23 MR. GARDOCKI: Hey, Ashley, this is Stan
24 Gardocki. Oh, this Victoria. I was thinking that's
25 Ashley. Sorry.

1 (Laughter.)

2 MS. ANDERSON: That's Kelli.

3 MS. ANDERSON: Ashley is at home with her
4 baby. She's beat all of us today.

5 MR. GARDOCKI: Okay. Just one comment on
6 this graph. We've used it in the Generic Issues
7 Program, and people understand that it's not a go/no-
8 go definitive line there.

9 MS. ANDERSON: Yes.

10 MR. GARDOCKI: It's a gradient --

11 MS. ANDERSON: It's soft line, yes.

12 MR. GARDOCKI: It's a gradient line. And
13 if you go back to the PRA Reg Guide 1.197, you'll see
14 that notation in there that says you take a gradient
15 approach when you get near that line. So, it gets a
16 little bit, you know --

17 MS. ANDERSON: Yes.

18 MR. GARDOCKI: It gives that go/no-go
19 approach. Okay?

20 MS. ANDERSON: Yes. I should take a
21 blurring tool to that and sort of make it nice and
22 fuzzy. If you're right on the line, you still have
23 further evaluation to do probably.

24 MR. GARDOCKI: You can try. I'm doing
25 that in updated documents that we have --

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1 MS. ANDERSON: Yes.

2 MR. GARDOCKI: -- to try to show that.

3 MS. ANDERSON: Actually, I believe NEI put
4 in a comment to the effect that that should be done --

5 MR. GARDOCKI: Yes.

6 MS. ANDERSON: -- in NRC documents.

7 MR. GARDOCKI: One question I do have is,
8 we put an IN out about a year ago. And based on
9 operating in a plant, you have to take an IN that the
10 NRC puts out and evaluate for your plant to see if it
11 has impact. But the NRC doesn't have resources to go
12 out and see what reaction the plants had to the IN
13 that we put out. I don't know if your agency can
14 somehow get that information to see how the plants
15 reacted to that IN. If they put it in a corrective
16 action base, and they say, well, does it apply to our
17 plant, does it not apply to our plant, and what action
18 plan they have and correspond to that IN, that would
19 be a resource available maybe for your reach-out to
20 the plants that already out there. They don't have to
21 do anything. They already have done that, or
22 supposedly have done that.

23 MS. ANDERSON: Yes. From what I
24 understand, I believe most plants looked at that
25 testing and they believed that it was not

1 representative of their plant configurations and I
2 think determined that there was no action needed on
3 their part. So, are there any licensees with action
4 to the contrary? There are a couple of licensees in
5 the room, but I don't see any of them getting up to
6 correct me. So, I do not believe any plants made any
7 physical modifications as a result of that Information
8 Notice.

9 PARTICIPANT: I would say, because of the
10 prototypicality of the --

11 MS. ANDERSON: Yes, yes. I think that was
12 the determination, was that the tests that the
13 Information Notice was based on, most plants believed
14 that the data didn't have applicability to their
15 plant. So, they did not take any action to make
16 physical modifications. But, again, there are many
17 operating plants throughout the fleet, and I don't
18 have full knowledge of what all of them have done, and
19 no licensees have come to correct me yet.

20 MR. BOYCE: Hi. Tom Boyce. I'm the
21 Branch Chief for Regulatory Guidance and Generic
22 Issues.

23 These might be just feel-good comments,
24 but I'm observing this and I just wanted to share
25 that, from the program perspective, having the

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1 participation today is really very positive. The
2 worst scenario for the GI program is that we don't
3 even have public meetings and we don't get this input,
4 and we do operate with one-size-fits-all and perhaps
5 overly conservative type of outcomes. So, I think
6 this is very positive.

7 And the best thing for the program and for
8 safety, honestly, is if all those green dots and those
9 orange dots became blue dots. So, we're not in it
10 just to do something. We're in it to make sure safety
11 is accomplished.

12 MS. ANDERSON: Yes, we concur with that.

13 MR. HAMBURGER: Okay. Anything else for
14 Victoria?

15 (No response.)

16 MR. HAMBURGER: Okay. Thank you.

17 MS. ANDERSON: Thank you.

18 MR. HAMBURGER: Anything from the webinar?

19 (No response.)

20 MR. HAMBURGER: Okay. So, the floor is
21 now open for anyone who would like to make any
22 comments about any of the presentations we've given
23 today or anything tangentially related, HEAF-related.

24 MR. BOYCE: We just got a question from
25 Paul Gunther on the GI process. So, his question is,

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1 "Will the GI process look at any age-related
2 degradation mechanisms that might contribute to the
3 risk frequency for HEAF events?"

4 MR. GARDOCKI: This is Stan Gardocki.

5 As part of the Generic Issues Program
6 itself, we would look at the initiators of the event
7 and the contributors to the probability of the event
8 in the risk analysis. As far as aging management
9 specifically, the NRC has its own aging management
10 program for life extension, AMR process, and they have
11 specific engineers that work on cabling, submerged
12 cabling, and they put out the report on that as
13 influence to aging management. I don't know if that
14 addresses it correctly.

15 Do you want to add some more?

16 MR. MELLY: This is Nick Melly from the
17 Office of Research.

18 In addition to when we do the frequency
19 work, we also trend the frequencies of fire events
20 within power plants and the most significant events.
21 So, we're trying to capture any aging-related issues
22 when we're looking at the root cause of the events
23 themselves, as well as the frequency of occurrence in
24 the plants.

25 Currently, we have seen no increase in

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1 frequency of high energy arcing fault events that are
2 solely attributed to aging concerns. When we look at
3 the root cause, it's kind of all over the board of
4 different factors, such as human-related failures,
5 design specifications. Aging is also in there as well
6 as foreign material. It is an aspect that we're aware
7 of, and we look for it when we evaluate the frequency
8 of these events.

9 MR. TAYLOR: Yes, this is Gabe Taylor,
10 Office of Research. I'll just add one additional
11 piece of information that kind of goes on what Nick
12 said.

13 Back when we issued the Information Notice
14 last year, although we didn't do any type of formal
15 trending analysis, I did do an informal kind of back-
16 of-the-envelope-type evaluation. And from the data
17 that we had, the operating experience that we had, we
18 didn't see any increase, any decreasing trend versus
19 time. So, it looks like it's somewhat of a constant
20 hazard or a constant failure rate type of event.

21 MR. HAMBURGER: Any other questions from
22 anybody in the room?

23 (No response.)

24 MR. HAMBURGER: You have one more?

25 MR. BOYCE: Yes. We have one more

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1 question from Rob Cavado. His comment or question is,
2 "I want to reinforce the comment earlier that we need
3 a public meeting prior to finalizing the actual PRA
4 modeling to ensure the updated HEAF modeling is usable
5 and realistic." So, more of a comment.

6 MR. TAYLOR: Yes, I don't think we've
7 changed from this morning. I think we agree, agree
8 with that. And when we get to that stage, we'll
9 probably engage the stakeholders.

10 MR. HAMBURGER: Okay. And just for --

11 MR. CHEOK: Actually, I also have one
12 question. I said this morning that we need to get a
13 clarification of industry and other stakeholder
14 comments. I know that we have received an abundance
15 of comments, and I think the staff feels like we have
16 dispositioned them. I get the sense that a lot of the
17 disposition is not satisfying. Put it this way.

18 So, I'm going to offer again -- I heard it
19 from Victoria again, which is what reminded me of
20 this. That one of the steps that was proposed by NEI
21 was that we resolve all the comments before we start
22 on the next set of testing. So, I don't want to do
23 the next set of testing and hear that we did not
24 resolve all the comments. I think that would not be
25 fair to the staff or to all of our stakeholders.

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1 So, again, I think I want to work with the
2 staff and work with NEI and EPRI on maybe a date as to
3 what we can do in terms of resolving all the remaining
4 comments, all the comments that need to be resolved
5 before we start our next set of testing.

6 MR. HAMBURGER: Go ahead.

7 MS. UHLE: Okay. Jennifer Uhle from NEI.

8 So, thanks, Mike. We are very interested
9 in working together collegially here to address the
10 issue. And we recognize the importance of a pilot in
11 determining the delta CDF. And so, yes, we hear you
12 and appreciate that.

13 But there's also the element of the
14 modeling that has to be, I think, discussed because I
15 think at least what I've heard is that we'll be given
16 the results of the modeling. And that, to us, is not
17 pleasing, considering the modeling -- having a
18 modeling background myself -- can go in a very
19 conservative direction. It can go in a very non-
20 conservative direction.

21 And so, if we are going to be as an
22 industry -- you know, the generic issue disposition is
23 going to be impacted by the modeling. We would like,
24 the industry would like to play a role in at least
25 commenting on the modeling approach, rather than just

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1 the data or the results that get generated through the
2 use of the model.

3 So, the more cooperation, and cooperation
4 -- obviously, NRC still maintains its independence --
5 cooperation is what I mean when I say "communication"
6 and justifying a variety of assumptions. The more
7 that occurs, I think the more confidence that people
8 will have in participating in a pilot, which is going
9 to be a critical part of this.

10 But, if we are just given a model and it's
11 used, and we haven't participated or aware of how it
12 was developed, that's going to be problematic from our
13 side of the issue.

14 MR. TAYLOR: Yes, I'll go ahead and
15 respond to that. I think I agree with what you said.
16 We need to get involvement early on. Probably I
17 misspoke earlier about not getting involvement early
18 on.

19 MS. UHLE: Okay.

20 MR. TAYLOR: As I said earlier, we're just
21 changing approaches. Just recently, that happened.
22 So, I think once we get moving, we'll obviously be
23 working with EPRI through that format. And then, as
24 we move along, we'll identify points and try to bring
25 in other stakeholders via public meetings or other

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1 forums.

2 MS. UHLE: Okay. Great. I appreciate
3 that, Gabe.

4 And so, if I can just continue and say
5 that, getting industry information to give to the NRC
6 is obviously work on our part as well as your
7 licensees. And so, having assurance that this
8 information is going to be used in a realistic manner
9 would also help in encouraging the industry to be more
10 willing to participate in the process.

11 Thanks.

12 MS. VOELSING: This is Kelli Voelsing from
13 EPRI again.

14 Mike, I really appreciate your commitment
15 to go back and make sure that we addressed and
16 resolved all comments. And at least speaking for
17 EPRI, we'll make sure that we get you any that we
18 think are still outstanding in a concise format.

19 I would, however, say that I think there's
20 a strong probability that there will be additional
21 comments that we want to take into account in planning
22 future test phases based on the results of previous
23 tests. And so, until we have those test results and
24 the ability to spend the time and look at them, we
25 probably don't have a complete set of comments. But

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1 we'll certainly get you the previous ones in a concise
2 and consolidated fashion.

3 MR. CHEOK: So, at lunch today, Stan
4 Gardocki came over to my office, and coming over to
5 this meeting, Tom Boyce was also talking to me. And
6 they looked at the generic issue timeline, right? And
7 we saw that this morning. And rightly so, the generic
8 issues staff would like to see things move on, so they
9 do not drag on forever. And if it's something that's
10 a safety case, we should not take forever to resolve
11 something that potentially could be safety.

12 But, on the other hand, we also have got
13 to get it right, right? So, I think when we talk to
14 Stan and Tom, we understand that this process maybe
15 may take a little longer because we want to get it
16 right, but we still cannot push it out too far. But
17 we understand the sequence of events that you laid
18 out, and we'll talk, talk over this with the staff on
19 the effect of the test schedules, the availability of
20 the lab, and things like that.

21 But those are comments that are good
22 comments. We will take that into account.

23 MR. GARDOCKI: To point out -- this is
24 Stan Gardocki -- point out exactly what this
25 conversation was, we had the pilot plants. You could

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1 see on the screen the assessment plant timeline. And
2 the people on the phone, if they want to go to that in
3 my presentation?

4 We plan on completing the assessment by
5 the end of 2019, and then, rolling it all up and have
6 the assessment report done in the first quarter or two
7 of 2020. It's a very aggressive schedule based on
8 getting all this testing complete.

9 Based on the comments we are having today,
10 we see the pilot plant study is being done right after
11 June, July, and completed by August. And that's in
12 the summer of this year is when we're going to do that
13 additional testing with the bus ducts and the low
14 voltage. To complete the pilot plant study prior to
15 that testing is going to be a challenge.

16 MR. CHEOK: Again, we will work this out.
17 I think it's more important to get this right. I
18 think everyone wants to get this correct. So, we will
19 take everything, all the comments we heard today, into
20 consideration, and we will work out a schedule that is
21 not going to drag this thing out too much. But we
22 will work to do the right, to get the right
23 information, so that we can resolve the issue that has
24 a recommendation that could be defensible and that is
25 robust.

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1 MR. HAMBURGER: I think we have one more
2 question on the webinar?

3 MR. BOYCE: Yes, we have a brief question
4 from Mohammad Mustafa, Entergy.

5 His question is, "Do existing Appendix R
6 and NFPA 805 separation criteria remain adequate?"

7 MR. HYSLOP: I don't know. We'll have to
8 see what the testing does. Certainly, this generic
9 issue is looking at a PRA and looking at risk results,
10 but I don't think it's limited to that. I think we
11 talked about Appendix R, the impact on that as well.
12 So, we just have to see, and I can't speculate any
13 further than that.

14 MR. HAMBURGER: I just want to do one
15 final sweep of the webinar for anyone who may have
16 called-in only. Can we open up all the phone lines on
17 the webinar to see if anybody has any questions they
18 need to ask? And if you don't have a question, now is
19 a great time to put yourself on mute.

20 Just give us a second to open up all the
21 lines.

22 Anybody on the webinar with a question?

23 (No response.)

24 MR. HAMBURGER: Okay. And again, if
25 anything occurs to you later, you can get in touch

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1 with anybody on the meeting notice. We will sure the
2 comment or question gets to the right place, and we'll
3 get back to you.

4 Any last questions from anyone in the
5 room?

6 (No response.)

7 MR. HAMBURGER: Okay. And just a note.
8 I have two actions here for me. One is to circulate
9 the Draft Charter.

10 MR. BOYCE: We have, I think, one question
11 from Rodney Pletz. If you have your question, you can
12 ask it now. I unmuted you. Go ahead, Rodney.

13 (No response.)

14 MR. HAMBURGER: We have to open up the
15 phone lines again in the control booth. No, he says
16 we're good.

17 Rodney, do you have a question for us?

18 (No response.)

19 MR. HAMBURGER: Okay. Well, if you can
20 type it, we'll answer it.

21 So, I'm going to make sure that the Draft
22 Charter gets circulated and placed in public ADAMS for
23 industry comment before that becomes finalized.

24 And I will also publish today's meeting
25 package that includes all the presentations, the

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1 transcripts, and everything that was presented today.

2 So, if nobody has anything else, I want to
3 turn it over to Mr. Michael Franovich. He has some
4 closing remarks.

5 MR. FRANOVICH: Good afternoon. I'm Mike
6 Franovich. I'm the Director of Risk Assessment in
7 NRR.

8 I am Co-Chair of the GIRP. Mike and I co-
9 chair the GIRP. There's a reason we've structured it
10 that way. We want to make sure that when or if this
11 issue migrates to NRR in terms of a transition, that
12 the expectations are really met.

13 Stan this morning described in detail the
14 process for the GI program. An issue migrating over
15 to NRR in the Program Office, there are a series of
16 processes that we have in the Program Office.
17 Certainly, if there's a viewpoint that there's an
18 imposition of a new requirement or a new position, we
19 will go through a very structured process. Even if
20 it's a generic communication such as a Regulatory
21 Information Summary, we do have processes to ensure
22 that we're not imposing undue burdens.

23 We have revamped those processes,
24 actually, as many of us have gone through, or,
25 actually, all of us have gone through backfit reset

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1 training. And I want to emphasize that it is not
2 success for us to have incomplete information moving
3 in the regulatory program space and trying to move
4 forward with some types of expectations for licensees
5 to do more work.

6 Certainly, some of the issues discussed
7 today about risk modeling, fire modeling, the testing
8 and how representative it is, those are the types of
9 issues that would come up in our internal review in
10 NRR. Because when we look at it, we actually bring
11 those types of issues to our leadership team. The
12 leadership team is looking at it from a resource
13 impact, not just a safety perspective, but a resource
14 impact, as we have to approve resources to be able to
15 move forward. And that looks at both how long those
16 processes can involve and what will be the ultimate
17 end state.

18 We've talked about a lot of testing today
19 and the need for more communication. And I won't
20 reiterate that. There are some very good
21 characterizations of that.

22 I think it was recognized early on in the
23 GIRP when we did the Assessment Plan Report in the
24 summer timeframe that this is living plan; there would
25 be give-and-take back and forth.

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1 If you notice in that plan, there are a
2 number of highlighted engagement points, in
3 particular, with ACRS. ACRS is a vital stakeholder
4 for us and they will scrutinize the pedigree of the
5 work and the fidelity, any kind of outcomes that come
6 from the research activity. And also, they want to
7 know which direction we'll be moving in. Those
8 processes engaging with the ACRS are very public, and
9 information is released in advance of the meetings at
10 ACRS. So, there are other engagement points where
11 information will be made available to other
12 stakeholders, not just the ACRS.

13 But point well taken about more
14 interaction. I think the interest we've had both here
15 in the room and on the webinar illustrates the need
16 for more dialog.

17 The other thing I want to really point to
18 is, ultimately, this comes down to a risk management
19 equation. And in risk management equation space
20 -- set aside the regulatory piece -- there's both
21 prevention and mitigation. And I think we need to not
22 lose perspective, that if more can be done with
23 prevention in terms of looking at predictive
24 maintenance and preventative maintenance practices, at
25 least that can help shape the risk management approach

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1 to the issue and resolution.

2 We had some dialog. Kelli shared some
3 information about parsing more of the data and looking
4 more closely at the OpE. But we may not be able to do
5 statistical changes based on some qualitative
6 analysis, but if there are better practices that are
7 going to be promoted, we can take those matters into
8 consideration.

9 Victoria had some graphs up with the lines
10 that aren't really fuzzy, at least drawn on yours. We
11 do have some documents that do have some fuzzy lines,
12 by the way. NUREG-1855 on the treatment uncertainties
13 actually some illustrative points there, how to weigh
14 those in decisionmakings when you're not clearly on
15 one side or one regime versus another regime in terms
16 of thresholds.

17 But, to that point, we would consider
18 qualitative type of information there to say which
19 direction are we taking. The other thing we need to
20 keep in mind is, if there are other improvements in
21 the fleet, and we talk about FLEX, although FLEX was
22 not designed specifically for this type of hazard,
23 there is an optimization process that the industry has
24 promoted that we're well aware of and we're engaged.
25 And that's in NEI 1606 and 1608.

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1 Some plants have gone forward and actually
2 done some modifications for other hazards to mitigate
3 those risks by modifying FLEX. With very subtle mods,
4 they've been showing -- granted, it's plant-specific
5 type of risk -- that there can be significant
6 reductions in risk.

7 So, irrespective of the regulatory piece
8 for a moment, just keep those in mind. If you're out
9 looking at doing modifications of the plants and you
10 see somewhere where there's an opportunity here to do
11 that, it may be a great opportunity in the span of
12 doing other work at the plant.

13 But I do want to note again, when we get
14 to the transition point, there will be open questions
15 that we need to make sure we have a smooth transition
16 of the issue to the Program Office.

17 There will be a risk-informed resolution
18 of the issue one way or another. That's the climate
19 we're working in. It's a smart climate.

20 And with that -- we are well ahead of
21 schedule, actually -- I will open it up for any last
22 questions here in the room and on the line.

23 MR. HAMBURGER: All right. We have one
24 question in the room, and then, we'll get to the last
25 question on the line.

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1 MS. VOELSING: Again, sorry not a
2 question. Kelli Voelsing with EPRI.

3 Mike, I did want to give you confidence
4 regarding the holistic treatment, that at least from
5 an EPRI perspective, we've gone back and looked at is
6 there more guidance needed around these maintenance
7 and operational best practices. We found that there's
8 plenty of historical documents on that research, and
9 we've engaged with our advisors in both the
10 maintenance organization and the engineering
11 organizations, discussed it with executives, and we
12 highlight those in our pointers to those best
13 practices. So, that is definitely work that is out
14 there in the industry and ongoing. And the holistic
15 treatment at least is not lost on EPRI, and I think
16 the industry is well aware of that through our
17 advisory structure and their interactions with NEI as
18 well.

19 MR. FRANOVICH: Okay. Appreciate that.

20 MR. BOYCE: We have one question from the
21 webinar. Rodney managed to get his question in. So,
22 here's his question. He says, "This question is more
23 for participants from the industry. As we work to
24 refine and define the impact of HEAF, are any sites
25 taking action with their operators and fire responders

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1 to train them in the potential for increased ZOI from
2 these events? In other words, the survey that we did
3 over a year ago gave at least preliminary
4 identification of where HEAFs with aluminum are
5 located and could happen. Are any sites improving
6 their fire response training or fire preplan
7 information to account for these events? Do we need
8 any or want any industry alignment on this during the
9 interim period while the GI process continues?"

10 MR. HAMBURGER: I can't make anybody field
11 that question, but if anybody would like to?

12 MS. UHLE: This is Jennifer Uhle from NEI.

13 I don't have an answer to that question.
14 As with any issue, there's plant interdependency -- or
15 excuse me -- plant-specific dependencies of the impact
16 of the current knowledge. But, going forward, we
17 certainly, as an industry, are getting our views
18 together and ensuring that there is a common
19 understanding at both the staff and management level.
20 And we can certainly bring that up for consideration
21 on the industry side.

22 MR. BOYCE: We have a comment from Rob.
23 He says that, "We already have procedures in place
24 that address full compartment losses. This bounds the
25 issue."

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1 MR. HAMBURGER: Okay. Any last questions
2 or comments before we close the meeting?

3 All right. Thank you all for your
4 participation.

5 (Whereupon, the above-entitled matter went
6 off the record at 2:31 p.m.)

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